Part II

Chapter VII

TECHNOLOGY TRANSFER FROM EEC COUNTRIES TO INDIA: PROBLEMS AND PROSPECTS

Till now our focus has been on the process of structural change in industry in Western Europe, its past developments, major determinants and future prospects. While dealing with the decline of traditional, maturing industries, such as Steel and Chemicals we have touched on the motives, plans and obstacles on the EEC based individual industrial companies (like McKee Davy or ICI) for redeploying part of their activities in developing countries like India. This chapter on Technology Transfer would be viewed as a part of the impact and implications of redeployment of European Industry for developing countries.

Role of Technology in Economic Development:

Eversince the Industrial Revolution, it has been apparent that the fundamental determinant of modern economic growth is what David Landes terms as the "Unbound Prometheus" of cumulative technological change. According to Ronald Findlay, a specialist on Technology Transfer/Foreign Investment:

...correspondingly, the spread of modern economic growth from the shifting dynamic centres of the world economy to the
relatively more stagnant peripheries is intimately related to the processes by which technological changes have been diffused, imitated and adopted. Speculative thinkers of the "magnificent dynamics" type from Marx, Veblen and Schumpeter to Gerschenkron and Rostow are all united in the recognition of this fact, inspite of their otherwise widely differing viewpoints. (1)

In the last twenty years the most important contribution to literature on economic growth has been made in Solow's paper 'Technical Change and the Aggregate Production Function' (1957), where the method was skewed towards the dominance of technical change. In his paper, he showed that from 1909 to 1949, for the non-farm American economy, 90 percent of the increase in output per head owed to technical change, and therefore "only a minor percentage to increases in capital per worker". But the shortcoming of his paper lay in the fact that he measured increases:

...in only two factor inputs—capital and labour—and he took into account purely quantitative changes. The size of his residual reflected this procedure. When, later, Denison included in his estimate of increased labour inputs, changes in labour quality associated with increases in education, his estimate of the

1 See Thomas F Malone, "Reflections on the Role of Science and Technology in Development", Environmental Conservation (Lausanne) vol.6, no.2, Summer 1979, pp.89-93. According to Thomas F Malone, "Development is a Continuous Socio-Economic Political Process of which Science and Technology must be an integral part".
increase in output not explained by increases in labour and capital inputs came down to less than half Solow's figure. (2)

Denison's paper entitled "The Sources of Economic Growth in the United States" was another major contribution, which tried to identify the nature of the residual. Commenting on his contribution, B.R. Williams, an expert on economic growth, writes:

...in addition to allowing for the effects of education on labour inputs, he allowed also for the improved allocation of resources between industries, changes in lags in the application of knowledge, economies of scale, and 'advances of knowledge'. His later book, Why Growth Rates Differ (1967) extended his analysis to Western Europe. Though the statistical information was less adequate than for the United States, and at times his calculations smacked a little of 'pulling rabbits out of a hat'. His results were both plausible and useful, and increased our understanding of changes in the relative importance of sources of growth from time to time and from place to place. (3)

In recent years, growth economists have been studying the role of R and D in economic development. According to


3 Ibid., pp. Xiii - Xiv.
B.R. Williams:

...there has been a marked improvement in the quality of specification and measurement as the result of work by, for example, Terleckyj, Griliches, Jorgensen, Mansfield, Minasian, Brown and Conrad. But more work is needed on the extent of spurious correlations, on the length of time-lags between R and D and its application, and on the appropriate and classification of R and D expenditures. (4)

On an industry-by-industry basis, useful econometric work has been done on the influence of R and D. If one has to achieve aggregated results, defence and space research should also be taken into account for earlier one had wrong impression that the impact of non-economically motivated research on factor-productivity is minimal. One also needs to study the inter-industry flow of new technology, for the impact of R and D in one industry may have a substantial effect on productivity in other industries.

Inter-industry and international diffusion of technology has also been studied by economic historians, but current interest is on contemporary diffusion processes. Study of this field would be crucial in unravelling unknown facts about inter-related factors like management, market structures, international flows of investment, capital markets and tax structures.

4 Ibid., p. XV.
The implications of some of these factors for public policy measures would not only be direct but also crucial:

Public policy decisions relevant to economic growth do not wait for a complete or even a reasonably full, understanding of the processes of economic growth. Nor are all economists noted for their reluctance to give advice on policy issues before they have a rounded and substantiated theory. Some of the advice given has been properly concerned to combat error at the basis of public policies or proposals; some positive advice has, regrettably, been based in error.(5)

In many countries inward direct investment has played a crucial role in the diffusion of technology and accelerating economic growth. But because of strong political objections, it is not having a smooth sailing. Economists studying this process have drawn our attention to the conflicts between policy objectives in this sphere by analysing the effects of tariffs, restrictive business practices, and management weaknesses in encouraging diffusion through the establishment of foreign companies. In this context, it would be necessary to do more research on different diffusion processes in conformity with different policy mixes.

Developing Countries and the Emerging International Technological Order:

One of the important premises currently under circulation in the debate on New International Economic Order is

5 Ibid., pp. XVI - XVII.
that the Third World is wholly dependent on the Industrialised West for access to latest technology. Proponents of this argument cite the highly fragmented and monopolistic nature of the technology sellers, which are mostly the multinational corporations. This was also echoed in the sixth special session of the United Nations, where a resolution entitled, Declaration on the Establishment of the New International Economic Order was passed:

Technological progress has also been made in all spheres of economic activities in the last three decades, thus providing a solid potential for improving the well-being of all peoples. However, the remaining vestiges of alien and colonial domination foreign occupation, racial discrimination, apartheid and neocolonialism in all its forms continue to be among the greatest obstacles to the full emancipation and progress of the developing countries and all the peoples involved. The benefits of technological progress are not shared equitably by all members of the international community. (6)

Notwithstanding such resolutions, there is a widening gulf between the Third World and the Industrialised West in R and D investments. Commenting on the concentration of global research and development budget in a handful of industrial countries, Francisco Sagasti, the noted Peruvian economist, specialising on Science Policy in developing countries, observes:

We are witnessing a shift towards the use of access to modern technology as the main vehicle for exerting control over the productive activities of Third World countries ... a few

6 UN General Assembly, special session 6, UN Doc. A/9556.
hundred people in the highly industrialized countries now make decisions on who is going to get which part of new technologies at the world level, and under what conditions.

Colin Norman, a noted analyst at Worldwatch Institute Washington, United States in his study entitled, 'Knowledge and Power: The Global Research and Development Budget', has shown that the worldwide distribution of R and D capacity has a correlation with the global distribution of economic power. His findings were corroborated by Jan Annerstedt of Roskilde University, Denmark, whose study indicates that in the early seventies, six countries -- the United States, Soviet Union, West Germany, Japan, France and Britain accounted for about 85 percent of the world's R and D expenditure and employed about 70 percent of its scientists and engineers. On the other hand, developing countries of Africa, Asia, and Latin America accounted for less than 3 percent of the global R and D budget, employing just 13 percent of the world's scientists and engineers. (See Table 1)

<table>
<thead>
<tr>
<th>Region</th>
<th>Funds (billion dollars)</th>
<th>Share of World total (%)</th>
<th>Scientists R &amp; D(thousand)</th>
<th>Share of World total(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing Countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa (with South Africa)</td>
<td>2.77</td>
<td>2.9</td>
<td>288</td>
<td>12.6</td>
</tr>
</tbody>
</table>

Table cont...n/p.
### Table 1 continues...

<table>
<thead>
<tr>
<th>Region</th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
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</thead>
<tbody>
<tr>
<td>Asia (without Japan)</td>
<td>1.57</td>
<td>1.6</td>
<td>214</td>
<td>9.4</td>
<td></td>
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<tr>
<td>Latin America</td>
<td>0.90</td>
<td>0.9</td>
<td>46</td>
<td>2.0</td>
<td></td>
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<tr>
<td>Developed Countries</td>
<td>93.65</td>
<td>97.1</td>
<td>1,990</td>
<td>87.4</td>
<td></td>
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<tr>
<td>Eastern Europe (with USSR)</td>
<td>29.51</td>
<td>30.6</td>
<td>730</td>
<td>32.0</td>
<td></td>
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<td>Western Europe (with Israel and Turkey)</td>
<td>21.42</td>
<td>22.2</td>
<td>387</td>
<td>17.0</td>
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<td>North America</td>
<td>33.72</td>
<td>35.0</td>
<td>548</td>
<td>24.1</td>
<td></td>
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<tr>
<td>Other (with Japan and Australia)</td>
<td>9.01</td>
<td>9.3</td>
<td>325</td>
<td>14.3</td>
<td></td>
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<tr>
<td><strong>World Total</strong></td>
<td><strong>96.42</strong></td>
<td><strong>100.0</strong></td>
<td><strong>2,279</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Jan Annerstedt, "Indigenous R and D capacities and International Diplomacy", Roskilde University, Denmark, 1979. Published subsequently by OECD under the title World R and D Survey, Quoted in Colin Norman, Knowledge and Power: The Global Research and Development Budget, Worldwatch Paper 31, July 1979, pp. 9-10.

Commenting on these striking disparities, Colin Norman observes:

The striking disparities between rich and poor countries in levels of expenditure on research and development are even more marked when outlays are expressed in per capita terms. In 1979, the United States will spend about $200 for every person in the country, and several European nations will spend close to that level. In contrast, most Latin American nations will spend less than $5 per person, and the poorer countries of Africa and Asia will be able to afford less than $1 per person. The developing countries' share of the world's pool of researchers has been
growing in recent years, thanks to an expansion of university education in some countries. But the Third World has only a tiny fraction of its labour force engaged in research and development compared with the portion in the industrial world. Jan Annerstedt calculates that there were about 300 scientists and engineers working on Research and Development for every one million workers in developing countries during the early seventies, while the industrial world had almost 4,000 researchers per million workers.(7)

As long as the world's R and D capacity remains confined to the industrial world, the developing countries would remain dependent, and often on inappropriate technology for its economic development.

Policy Implications:

The lack of R and D in Third World contributes to their technological dependence on the West. Apart from the fact, that new technologies are developed outside the domain of the economic control of the developing world, lack of trained scientists and engineers also warp their negotiating capacity over the import of technology. As Jan Annerstedt has argued: "Those developing countries that do not even have such a minimal R and D capacity to be able to evaluate different technologies are, in a basic sense, in the hands of

those who control the technologies". The problem is compounded by the fact that research and development is an expensive business, and that too for developing countries faced with other pressing needs. Even then a few developing countries have made considerable investments in R and D:

India's Five-Year Plan calls for the expenditure of about $3 billion on R and D between 1978 and 1983. Mexico spent approximately $360 million in 1978, about 0.6 percent of its GNP; and Brazil spent around $2.5 billion between 1975 and 1978. (8)

Significantly, one notices a low share of corporate investment in the developing countries. Funds for research and development in Third World countries come predominantly from government sources:

Of the $484 million spent on R and D in India in 1977, for example, $387 million was provided by the central Government, $41 million by state Governments, and only $56 million by private industry. One reason for the relatively low share of corporate investment is that the modern industrial sector is usually dominated by subsidiaries of foreign multinational corporations, which perform most of their R and D in centralized laboratories in their home countries. Even when multinationals do carry out research overseas, it tends to be relatively low-level work designed to adapt existing products to local markets. (9)

8 Norman, n.7, p.38.
9 Ibid., p.39.
Technology has always been an important issue in International Trade Theory. Ricardo's theory of comparative advantage was based on the existence of 'relative' technological differences among trading partners. The analytical basis for the modern version of the Heckscher-Ohlin model theory of comparative advantage drew its succour from the neo-classical model, with its taxonomy of goods, factors and production functions. The model provides a convenient framework with which to probe the effects of exogenous technical change in trade patterns, terms of trade, and functional distribution of income, in which the trade theorists had dabbled during the 1950s and 1960s. According to Carlos Rodriguez, a specialist on technology transfer:

...inspite of the early recognition given to technological differences and technological change, it is fair to say that the main focus of theoretical analysis has been the study of trade in either goods or factors of production. Only in recent years have theoretical models been developed which study 'technology transfer', which is the process through which the 'superior' technological knowledge of one trading partner is 'moved' to the geographical location of the other partners. The term 'transfer' as applied to the above process is probably misleading since it is consistently being used..., in reference to such diverse situations as the receiving country purchasing the technology, renting it through royalty payments, receiving it free, imitating it or simply allowing foreign firms to produce within its borders with the superior technology. In connection with the last interpretation, too many authors have identified
'technology transfer' with the issue of direct foreign investment, and in particular with the popular issue of the multinational corporations.(10)

Since technology is not static, but has been changing continuously,

...with new or improved products, new materials or new uses of old materials, and new techniques of production the need to acquire technology is not once for all, but a continuing one. Thus the question of technology transfer - how it is transferred, the terms of transfer and the effects of the transfer - is at least as critical to economic development, as the question of transfer of capital resources.(11)

Why Technology is transferred:

International transfer of Technology takes place when knowledge in one country (whose development has taken place there or has been acquired from external sources) is communicated to another country so that it could be utilised by the latter. According to Francis Stewart, the most well-known expert on Technology Transfer:

The communication may occur freely outside the market, or may be a commercial transaction. Effective communication of knowledge for economic


activity is not normally just a matter of communication of design sheets and formulae, but also involves an essential software element, the communication of how to use the information, which may require the transfer of skills, managerial know-how ... the sale of technology occurs when some essential part of the package which constitutes the technology, is in the commercial possession of some agent, who will only part with it for a price. (12)

The monopolization of the 'desired' knowledge might constitute this 'possession', which may occur due to the following factors: (1) because it has been first developed, even before others have caught up with the latest technological developments (2) result of legal restrictions imparting a protective shield to the owners of technology, which would enable them to sell it much to the chagrin of imitators, through patent laws and trademarks. In both cases, a monopolistic element enters the market, which allows the owners of technology to charge monopolistic rents i.e. to charge a price, which is far in excess of the actual cost incurred during communication:

The monopolistic element may pervade a much wider area than that specifically covered by legal protection, because of the bundled aspect of such technology, so that some element of the bundle which is apparently freely available

12 Ibid., p.2.
without legal restriction is in practice protected by restrictions affecting some other element in the bundle. The actual costs of communication are by no means negligible. Technology Transfer may command a price to cover these costs in the absence of any monopolistic elements in the market for technology. (13)

One of the major elements in technology transfer is the right of using certain trademarks and also the access one has to certain markets and inputs. By having access to inputs, one can ensure that the firm can keep abreast of the latest technical developments. These all come under the rubric of marketing rights:

These may be highly valuable to individual firms in helping gain markets or inputs. While they are often associated with the communication of useful knowledge, and form a significant part of technology contracts, they are not themselves accurately described as consisting in the communication of useful knowledge. Nonetheless, in the context of discussion of international technology transfer, the acquisition of marketing rights forms an important element of costs and is also a significant aspect of motivation. Discussion of the international transfer of technology thus covers both the communication (or sale) of knowledge and the sale of marketing rights. (14)

13 Ibid., p.3. Technology as referred to in this chapter, conforms to the definition as given by J. Baranson in his study 'Technology and the Multinationals', which refers to "the package of product designs, production and processing techniques and managerial systems that are used to manufacture particular industrial products".

14 Ibid., pp.3-4.
If International Transfer of Technology has to take place, two necessary conditions have to be met. They are:

(1) decision makers in one country have to express their need for a particular technology.

(2) Technology transfer may also take place because a country may not have the necessary know-how. In such a case, the transfer of know-how may be conditioned by the extent of its need for industrial and/or defence purposes, and the extent of willingness of the technology-base country.

**Condition One:** Some economists like S. Kuznets believe almost axiomatically that countries should go in for the latest technology, for it would definitely benefit them. In his classic entitled *Modern Economic Growth*, he observes: "Whatever the source, the increase in the stock of useful knowledge and the extension of its application are of the essence of economic growth ... no matter where these technological and social innovations emerge - and they are largely the product of the developed countries - the economic growth of any nation depends upon their adoption". 15

Kuznet's view would be unacceptable, if one takes into account factors like social interest and long-term development prospects of developing countries. One has to qualify Kuznet's view for three reasons:

15 Ibid., pp.4-5.
(1) There are biases in the development of technology which are greatly influenced by the economic and social conditions in the economy, where it is initially developed. As a result the technology developed in the West often tends to be increasingly capital-intensive, of increasing scale of production and geared to the needs of a consumer society in the high income bracket. This also confirms the fact that technical advance is not neutral with respect to factor use and product design.

(2) Secondly, one has to reckon with significant learning effects. The Japanese case clearly illustrates the fact that restricted import of technology might contribute to local development of technological capability.

(3) Transfer of Technology involves more than the recent progress in Technology; it also involves the transfer of marketing rights.

Current trends however show that the social objectives of industrial growth in the developing countries have been relegated to the background, and even if technology is considered 'neutral', (which in itself is debatable), the West has put the developing countries in a precarious position by influencing international institutions, restructuring aid, trade and monetary relations. There is also enough literature analysing the cost aspects of technological
dependence, such as excessive financial costs, extra-territoriality, inappropriate technology, and inhibition of local scientific and technological development. 16

**Condition Two:** There is absence of indigenous technology. Only a few countries exercise monopoly over technological innovations. A study by OECD (1970) indicated that out of 110 significant innovation in the twentieth century, 60 percent were made by United States, 14 percent by United Kingdom, and 11 percent by Germany. Although this data reflects the fact that even in the developed countries, innovations were not evenly spread, the reality is that innovations were concentrated in a very few countries. The two countries which were creditors in terms of royalty payments were US and UK. In 1977, US alone, accounted for nearly two-thirds of the gross receipts of royalty payments among the major recipients 17 the main European countries accounted for nearly 30%, and Japan for 3%. According to Frances Stewart:

These figures reflect the past history of technological domination by a few developed countries. But much of this domination remains. The developed countries are responsible for

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97% of world research and development expenditure. Six nations employ nearly 70% of the world's research and development manpower and spend nearly 85% of R and D funds; only 6% of an estimated 3½ million patents issued in 1972 were granted by developing countries, and less than one sixth of those issued by developing countries were owned by developing country nationals. (18)

With the exception of India and Brazil, developing countries import over 90% of plant and machinery. Recently, there has been slight improvement in the situation in terms of technological capacity:

...an increase which, as is to be expected, has been unevenly spread among developing countries. This is indicated by rising expenditure on research and development and, by some evidence of incipient exports of technology by some developing countries. But while these developments are potentially significant, particularly in relation to policy, they are of relative insignificance in the general picture. The developed countries retain a massive preponderance in technological innovation which is a fundamental fact which must underly any discussion of technology transfer: it is this preponderance that is sometimes described as technological dependence. (19)

Transfer Mechanisms:

Most of the technology is transferred informally through books, journals, sales literature, through personal contacts and through the mobility of trained people. However distinction should be made between direct and indirect

18 Stewart, n.11, p.7.
19 Ibid., p.7.
mechanism of transfer:

...direct mechanisms are those when the recipient enterprises are in direct contact with the suppliers of technology; indirect transfer occurs when a company in an advanced country plays an intermediary role packaging the technology for the developed country. In practice this distinction is too firm; there are a large variety of types of transfer involving varying degrees of packaging. (20)

Direct forms of transfer involves direct contracting of individual experts and consultant companies, transfer of process engineering through capital goods, disseminating technical information, etc. Indirect mechanisms, on the other hand, involve complete packaging in the form of direct investment, through a wholly-owned subsidiary, through joint ventures, turn-key projects and license and management contracts. The most important are licensing arrangements:

License agreements encompass a considerable range of contracts which vary in what they cover, in the restrictive provisions involved, and in the form and rate of payment. Some license agreements contain provisions for some equity participation; some include management contracts, or the right of the licensor to appoint managers and directors; licensors may sometimes appoint quality control experts, and occasionally control marketing through wholly-owned subsidiaries. License agreements often contain restrictive clauses in relation to the rights of the licensee to export, to conduct and/or use independent research and tie-in causes, whereby the licensee has to purchase inputs from the licensor...(21)

20 Stewart, n.11, p.11.
21 Ibid., p.12.
Transfer mechanisms vary between countries, industries and over time. There is a direct correlation between the technology package and the level of a country's development, for a developing country might lack the capability to handle the package.

The nature of transfer mechanism would be different in different industries. If the country is technologically sophisticated, it would find difficult to rely on direct transfer. The significance of trademarks and extent and nature of property rights over technology would vary with industry. In a survey conducted by UNCTAD in 1975, industries were classified either as 'modern' (involving heavy research and development) and with a recent track record of technological innovation, 'traditional' and 'other' both of which use tested technologies.

They found that for 13 countries, 57% of the contractual arrangements were in the "modern" classification in manufacturing, but there was a wide dispersion between countries. Relatively sophisticated countries, like South Korea, had as much as 80% of contractual arrangements in the modern industries, presumably indicating that direct transfer occurs in mature industries with well established technologies; but in Dahomey, 80% of contracts were outside the research intensive sectors. A comparative study of pharmaceuticals, chemicals and electrical engineering in Latin America found significant differences in preferences of supplying firms for different mechanisms of transfer. Broadly, these differences in preference were reflected in the actual arrangements. In the pharmaceutical industry, there was a strong preference for transfer via wholly-owned
subsidiaries, and also for patent protection of the technology transferred. In chemicals, the majority of firms preferred joint ventures, or pure licensing arrangements - the preference being greater the smaller the size of the supplying firm. In electrical machinery - which on the whole is a mature technology which has been widely dispersed - by far the largest number of preferences was for licensing agreements. (22)

In her classic study of metal working and chemical firms in three Andean Pact countries, Lynn Mytelka, of Carleton University, Canada, has shown the distinction between technology transfer via licensing and direct acquisition through experience of personnel, non-negotiable means (e.g. copying), the buying of machinery, and processes, journals and professional meetings: "Ownership structure, product sector and firm size ... correlated highly with the decision to license".

Table 2
Ownership Characteristics of the Contracting Enterprises in the Technology Receiving Country, end 1970

<table>
<thead>
<tr>
<th>Country</th>
<th>% of contracts in enterprises with</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Majority foreign ownership</td>
<td>Minority foreign ownership</td>
<td>Wholly nationally owned</td>
</tr>
<tr>
<td>Cyprus</td>
<td>48</td>
<td>44</td>
<td>8</td>
</tr>
<tr>
<td>Colombia</td>
<td>45</td>
<td>12</td>
<td>43</td>
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</tbody>
</table>

Table cont... n/p.

22 UNCTAD, Major Issues Arising in the Transfer of Technology to Developing Countries, TD/B/AC.11/10, Rev.1, quoted in Stewart n.11, pp.14-16.
Country variation as reflected in Table 2, reflects not only national policy towards technology transfer and private foreign investment, but also the level of development, especially in terms of the technological and managerial sophistication of the country concerned.

In a study of sources of technology in South Korea, two researchers, G. Pursell and Y.W. Rhee found that formal mechanisms of transfer, in the form of licenses and technical agreements were not of prime importance. 23

Formal mechanisms from foreign suppliers played a crucial role in the modern sector: accounting for 21% of all important technology sources. Even then it was miniscule as compared with other sources of foreign technology, which included technology as embodied in Korean labour and management: 18.6%, foreign suppliers of capital equipment or raw materials (8.2%), and foreign buyers (.6%).

In the traditional and resource based sectors formal mechanisms played a significantly smaller role. While there may be special factors in S. Korea accounting for some of the importance of informal mechanisms - for example, buyers can only play a significant role in an export-oriented economy - the study suggests we may often overemphasize the role of formal mechanisms in technology transfer.(24)

Data available from UNIDO suggests that less packaged forms of transfer have become the accepted form, vis-a-vis both recipient and supplying countries. Recipients are becoming technologically more sophisticated, so now they are in a position to contribute to the elements of the package themselves. But ironically they are switching over to more sophisticated technology-based industries, where packaging is equally crucial:

Increasing political and economic sophistication, combined with the accumulation and spread of knowledge about the technology transfer process, has increased countries' intervention in technology

24 Ibid., p.6.
transfer, sometimes involving a search for unpackaged alternatives. In some of the supplying countries, government regulations curtailing investment overseas, and fears of the riskiness of overseas investment in the light of moves among recipients to reduce equity participation, have contributed to more arms length forms of technology transfer. (25)

One however gets a mixed evidence. The noted economist J. Baranson has observed that:

...the most dramatic of the new strategies has been the adoption by some US firms of an explicit policy to shift from equity investment and managerial control of overseas facilities to the sale of technology and management services as a direct means to earn returns on corporate assets. (26)

His observation is based on five major research-intensive industries. In countries like India and Andean Pact countries, where government policies have been directed against packaged forms of technology inflow, there is evidence to suggest a move towards less packaged forms. But from Table 3 it can be deduced that for the world as a whole, and for developing countries other than Latin America, there has been a significant increase in the proportion of US technology receipts which are intra-firm. The US accounted

25 UNIDO, Recent Developments in the Regulation of Foreign Technology in (1978) Selected Developing Countries, ID/NG.275/8.

for 73 per cent of gross receipts for technology among the US, Japan and Europe in 1969, although the proportion has declined to 68 per cent in 1977, giving the impression that US technology supplies are more often intra-firm than supplies from other countries.

**Table 3**

<table>
<thead>
<tr>
<th>Year</th>
<th>World</th>
<th>Latin America</th>
<th>Other Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956</td>
<td>64</td>
<td>88</td>
<td>n.a.</td>
</tr>
<tr>
<td>1960</td>
<td>62</td>
<td>83</td>
<td>72</td>
</tr>
<tr>
<td>1972</td>
<td>76</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>1976</td>
<td>82</td>
<td>82</td>
<td>90</td>
</tr>
</tbody>
</table>


India's attitude towards foreign investment or technology transfer is markedly different from other developing countries. There is no direct corelation between foreign investment and foreign technology. Pranab Mukherjee, who has been Finance Minister of India since January 1982, has reiterated this fact in his latest book, *Beyond Survival,*
when he writes:

In many cases, foreign technology is not accompanied by foreign investment. Purely technical collaboration agreements are favourably considered. In fact, the bulk of the foreign collaboration agreements belong to this category. Approval of a foreign investment or collaboration proposal depends on various factors like the nature of technology, the priority, nature of the industry, the terms offered, etc. (27)

Government of India's Policy Towards Technology Transfer/Foreign Investment:
**Foreign Equity:**

According to the guidelines issued by the Indian Government, foreign equity shareholding in a joint venture in India, should be pegged at 40 percent of the total equity capital of the company:

However a higher percentage of foreign equity is allowed on merits in priority industries if the technology required is not available in the country or if the venture is largely export-oriented. On technology considerations, foreign equity can go up to 74 percent in projects which would cater mainly to the home market in respect of export-oriented projects, the percentage of foreign equity may even go up to 100 percent. (28)

Technology Payments:

The Government of India has stipulated, that a foreign firm entering into licensing arrangements in India can receive the payment for technology and knowhow in the form


of royalty, or lumpsum payment or both:

...the rate of royalty . . depends on the nature of technology and is calculated on the basis of net ex-factory value of the product. Royalty is normally limited to 5 percent and for a period of five years from the date of commercial production or eight years from the date of agreement. (29)

According to Pranab Mukherjee, the Government is quite liberal towards foreign investors, and to the latter it "freely allows remittances of royalties technical fees, interest and dividend on capital invested in India in foreign currencies. Capital invested by them can be repatriated at any time, together with capital appreciation, if any, after the payment of taxes." (30)

The Government's liberal policy towards import of technology has given rise to a spurt in the number of foreign collaborations. Between 1957 and 1 January 1983, over 7,200 foreign collaboration agreements have been signed with developed countries like USA (110), the UK (106) FRG (110), Switzerland (41), Japan (51), and France (28). These agreements not only involved transfer of technology but also foreign financial investment. A countrywise list (from selected EEC countries) of foreign collaborations approved by the Government of India, during the period 1978-83 is given in Table 4. Most of the technical collaborations were in the field of

industrial machinery, transportation equipment, electrical equipment, machine tools, metallurgical industries, chemicals and related industries:

Table 4
Selected Country-wise (EEC) break-up in foreign Collaboration Cases Approved by Government of India during 1978-83(Jan.-June)

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<td>2</td>
</tr>
<tr>
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<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
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</tr>
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<td>61</td>
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</tr>
</tbody>
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Source: Pranab Mukherjee, Beyond Survival (New Delhi,1984), pp.204-205.

Foreign Collaboration in India: A Review:

The economy of pre-independence India had the following characteristics: (i) Its industries were skewed towards textiles and agriculture-based goods, and import dependence was prevalent in a wide variety of goods (ii) there was division
of large-scale industry between foreign (largely British) and Indian ownership, with joint enterprises virtually non-existent.

The post-independence growth, however, has been based on technology-intensive industries like engineering and chemicals. It also laid emphasis on heavy industrialisation, which was to form the base for a 'self-sustaining' and 'self-generating' growth. State supported heavy industry was taken to be an instrument of progress. The principal architect of the Second Five Year Plan, late P.C. Mahalanobis strongly supported such an idea. In an officially published and oft-quoted paper, he made a fervent plea for heavy Industrialisation:

In the long run, the rate of industrialisation and the growth of national economy would depend on the increasing production of coal, electricity, iron and steel, heavy machinery, heavy chemicals and the heavy industries generally which would increase the capacity for capital formation... heavy industries must, therefore, be expanded with all possible speed. (31)

But the emphasis was always on 'self-reliance', so it was not surprising to see the enactment of the Industrial Development and Regulation Act in 1951 and the act on regulation of

technology imports in 1956. The committee which regulated them also had a say in control of foreign investment:

Foreign investment without technology imports was generally not allowed, though an exception was made for certain non-controlling investments by non-resident Indians in the 1970s and for Arab investments in 1982. The latter, though allowed in principle, continue to be regulated. (32)

Foreign enterprises did not face discrimination till the mid-sixties. But with industrial recession setting in 1966, the Industrial Licensing Committee started discriminating against foreign enterprises. On 27 November 1968, the Government categorically declared that only in high-technology and that too, in export-oriented industries, foreign investment would be permitted. But it also added a rider which declared that all cases where the foreign share of equity exceeded 40 percent would require approval of the Cabinet. To the chagrin of the foreign enterprises, the Monopolies and Restrictive Trade Practices Act was also passed in 1969, which introduced special licensing procedures for undertakings belonging to business houses under foreign ownership.

The Foreign Exchange Regulation Act (FERA) enacted in 1974, had tried to assuage the bruised feelings of the

foreign investors by exempting companies with 40 percent or lower foreign share in equity from the application of the MRTP act. But the "1974 Act also compelled foreign owned companies to reduce the foreign shareholding to 40 percent though a higher percentage was allowed to companies which could convince the Government that they possessed high technology or exported a large proportion of their output". 33

In the wake of FERA, one saw a large number of divestitures. Although its aim was to relax the rules imposed on foreign companies, foreign investors, who wanted to retain majority ownership did not swallow the bait:

A handful of them left India, some made agreements with their Indian affiliates whereby they would lose access to their parents' technology if the parents' shareholding in them fell any further. By and large the MRTP and FERA Acts discouraged foreign investment, which fell in the seventies. 34

Major Issues in Foreign Collaboration
Technology Transfer in India

(i) Import of Repetitive Technology:

In the draft 5th Five Year Plan, it was suggested that import of repetitive technology should be avoided, and

...where import and assimilation had already taken place all possible measures should be taken to promote horizontal transfer of that technology to other enterprises. 35

33 Ibid., p.27.
The Thirty-First Report of the Committee on Public Undertakings (1978-79) of the Sixth Lok Sabha, on Foreign collaboration in Public Undertakings as a follow-up suggested some additional measures:

...that where for the same product collaborations had been made with different countries, it would be useful to make a comparative study of the technology and the cost of product under different collaborations so as to assess the comparative merit. (36)

Responding to the suggestion of the Committee, the Bureau of Public Enterprises had stated that the Directorate-General of Technical Development, Ministry of Industry, had a Technological Data Bank, which had been assigned the task of making a comparative study of various technologies, with a view to ascertain the cost and merit.

(ii) Lack of Robust Consultancy Service:

In India, there is no systematic registration of consultancy organisations in various fields, with a view to identifying the specific areas in which consultancy could be developed. The Committee on Public Undertakings was of the view that it was a deplorable situation that the Ministry of Industrial Development "had not been able to indicate categorically the fields in which there was absence

36 Ibid., p.3.
of consultancy organisations". They felt that, "a procedure should be evolved by which consultancy organizations in various fields might be compulsorily required to enlist themselves with the Ministry/DGTD." The Committee also desired that "Government should in consultation with the Public Undertakings and national research organisations like NRDC (National Research Development Corporation), Department of Science and Technology, CSIR (Council of Scientific and Industrial Research), etc. take steps to identify the specific areas in which consultancy was yet to be developed and consider whether the existing organisations could be strengthened for providing consultancy services in such fields." 37

However, the Government has taken certain steps to strengthen the consultancy services: they are: (i) In order to ensure that consultancy services available in the country are fully utilised, import of foreign consultancy is permitted only in those fields "where Indian Consultancy Services are not available. Where foreign consultancy is also required in addition to Indian consultancy, it is provided that the Indian consultants should also be associated with such projects". 38

(ii) Giving Incentives: There are provisions in Indian Income

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37 Ibid., p.
38 Ibid., p.3.
Tax Act 1961 which entitles assessees (firms providing technical know-how or rendering technical services) to a deduction for purposes of computation of taxable income, of 40% of income by way of royalties, technical service fees, commission or otherwise (except gains).³⁹

(iii) Lack of Standardization: Although India has been obtaining technology from different sources, it has failed to evolve some standardisation/standard specifications. It was necessary to bring about standardisation and rationalisation of equipments, so as to reduce dependence on imports and encourage full utilisation of installed capacity, especially in the public sector. However, lately some actions have been taken by the Technology Development Division of DGTD in bringing about standardisation and rationalisation of equipment. They are:

(a) Endeavour is made to exclude from technical package certain know-how or equipment for which capability has been developed or absorbed.

(b) Wherever possible, import of design and drawings has been encouraged through R and D institutions/consultancy engineering firms.

(c) Mechanism of forward planning is intended to obtain or develop the technologies on centralised basis in selected areas and to give further impetus to horizontal transfer of technology after due regard to productivity aspects etc.

(d) Reviews of norms of import of capital equipment, material etc. through collaboration which will give impetus to the capabilities developed in the country in the interim period.

(e) closer rapport and communication between consultancy and design engineering firms, ISI and R and D which would give a further fillip to standardisation and standard specifications.

(iv) Inadequate Expenditure on Research and Development: There is need to assess the relative advantage of investment in R and D on a long-term basis instead of relying on import of technology from abroad. According to data available till March 1979, the overall expenditure on R and D in the public sector as percentage of turnover was only 0.6 percent, which was expected to be about 1 percent by the end of the Fifth Plan. According to the information supplied by the Government to the Committee on Public Undertakings (1978-79).

...in the area of high investment a long-term investment in research and development is generally desirable so that over a period, the necessary infrastructure for absorbing the imported technology is established. Funding for research and development is under review and a proposal for levying R and D cess has also reached an advanced state. Even now, funds are allocated for R and D activities in several central agencies within the overall financial constraints of the Government. In addition to providing direct support to R and D from the central fund, alternative forms of supporting R and D activities in the industry have been given effect to, particularly in the form of fiscal incentives. (41)

40 COPU (1978-79), n.35, p.4.
Transfer of European Advanced Technology to India: A Case Study of Computers:

In the earlier section, an attempt was made to understand the major constraints which operate in India, on the issue of technology transfer/foreign collaboration. Understanding of these constraints is important for a meaningful evaluation of the foreign collaboration agreements on national, sectoral and unit basis. In this case study of India's experience with an EEC based international computer company, ICL of UK, it would be tested whether developing countries like India, can get the best out of bargaining with high technology multinationals like ICL. From this case it could be shown that (i) at the international level, sea-changes in data processing technology, and in the structure of the industry, generated new opportunities for India to become self-directed in computing. (ii) at the domestic level, India has succeeded in nurturing the institutions required to exploit these international changes in way that could favour the country.

India and International Computer Industry: 1960-1980:

By the mid 1960s, the Indian Government had three stated aims (1) that India should be involved in the ownership and control of foreign computer subsidiaries in the country. Secondly, by the late 1960s, wholly Indian producers should be able to cater to most of the country's needs, with
foreign units supplying very futuristic technologies and large systems. Thirdly, India must have access to and contribute actively in the manufacture of most advanced systems of international standards.42

In 1966, the two foreign computer companies which had substantial sales and manufacturing presence in India were US based International Business Machines and UK based International Computers and Tabulators (ICT). By 1968, ICT had come under the tutelage of International Computers Limited (ICL).

In 1966 and 1968, IBM was advised by the Government of India to share ownership of its local operations with Indian nationals. IBM however refused to budge under Government pressure and countered that centralized coordination and control was essential for its highly internationalized and interdependent operations.43

This precluded sharing ownership of any particular international subsidiary with individuals of the country in which the firm's


unit was operating. Indeed, in 1968 IBM advised the government that it would terminate its operations in India rather than share ownership of its Indian subsidiary. The government decided not to press the matter, and IBM was permitted to retain full control over its Indian operations.\(^{(44)}\)

ICT/ICL's experience in India was much more complicated. Its operations had been bifurcated into two units: one for manufacturing, and one for sales. The manufacturing unit had a 40 percent ownership, which apparently gave the impression that ICT/ICL was sensitive to Indian policy concerns:

However, the sales unit was appointed the sole distributor of the manufacturing unit's products (this was in fact a provision of the manufacturing unit's statement of incorporation), and, furthermore, made all of the decisions about the activities it would undertake. This relationship rendered irrelevant Indian partial ownerships of the manufacturing unit, which could not affect the activities of ICT/ICL in India.\(^{(45)}\)

In the late 1960s, the Indian Government was finding it difficult to ensure "effective Indian participation in the ownership and direction of the local units of foreign computer firms". But in the 1970s, the Indian experience was quite different. For example, after intense pressure and prolonged negotiations ICL agreed to coalesce its two

\(^{44}\) Grieco, n.42, p.613.

\(^{45}\) Ibid., p.613.
units, and to retain 40 percent of the successor corporation in India, thus ensuring Indian presence in both the marketing and manufacturing activities of ICL in India. While exerting pressure on ICL, the Government was at the same time trying to resist Burrough's wish to establish a wholly owned subsidiary. After seeing Burrough's resistance crumbling before the Indian Government's tough stand, ICL announced in 1977, that it was eager to establish a subsidiary in India, as a joint venture with Tata Enterprises; with each deciding to own 50 percent of the new company.

After neutralising both ICL and Burroughs, the Indian Government turned towards IBM. In 1973-74, it again started pressurising IBM to share equity of its local unit with Indian nationals:

...the company responded by offering new and quite high levels of manufacturing activities that would be useful to the government in terms of foreign exchange earnings and the transfer of technology, as well as direct technical assistance to India's data processing programmes, to be exchanged for an exemption from the Indian policy that the company share equity. (46)

But IBM was in no mood to oblige the Indian Government. The former made it clear, that it would prefer to withdraw from India, rather than be coerced to share ownership, and be subjected to other controls on its Indian operations:

46 Grieco, n.42, p.614.
In contrast to 1966 and 1968, the government decided to press its maximum demands on equity. IBM announced in November 1977 that it would withdraw from India by June 1978 - as in fact it did. Thus, in contrast to the 1960s, the government had decided by the mid 1970s that it would afford to pursue its policy even at the cost of losing the world's premier computer enterprise. (47)

During the late 1970s Burroughs and ICL consolidated their position in India. At the same time a new development was taking place in India, with the emergence of several wholly Indian systems - engineering firms, which were not under direct control of the Indian Government.

While in the 1970s, the only wholly Indian computer enterprise had been Electronics Corporation of India Limited (ECIL) under the central government, by the end of the decade, three more Indian firms had sprung up. These firms were specialising in designing and assembling systems. They were Hindustan Computers Limited (HCL), a joint venture between a private Indian firm and the State Government of Uttar Pradesh; DCM Data Products (DCM), a subsidiary of Delhi Cloth Mills; and Operations Research Group (ORG), a subsidiary of Sarabhai Enterprises. The fourth Indian enterprise was International Data Machines (IDM) founded by ex-employees of IBM, with assistance from IBM, which marketed

and serviced a micro-system, designed and assembled by the Indian firm, National Radio and Electronics Company, a subsidiary of the Tata Enterprises. According to data available with International Computers India Manufactures published in its Annual Report and Accounts, by 1980, ECIL's Computer Division had about 1000 employees; together Burroughs and ICL employed roughly 600 employees; and the new Indian Companies employed about 1900 employees. 48

**Indigenization of Computer Needs:**

India's sponsoring of local firms was aimed at maintaining indigenous sources of supply which could cater to most of country's computer needs. India's performance in this sector is reflected in Table 5. The data assembled in this table incorporates absolute numbers, and the percentage shares of the total, of all systems installed during 1960-1980. From the table the following observations can be made:

In the first six years after India announced its desire to be self-sufficient in computers, the country's progress was sluggish. As a result there was no marked progress toward the development of an indigenous computer supplier. 49

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49 *Commerce* (Bombay) 31 May 1980, p.925.
Table 5
Computer Market Structure of India, 1960-1980 (systems installed, by source and by period, in absolute numbers and percentage shares of total)

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<td>106 73.0</td>
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<td>145</td>
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<td>99.7</td>
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<td>317</td>
<td>99.8</td>
<td>962</td>
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</table>

Between 1967 and 1972, ECIL was the principal supplier of 8.5 percent of all systems which were set up in the country, and its market share was as low as 3.4 percent. In sharp contrast, IBM was instrumental in setting up three-fourths of all systems for the same time span, and the proportion of its market share was almost the same that it had enjoyed from 1960 to 1966, the period before India started charting out its national computer policy.

From the table it is also evident that between 1973 and 1977, ECIL had gradually become the largest systems supplier in India at the expense of IBM's market share.

In the last years of the decade, wholly Indian enterprises had become an important force to reckon with:

Within the indigenous computer industry what was remarkable about the 1978-80 period was the extremely important role taken on so rapidly by Indian enterprises other than ECIL. During this period the four new suppliers almost immediately outpaced ECIL. This was a noteworthy development because the new firms had made deliveries for no more than three years, while ECIL had done so for almost ten years. Moreover, while in mid-decade ECIL's share by number of installations was greater than that of foreign suppliers, during 1978 to 1980 it fell behind both enterprises not fostered by the central Government and foreign suppliers active in India. (50)

50 Grieco, n.42, p.615.
India's technological lag increased in the 1967-1972 period in contrast to the pre-policy period of 1960-67, but in 1973-77 period this technological regression was reversed, and by the end of the decade the technological gap had been considerably narrowed. IBM and ICL had contributed to the technological lag of 1967-72 by increasing its manufacturing efforts, which consisted of refurbishing previously used imported systems and then renting them out to their Indian clients. However in the mid and late 1970s, imports became the principal form of access to foreign-origin systems, contributing to India's increasing technological sophistication of its computers, and also bridging the technological lag.

**Contribution of ICL to India's Computing Capability:**

In India, ICL's operations were largely confined to business manufacturing and hiring of data processing business machines. Its earnings in India mostly came from hire charges levied through its Indian subsidiary. The Twenty-Eighth Report of the Public Accounts Committee (1980-81) of Lok Sabha, in its report on International Computers Limited, UK made the following criticism on its computation of business income:
The hire charges receivable by the Indian subsidiary were inclusive of the rental liability payable by it to the foreign multinational company. Under the arrangement which the Indian company had with the foreign company, an amount equal to forty-five percent of the gross rental charged by it to its customers was payable to the foreign company as its rental liability in turn. This amount of forty-five percent of rental in fact represented the Indian turnover of the foreign company viz. the assessed company. The head-office expenses deductible in the computation of business income of the assessee company should have been related to this turnover as against the total turnover. Instead, the assessee claimed and was allowed such expenses in the ratio of the entire rental income of the Indian subsidiary to the world turnover of the assessee company. The excessive allowance of head office expenses year after year resulted in under-assessment of income of the foreign company by Rs. 64 lakhs in the assessment years 1961-62 to 1974-75 with consequent short levy of tax of about Rs. 42.5 lakhs in these years. (51)

When this criticism was made known to the Ministry of Finance (Department of Revenue), of the Government of India, its laconic reply was the following:

...since the assessment orders from assessment years 1962-63 to 1974-75 (both inclusive) were completed more than 2 years prior to the date of receipt of the audit report, action under Section 263 (Cancellation by Commissioner of Income-tax of assessment orders prejudicial to revenue) could not be taken. Again, as all the material facts necessary for the assessments in so far as this issue is concerned, had been fully disclosed, no action under Section 147(a) (re-opening of assessment for failure on the part of the assessee to disclose fully and truly

all material facts) could be taken. ...(52)

As an atonement, but also as an excuse, the Finance Secretary added:

The computation of allowance for the head office expenses by the multinationals has been a major problem for the Department. It is in recognition of this problem and the difficulty in assessing the proper allowance for the head office expenses that Government have enacted Section 44 C of the Income-tax Act in 1976. Some of the difficulties which we have been hitherto encountering in allowing for head office expenses should now be overcome. We are progressively becoming wiser and trying to catch up with the tricks of the multi-nationals. With the implementation of the Foreign Exchange Regulations Act, and with the conversion of the branches of foreign companies into Indian companies here, the problem would largely disappear because they have not converted into Indian companies and the question of payment of head office expenses will not hereafter arise in the case of these companies.(53)

The Committee on Public Undertakings was however not impressed by this reply, and saw no justification for the indulgence shown by the Government to ICL on the following grounds viz. the necessity for import of sophisticated technology and conservation of foreign exchange resources through the building up of export potential. Instead, the Committee emphasised the need for a review of the technical collaboration agreements so as to ensure that the import of technology

52 Ibid., p.3.
53 Ibid., pp.4-5.
was consistent with India's needs as gauged by the development of indigenous know-how.

While taking into account the strictures passed by the Public Accounts Committee regarding the irregularities committed by ICL, one must concede that ICL had helped the Government of India in having a better bargaining position vis-a-vis IBM. For example, when IBM refused to fabricate its IBM-370 models (especially models 115, 125, or 135), ICL came to India's rescue by agreeing in 1977 to assemble the new ICL-2904s, which compared favourably with the 370 models which IBM was likely to have fabricated in India. Secondly, not only in India, but also in other developing countries, ICL had contributed in enhancement of bargaining opportunities.\footnote{Grieco, n.42, p.622.}

ICL's contribution to India's computing capability was initially made through its ICL-1900 series which was meant for business data-processing. However, the training it imparted in its Data Centres was rudimentary in nature and contributed very little to increase in computing knowledge. This was pointed out by the Public Accounts Committee (1975-76) of the Lok Sabha, which commented:

They provide only that kind of information that is required for them to carry on the business over here... their training programme is completely geared to their business interests and activities here.\footnote{55}
To an Indian buyer, ICL had only second generation computers to offer, which consisted of 1300, 1909, 1903, 1902 SIRIUS, 1904, 1901 and 1004 (calculating machines); except SIRIUS, almost all the computers were meant for business data processing. However, India had very little option but to depend on ICL (and IBM) because of (i) ignorance of the second-hand computing market; (ii) ignorance of the existing international technology, and (iii) lack of communication at an inter-organisational level.\(^{56}\)

The most important factor which contributed to India's initial dependence on ICL was of its own making, which was result of:

a combination of an ill-conceived computer strategy and an application of general industrial policies that unintentionally detracted from achievement of the country's computer goals. In terms of strategy, throughout the 1960s India sought to move toward the efficient (i.e. intensive) use of a small number of large systems. This interest in large systems through the end of the 1960s (when in the developed countries consumers were switching to small systems) led India to use computers that the country was least able to fabricate domestically.\(^{57}\)

\(^{56}\) India, Public Accounts Committee (1975-76) Lok Sabha, Two hundred and twenty-first Report, Computerisation in Government Department, p.1.

The Government was desperate during the late 1960s and early 1970s for some form of computer manufacturing in India, so it had turned to ICL (and IBM) offering it incentives in the form of control over foreign earnings from the export of non-computer products. This was encouraged so that the necessary capital equipment could be imported:

This policy, of course meant that only IBM (and ICL to a lesser extent) could be highly active as computer suppliers in India, since only they had the export capabilities that India had made a prerequisite to the importing of items needed for the local supply of systems. (58)

In 1971 and 1972, there was a sea-change in the government's strategy, which now laid emphasis on small systems, which could be designed and assembled in India with imported components and peripherals. Apart from retaining ICL, the government succeeded in attracting Burroughs. It enabled the Government to lower the cost of pushing IBM on the equity issue, and also on other issues relating to control over IBM's operations in India.

ICL's role in India, therefore, has been more as a pawn in the Government's strategy in ousting IBM from India, than as a conduit of technology transfer. The Government's

aim has been, since 1976, to make ECIL the 'national champion' in computers, with ICL allowed to fabricate (with increasing levels of local value added) minisystems - in particular the ICL-2904 - with capabilities beyond the range of systems provided by ECIL.

A case study of ICL's operations in India clearly shows that although initially India was unsuccessful in modulating the local activities of powerful, high-technology computer firms like ICL, over time it could persuade ICL to conform to its data processing objectives. As a result to-day the country's data-processing industry has been able to strike a much more balanced note as it was in the late 1960s.