Sputnik Enterprises

High-Technology Enterprise Creation in Russia

Marie-Laure Couderc and Vittorio Franceschi

IDS Bulletin Vol 29 No 3 1998

1 Introduction

'I hate uselessly precise figures of chaotic and absolute
statistics, that tell nothing, and I rely on the reader's gratitude on whom I
have not inflicted the pain of reading them or the mortification of skipping them.'
translated from Ciocca 1933: 243[1]

The sprouting of high-technology, small- and medium-sized enterprises (SMEs) around Academy of Sciences' institutes was first noticed during field visits to Novosibirsk,[2] Siberia. We have defined euphemistically as 'sputnik company creation' the creation of satellite enterprises from scientific and research centres, due to the link with the parent organisation that persists throughout the life-cycle of the new ventures. Similar to the spin-off phenomenon in Western economies, this process shows specific characteristics linked to the particular economic environment.

The process studied is a key element in the development of the local, regional and national economy. This is even more relevant considering that Siberia is richly endowed with natural resources, which are still underexploited by a backward industry. The future of research in Russia is also inevitably affected by this phenomenon.

The 1992 rupture made possible and forced a recasting of the rules of exploitation of the scientific system inherited from the socialist era. This revision was sanctioned by a tacit agreement between those who administered and controlled and those who **were** administered and controlled.

To describe the process, more emphasis was given

[1] *'Io odio le cifre inutilmente precise delle statistiche caotiche e assolute, che non dicono nulla, e confido nella gratitudine del lettore a cui non ho inflitto nè la pena di doverle leggere nè la mortificazione di doverle saltare.'*

[2] The research in Akademgorodok, Novosibirsk was partially financed by the European Commission Programme for Cooperation in Science and Technology with CCE/NIS, INCO/COPERNICUS – 1995/96. Title of the project: 'Adaptation to the new environment of the Science Academy institutes in Russia. Analysis of the socialist and post-socialist situation of the Science Academy institutes in Russia and their mode of adaptation: the case of Akademgorodok.'

to qualitative description than quantitative analysis. This seemed inevitable as the research was mostly based on case studies resulting from visits and interviews carried out in Novosibirsk province (*oblast*). Moreover, it is our belief that the opposite approach, where too much stress is given to figures, would not lead to a correct interpretation of the topic under survey.

2 The effects of the collapse of the Soviet system on the research institutes

The rupture

In March 1990 the 28th Communist Party Congress cancelled Article 6 of the Soviet Constitution, thus abolishing the leading role of the party. The planning process also disappeared, along with the party. From January 1992 on, a new pricing system was enacted and mass privatisation programmes were undertaken. For institutes of the Academy of Sciences this implied a financial and structural rupture. The former mode of financing had linked research plans and budgets. But now, plans, research tasks and most of the related funds were withheld from the institutes, affecting allocations to personnel and wages, supplies, equipment and so on.

The institutes

- had to earn their keep: find non-state means to finance their activity;
- were free to select their own research projects and link them to their own financing strategies;
- were free to look for financial resources and allocate them as they pleased: free to buy their equipment from any company, decide the quota of revenues to cover costs (wages, general expenses, social sphere expenditures).

Up to 1992 all research financing came from the state. After the rupture these sources had to be diversified. As an example, the 1995 budget of the Boreskov Institute of Catalysis included the following items:

- 43 % Contracts with foreign industries
- 25 % State budget
- 20 % Competitive programme
- 6 % Contracts with Russian industries
- 3 % Russia Fund for Fundamental Research
- 2 % International Fund for Research

Contracts from industry came to nearly one half of the total.

The state budget for research is voted each year by the Duma (parliament) and allocated through the Ministry of Science and Technology to the Academy of Sciences institutes. The competitive programmes are open research tenders of local and regional authorities or of ministries. The international funds for research include sponsors such as the European Commission, the Soros Foundation, USAID and ISTC.

In this situation the institutes have to face problems such as:

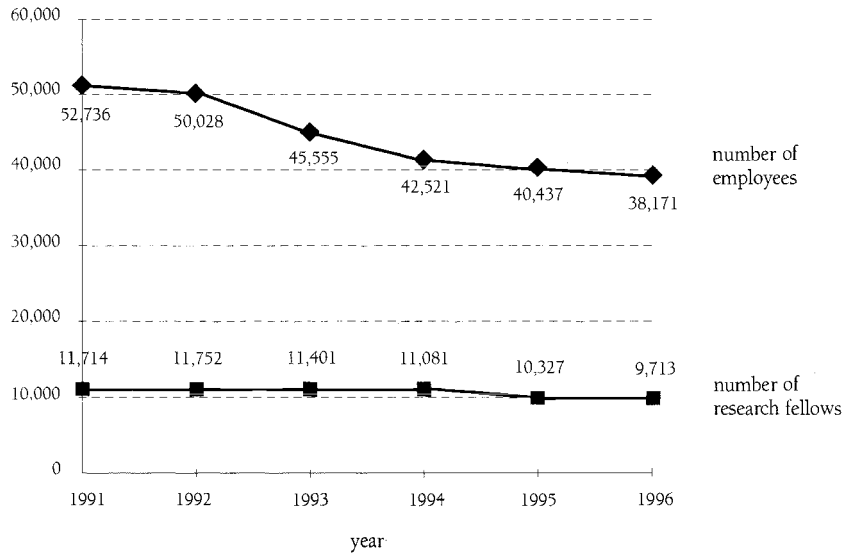
- difficulties in paying all employees an appropriate wage. By 1993 the average wage of scientists had fallen to 65 per cent of the average wage in Russia (CCET 1994: 75). The decrease in state funding prevented the Academy of Sciences from preserving real wage levels.
- the impossibility of sustaining the same number of research projects. A strict internal selection of research activities has to be carried out.
- the necessity of introducing new managerial and operative mechanisms into the institutes. The institutes' managers acquire new managerial skills to implement the changes needed: build their own restructuring strategy in terms of research domains and development of commercial applications. Financially and strategically they can no longer keep open all scientific fields explored so far, without linking them with a possible source of funding and hence of economic return.

Immediate consequences for the research institutes

Institutes had to reduce the scope of their research and support only that which they could afford. Decisions were taken according to financial constraints, and therefore acquired an economic rationale – a new procedure that the socialist model of managing the institutes had ignored.

Funding of uneconomic research was stopped, leaving the researchers and technicians themselves to find ways and means to continue their work in the institutes. In most cases they continued to receive a wage devalued in real terms and, though enrolled in

Figure 1: Decline of the workforce in the Siberian branch RAN Research Institutes, 1991–96



Source: Institute of Economics and Industrial Engineering (SBRSA) (1997)

the institutes, received little or no support for their scientific and research activity.

Many institute employees faced difficulties:

- **empty wallets** rapidly growing inflation with no salary correction
- **frustration** professional skills no longer considered useful under new economic criteria
- **uncertainty** end of a privileged situation in the new economic context
- **disenchantment** the system in which they believed and for which they worked had failed[3].

With this perspective, the 1992 rupture pushed many to leave the research institutes and look for opportunities in commerce and industry. A limited number preferred to continue their academic and scientific career overseas (700 for all Russia according to the president of the Science Academy[4]).

Figure 1 shows that for the Siberian branch of the Russian Academy of Sciences (*Russkaya Akademiya Nauk*, or RAN), the brain drain was limited (-17.1 per cent between 1991 and 1996). The number of research fellows started to decrease in 1993 with an acceleration in 1995 (-6.8 per cent) and 1996 (-5.9 per cent). Statistics on employment show a steeper decrease of technicians and non-scientific personnel (such as workers involved in the social sphere) than researchers. The total number of workers in the Siberian branch research institutes fell to 38,171 in 1996 from a peak of 52,736 in 1991 (-27.7 per cent), the biggest decrease being in 1992 (-5,474 workers).

[3] Between 10 per cent and 50 per cent of employees in Akademgorodok institutes 'were in extreme need of psychological support', according to research funded by the Federal Agency for Unemployment carried out in 1992 and 1994. Another survey carried out in May/June 1997 on 560 scientists found that 40 per cent were living below the poverty line and food was the main concern for 58 per cent of them (cited from an oral presentation by the coordinator of this research).

[4] **Nezavisimaya Gazeta**, 8 November 1997

Why is the decrease for the less educated categories greater than that for scientists? An acceptable explanation could be as follows.[5]

Scientists and research fellows:

- were less attractive to and less attracted by industry and commerce, which have a lower capacity for absorbing people whose major experience focusses on academic and scientific research. On the other hand, technicians and specialised support labour working in research institutes can adapt more easily to positions in the productive sector. Highly qualified engineers with hands-on experience in innovative technologies are in strong demand in an economy in transformation.
- were freer to reallocate their working time than the other categories of workers. Most of the institutes' executives understood that one way not to lose their main asset (scientific know-how) was to grant sufficient freedom. Researchers were allowed and even encouraged, for their personal economic benefit, to continue activities no longer supported by the institute.
- were generally given priority of payment over technicians and administrative employees. After 1992, institutes were free to adopt their own policy concerning the allocation of state budgets.

3 Creation of sputnik enterprises: reorganisation of inherited research assets as high-technology enterprises

The social and economic situation laid down the conditions for the creation of spin-offs from research institutes, a process labelled above as 'sputnik enterprise creation': the establishment and development of a new independent entrepreneurial organisation. This is the transformation of an existing organisation into a structure combining highly skilled labour with the physical and non-physical assets of science and technology in a new way, with the ultimate objective of obtaining profits from its activities.

Independence requires the newly established enterprise to maintain the capacity to make autonomous decisions concerning its activities. This is often the result of establishing new enterprises from scratch, not linked to formal intervention by any authority or existing economic entity. It thus differs from the privatisation of former state organisations, but includes privatised units if these are transformed in the manner described above.

This process was observed to be the main way in which high-technology entrepreneurial ventures have been set up in the science city of Akademgorodok, Novosibirsk province. It covers a wide range of cases: from the transformation of an existing research unit into a *de jure* enterprise, to the commercial exploitation of one innovative idea with a *de facto* but not legally recognised activity. The common basic feature observed in the creation of high-technology companies is the transfer of know-how from research institutes.

The incubation phase

Autonomous ventures need a period of gestation. During this period the founders of a future enterprise usually remain employed at their institute while spending part of their work time formulating the new business idea. The organisation for which they work is known as the 'incubator' where new ideas are conceived and developed. The risk of failure is limited to the time, efforts and working capital already used. Until the founders have left the parent organisation, failure in establishing the new venture has no dramatic effects other than psychological ones.

In Akademgorodok, researchers often remained employed at the institutes receiving a salary (even though devalued by inflation and on several occasions paid months late) and social services. Research personnel were allowed to remain on the institute's premises and use their time freely[6] between research (often no longer financed by the institute) and activities that could compensate for low income.

---

[5] These considerations emerged during the interviews carried out in Akademgorodok.

[6] It appears that an informal understanding existed between institutes and researchers. The latter were free to allocate half of their work time for activities other than research for the institute. This included research work carried out inside the institute for personal aspirations.

After 1992, this status soon became advantageous for both the institute and the researchers. The institutes could preserve skilled staff, equipment and facilities with a minimal financial outlay. Scientists continued research work inside the institute in order to produce applications hoping to yield a profit from them. To do so they used the institute's equipment and facilities and their colleagues' embodied know-how. The situation secured social peace and reduced the risk of mass defections of researchers whose project budgets had been stopped or reduced. It was meant to be a temporary solution to preserve non-physical assets (knowledge) and physical assets (equipment, instruments) until better days. Institutes could not always pay their researchers adequately and feared an exodus towards more rewarding activities. The labour force was their most precious asset, embodying scientific and technical knowledge, as well as the entire relational network. To lose this labour force could jeopardise the institutes' existence.

Starting capital: founder's expertise and seizure of institute's scientific and technical knowledge

Many researchers chose to exploit research results and applications, the outcome of the institutes' past activities and of their latest work. Often a team from the same laboratory, these researchers would find their own way to the market.

In the Soviet Union the state had held the exclusive right to exploit scientific and technological (S&T) discoveries. Scientists and researchers whose S&T findings were of some importance were rewarded with an author's certificate. This document nominally[7] recognised the paternity and granted a symbolic pecuniary reward. It gave no property rights to the author or the institute, property being an alien concept in the Soviet system. The new legislation introduced property rights for inventions, discoveries, industrial designs, innovations and so on. Authors' certificates could now be legally translated into patents, granting an exclusive property right. The number of certificates compelled the institutes to convert only those that seemed economically rewarding. The translation fees discouraged the institutes from engaging in this procedure. Moreover, many certificates were held on to by the authors, and legislation regulating the translation of author certificates into propriety rights generated conflicts between institutes and authors.

The launch of the high-tech venture: low initial working capital

The new independent enterprises are created with no venture capital from banks, financial or state organisations. Working capital is supplied entirely by the founders' personal savings. The development, testing and prototyping of the applications[8] to be marketed are necessarily carried out with a low initial cash injection from the new entrepreneurs, initial working capital being limited to covering supplies and low-cost equipment. Clients' prepayments cover expenses like purchase of parts for the construction of applications/prototypes, payment of sub-contractors (for example the casting of metal parts in a foundry), etc. This is due to the high insolvency risk of Russian firms and the difficulties in finding legal means to cover this danger. Stocks too are limited to the basics (raw material, semi-finished or components) for the completion of the production cycle.

To reduce all unnecessary costs to a minimum, new ventures also avoid constituting themselves as formal legal entities at the beginning of their activity. They register only after their business has consolidated and/or when it seems necessary to increase their clients' portfolio. Founders remain closely related to the parent institute, exploiting their local intimate network of scientific, business and political connections. The link with the parent institute and with the local scientific community is an important feature throughout the entire life of the spin-off, before and after breaking away from the parent organisation.

The new high-tech ventures in Akademgorodok are like satellites orbiting around one or more research institutes. The orbit is very tight initially, gradually loosening up as the new enterprise consolidates, though still receiving vital input from the research institute(s). The founders act as a cooperative of professionals, each conveying their scientific expertise in the new venture, often concretised by one or

[7] The author's name was printed on the certificate.

[8] Usually one application, developed for a limited number of customers (often one application for a single client).

more author's certificates. They have a clear orientation and share the means to exploit their scientific domain from their common past work at the institute and the gestation of their venture.

The first clients are known from the incubation phase. They are usually limited in number and soon new clients must be found and/or new products developed. New products are usually an improvement of original prototypes made to suit a new customer. For these, R&D phases are mainly carried out inside the parent research institute, limiting expenditure to immediate supplies. New and old clients are asked for prepayments to cover larger expenditures for the completion of the applications ordered. The main input of the enterprise (S&T know-how) still originates with the founders.

Consolidation of high-technology spin-offs

The situation described above initially contributes to lower entry barriers in the creation of new enterprises. Re-arrangements of assets into new activities and new structures is not free from conflict, which is more or less open, with the incubator institutes. Allowing their skilled personnel independently to find the means to reward research was meant to be a temporary trade-off, accepted in order to preserve the institutes' assets. Otherwise, the researchers would have left *en masse*, imploding an empty structure. This danger remains, but with the risk now spread between the institutes and the newly created high-tech enterprises. The institutes still rely mainly on financial resources that are both low for their size and risky – and consist mainly of short-term contracts with industry – and on state budgets and programmes. The new enterprises are undercapitalised and can carry out only a minimal part of the R&D for new applications outside the institutes' premises.

Links with the incubator institute can weaken or strengthen. In either case they evolve into formal agreements that regulate the use of the institute's equipment and facilities, and sometimes also arrange the use of the building itself for business activities. The nature and extent of agreements differ from case to case. In most simple cases the enterprise pays a rent. In other cases the enterprise and the institute become partners, sharing profits for one particular business activity while remaining independent organisations.

Once created, these new SMEs use the institute's network: relations with the affiliated design bureau, with industry, with other research institutes. Marketing efforts are intensified through the existing network of contacts. For instance, new clients are often connected to or referred by previous clients, technical and company brochures are printed, advertising is done in local specialised journals, or articles related to the technology exploited are published in local and foreign scientific journals.

As already noted, an existing client may well ask for new applications requiring more investment in R&D. Generally, the client's portfolio is limited and has to be extended with tailored innovative applications. There is a natural demand for high-tech products that exploit a similar S&T base but which have differentiated applications and development phases. This forces the newly created enterprise to keep its R&D effort high and maintain a flexible, creative approach to customer.

The need to expand beyond the institute's boundaries encourages the introduction of more defined roles and responsibilities inside the new firms. Founders gradually specialise in a specific managerial position, as well as that of researcher or innovator. Although this does not imply a rigid definition of positions inside the enterprise, it helps focus managerial effort and is more effective. Emerging managerial needs could include, for example, advertising, concluding agreements with the parent or other institutes to use research facilities, or networking with local enterprises or authorities.

In this environment, innovation is continuous and mass production does not exist. The demand for standardised products is weak. This has proved to be a protective mechanism for high-tech SMEs in Akademgorodok. When this is not the case, the amount of S&T and R&D falls and the sputnik company transforms a low-rate financial environment and murky business practices into a commercial enterprise doomed to suffer from its lack of economies of scale. The high-tech SMEs are small, headed by scientists, undercapitalised and not meant to be manufacturing firms relying on a single innovation.

One important aspect is that a direct relationship now exists with the clients, who are also the end-users of the innovation. This phenomenon did not exist under socialism and was one of the causes of the low effectiveness of the diffusion of technology to industry. The market is competitive by nature and the SMEs are doomed to enter a continuous cycle of innovation. After the first project has gone from research to development, production and sale, the SME undertakes new research. At this stage the enterprise has stabilised, new slightly differentiated products based on the same S&T are developed for similar final uses and a few workers are hired for unskilled work when needed.

Modes of growth of spin-offs

In the second stage of their development, the SMEs were observed to choose between two modes of growth:

1 **Growth by expansion**: new researchers are accepted by the company. They bring in new skills and innovative applications, while the SME offers them scientific, technical, logistical and financial support. But the new individuals are usually not part of the SME and receive no wage. They eventually share the profits only from the commercial activity towards which their research has contributed.
2 **Growth by division**: new independent subsidiaries are created for new business areas/projects. This step usually follows the taking on of new researchers and investment in new R&D axes. In this second case the SME is not endangered by the failure of a new project and the risk involved in branching out into new business is spread between the subsidiaries.

The high-tech enterprises are likely to develop as industrial research laboratories, initially organised according to the first scheme: several departments of a single organisation. The next step is the transformation into independent subsidiaries. This step is taken when the risk increases with the inclusion/enlargement of R&D projects. New projects imply a high level of risk for a small under-capitalised enterprise, due to the time needed to complete the R&D cycle, the financial incidence of new investments and the uncertainty of the outcomes.

In both cases the SMEs grow, thanks to new recruits offering to carry on the research work they have started in their own institutes. Researchers who are unable to convince the institute of the potential economic benefit of their work, or who are unable to find the financial means, turn to existing SMEs. They may know one or more founders from previous scientific exchanges in the Academy structure. This acquaintance is not sufficient to open doors: in order to take on the project, SME's managers must be convinced of the potential of the proposed applications and their marketing and financing aspects.

At this stage the enterprise possesses a mix of R&D projects involved in different S&T domains. New researchers are supported to develop new applications. The client portfolio is broader and possibly more heterogeneous (industrial firms, institutes, households...) and geographically broader. Investment in innovation remains strong and the enterprise maintains its links to the scientific structure. The risk of failure has decreased overall, even though the financial structure of the venture remains weak.

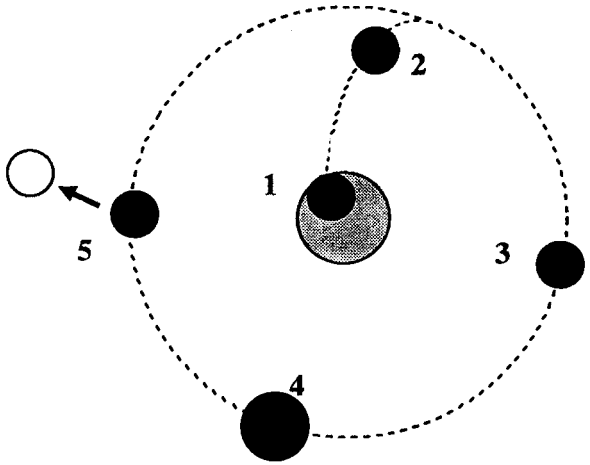
4 Scope of the phenomenon

In Akademgorodok, the creation of sputnik firms is a widespread phenomenon. For example, each institute visited appeared to have a minimum of 6 sputniks with between 3 and 50 employees each. This figure includes both officially registered and unregistered firms in the innovative sector, but does not include new firms involved in trade and other activities. From discussion with institutes in Akademgorodok, it is estimated that there are more than 200 sputniks with more than 2,000 employees involved at least part-time. They began to flourish in 1988 after the 'law of cooperation' was passed by the parliament. This rapid expansion decreased in 1993 due to the opposition of the Presidium of the Siberian Branch of the Academy of Sciences.

The figures on the next page include all new firms officially registered under the category of 'scientific activity' in Akademgorodok:

The failure and bankruptcy rate is markedly lower than that of other SMEs, as, at the initial stage, the sputnik firms have few general expenses, no invested capital and little debt. Rather than going bankrupt, sputnik firms can endure long periods of

Figure 2: The Sputnik Process



The Sputnik Revolution

1. Incubation

Gestation of the high-tech venture while remaining employed in the institute. Business idea based on personal scientific and technical knowledge. Use of the institute's facilities and first contacts with the market.

2. Launch

First client orders and injection of working capital. Still strongly relying on the institute's salary and R&D facilities.

3. Consolidation

Expanding/stabilising business activity. Official agreements with the parent institute. Founders could still be employed in the institute. Widening commercial outlook.

4. Growth by expansion

Opening to new S&T business domains by including new researchers from the same/other institutes.

5. Growth by division

Creation of new independent enterprises from the original spin-off to take charge of new technology business acquired as in point 4.

low activity. The real rate of failure is therefore difficult to establish. During the fieldwork, of the dozen enterprises visited only one had failed.[9] Moreover, the interviews revealed no unsuccessful sputnik. A concentration of sputniks forming around the most successful companies, which act as venture capitalists, is likely and, indeed, is already happening. The concentration is a result of the creation of new sputniks by the same team, which prefers to diversify its risks by creating new firms, rather than accept new projects in existing structures.

Nationally, the sputnik firms are obviously not registered as such by the Russian Federal Committee for statistics; but Organisation for Economic Cooperation and Development figures (CCET 1998: 28) figures show that, in 1996, 877,000 SMEs were registered in Russia, with 6 per cent involved in scientific services. The number of SMEs involved in 'Science and skilled scientific services' grew by 340 per cent in 1992 and 181 per cent in 1993, but decreased by one fifth as for all other SMEs in 1994 and by another 6 per cent in 1995 (CCET 1998: 30). All the registered sputniks visited in Akademgorodok have a status equivalent to

	1991	1992	1993	1994	1995	1996	1997	1998
registered	160	160	126	19	4	0	0	0
failed			1	1	8	7	2	na

Source: Information transmited by Pensionnyy Fund, Akademgorodok

[9] This can also be explained by the fact that bankrupted enterprises are usually difficult to visit.

private limited companies: shares are generally owned by the team and may only be sold or transferred with the agreement of all shareholders.

From case studies, it appears that the sputnik firm's typology of customers is broad. Mainly, customers are local SMEs, research institutes or former research institutes converted into medium- to high-tech companies. Some Academy of Sciences institutes are still quite well off and in need of tailor-made high-tech instruments. These are generally large institutions employing more than 500 employees and partly involved in developing applications. Moreover, all former branch institutes have been privatised and converted into sometimes very successful engineering and scientific service companies. Some of the sputniks include in their reference list large industrial companies, such as steel mills, power plants or a diesel engine factory. Of our sample, only two sputniks targeted their products to private clients (3D design software) or households (water cleaning systems). In sectors such as natural resources (for example, gas, geological services, mining) as well as in previously privileged sectors (nuclear, space, lasers etc.) the level of existing technology is high and their developing needs indicate that they could constitute good clients for sputnik firms in the near future.

5 Conclusion

The phenomenon of spin-offs has been observed in all economies that reward entrepreneurial initiative. It is a natural process that allows industry to renew, strengthen and consolidate itself. The structure of the Russian economy exhibits features that can stifle the creation of SMEs. Most of them are due to the Soviet heritage:

- dinosaur enterprises: large and technologically outmoded former combines with low-quality output;
- low entrepreneurial culture;
- unresponsive capital market for SMEs.

The fact that civil research organisations have fed the creation and consolidation of high-tech SMEs seems particularly encouraging for the evolutionary path of the Russian economy. It assumes the birth of a more heterogeneous and fluid industrial system endowed with multiple innovating forces. It constitutes a stratum of entrepreneurs not merely basing their activities on short-term speculation. Paradoxically, it accomplishes the technology diffusion ring between S&T and industry production: the longstanding objective of civil science in socialism.

It emerges that success or failure of the sputnik process is strongly related to the history and evolution of the parent research organisations, for both independent spin-offs and joint-stock enterprises.

How long and how intensive will the process described be and what will be the new-born high-tech SMEs' survival rate? A precise answer is difficult to gauge and would be of marginal interest. As long as the institutes are unable to pay high enough wages, researchers will be prepared to take risks to improve their standard of living and the phenomenon is likely to continue. The financial risk in a venture is often minimal and limited to the initial working capital, as researchers remain employed in the institute and are free to develop their own high-tech business concept. However, this presupposes the pauperisation of institutes, the durability of the new SMEs, and the development of local and regional industry.

It seems important to understand what factors can strengthen the effectiveness of the sputnik enterprise creation process. The success of the phenomenon is linked to a non-myopic reorganisation of science in Russia. This means safeguarding the research potential of institutes by supplying them with managerial skills, know-how, support structures and a legal environment to challenge the new scenario. The stake of high-tech SME development is central to the future of Russia. Indeed, success of high-tech SMEs is based on a new model, linking industry and S&T assets inherited from the past. The ways these assets are capitalised can ensure the survival of the Russian S&T system.

References

Berliner, J.S., 1976, **The Innovation Decision in Soviet Industry**, Cambridge: Massachusetts Institute of Technology Press

Bernstein, D. *et al.*, 1994, 'Defense Industry Restructuring in Russia: Case Studies and Analysis', mimeo, Center for International Security and Arms Control, Stanford University

Bomsel, O., 1996, 'Enjeux industriels du Post-socialisme', **Revue d'Economie Industrielle**, Vol 72 No 2: 31–46

Bomsel, O., Le Blanc, G. and Couderc, M.L., 1994, 'Industrial Policy Audit on Military Enterprises in the Moscow Region', mimeo, Final Report of European Union Tacis Project No 92/C001

CCET (Centre for Cooperation with the Economies in Transition), 1994, **Politiques de la Science, de la Technologie et de l'Innovation: Fédération de Russie, Vol 2, Rapport de Base**, Paris: Organisation for Economic Cooperation and Development

—1998, **Entrepreneurship and Small Business in the Russian Federation**, Paris: Organisation for Economic Cooperation and Development

Ciocca, G., 1933, **Giudizio sul Bolscevismo**, Milano: Bompiani, 3rd edition

Couderc, M.L., 1996, 'Adaptation of some former research units to the new economic environment in Russia', **Science and Public Policy**, Vol 23 No 6: 375–84

Couderc, M.L. and Franceschi, V., 1997, 'Modes of Creation of High Technology Enterprises in Russia', paper given at Third Conference on SME Development Policy in Transition Economies, Wolverhampton, October

von Hirschhausen, Ch., 1996, **Du Combinat Socialiste à l'Entreprise Capitaliste – une Analyse des Réformes Industrielles en Europe de l'Est**, Paris: L'Harmattan

Schneider, Ch.M., 1994, **Research and Development Management: From the Soviet Union to Russia**, Heidelberg: Springer Verlag/International Institute for Applied Systems Analysis