

Facilitation of technology transfer from research institutes to industry

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The command economy is slowly giving way to market-driven economy, which demands quality, cost economy and high productivity. The Indian industry is finally waking up to the need for technology to inject competitiveness into corporate performance after thriving for decades on protectionism and political patronage. The attitude that what is good for the industry is good for the masses has given way to consumer being wooed by a multitude of producers and service-vendors, each vying for the key to the legendary middle-class treasury.

An unexpected outcome of liberalization with its concurrent demand for tightening up drains in economy, is that state patronage is no longer freely available to the scientific class. Inconvenient questions are being asked on performance rather than promises. Scientific institutions are vying with one another in finding ways to transfer their knowhow to industries. They have to compete with foreign vendors all too willing to dump outdated and sometimes even dangerous technologies (waste incinerators, spewing out poisonous dioxins, as a very recent example) and the joint ventures where foreign equity assures technology transfer. The available time span for technology generation by the scientific institutions is compressed, because industries are now aware of, and demand a technology which developed and matured in advanced economies over a considerable period of time. These institutions have also to fight the credibility battle; the Indian industrialist, by historical experience, views Indian technology with suspicion. Moreover, the scarcity of techno-commercial database inhibits an objective assessment of its financial viability and consequently its funding by venture capital financing bodies, which perceive indigenous high technology development as high risk ventures. Finally lack of trained, sophisticated manpower affects efficient transfer of technological know-how from lab to fab.

In this seemingly bleak scenario, it is instructive to ask whether there is any chance of indigenous technology reaching Indian industry. Is building bridges

between science and industry, demanding nontrivial efforts, feasible? Given the essential conservatism of the Indian industry and the general perception of high risks associated with indigenous technologies, how does one accelerate the pace of commercial acceptance of home-grown technologies? I gathered some answers to these questions while attending a recent meeting organized by the Technology Offer Cell of the Department of Atomic Energy (DAE) which brought together the technology sources within the DAE community and some of the potential buyers of the technology.

The essence of various presentations from the industries revealed the divergence in perception between the industry and research institute on what comprises a technology package. The industry wants a finished product, with all technological and techno-economic uncertainties ironed out, ready to be put on the factory floor and integrated with the production line. The transition from a concept to a prototype, prototype to a pilot plant, endless and dreary tests for optimization, the despair when nothing seems to work are unacceptable. Industry is willing to pay for the finished product; no subsidies please, but no risks either.

In justification of this stand, the industry often claims that they can and do buy finished technology from the advanced countries. This transition from concept to the finished product must have been made in the advanced countries as well and someone must have paid for it. Very often an interesting concept is bought by industries right at the patent stage from universities, research institutes or even individual inventors, and after investing substantial sums of money in going through the transitional and development process it exploits the technology for its own use. The technologies available for sale are very often dated because industries would like to use a new technology to establish market leadership before making it available to the competition. Hence, if the Indian industry wants to access the state-of-the-art technology, to be internationally competitive,

the argument that it can be bought from the open market is fallacious.

The rather naive belief that advanced technology is easily available is not based on facts because of several types of invisible barriers; social clauses, CTBT non-compliance, etc. exist in the so-called free market. Control of critical technologies is a powerful weapon which has been repeatedly and ruthlessly used to choke the industrialization of developing countries. Consider the recent decision by countries of the European Union to restrict sale of the so-called 'dual use' (i.e. which can be used for both civil and military purposes) equipment, materials and technology directly relevant to surface engineering like plasma chemical vapour deposition, cathodic arc discharge, laser evaporation and electron-beam-assisted physical vapour deposition processes, ion-assisted physical vapour deposition including ion plating, plasma spraying, sputter deposition, ion implantation, etc.

If the industry is not willing to pay for development of technology because it is too risky, who should pay for the risk? The scientist? For the scientists in many premier institutes, the technology concept is often a byproduct of his main concerns, what is euphemistically called a spin-off. He is not willing to divert his attention from his main tasks and even if he is willing, may not be allowed by his organization because of time and resource constraints. Quite often he will write a paper or, nowadays, with the IPR concerns at a feverish pitch, he may take a step of filing a patent, but will not pursue it further. Thus, the exploitation potential of indigenous technological ideas is not realizable because of this serious mismatch between the innovators and the users. To improve this situation, it is obvious that the solutions lie both in changing industry's perceptions about indigenous technology as well as strengthening technology delivery systems.

The technological innovation germinates in a creative mind and terminates in the market place. While the sources of technological innovation are complex

and its ultimate exploitation is determined by market and economic forces, the transition from idea to a societally useful product, process or service, goes through a universal flowchart of proof of principle experiments, laboratory validation, scaling up and determining the optimum operational constraints with prototypes and pilot plants and the resultant market-worthy product.

It is obvious that it is in no man's land of prototypes, pilot plants and pre-commercial development, where efforts should be concentrated – a process which can be variously called, 'technology incubation', 'technology manufacturing' or 'technology facilitation', since it adds value to an innovation idea by clothing it in all the embodiments of technology which a user wants. These embodiments are in the form of process optimization, process equipment and instrumentation, reliability assessment, and techno-economic data. It is also a high-risk venture since there is no assurance that all its final products would be bought by the industry: the end user. It requires specialists of a much broader range of expertise to put all this flesh into the basic innovation idea, and infrastructural facilities comparable to the best in basic research organizations. This is not an original concept; the Fraunhofer Centres in Germany is a close example to these technology delivery organizations.

The Technology Incubation and Facilitation Centres demand an institutional and cultural framework where knowledge is treated as a commercial entity, in contrast to the ambience of research laboratories where pursuit of pure knowledge is an end in itself. The corporate structure can be similar to R&D companies in the companies act, but with an important modification that they should be allowed to manufacture process equipment. These can be directly financed by the apex bodies which oversee technology development in the country. PATSER of the Department of Scientific and Industrial Research, Home Grown Technologies project of TIFAC and SPREAD (Spon-

sored Research and Development) programme of ICICI are cited as programmes to finance transformation of basic research into productive technology. SPREAD has now reappeared as the Technology Development Fund under the Department of Science and Technology. It is a fact that considerable sums of money are available under very soft-loan basis for research institutes and industries to get together to finance technology development. However, to enable these monies to be properly utilized, a minimum of initial investment of infrastructure, staff and other facilities must be provided, in addition to project mode funding.

The mode of technology transfer to industries is an area that requires attention. There is a genuine problem faced by Indian entrepreneurs, who are willing to accept indigenous technologies, but are unable to assess the technology risks. A workable solution is to set up joint ventures where the equity of the institutes can be in the form of technology and its support. This is unconventional and requires procedures to be developed to enable its implementation. But considering the sterility of conventional technology transfer processes so far, such radical approaches may be necessary.

There is a need to promote marketing of the advantages of adapting indigenous technology. This involves changing the present mindset of trashing everything Indian, which can be more easily accomplished if the technocommercial advantages can be brought out effectively. In my opinion an enlightened partnership between Indian industry and research institutions can, in principle, yield truly innovative, 'first in the world' technologies, in contrast to mere duplication of a product or process from the western market place. This is already happening in the software technology front and could be emulated by engineering and material processing. The relatively low costs of indigenously engineered system should give these hardware technologies another competitive advantage.

In conclusion, a recent experiment in building institute–industry bridge initiated by the Institute for Plasma Research in addressing the problems of commercialization of plasma-assisted material processing technologies needs a mention. IPR has responded to the above boundary conditions by setting up the Facilitation Centre for Industrial Plasma Technologies (FCIPT) to bridge the IPR knowledge base with the needs of the Indian industry. FCIPT has set up prototypes and pilot plants covering a range of plasma technologies and utilizes them for extensive job-working of industrial components to generate the database on instrument and process reliability and economics. The material characterization facility, consisting of advanced instruments, is open to users from industries, research establishments and universities. The process development laboratory exploits the areas of expertise in plasma and other allied fields of the institute in developing new plasma-based technologies for the industry. It will train industry manpower and engage itself in all activities which will develop linkage with the industries.

Indigenously sourced manufacturing technologies are critical to India's emergence as a globally competitive industrial power. The weak links in the process of converting indigenous knowhow to marketable technologies have to be addressed realistically. Institutional and infrastructural inputs are needed to make this happen.

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