LECTURE 6 20 March 1988

AN OVERVIEW OF R & D IN INDIA*

1. Introduction

The preoccupation thus far has been with modelling Indian technology, science and innovation in the context of a stratified society in strong interaction with the industrialized countries particularly through the import of technologies. Now, an overview of R & D in India will be presented. Since analogies are valuable heuristic devices serving as conceptual aids to discovery and reducing the search for the understanding of complex situations, the analogy with the medical approach to human beings (in which emphasis is directed towards the growth, anatomy, physiology and pathology) will be explored. Attention wiil therefore be focussed on the history/origins, structure/ organization, function/behaviour and diseases of Indian R & D.

2. History of R & D in India**

Research in India, as a conscious, systematic and organized activity has a very brief history. Although ancient India can boast of numerous contributions to fundamental science, the last period from about 1000 to 1800 A.D. saw little further growth in Indian Science. Early European visitors to India did not find her deficient in scientific and technological growth; but, between then and India's independence, the country did not keep abreast of the rapid changes that were taking place in the West. More than two hundred years of British rule in India, destroyed traditional Indian technology almost completely. Hence, if one wishes to trace the roots of the present day research in the country one can contain his study to specifically the origin of Western Science in India - without any loss. The rise of Western Science in India can be classified into three phases.

The first phase begins with the establishment of the Asiatic Society in Calcutta, in the year 1784, and a host of other institutes started under its initiative. This phase was essentially and extension of the "overall European scientific effort, about which there was hardly anything 'Indian', except the objects of research, the living as well as the non-living belonging inseparably to the geographic world of India".

The second phase saw the growth of professionalisation of Science and its consequent Indianisation. The first few laboratories were set up under Indian control. However, there was no attempt at this stage to link science to technology.

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** The material in this section has been abstracted from Vishwanathan (1980).

It was only in the third phase, as the nationalist movement gained momentum, that an attempt was made to link science and technology. The Indian Industrial Survey of 1918, possibly the first survey into the status of R & D in India, reported that it found no industrial R & D of note in India. The Committee in its report observed that:

So far as Private industry is concerned, there is a manifest lack of research mindedness among the industrialists with a few exceptions . . . The stinted expenditure on research also testifies to the general attitude of apathy of the vast majority of industrialists towards research.

However, since then there has been impressive strides in R & D in India - as will be apparent from the statistics to be presented in the succeeding sections. The changes that have been brought about in the last half-century or so, is the result of concerted effort by the Government of India in the national management of R & D as also the the changing nature of the business and political environments in the country. These aspects will be dealt with in the following sections.

3. Management of R & D at the National Level

After India's independence, the absence of a capital goods base and the utter lack of research and developmental capability within the country necessitated the active intervention of the Government into the R & D sector. The leaders of the nation realised that in order to effect the reconstruction of the country, science and technology would have to play a major role. R & D was given emphasis from the First Five-Year Plan itself.

To define goals and objectives, the Government came out in 1958 with a Science Policy Statement with the following as its aims:

1. To foster, promote, and sustain, by all appropriate means, the cultivation of science and scientific research in all its aspects - pure, applied and educational;
2. To ensure an adequate supply, within the country. of research scientists of the highest quality, and to recognise their work as an important component of the strength of the nation;
3. To encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfill the country's needs in science and education, agriculture and industry, and defence;
4. To ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;
5. To encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom;

6. and in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

It is very interesting -- and perhaps also very strange -- that a technology policy resolution was not issued simultaneously along with the Science Policy Resolution of 1958. In fact, a Technology Policy Resolution was formulated only in 1984, i.e., more than a quarter of a century later. In the meantime, an Industrial Policy Resolution was formulated and operated for about three decades even though industry's approach to innovation and the use of technology imports are crucial to the development of technology and technological capability.

In keeping with the objectives spelt out in the Science Policy Resolution, the Government of India implemented various strategies for managing R & D at the national level. These strategies include:

(1) creation of institutions to foster research in the country,
(2) funding of research activities in educational institutions,
(3) legislation for the promotion of R & D,
(4) provision of incentives and disincentives for individuals and firms to innovate , etc.

With regard to the R & D institutions and the funding of research activities, the recent position is as shown in Table 1. It is seen that the bulk of the R & D expenditure is accounted for by the central agencies, with the private sector contributing only 13%. Further details regarding the central R & D agencies is shown in Table 2. Table 3 gives the data on R & D expenditure in India over the years. The organisation of the various R & D establishments within the country and their positions in the hierarchy are shown in Fig.1.

These institutions license-out technology to private industry through NRDC (or directly in some cases like that of ISRO). The CSIR (which was specifically set up to aid private industry by providing R & D support) has licensed out over 1200 technologies since inception. Some of the important technologies successfully developed and used by the industry include infant food popularly sold under the brand name of AMUL, Swaraj Tractors manufactured by Punjab Tractors Ltd., titanium substrate insoluble anodes for the chlor-alkali industry in the country manufactured by BHPV, TEAM and WIMCO etc.. For a detailed description of each of the Government agencies performing R & D, reference may be made to Nayyar(1983) pp. 239-338.

Besides being directly involved in the creation and funding

of R & D institutions, the Government of India has also implemented the strategies of enacting R & D-related legislation and of providing incentives for individual and firms to innovate. Some of the policy instruments used to implement these strategies are:

a. Various awards and citations are offered to individuals who demonstrate scientific and technological mastery. Examples of these are the Independence Day Awards for the best innovation in various sectors given by NRDC, the Shanti Swaroop Bhatnagar Award for scientists who have made outstanding contributions to the cause of science, etc.;
b. Delicensing facilities for non-FERA/MRTP companies in India that make use of indigenous technology;
c. Financial assistance given by NRDC and IFCI in the form of seed-capital to scientists-innovators to commercialise their innovations;
d. Import ban on technologies that have been indigenously produced. This is effected by putting a CSIR nominee in the DGTD Board which approves foreign collaborations;
e. Weighted income tax allowances upto 133% on R & D expenditures directly incurred or incurred through sponsored projects in Government Labs;
f. Recognising private sector R & D labs for granting higher degrees to personnel employed there;
g. Modifying the patent laws by passing the Patents Act, 1970 and thus removing barriers on various avenues for research hitherto blocked by patents of foreign firms and their Indian subsidiaries
h. Framing and implementing the Technology Policy Statement of 1984, in order rationalise government decisions on technological developments.

4. Industrial in-house R & D in India

The share of in-house R & D performed in India has been increasing rapidly since 1958.(Table 4). A industry-wise breakup of R & D expenditure by companies for the year 1974 is shown in Table 5. A comparison of these figures with those of some OECD countries shows that by and large there is a similarity in their distributions.[Desai(1980)]. An important distinction is the lack of government finance in corporate R & D which is prevalent in those countries. Chemicals, instruments, electronics, electricals, machinery and transport equipment are the relatively research intensive industries in India.

Table 6 shows research-intensity and size of R & D expenditure in privately owned companies. Firm size appears to be correlated with research-intensity in India; a result that is distinctly different from similar analysis in OECD countries.

The content of R & D in India is mainly towards trouble-

shooting and technical services. If all R & D is classified into operational investigations, development and exploratory research, then majority of Indian firms concentrate on the former two. However, Desai(1980) observes that:

Most of the R & D of small firms was concentrated on adaptation of raw materials and on process improvements; large firms, on the other hand, spent about 40% of their R & D budget on equipment construction and product improvement.

Four major factors affecting corporate R & D were thrown up in the survey by Desai(1980). These factirs which reveal the "pathology" of Indian R & D are discussed below.

(1) The Make-or-Buy Decision:

The decision to make or buy the technology depends largely on the current resources of the company, as also the ease of importing the technology -- since most technology bought in the country is from outside sources through financial or technical collaborations. Making the technology would entail R & D expenditures with the uncertainties associated with R & D and the recruitment of competent technical personnel for the project. The import of technology on the other hand, requires the approval of the Government, which in recent years is obtained with ease. Thus, companies prefer the latter and concentrate their R & D efforts in adaptive engineering and process improvements. The 1970s which saw tight control by the government over import of technology, saw increases in R & D expenditures by firms towards product development.

(2) Short- vs Long-Term Priorities:

In Indian companies, immediate problems tend to have priority over long-term projects. Production problems like non-availability of raw materials and its consequent replacement by a substitute; Engineering developments etc., occupy a great deal of the R & D personnel's efforts. Also, development of new products which are long term projects incur the risk of having to compete with an imported equivalent. Thus, not much priority is given to long term R & D projects in India.

(3) Personnel Policy:

Most companies do not have a systematic long-term policy for personnel development. This is due to the high turnover of personnel in R & D departments. However, in firms that have had a consistent record of successful R & D, technical staff turnover is less and there is some expenditure in these companies towards personnel development.

(4) Patent policy:

In the sixties, a modest number of patent infringement cases came to light. In these cases, it was found that the foreign firms and their subsidiaries in India filed patents in a way so as to block whole avenues for indigenous R & D. A case in this point is the Hoechst vs Unichem case which was heard by the Bombay High Court. This created a necessity for new patent laws, and the Government in 1970 passed the Patents Act. The features of this act was that it reduced the duration of patents to 7 years. Provisions were made for the issue of compulsory licenses with a ceiling on the royalty. Patent protection in foods, drugs and chemicals was limited to a specific product made by a specific process. These measures have made entry into the market easier and relative less protection to patents. However Desai(1980) found that 'the evidence on the growth of R & D expenditure, sparse as it is, shows no slackening for the industry or for foreign firms after the passing of the 1970 Patents Act'.

In conclusion, it would be appropriate to quote Desai(1980) about the state of R & D in India:

The reasons for the lack of impact of R & D must therefore be sought in the way the Indian technology market has developed. At the rate of industrial growth achieved, major bottlenecks have been infrequent, and the demand for innovations to remove them has been too spasmodic to justify sustained R & D.

References:

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