

# **Creating Incentives: A comparison of government strategies in India and France**

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**An examination of the French government's approach to the development of biotechnology as a potential strategy for a 'latecomer country' might be interesting for any developing country where the government is the principal actor committed to the development of biotechnology. The French case reveals the effectiveness with which institutional problems also innate to developing economies, can be tackled. The comparison between India and France made in this article indicates that institutional problems are as important as financial constraints.**

Despite large differences in budgets allocated to the development of biotechnology, it is relevant to compare the evolution of the biotechnology sectors in an European country and a large country in the developing world like China, Brazil and India. These large developing countries have the potential to develop the scientific competence that forms the basis of industrial development, comparable to that of any European country. This article illustrates that the greater effectiveness of the French government's strategy is not only its ability to allocate more resources to biotechnology, but also in its promotion of industrial competence. Incentives for scientists to create firms, incentives for firms to form strategic R&D alliances, regulating public research and developing networks between the different kinds of agents involved in the commercialization of innovations are all part of the government's strategy.

## **Expenditures**

The total expenditure on biotechnology research in India increased from US\$ 13 million in 1988 to US\$ 28 million in 1994. The private sector contributes only 15 per cent of the total R&D expenditure reflecting the important role played by the government. As compared to this, under the latest French national biotechnology programme, BioAvenir (1992-1997), more than twice that amount (US\$ 58 million) is being spent annually, with about 62 per cent coming from the private sector.

## **Scientific community**

When the French government declared biotechnology to be a strategic sector in 1980, France was years behind the USA and UK in the scientific fields relevant to modern biotechnology. The situation was very different in India. In the early eighties, when knowledge on the latest developments in biotechnology related disciplines was not widespread, the scientists in the elite centres of academic excellence were nevertheless well aware of them. The potential of biotechnology was conveyed to the government and the development of biotechnology in India was subsequently spearheaded by these scientists. Now, not only has the French scientific community caught up with those of the USA and UK, France has at least 40 to 50 firms created by French scientists. To date, we know of only one firm in India in biotechnology which has been formed by a scientist from an Indian university to commercialize his scientific discovery, indicating that there has been no incentive for scientists to start firms.

## **Industry**

Initially, both in France and India, the networks connecting public laboratories, entrepreneurs and financial markets were weak. In France, however, there were some large chemical and pharmaceutical firms with established research centres with a tradition of pursuing technological innovations. In India most firms did not regard R&D as an activity that could make a worthwhile contribution. If Indian firms undertook R&D, it was aimed at technology absorption, improvement of processes in imported technology, import substitution through reverse engineering of items not covered by patent under Indian law and of those whose patents had expired. Thus the institutional problem faced by India was to provide incentives to reverse the

tradition inculcated by its industrial development in this century whereby neither public nor private research was oriented to the creation of incremental or radical technological innovations.

### **Governmental strategies**

In order to initiate biotechnology, the first tasks that both governments undertook were to: (a) identify priority areas in biotechnology, (b) identify infrastructural needs and (c) implement a coordinated programme to realize certain national objectives on the basis of the findings of categories (a) and (b). In France, targets (a) and (b) were fulfilled within a year by a task force in the form of the Gros and Jacob and Royer report "*Sciences de la vie et de la Société*" in 1979. Even as the report was written, a high level ministerial task force had started to implement a programme for bringing the academic community in the biological sciences up to date, establishing links between the academic community and the industrial community, and implementing certain 'pilot' programmes. This initial programme was completed by 1982. In India the *National Biotechnology Board* was set up in 1982 and during its four years of existence it seems to have fulfilled objectives (a) and (b). Then it was replaced by the *Department of Biotechnology* (DBT) which set out to implement a number of projects covering food, vaccines and edible oils. DBT also focused on creating scientific competence in genetic engineering, and techniques like cell culture and tissue culture.

### **France: evolving strategy**

The French government realized that making public sector researchers competent in the relevant scientific disciplines could not guarantee the creation of industrial competence, and that collaboration with the private sector was needed. In addition, the organizational networks for the optimal exploitation of scientific competence to create commercial innovations had to be found. Thus the French government launched the Mobilization Programme (1982-1986), followed by the National Programme (1986-1990), and finally BioAvenir (1992-1997). Their common aim was to stimulate public research and promote conversion of fundamental discoveries in the biological sciences into products of economic value through facilitating the

interface between public research and industrial research. The fact that there were distinct differences in the orientation of the programmes indicated that the government was learning from its experience and evolving its strategy accordingly. The objective of the first Mobilization Programme *Essor des Biotechnologies*, under the aegis of the Ministry for Research and Technology, was to develop competence in microbiology, fermentation, enzymology, genetic engineering, improvement of seeds and plants, vaccines, logistics and supplies of equipment, and education of researchers. It involved a three-pronged approach:

- coordinating various types of organizational networks through government created research consortiums between big firms, small firms, research institutions and university laboratories to find the best mode for the creation of new technology;
- creating awareness of the potential of biotechnology by involving firms not currently interested in the biotechnology sectors in research programmes;
- restructuring and reorienting the national research institutes to gear basic research towards projects of commercial value.

The 1986 National Programme reflected some lessons learnt from the mobilization programme. With the establishment of biotechnology programmes in a number of universities, it was felt that the returns to government investment in public research could be increased by concentrating on a narrower set of generic technologies, namely genetic engineering, microbiology and protein engineering. Additionally, government directed research collaborations were not found to be very effective and it was decided that the role of the government should be limited to providing the incentives for R&D cooperation. Therefore, the government should create a lenient tax policy and subventions for research consortiums, while companies should find their own partners for initiating strategic alliances. The firms were also encouraged to be active in a number of European collaborative research programmes.

The strategy of the government became even more focused with BioAvenir which was instigated by the firm Rhône-Poulenc (privatized in 1993), a firm with an international technological and market leadership in the chemical and pharmaceutical sectors. It represented a major shift in policy. Instead of the government playing the leading role, biotechnology research in France became a cooperative effort between

the private sector and the government. Moreover, the focus was on a single firm, Rhône-Poulenc, instead of being spread out over various firms.

### **India: creation of new institutes**

It is difficult to mark such an evolution of government strategy in India in terms of thrust or orientation. The evolution of government involvement is better traced by a string of new institutes created to stimulate the development of biotechnology. Besides the National Biotechnology Board and the DBT, new institutions such as the *National Institute of Immunology*, *Centre for Cellular and Molecular Biology*, *National Facility for Animal Tissue and Cell Culture*, and *International Centre for Genetic Engineering and Biotechnology* (in collaboration with UNIDO) were created in the early 1980s. These new institutes are mainly responsible for the transfer of technology to Indian firms. It is not clear whether this represented a particular strategy of the government or a deeper problem characterizing many developing countries, namely the lack of flexibility of existing institutions to change, to learn and to adapt to new circumstances, necessitating the creation of new institutions with new competencies.

Finding the response of the industrial establishment to be quite modest, a public sector company *Biotech Consortium India LTD* (BCIL) was set up in 1990. It was to fulfil the same functions as the venture capital companies in the USA, i.e. promote the creation of firms by providing venture capital and other forms of assistance for scientists to set up firms. However there was no major restructuring of the public research establishments except for a cut in subventions apparently to provoke researchers into seeking funds from industry.

### **Industrial competence in the biotechnology sectors**

The latest 1994-1995 directory of biotechnology companies issued by the BCIL indicates that there are 97 production units and 45 equipment suppliers in India. In France, there are between 100 and 150 firms active in modern biotechnology, of which 25 per cent are equipment suppliers. Two kinds of companies are active: *New biotechnology firms* (NBFs). Roughly 40 per cent of the existing French firms

are NBFs established mostly in the beginning of the 1980s. In our sample, about 10 per cent of the existing Indian firms are comprised of NBFs and they were mainly formed after 1985.

About half of the NBFs in France were formed by scientists from public labs. The firms were often geographically close to the laboratory of the founder in order to tap the academic network for recruitment and research collaboration. In India, a number of firms have been formed by scientists who had gone abroad to study and then started their firms on the basis of contract research or contract production for a foreign firm or university, exploiting their foreign network. None of the Indian firms seems to have been influenced by the proximity to any public research institution. While the principal problem cited by the French NBFs is access to capital, the principal problem cited by the Indian NBFs is infrastructural deficiencies, such as a lack of appropriate storage facilities at airports, a lack of phytosanitary certification facilities, high costs of air freights. None of the French NBFs or Indian NBFs are pursuing any radical innovations like blockbuster drugs, which are however the preserve of a number of small US NBFs.

*Large firms.* A large French firm is defined as one with 500 or more employees and a large Indian firm as one with a turnover of US\$ 300 million or more. This difference in definition is based on the assumption that the distinction between small and large in a Western country is best determined by its personnel because there are some small firms with high revenues. This makes no sense for a developing country, where capital instead of labour is scarce.

There are about a dozen large firms active in biotechnology in both India and France. These are firms with a traditionally strong technological and marketing leadership in either the national (Indian companies) or the international (French companies) pharmaceutical or chemical market. It is noteworthy that no public sector firm has made headline news in India despite their established production and commercial networks except for a vaccines unit which later had to be abandoned. The large French firms are competing with their US counterparts in the race to create radical innovations such as therapeutic proteins. The development costs of these

blockbuster drugs is about US\$ 500 million and it takes ten to fifteen years to bring them to the market place. The large Indian firms are active in human and animal diagnostics, cell and tissue culture, biopesticides, hybrid seeds, and bioremediation. While the non-involvement of Indian firms in radical innovations can be explained in part by their financial constraints, they are also distinct from their Western counterparts in developing their technological competence in-house. The large French firms have a complex web of research collaborations and strategic alliances with US and European laboratories and firms to develop innovations. The slogan is 'collaborate with your competitors' on pre-competitive R&D because the research involved in creating innovations is too costly and too risky for a firm to undertake alone. To date, no systematic strategic alliances between Indian firms themselves or between firms and research institutes to develop innovations are known. Links with foreign firms are for co-production of an existing product or distribution of foreign product, never for pre-competitive research.

### **Government roles reviewed**

France is now a leading European player in biotechnology, along with the UK and Germany. Unlike the UK, where biotechnology was initiated by the academics and Germany, where it was pushed by large companies, the French government has played a leading role in the initiation and further development of the biotechnology sector.

The success of the French government's strategy lays in developing and stimulating the transformation of scientific competence into industrial competence. Incentives are created not only through tax or fiscal policies, but also through the initiation and nurturing of networks between research laboratories, firms and venture capitalists. This is a model that large developing countries may reflect upon, given the crucial role often played by the government in these countries, in the creation of industrial competence.

While developing countries may have less resources to invest in a sector based on a new science like biotechnology than a European country, the returns to any such investment can be maximized through providing the right incentives for the

transformation of scientific competence into usable technology. India, which compares favourably with any European country in terms of number of firms or number of research institutes active in biotechnology, failed to create a strong competence in biotechnology since it did not stimulate the appropriate networks. Unlike in France, companies active in biotechnology in India are those that diversified into biotechnology rather than being created to exploit biotechnology. Very few firms have been founded by scientists from Indian Institutions. There are very few strategic alliances or research collaboration to create innovations.

The Indian government, while playing a primordial role in the creation of 'awareness' of the potential of biotechnology and development of scientific competence, has had a minuscule impact on the creation of industrial competence. It envisages its role as being limited to the promotion of 'socially relevant' research and production. However, the high potential for development of biotechnology in India could be realized if the government would be more active in this field. As the French experience shows, government led efforts in biotechnology can have a larger impact if investment of resources is coupled with the provision of institutional stimuli such as regulation of the public research establishment through recognition of a variety of competencies, and creation of networks between firms themselves, and between firms and laboratories.

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