S&T in the red: Soviet mismanagement, the Indian refrain

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A commentary on Soviet science from impressions of a visit made before the demise of the former Union, and lessons for Indian science.

Soviet science and technology has been an enigma, especially in the post-war years when the cold war enveloped it in a shroud of secrecy. We know of many spectacular successes of Soviet S&T, particularly in their space and nuclear programmes. We know of excellent scientific establishments, like the Kurchatov Institute which has been a showpiece of Soviet science. On the other hand, there is a feeling that no seminal scientific work has come from the Soviet Union in recent years. Russian-language journals report painstaking research work, but the impression remains that they are not in the forefront of modern science. We come across erudite Soviet scientists, but their presentations at international conferences are often complicated by the language barrier. At the same time, one realizes that Soviet science was behind all their technological successes. It must therefore be interesting to find out where they stand today. It was in this spirit that I grabbed an opportunity to visit the Soviet Union under the exchange programme between the Indian and Soviet academies.

I was quite fortunate with the timing of my visit. *Glasnost* had set in and there appeared to be tremendous freedom of expression. It opened the door to many Soviet laboratories and homes, and to close interaction with warm, affectionate people. A senior scientist remarked over lunch that inviting a visiting foreign scientist to his home would have been unthinkable only a year ago.

I visited many laboratories in Moscow and Leningrad, and discussed with scientists their work, problems and perspectives. As I am interested in mass spectrometry, many of these machines were shown to me — there must be a few hundreds of them in Moscow itself. Most are at least 20 years old and resemble those made in the US in the early sixties. 'That shows that we were only a few years behind them in the early seventies' a scientist remarked. Apparently, in that period these instruments were top priority and many were made following orders from the top. My host, a pioneer in the field, recalls how armed guards stood outside his door when he worked with his fancy new acquisition. Somewhat better models have since been made but they are available only to a privileged few and have many imported parts, especially in electronics.

It is in digital electronics that the Soviets have missed the bus. They do not seem to have VLSI chips (very-large-scale integrated circuits) or personal computers that are common in any laboratory or factory. And it is not surprising, considering that the electronics revolution hardly made an impact on the average Soviet citizen. Cashiers in departmental stores and restaurants still use the abacus — I never saw an electronic calculating machine. Consumer products like the VCR and domestic appliances are not readily available; the ones I saw in homes were mostly imported.

Modern science needs sophisticated equipment without which one is left behind. In today's competitive world it is imperative to move quickly to be in the forefront. A scientist working in Western countries can refer to the entire world literature for details of earlier work in the field by merely dialling a number through his or her computer. The computer also performs laborious calculations, with user-friendly software packages and data bases available through telephone lines, giving scientists time to think, plan and write. If one is stuck with obsolete equipment and manual operations, one simply cannot compete. Soviet science has fallen far behind its Western counterparts. Today they do not have hard currency to buy state-of-the-art equipment, while their own industry is unable to introduce local equivalents.

What went wrong? Possibly a result of the deficiencies of a centrally planned system. Decisions taken by a few people, totally isolated, cannot stimulate progress in a rapidly changing world that demands quick local decisions and initiative. Creative work, including scientific research and instrument development, cannot be nurtured under excessive bureaucratic control. Development of scientific instruments, for example, demands a combination of skills such as entrepreneurship, technical knowledge, scientific insight, projection and marketing.

The second problem is poor communication. The difficulty of contacting Soviet scientists from outside is well known, but their internal communication is also poor by Western standards. Moscow city does not have a telephone directory and hence you can call only known friends. Scientists working in a given field meet periodically in conferences, but cross-fertilization through interdisciplinary interaction, which is the real stimulus for scientific progress, takes the back seat. There is little interaction between industry and research institutes. With the economic crunch, laboratories have been asked to get financial support from industry, but this has proved difficult as the latter does not know how to use the fruits of research.

Scientists feel that there are not many incentives for creative work. A university professor is paid 500 roubles a month, while a steel worker or a taxi driver gets 2000. Young scientists start on 250 roubles a month after the PhD. Yet I found many were hard-working. This is probably because of non-monetary goals like professorship and international recognition from peers.

Lessons for India

What can Indian science learn from the Soviet experience? There are common weaknesses, though with varying degrees of difference. For example, one of the real handicaps of scientists in both countries is the non-availability of indigenous scientific instruments. This, coupled with the scarcity of foreign exchange, makes it difficult to be in the forefront of modern science. Consider the scientific scene in the last four years. Three major discoveries caught the imagination of scientists and the general public alike—high-temperature superconductivity, cold fusion, and molecular clusters, especially buckminsterfullerene. Only a few Indian laboratories could get involved in the excitement as they alone had the necessary equipment. It is true that the government has heavily funded some of these laboratories for work in superconductivity, but it takes two to three years to import, install and use new equipment. Meanwhile, all the others have been left behind. On the other hand, the American scientist who prepared buckminsterfullerene in the laboratory just a year ago, has since then obtained an ICR mass spectrometer (FT-MS) and modified it to suit cluster studies. Speed is crucial for retaining leadership in a highly competitive field, and this requires ready availability of funds, equipment and technical skills. Indian science is bound to become quite obsolete if scientists do not have access to state-of-the-art equipment. These cannot be developed and marketed in the government sector, which does not have the flexibility to respond to rapidly changing technology.

The second common deficiency is lack of interaction between laboratory and industry. One is not able to support the other and consequently both suffer. This is perhaps because of the overemphasis on open-ended research. There are many who believe that applied research is under-rewarded in our country.

This will become clear if we examine the situation with respect to patents. It is generally accepted that the number of patents taken by a country is a reflection of its technological standing. Japan and the US lead the world in this respect while India is far behind. The reason perhaps is that applied research is not receiving enough encouragement. Even those who develop new products and processes do not apply for patents as the procedure is very cumbersome (in Western countries all R&D institutions have patent attorneys to take care of this). The patent is valid only if it is also filed in technologically advanced countries and this can be a costly proposition. Further, Indian entrepreneurs do not come forward to exploit the patents. To top it all, most of our research institutes do not even have a policy in this matter. I found a similar situation in the USSR. I went to visit Prof. Mamryn's laboratory in Leningrad, because they are the inventors of the 'reflectron', a new development in time-of-flight mass spectrometry, which has revolutionized scientific instruments in the last five years. There are several Western companies that sell sophisticated reflectrons, but the ones in Mamryn's laboratory are not very different from their pioneering invention of 1973. They do not own a patent or get any royalty for their invention. What about their intellectual property rights?

One of the most perceptive comments on Soviet S&T was made by a European scientist I met in Moscow. He pointed out that the space programmes of both the US and the USSR were comparable. While the American space technology has made a profound impact on the day-to-day lives of Americans through commercial products such as new materials, miniaturized electronics and food articles, in the USSR there have been no such spin offs. The difference can be traced to the association of American industry in their space programme and the ease with which entrepreneurs can exploit new technology. Aren't we at the Soviet end of the spectrum?

Both the USSR and India have centralized decision-making, which is in the hands of a few individuals. Thus their perceptions and prejudices influence our policies, rather than what the Americans call 'market forces'. A case in point is the sorry state of analytical chemistry in India. Analytical chemistry is one of the most vibrant branches of science in the US, with high enrolment in the universities dictated by industrial demand. Over the last two decades, a new breed of analytical chemists have come up who combine skills in chemistry and instrumentation. Professors of analytical chemistry are bagging all the coveted awards. But in India analytical chemistry is an outdated subject. While the analytical chemists remain satisfied with their test tubes, the physicists who dominated Indian science after independence thought that instrumentation was a physicists' prerogative. As a consequence we do not have people to operate and maintain even the expensive analytical equipment imported by industry. Nor are our universities able to meet the manpower needs of industry in this area.

Perhaps the time has come to take a look at our system of rewards, which does not seem to encourage those who contribute to indigenous development and to the strength of Indian science. In the existing system the most successful ones are those linked through an umbilical cord with an American or European group. They frequently spend long periods with the host groups abroad and do similar work in India, and thus manage to exist on the fringes of Western science. They produce PhDs who are tailor-made for American laboratories. If Indian industry is accused of permanent dependence on the West through successive collaboration agreements, Indian science can be accused of an equal dependence on Western science. As a result, our priorities and our direction in scientific research reflect those in the West. It is necessary to ponder over these issues so that our S&T effort takes strong indigenous roots and is directed to meet the country's needs. This has happened to a degree in some areas like atomic energy, defence and space research, where we had very little choice but to go it alone.

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