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BRIDGING THE TECHNOLOGY GAP

How Dynamic and Far-sighted Is The Indian Corporate Sector?

Padmini Swaminathan

Issued for Discussion

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I. INTRODUCTION

"While government will continue to follow the policy of self-reliance there would be greater emphasis placed on building up our ability to pay for imports through our own foreign exchange earnings. Government is also committed to development and utilisation of indigenous capabilities in technology and manufacturing as well as its upgradation to world standards.

"... There is a great need for promoting an industrial environment where the acquisition of technological capability receives priority. In the fast changing world of technology the relationship between the suppliers and users of technology must be a continuous one...

"With a view to injecting the desired level of technological dynamism in Indian industry, government will provide automatic approval for technology agreements related to high priority industries within specified

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parameters. Indian companies will be free to negotiate the terms of technology transfer with their foreign counterparts according to their own commercial judgement. The predictability and independence of action that this measure is providing (sic) to Indian industry will ***induce*** *them to develop indigenous competence for the* ***efficient absorption*** *of foreign technology. Greater competitive pressure will also induce our industry to* ***invest much more in research and development*** *than they have been doing in the past."*

"...Government will ***fully protect the interests of labour,*** *enhance their welfare and* ***equip them*** *in all respects to deal with the inevitability of technological change. Government believe, that no small section of society can corner the gains of growth, leaving workers to bear its pains. Labour will be made an equal partner in progress and prosperity...* ***Intensive training, skill development and upgradation programmes*** *will be launched."*[1]

These are excerpts from the Government of India's **Statement on Industrial Policy** made on July 24, 1991. Yet almost two years after this declaration of intention there is very little discussion (and even less visibility) of the substantive impact of the policy. The fact that any attempt to operationalize the contents of the policy would require fundamental structural changes in the production-structure of the economy is not being openly and squarely faced; the debate on the other hand has degenerated into one of discussing the pros and cons of **free trade** versus **protection**. More important, from a technology standpoint, the issue posed is in terms of access to newer and more sophisticated technology rather than analysing why, improvement of technology thus far imported, and innovation, have largely eluded the Indian corporate sector. One disturbing aspect of the present situation is that there is hardly any serious, informed debate on the **quality** of state intervention, particularly the difference this can make to an economy.

The imperative of state intervention in economic development, particularly industrial development, has formed the theme of much

of development literature. Most Third World states have attempted to accelerate economic development through growth strategies which however exhibit substantial variation in content, form, degree of commitment - across countries, instruments of implementation and over time. We borrow a distinction made in the literature between **state-led** and **state-induced** strategies,[2] to understand, in the Indian context, the relationship between state and industrial strategy. State-led strategies, according to Deyo, entail continuing, selective intervention by state agencies in private sector decision-making and market transactions to achieve strategic goals. State-induced strategies, on the other hand, emphasize the role of the private sector in implementing strategies within a broad, political, legal, infrastructural and economic framework that the state establishes to pursue its chosen development objectives. In the Indian context this basic distinction suffices to separate periods of state-led import-substituting industrial restructuring (the decade of the sixties and seventies) from state-induced neo-conservative experiments in economic liberalization (beginning with the eighties).

This study is a modest attempt to assess the (technological) performance of the Indian private corporate sector during the post-independence period. Such an examination would broadly involve an exploration into several interconnected themes, namely,

(a) the quality of state intervention in industrial development affecting directly the functioning of the corporate sector;

(b) the flexibility (or otherwise) of the internal organization of the enterprises making up the corporate sector and therefore their ability (inability) to orient their production to meet changing technological requirements;

(c) the integration of labour is/is not enmeshed with the production structure as also the increasing disjuncture between the skill level of the existing labour and the requirement of production.

That governmental statements of industrial policy have failed to incorporate labour as an integral component of the total process of restructuring of the economy is an important but only one part of the story. A major assumption of the economic liberalization measures now being pursued in the country is that the *forms of production* could be uniform across the country, although there would in reality be differential impact of such measures on different segments of the population.

The proponents of a liberal technology import policy also argue that liberalization measures are essential to raise the overall technological competence, productivity and output growth of Indian industry. It is also claimed that the higher cost of collaboration in the form of outgo of resources would be more than compensated by gains in output growth and export. While there is some logic in this argument, the outcome may well turn out to be different.

A general policy of liberalization **per se** and/or a technology import policy **per se** cannot raise the technological dynamism or accelerate the growth rate in productivity and output of Indian industry. The transformation of an economy into an internationally competitive one (through a liberal technology policy) necessarily involves a number of stages, including fundamental changes in the organization of production. The most vital, at the same time the most difficult, factor forging and maintaining linkages between different actors in the whole drama of industrial development is political will — which factor, in our view, has been instrumental to a large extent, in imparting to the East Asian economies a very high degree of integration, particularly as far as the industrial sector is concerned.

In contrast, the Indian industrial sector presents a picture of a fractured production system. In other words, the multiplier and feedback effects which should be generated as part of the process of diffusion of technological capability and which should in turn form

the basis for complex production-systems-link between firms of all sizes (with bonds of interdependence that are forged by flows of goods, services and information) have over the years, and in the absence of a conscious policy of nurturing, got truncated leading to a considerable degree, of dysfunctioning industrial system.

The analysis of this problem is attempted at two levels: (i) at the macro-level which includes, among other things,a critique of the substance and direction of government policy; (b) at the micro-level an analysis of the organizational structure of firms, which in combination with an ineffective state intervention policy, has hindered innovation and, therefore, technological dynamism. There is need to approach the problem from both macro and micro angles, separately **and simultaneously**, because a study of individual firms alone could well underplay even negate the crucial set of social and political institutions that have a bearing on the functioning of firms in the economy. Making use of Granovetter's very useful concept of 'embeddedness' we hope to show (in the Indian context), that the networks of institutionalized relationships in which the firm is 'embedded' directly determines the type of firms that develop, the management of the firms and organizational strategies generally. Each society develops its own unique form of economic embeddedness in relation to its political institutions which in turn determine among other things, its industrialization path.[3]

The debates on the 'labour' implications of the new economic measures largely seem to centre around the problem of retention of jobs and consequently the very survival of the labour force. The proponents of liberalization view this as a transition problem — the assumption being that, over time, when the new measures work themselves out, there would be more jobs in the offing. One could disagree with this observation on two counts:

(a) the qualitative change in the composition and skill level of labour that the goes with technological change has not been seriously worked out;

(b) mere investment in higher learning and in R & D (that is, the creation of 'social capabilities')[4] is not enough. As has been pointed out, much of what is involved in mastering a technology is organization - specific investment and learning. And therefore, it is argued that, "if the economic conditions and incentives facing firms in different countries differ significantly, then firms in one country will require technological capabilities very different from those in another country. This argument is far removed from the conventional distinction according to which firms simply "choose" to employ different techniques (e.g., factor mixes) within a common underlying technology."[5]

In an attempt to focus on the magnitude of the problem facing Indian labour, and, therefore, the Indian corporate sector, we have brought together data from the Census depicting the composition of the workforce and their existing educational/skill level. The issue being highlighted is precisely this: the success of the new measures is largely dependent upon the strategies and structures and performance of private business organizations. There is increasing realization now, not only of the abysmally low educational level of the Indian population, but also of the fact that, the kind of higher/technical education being imparted in our institutions of higher learning, is obsolete, when compared to the levels of technology being imported and/or currently in use by the Indian private corporate sector.[6] Hence, at one level, the need to constantly strive for some parity between the drive to acquire state-of-the-art technology (to compete on an international level and scale) and the upgradation of knowledge and skill level among the population, goes without saying. At another level, what is important, is not just the sheer number of students or the quantity of their training but the effectiveness with which that training is integrated into the process of improving the technology of operating firms.

II. TECHNOLOGY POLICY : A MACRO PERSPECTIVE

A substantive thrust of India's technology import policy has been the encouragement of domestic production to substitute for imports implemented through import-substitution industrialization. This in turn necessitated protection of domestic industry under the infant-industry argument. The manner of implementation and operationalization of this strategy in India has led to two major negative results.[7] One is, a far less than competitive environment; the other is the continued dependence of the economy on imports of production goods with substantial underutilization of capacity of the same at home. Given the inefficiency of final goods industries and hence their inability to compete in external markets through exports, a limit to the imports capacity of production goods has appeared as a result of foreign exchange constraints. The net result has been a stagnant, inefficient and non-integrated industrial sector.

The important point however is that the examination of such results needs to be done in a more rigorous manner than adopting the conventional argument of market inefficiency. One crucial thread of analysis revolves around the way in which technological change has been incorporated into and has determined the industrial structure during the process of import substitution industrialization.

An interesting hypothesis that has been put forward with reference to the South Korean industries is that the latter's superior performance can be attributed to a combination of selective infant industry protection and export activity.[8] Thus, it is argued that the protection of infant industries is most effective not as a part of import-substitution regime but rather under an export-oriented one. Several reasons have been put forward to account for the positive effects that exports may have on total factor productivity, namely,

"(a) the competitive pressures that compel improvements in product quality and reduction in cost,

(b) opportunities for international inter-firm learning that are opened up by exporting activities;

(c) economies of scale due to increased market size as a result of exporting possibilities and also fall in costs;

(d) overall improvement in productivity due to greater availability of foreign exchange and more productive inputs."[9]

Underlying this beneficial positive association between economic performance and exports is an implicit assumption: the attainment of a minimum threshold level of technological capability which can only be built up during a prior period of protected import substitution.

The central role played by the *domestic market* in the growth of countries like South Korea and Japan has also been emphasized and needs to be noted. Using a decomposition methodology, Nishimizu and Robinson in their study of trade policies and productivity find a great deal of variation in the relative roles of domestic demand expansion, export expansion and import substitution, both over time and across the countries studied by them, namely, Korea, Yugoslavia, Japan and Turkey.[10] In the case of Korea they estimate that while export expansion constituted an increasing source of growth of manufacturing demand (rising from seven percent in 1955-63 to 18 per cent in 1963-70 and 38 per cent in 1970-73), and import substitution a decreasing source (falling from 29 per cent to 0.2 per cent over the same period), *domestic demand expansion comprised 64 per cent, 82 per cent and 63 per cent at the corresponding times.* Japan presents an even more startling picture. Export expansion constituted six per cent, ten per cent and eight percent of the growth of manufacturing demand for the years 1955-60, 1960-65

and 1965-70, while import-substitution fell only slightly from -1.2 per cent to -0.1 per cent and -0.2 per cent over the same period. On the other hand *domestic demand expansion comprised 95 per cent, 90 per cent and 92 per cent of the growth of manufacturing demand.* Nishimizu and Robinson's study raises some interesting questions worth reproducing:

> "First, the results do not support the simple version of Verdoorn's law which implies that any expansion of the market, regardless of source, should improve productivity performance. There are significant and strong differences in the impact of export expansion versus import substitution.
>
> Second, the results are consistent with the hypothesis that export-expansion leads to higher TFP growth, through economies of scale and/or through competitive incentives.
>
> Third, the results are also consistent with the converse hypothesis that increased import substitution (import liberalization) leads to lower (higher) TFP growth, perhaps through reducing (increasing) competitive cost-reduction incentives.
>
> Finally, the results are also consistent with the hypothesis that export expansion and import liberalization increase TFP growth through relaxing the foreign exchange constraint and imports of non-substitutable intermediate and capital goods."[11]

However, in each of the above, the precise causal mechanisms need to be worked out. Moreover, while technical progress is necessary and occurs under both protected and more open regimes, the **type** of technical change may be different in each case leading to differing consequences for the nature of growth of the economy. For example, it has been suggested that technical change may be more adaptive and less innovative under high protection, and more cost-reducing under the low protection of open economies. But no

definite conclusions can be reached nor can any generalizations be drawn since one will have to come to terms with the phenomenon of import-substituting industries of today becoming the export industries of tomorrow in which case the connections between technical change for adaptation and subsequently for effective assimilation and innovation needs to be rigorously made. South Korea is a prime example of an economy that was/is both open and protected.

The fact that Indian firms operate in an environment characterized by low scales of production (stemming from a low order of demand) is not just well-known, but is acknowledged as an important reason for the inability of firms to lower costs of production. And yet, statements of industrial policy do not deem it essential to discuss why levels of demand are so low and / or how domestic demand expansion should form an essential and inbuilt component of policy.

It would be in the fitness of things at this juncture to summarize the findings of a study on the status of Indian science and technological capability vis-a-vis the Republic of Korea.[12] India began on its science and technology-led development path about the same time as did the Republic of Korea. The strategies however differed fundamentally reflecting among other things the differing historical, cultural, and political contexts of Independence in which national plans of development were contextualized and operationalized.

India has changed slowly with emphasis having been laid all along, mainly on internal technological sufficiency rather than international competitiveness while Korea has emerged as a star performer in the economic miracle characterizing the East Asian economies. Korea has built its scientific capability out of prior attention to reverse engineering — by 'digesting' and replacing imported technology. It linked its science with sequential building

of industrial infrastructures for each subsequent stage of development. Basic research has only recently been introduced on top of the practical and applied research platform that the nation has constructed in intimate relationship with industry.

India, which started with a basic science philosophy and a European organization model of scientific 'autonomy' sought to weave an applied science for the people out of this intellectual fabric but had little contact with industry which was largely resistant to implantation of Indian research results. Indian science to a large extent remained a separate 'estate' from economic development, its directions poorly connected with national economic and technological policies. Indian private sector in general, and, business interests represented through FICCI and ASSOCHAM in particular, have largely been reactive to government policy rather than leaders - more with power of veto than of setting an economic agenda. Further, what the Abid Hussain Review emphasizes about CSIR is very important. The Review points out that the combination of both a 'technologically unabsorptive' industrial environment with low funding levels for CSIR work together to paralyse the organization. The culture of corporate R & D in the private sector (able to translate CSIR's research into practice) is largely missing in the Indian environment because of excessive dependence on imported production technologies. There are therefore major missing links in the chain of absorption of imported technologies and indigenous invention and innovation.[13]

This comparative study of Korea and India can be placed in the context of the ongoing debate about the relative importance of *'science and technology push'* and *'demand pull'* strategies in determining patterns of innovative activity and in triggering innovative activity.[14] One school of thought has pointed out that both, technology push, and demand pull, are necessary for any successful innovation and that, much of the debate about the relative importance of the two has been ill-conceived. Another school however

argues that 'demand pull' has been a stronger influence than 'science and technology' push on patterns of innovative activity both across industry and over time.

When applied specifically and concretely to the economies of late industrializers, India and Korea, in our case, we find that:

(a) the significant point to note about Korea is not that it adopted the *demand pull* strategy, but that it combined the latter with an authority structure which obtained, to a large extent the much needed sequential building of industrial infrastructures for each subsequent stage of development;

(b) the Indian 'science and technology push' strategy not only lacks an active interaction with the user industries but is not backed by an organizational structure which can make this strategy operationally effective.

Under such conditions it is difficult to understand how the micro and macro objectives of the new industrialization strategy is sought to be achieved considering that, past experience with regard to entreprenurial behaviour during import substituting industrialization, supports neither the demands nor the expectations raised by the new strategies. In addition, as Unger argues, the user-producer interactive scheme of industrial innovation is particularly weak in India due to the lack of a sufficiently strong and integrated capital goods sector as well as the poor development of the institutional framework essential to the creation of a national system of innovation.[15]

Some of the recent trends in industrial restructuring in industrialized countries provide an added dimension to the problem and have serious implications for the economy of less developed countries including India. These major trends commonly stressed in recent literature include:

(a) the locational effect of new technologies;

(b) the organizational changes required at the firm level and accompanying the application of micro electronics to production;

(c) the protectionism of major importing countries as they face trade imbalances along their restructuring process.[16]

In a study of the international sourcing of technology and more broadly of scientific and technological knowledge by multinational enterprises, Chesnais refers to the yawning gaps that have begun to develop between firms and countries even within the most advanced OECD countries.[17] While he acknowledges that more research will be required to understand the medium and long term effects of a situation where "the largest and the most advanced firms technologically speaking are exchanging between themselves vital complementary technologies", — "it can safely be stated that such cooperation creates formidable new entry barriers at the heart of the industry with respect to its core technology base; thus creating new conditions of inter firm and intercountry dependencies in the form of a whole new web of dependent technological links vis-a - vis the industry leaders. This is felt even by advanced small and medium sized OECD countries".[18]

The Government of India's attempt to send the Indian economy on a global trip has no space for a consideration of this new and fast changing global environment facing the country.

At one level national differences in the relations between business and government (which in effect reflect basic political choices) influence the position of a nation's firms in international markets. At another level, this also has an impact on the basic technological choices which companies make about products and production processes. For instance, the threat to the pre-eminence of the United States in international industrial competition, and the end of the

insulation of the American market from foreign competition has triggered off an intense debate and analysis of the American production system to locate its organizational weakness and strategic failures. In a study comparing the international competitive positions of the firms in the United States vis-a-vis their Japanese counterparts, Tyson and Zysman attribute the strong competitive position of Japanese firms in automobiles and the Japanese dominance of the consumer electronics sector to the radically different technological choices made by the Japanese as compared to the United States.[19] Their overall strategy amounting to a production strategy of **flexibility** (as opposed to the American strategy of **standardization**) has been more than mere marketing trick; it involves **real** product differentiation and consequently calls for production and design strategies of a high order.[20] The most important fall out of an examination of the Japanese strategy in our view, is a reconsideration of the concepts of economies of scale and production costs, apart from the radically different impact it has had on the labour force.

It needs therefore to be stressed that statements of official policies need to be backed by sound empirical analyses of the phenomena being addressed, which of necessity implies an evaluation of the problems that the government thinks need rectification. This is because we believe that governments **do** have the ability and the capacity to permanently alter the terms of international competition and irrevocably change the very structure of the market. In the Indian context there are hardly sufficient in-depth studies to suggest the (beneficial) impact that the government considers will (automatically) follow from its statement of Industrial Policy, namely

(a) "The predictability and independence of action that this measure (namely the freedom to negotiate the terms of technology transfer with their foreign counterparts according to their own commercial judgement) is providing to Indian industry will **induce** them to develop **indigenous competence** for the **efficient absorption** of foreign technology; and

(b) Greater competitive pressure will [also] induce our industry to **invest much more in research and development** than they have been doing in the past".

On the contrary, whatever little studies/data we have, while critical of the ineffectiveness/even harmful nature of government intervention, point out at one level, to fundamental structural weaknesses afflicting the production system; at another level they bring out starkly the inability of the political system to direct the economy towards certain well-defined economic goals.

III. TECHNOLOGICAL PERFORMANCE : MICRO-LEVEL ANALYSIS

The effective translation into action of any programme of industrialization depends on the organization of business in any society. Hamilton and Biggart stressed the fact that, while economic and cultural factors are critical in understanding the *growth* of markets and economic enterprise, the form or structure of enterprise is better understood by patterns of authority relations in society.[21] In their comparative analysis of management and organization in the Far East, Hamilton and Biggart show that in each of the three societies studied by them, namely, Japan, South Korea and Taiwan, a different combination of present and past circumstances led to the selection of a strategy of political legitimation. This strategy, in turn, had direct consequences for the relations between state and business sectors and for the formation of economic institutions. The point being stressed is that there is nothing inevitable about enterprise structure; it presents situational adaptations of pre-existing organizational forms to specific political and economic conditions.

Historically, underlying the growth of the Indian industrial economy has been the parallel development of powerful business groups. There are, generally, two types of explanations offered as a rationale for the existence of business groups.[22] The first one, in the

context of underdeveloped countries, views the formation of business groups as constituting an entreprenurial breakthrough in a situation where market mechanism does not exist - an explanation designated as bottom-up economic theory. From a political economy perspective business groups form as a result of collusions between political officials and business elites. The political economy explanation of business groups, however, has not been really formalized. In many newly industrializing countries the state apparatus itself directs the course of economic development through preferential linkages between indigenous business elites and national and international capital. Such linkages allow business elites to develop oligopolistic control over key industrial sectors thus creating business groups with politically supported networks linking them. While there is conceivably some overlap between the two explanations, in theoretical terms they are opposed.[23] While market and political factors are both important in any society and under any political system, and that both need to be mediated through an institutional framework to shape their influence, what however needs to be emphasized is that the Indian State has failed to channel this influence to the advantage of the Indian economy.

An important but deleterious consequence of this failure has been the increasing *segmentation* of the private industrial economy into large business houses/groups on the one hand, and an amorphous mass of medium, small, tiny and cottage sector enterprises on the other. Whatever association/network/linkages may exist between these different forms of production, it does not, however, serve to integrate the total economy in the same way that business groups do in Japan and to some extent in Taiwan as well. It could be argued that neither do the South Korean **chaebols** integrate the economy. But an important difference in functioning between the Indian business houses and the South Korean **chaebols** (discernible in the performance of the two economies) is the political handling of the business groups in the two countries. In any explanation of the Korean economy and particularly as regards the functioning of the

chaebols the political dimension is an essential feature. Comprehensive planning, strongly enforced implementation policies, government-controlled fiscal institutions that use indebtedness as the means to finance and also to control the large vertically integrated chaebols - these strategies clearly show that to a large extent Korea's industrial structure preceded market involvement and was not a consequence of it. The State in Korea does not, however, hesitate to use non-economic means to achieve compliance with policy directives. In general, it does not take a Korean firm long to learn that it will 'get along best' by 'going along'.[24]

In contrast, the Indian business groups while having to contend with a whole host of rules and regulations have not been under any pressure from any quarter to account for their performance either nationally or internationally. Industrial growth in this country has been so conceived and pursued that industrialists seek maximum benefits (profits) in the shortest possible time. The easiest manner of achieving this has been to tie-up with foreign manufactures, which also helps the domestic firm to dominate the market concerned in a situation of low volume demand thus leading to an overall situation of continued technological dependence. A survey of the available evidence indicates that the entire gamut of foreign technology agreements/foreign licensing arrangements/foreign investment approvals over the years has not made that impact on domestic technology absorption and innovative capacity and capability so fundamentally imperative to hold one's own in the international market.

In what follows we present firm level evidence culled from various sources to indicate the magnitude and depth of the task ahead (if the achievement of domestic/international competitiveness is among the primary aims of the new liberalization policy). We begin with the very detailed deliberations made by the MRTPC while examining cases referred to it by the Central government.[25] The six case studies we have chosen have to do with applications

made to the Central government for substantial expansion of productive capacity/setting up of new units etc., **with foreign collaboration**. We have indicated the dates of incorporation of these companies, the dates when they have applied to the government and the purpose of their application. Our aim in resurrecting this almost vintage material is because,

(a) the MRTPC has also commented on the technological performance of these companies, and, more important,

(b) these case studies are among the very few detailed firm/business-house level evidence that we have in evaluating the technological performance of the Indian private corporate sector.

We then take up firm-level studies done of the capital goods and engineering goods sectors to highlight the fact that mere 'opening up' of the economy, unless backed by a whole host of related measures will end in severely straining the economy and further eroding its productive base. Finally, we follow this up with an exercise analysing the data provided by the RBI in its annual study of the 'Finances of Public Ltd. Companies' (taking the latter as a proxy for the corporate sector) to enable us to make some generalizations regarding the performance (technological and otherwise) of this sector in the light of the liberalization policy.

One can broadly identify three phases in government approvals of foreign collaboration arrangements namely (i) period of liberalization until mid-sixties; (ii) period of tight regulation since then and until mid/late seventies and (iii) period of gradual relaxation from then onwards with the pace of relaxation accelerating from the mid-eighties onwards. Placing the case studies in this context we find that:

(a) The companies whose applications had been referred to the MRTPC had not only been in existence for a long time but had

also had foreign collaboration/investment arrangements right from their inception. This discussion would therefore fall under the first phase mentioned in (i) above.

(b) The second set of case studies very broadly compare the performance of companies in the capital goods/engineering goods sectors of the economy during the period of tight regulation and subsequently, when the liberalization process began.

(c) The 'success' of the liberalization measures hinges on the performance of the private sector. Taking the RBI data as proxy for the private sector, we indicate that the trends in performance of the private corporate sector show not only the hiatus between the policy pronouncements and achievement, but also the limitation in the perception that the Indian industry can become competitive when it is fully liberalized and take its place in the global arena.

A. Case studies from MRTPC files
(Performance evaluation during the pre-regulation period)

Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
C1[24]	Company belonging to a large Indian Industrial House	1955, on the basis of foreign Collaboration	December 1970.	Bonded Abrasives/Monopolistic position	The company's record regarding the use of foreign collaboration and the development of indigenous technology has not been very commendable. [Thus] even though 15 years had elapsed from the beginning of the foreign collaboration on very generous terms, the company continued to maintain that even royalty should continue in addition to the dividends on the equity share of the foreign partners in the venture. — The past

Contd.

Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
					record does not support the idea that the company is very keen on indigenous technological development. It has depended for too long on foreign collaboration. The expectation from it about exports from the beginning of its operations has not been fulfilled, and this has to be specially taken note of in view of the very large net foreign exchange payments that have resulted as a result of its operations".
C2[27]	Company belonging to a large Indian Industrial House	1949, with foreign & financial Collaboration	December 1972.	Pistons, Piston rings etc./ Absolute monopoly	Since the company had claimed that its export performance justified support for its expansion proposals, the Commission attempted an examination of the data provided by the company to find out whether the exports made by it were worthwhile. The Commission's observations made at that time in the context of uneconomic nature of exports made by the company are pertinent even now when the policy being stressed today is the need to meet foreign exchange requirements by exports. The Commission observed thus: "The company has been exporting piston assembly both in finished and semi-finished forms. From the data provided it will be seen that exports to collaborators - which are in the form of semi-finished pistons - constitute quite a significant portion of the exports. It may be recalled that these exports were undertaken almost at the behest of the government for the purpose of repaying the credits obtained from the collaborators for the second expansion carried out by the company. It was reportedly then laid down by government as a condi-

Contd.

Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
					tion that foreign exchange requirements for expansion will be met from credits, which were to be repaid by exports. The collaborator-company was apparently only interested in importing semi-finished pistons... Data given show that the realization from exports of semi-finished pistons was hardly adequate even to meet the cost of the material used for producing these exports. If we take the costs of the material, labour and selling expenses directly incurred for the exported products, and without allowing for any other overheads whatsoever, it is apparent that the exports were uneconomic, the cost of earning a dollar through these exports being as high as about Rs.11/- or more. This system of financing expansion has thus been very expensive. We are surprised that this aspect has not received government's attention. We want to specially mention this point because it appears to us that this aspect is being overlooked in many such cases. For our present purpose, the conclusion of this analysis is that the export of semi-finished pistons is not economically worthwhile."
C3[28]	Company belonging to a large Indian Industrial House	1961, on basis of foreign Collaboration	December 1970.	Electrical Accessories for Motor Vehicles/ Dominant position	The deliberations of the MRTPC in this case bring out very cleary the limitations of the R&D efforts undertaken by the applicant company as also the dim prospects for developing production of electrical accessory items in India for export purposes, given a non-dynamic automobile industry. ...."The applicant company has succeeded in establishing high quality

Contd.

Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced / Market Concentration	Remarks of MRTPC
					production of the items it is producing and these enjoy a good reputation both for OE and replacement purposes. They have also attained good success in terms of import substitution. From these two points of view, the assistance provided to the Company by the foreign collaborator must obviously have been of much use to them. At the same time the expectation that collaboration with a major concern in this field would build up exports has not only not materialized but there also seems to be little prospect of this happening on any significant scale in the near future." "As it is, the vehicle industry in India is continuing with the same designs for a prolonged period. As a matter of fact, the applicant company has pointed out that one of the reasons why the items produced by it cannot find an export market is that the designs appropriate for fitment in Indian vehicles are far outdated in terms of what is prevalent in foreign markets. It would not, therefore, be unreasonable to suggest that whatever learning was essential for the adoption and adaptation of the designs produced by the foreign collaborators to suit the Indian market would have been adequately done in the course of the initial collaboration agreement. Any minor assistance required should surely be available to 'LTVS' from a company which holds a large part of its equity capital. In case specific assistance is required because of some new require-

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Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
					ments - e.g. a new vehicle design being introduced and requiring some special type of accessory which 'LTVS' cannot itself design - it should be possible for the payment of a special fee on the merits of the case. — But except for such special considerations which may arise in the future, the requirements of the applicant company as at present or for the contemplated expansion does not appear to justify, the continuance of foreign collaboration on any elaborate basis."
C4[29]	Foreign Subsidiary	1936	June 1971.	Tyres/ Dominant	Drawing attention to the Company's efforts in R&D the MRTPC noted: "It will be seen that for a company which is operating in a field where there is constant technological change, the amounts spent have been comparatively small. The company's approach has been that as its parent company can afford larger amounts on technological research and the results of the research are available to it at a comparatively modest charge, it was not necessary to undertake much research in India itself. Recently, however, the company has decided to develop R & D in India especially in regard to products which are specially developing in India as compared to elsewhere in the world. It would however not be wrong to conclude that an almost inevitable result of the company being a foreign subsidiary appears to be that indigenous R & D is either neglected or is treated merely as a minor extension of, or a complementary activity to the main R & D undertaken by the foreign parent company".

Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
C5[30]	Foreign subsidiary	1954	August 1974.	Blasting Explosives Dominant	"The applicant company claimed that it had recognised from the beginning that the sophisticated and specialized technology involved in the industry had to be backed by a first class R & D set up. Accordingly, its R & D work involved not only product development but also covered fundamental studies in explosives technology, import substitution and the production of better materials as well as the use of better processes. According to the company's own estimates, out of ten major contributions (which could lead to patents), five related to adaptive improvement and five to basic development. Asked to distinguish between the expenditure incurred on innovative R & D and that incurred on supportive R & D, the company provided figures which showed that innovative R & D got a far larger share than supportive R&D." The Commission's examination of the claims of the company however led it to make the following observations: "— Even though the company has been in existence now for about 20 years and has been in operation for over 15 years with a comfortable financial position, its R & D activities have not been such as to enable it to be self-sufficient in respect of further development even in the explosives field. — [But] the point remains that even at this late stage of its functioning in the explosives field, the company cannot do without collaboration from abroad. It may be said that technical developments are taking

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Sr. No.	Ownership Status	Year of Establishment	Year of Application to Central Govt. for renewal of Collaboration	Product Produced/ Market Concentration	Remarks of MRTPC
					place in the world rapidly and that there is nothing wrong in purchasing technology. Even the largest producers in the world continue to buy technology from others. This is true. But the important point is that those who give proper attention to R & D buy as well as sell technology abroad. We do not find that the company has been able to sell technology developed by it anywhere else in the world. As in the case of many other foreign companies it appears to have been content with depending on its parent company for major technological developments confining its R & D more to adaptation for the purpose of meeting the requirements of import substitution regarding raw materials and from the point of view of orienting the product to the specific requirements of the Indian markets."
C6[31]	Large House	1929	December (for establishment of an undertaking)	—	"...It would be worthwhile to look at the record of the Group in respect of the capital structure of its companies and also the results of the foreign collaborations the the Group companies has been undertaken on the basis of foreign collaborations and the collaborations have usually been on generous terms. The equity participation of the foreign companies has been quite substantial-majority and the whole of the remaining equity is held by Group companies all of which are family concerns. Manufacturing is mainly in areas where the companies enjoy considerable monopoly power being one of the two or three concerns in that line of production. ..."

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Sr. No.	Owner-ship Status	Year of Establi-shment	Year of Application to Central Govt. for renewal of Collabo-ration	Product Produced/ Market Concen-tration	Remarks of MRTPC
					"It should be stated that, the Group of companies has a high reputation for producing quality products and from all accounts this reputation is well deserved. At the same time it cannot be ignored that the R & D effort has not been consistently good, the proportion of R & D expenditure to total expenditure being good in same concerns and low in others. Even in concerns where the outflow by way of payments to foreign collaborators has been high, the R & D effort has not always been large. With the high profitability enjoyed by the products, and the substantial share of foreign equity as well as other generous terms of collaboration, the payments going out of the country to the foreign partners have been quite high... For the Group as a whole, foreign payments come to about 60 per cent of the capital imported by the collaborators, taking its five foreign collaboration companies together and this over a period of less than 8 or 9 years."

These case studies reveal quite a few disturbing trends in operation in the functioning of the Indian private corporate sector, namely,

(a) the heavy and continued dependence on foreign collaboration (technical and financial) and their inability to face the market (domestic and international) **independently** even **after** collaboration periods ranging from 15 to 20 years and even more;

(b) a direct consequence of (a) above has been the minimal role allotted to in-house R & D. Looked at from another point of

view, these companies enjoyed virtual freedom in entering into and in continuing with collaborations without being pressurized to absorb, assimilate, and build on borrowed technology and to become domestically and internationally competitive within a specified period of time, thus making it almost redundant for the companies concerned to expend on R & D for the purpose of becoming innovative;

(c) the ineffectiveness of the state to monitor and evaluate whether conditions attached / agreed to at the time of the foreign collaboration agreement had been adhered to and if not, why. While almost all collaboration agreements had exports as one of their major argument for justifying the continuance of collaboration, their performance evaluation by the MRTPC has clearly brought out that either exports had not materialized and when it had, such exports had been effected at uneconomical prices.

IV. THE CAPITAL GOODS SECTOR: A RE-EXAMINATION

Performance during the regulation period

The key to industrial development lies with the manufacture of engineering goods, which also is a technology-embodying activity and requires for its development a considerable build-up of technology capacity. Here, we summarize the findings of two studies dealing with the performance of this sector. These studies show that the failure to innovate (and therefore the inability to compete internationally) on the part of Indian entrepreneurs is a deeper production-related problem, and not a question of free market versus protection. Our argument is that while free market is not a necessary condition to ensure competitiveness (as the East Asian economies have shown), protection per se is not a sufficient condition for achieving minimum threshold levels of technological capability (as the dismal performance of the Indian industrial sector

reveals).

The first study prepared for the UNCTAD dealt with the transfer and development of technology in the capital goods sector of India.[32] While underlining the significant shift in the output structure of the industrial sector in favour of capital goods and the extensive degree of industrial diversification that had been achieved over the years, the study, nevertheless, noted that, while capital goods production accounted for less than one fifth of total manufacturing output, foreign collaboration agreements in that sector accounted for more than one half of the total agreements approved in the country - which, according to the authors, reflected a high degree of technological dependence.

The analysis of the sample of 20 leading producers of complex capital goods in machine tools, electrical equipment and equipment for process industries revealed that the adaptive behaviour of firms was found to be different across ownership categories. Foreign controlled firms and minority joint ventures had renewed their licensing arrangements with more alacrity than had domestic firms —implying a high lead time for absorption and a low degree of local adaptation compared to domestic firms. They had rarely used the services of local consulting, engineering and design organisations and had shown less interest in upgrading the potential sources of local supplies; in contrast they had more often resorted to hiring the services of foreign designers for local adaptation. They had been remitting to foreign licensers three times more than what was spent on R & D. The study underlined the tendency of foreign-controlled firms and joint ventures engaged in the manufacture of complex capital goods to alienate technology import from the local S & T system.

Major constraints in the development of design capability as highlighted by the sample firms included (a) restrictive conditions and practices under licensing agreement; (b) weak subcontracting

network; (c) policy gyrations by the government; (d) users' xenomania, i.e., craze for imported equipment and reluctance to accept equipment based on indigenous designs; and (e) unimaginative and unstable approaches of the equipment producers to R & D investment and product diversification.

The survey highlighted two characteristic features of the innovation process in the Indian capital goods industry. First, producers had acquired substantial innovative capacity only in *standard* modern technology and were still very weak in *highly* modern technology despite the increasing R & D expenditure. Second, it was not always the giant firm but the medium-sized firm which had met with success in developing design capabilities and innovations, though confined to standard modern technology and less science-related fields such as machine tools.

The study made it clear that development of the Indian capital goods industry could not have taken place without the government's direct intervention in production through the public sector and through policies for the development of the industry in the private sector. It also underlined the fact that some policies and measures had worked at cross purposes and therefore the need to bring about rationalization in order to achieve coordination between creation of manufacturing capacities and development of design capabilities and production technology in highly modern complex areas. In short the authors called for technology planning in the capital goods sector.

V. THE ENGINEERING INDUSTRY : INITIAL LIBERALIZATION PHASE

The second study of the Indian engineering industry by Staffan Jacobsson contains among other things, a presentation of micro and macro level data showing how the behaviour of Indian industry actually changed in response to policy reforms undertaken in the

1980s.[33] The analysis of macro level data has been done by the author for the purpose of seeing if the trends at the micro level can be expected to have a relevance which went beyond the limited number of industry studies covered. The core of the micro level data consists of six industry case studies characterized, according to the author, by:

(a) *"a large number* of Indian producers. In these industries there was *virtual explosion* of new producers and holders of foreign technological collaborations (FTCs) in the 1980s. —Most of the firms in the now fragmented industries are new entrants with little or no experience of design and production of those particular products. In addition, many of them are not very large firms.

(b) a **reliance** of the Indian firms **on foreign technological collaborations**, (FTCs)) with occasional exceptions, as the source of their product technology. In each of the industries, the leading global actors have a licensee in India.

(c) **very little emphasis on own product development** — Although 85 percent of domestic content ratio must normally be achieved within four years, a certain amount of relaxation has taken place and production can be initiated with the importation of all or at least the bulk of components. This implies that firms perceive a less immediate need for R & D aimed at indigenization (per unit of FTC).

(d) fairly high global concentration ratios and where the leading Indian firm produces between one and five per cent of the output of the leading global firm". (emphasis as in the original)[34]

According to the author the key policy determinant to this development was the **simultaneous** liberalization of the industrial licensing laws as well as those relating to FTCs. This had led to the replacement of concentrated industries by fragmented industries

(the latter being miniature replications of the global industry) with almost every one of the Indian firms producing on the basis of a FTC. The result has naturally been a sharp increase in FTCs (and, therefore, FT payments) and in the number of variants of each product offered to the Indian consumers/investors.

Drawing inferences from his micro studies (supplemented with data at the macro level), Jacobsson observes that liberalization, has induced changes in both firm behaviour and in industry structure. He lists three main economic effects of the liberalized policy framework, namely, that

(a) liberalization has led to an improvement in the working of the Indian inward-looking industrialization model by increasing Indian access to the global shelf of technology. The increased access was, however, not primarily transmitted by existing firms in the industry but via new entrants;

(b) the 'natural' limit to the number of firms entering into an industry with the help of a FTC is very high at the moment and in a whole range of industries. This also implies a greater level of competition which was one argument in favour of the liberalization process. *A greater level of competition does not, however, necessarily lead to greater static efficiency;*

(c) the aim of the policy makers of inducing even a limited number of firms to become more innovative has not been met. *Indeed, if anything, the effect has been the opposite.* The fiercely competitive and fragmented industry structure, coupled with nearly free access to foreign technology even to those firms that could develop their own technology, has led to greater technology imports rather than to greater in-house innovative efforts.[35]

It would not be out of place in this context to refer to views expressed by foreign technology suppliers' on Indian industry

particularly the observations made by the former on the technological and managerial capacity of Indian enterprises to compete in export markets. These views have been culled from a series of studies undertaken under the ICRIER-NCAER project on technology development in the early eighties. Apart from demolishing certain 'received and established notions' at the macro level, they underscore certain structural weaknesses at the firm level and altogether call into question the quality of enterprise characterizing the private corporate sector in general, and particularly, the latter's commitment to the development of technology.[36]

— "Very few firms could expect within three or four years to be internationally competitive in the kinds of products for which technology imports were permitted in India. If you want to export you can't do it overnight. Among other things you have to master the technology first in order to meet the costs, quality and constantly rising product performance required for success in export markets."[37]

— "....the absence of export restrictions is one thing, and successful entry into export markets is another. In very many cases it did not seem that the first was associated with the second". — "Almost all the supplier firms emphasized the hard negotiating position taken by Indian firms on questions about payments. In some cases the Indian firms used the government regulations to support their bargaining on this issue, but in very many other cases the main supporting conditions were their own positions in a competitive Indian market, their search for alternative suppliers, and their ability to exploit those supply-side situations. Not surprisingly, then, a significant number of agreements appear to have involved total payments that were below the level of government norms."[38]

— "Very few Indian firms do anything with the technology they import. Even though many are quite profitable they won't invest in

R & D."[39]

— "Indian firms would be much better off if they took a longer term view. They get sufficient information and know-how to get off the ground, but not enough to go on developing and improving. In the process by endless negotiation and efforts to reduce costs, they not only limit what they get but they also lose goodwill."[40]

— "...it appears that no genuine capability to master and develop the technology is created at the end of a contract period. This impression is confirmed by the existence of repeated contracts which clearly indicate that renewed access to a foreign source of advanced technology is required."[41]

— "[Therefore I feel that] indiscriminate imports, unaccompanied by reforms in the economic management system in India, may easily lead the way straight into more profitable deals for foreign firms, *without* simultaneously raising the technological standards of Indian firms. In that case the whole exercise of liberalization of technology imports would have been a waste of time and resources for India" (emphasis as in the original).[42]

Ultimately 'opening up' of the economy and facilitating the import of hi-tech is not the important issue. It needs no research to state that today's hi-tech becomes old technology as soon as it is obtained and definitely by the time the transferee assimilates it successfully. The key to success really lies in the accumulation of experience and knowhow from the improvement of imported technologies.

VI. THE PERFORMANCE OF THE CORPORATE SECTOR IN THE EIGHTIES

Trends in direction and direction of trends

Limitations of data notwithstanding and given particularly the difficulties in interpreting structural ratios worked on the basis of nominal prices, we begin with an examination of the place of the engineering industry in the total manufacturing sector of the economy as also certain structural characteristics and technical coefficients indicating its performance. In the organized sector the engineering sector accounts for 27 per cent of factories, 28 per cent of employment, 27 per cent of fixed capital, 39 per cent of total output and 43 percent of value added of all manufacturing industries in 1988-89 **(Table I)**.

The ratios provided in **Table II** help to trace the direction in which the engineering sector is moving in relation to the manufacturing sector as a whole. The value of fixed capital per employee and per factory has increased during the period (1979-80 to 1988-89) at an annual average rate of 22 per cent and 20 per cent respectively for the engineering sector as against 25 per cent and 22 per cent for the manufacturing sector as a whole. Hence while capital intensity has increased in the engineering sector, the intensity of increase is not faster than that for the manufacturing sector as a whole. Further, not only has there not been any substantial rise in the capital-output ratio for the manufacturing sector as a whole, in the engineering sector on the contrary, the ratio of fixed capital to value added has declined. Another significant point to be noted is that the increase in the emoluments per employee has not outstripped the increase in labour productivity; in fact, the former is lower than the latter in all but the non-electrical machinery sector. The trend observed in the case of engineering goods in respect of wage cost and labour productivity is also the same for the manufacturing sector as a whole. Profitability of the engineering sector, measured by the ratio

of operating surplus (value added minus emoluments) to total productive capital (sum of fixed and working capital) has remained at a level generally higher than for manufacturing as a whole, though the rate of growth has not been substantial. What is of greater significance to us in our study of technological performance is the ratio of value added to output, which has declined both in the engineering goods sector and manufacturing sector suggesting a rise in input costs and inefficient material management.

Foreign collaboration agreements (**Table III**) in the engineering sector account for over 65 per cent of total agreements approved in the country, reflecting, among other things, a high degree of technological dependence.

Examining the export performance of the engineering sector we find that engineering exports as a percentage of total exports *declined* from 11.48 in 1979-80 to 7.85 in 1988-89; again engineering exports as a percentage of the value of engineering production *declined* from 4.61 in 1979-80 to 2.65 in 1988-89 (**Table IV**) .

A study of import intensities of Indian industries in the context of the new economic policy finds that the rank correlation between the sectoral export growth and their respective import intensities is very high (.94) indicating a strong positive association between the growth of export and import demand.[43] Among the observations made by the author and significant for our study is the following:

> *"[On the other hand], the newly engineering export sectors such as electrical machinery, communication and electronic equipments, rail equipment, other transport equipment, and other non-metallic mineral products, involve considerably large amounts of imports directly or indirectly. — It, therefore, follows that with every export expansion there is an implication on the import bill."*[44]

The primary objective of the liberalization measures is to make the industrial climate conducive so as to impart a dynamism to the functioning of the productive forces in the economy, particularly the private sector. On the assumption that the impact of such measures should get reflected to some extent in various indicators of performance, we turn to an examination of the RBI data on 'Finances of Public Limited Companies' for an assessment of the 'technological' performance of the corporate sector.

Tables V to IX indicate the direction in which the corporate sector has been moving during the decade of the eighties (the period when the liberalization measures have been in operation). **Table V** reveals the **minimal** (almost negligible) role played by exports as far as the corporate sector is concerned. Exports as a percentage of the value of production have either stagnated and/or increased only marginally but certainly nowhere close to acting as an engine of dynamic growth; this is true not just for all industry groups taken as a whole but also for each of the industry groups taken separately. The relative export/import ratio shown in **Table VI** again reflects an *overall decline* in performance. Even the earlier comparative advantage that the industry had in products like tea and tobacco have, over the years, steadily eroded.

On the other hand per firm expenditure on technology imports (**Table VII**) made up of royalty, dividends, technical and consultancy fees etc., reveals a steady increase for almost every sector of the industrial economy. The data provided by the RBI, an expenditure on R&D for the engineering sector, presents a dismal picture as far as the corporate sector is concerned (**Table VIII**), Engineering R&D as a percentage of total R&D expenditure for the industrial sector shows a declining trend between 1985-86 and 1989-90; this at a time when foreign collaboration agreements particularly in the Engineering sector have been showing an increasing trend. In **Table IX** we have brought together some of these indicators of performance at an aggregate level. We find, for example in 1989-90, that, while

technology imports expenditure added upto Rs.886 crores, R & D amounted to only Rs.55 crores; similarly while imports were of the order of Rs.6637 crores, exports were of the value of only Rs.4967 crores.

Bringing together the different strands of our argument, we note that,

(a) during the early phase of industrialization (until the mid sixties) when business houses/subsidiaries of multinational corporations had freely availed of imports and foreign technical collaboration/investment opportunities, their performance, as documented by the MRPTC, and as indicated in the nature of R & D undertaken by them, did not in any way contribute to make them innovative enough to be internationally competitive and/or dispense with further collaborations for the same product;

(b) the UNCTAD study which examined the performance of the capital goods sector during the period of regulation, namely, between 1973-74 and 1978-79, revealed two things:

  (i) that the 'impressive' growth of the capital goods industry during the period under study could not have been possible in the absence of government policies;

  (ii) capital goods producers had acquired substantial innovative capacity only in 'standard' modern technology while being still very weak in 'highly' modern technology despite the increasing R & D expenditures;

(c) Jacobsson's study of the engineering industry in the context of the new policy framework has brought out that while the liberalization measures have been successful in improving access to foreign technology, this has been at a price paid, in terms of both an inability to reap scale economies and a very poor

innovative performance;

(d) an examination of RBI data points to the dismal performance of the corporate sector in almost all indicators that one can associate with technological competence, namely, expenditure on R & D, volume of goods exported, value of imports and expenditure related to technology imports that is, royalty, technical and consultancy fees, dividends etc.

This really brings us back to two of the observations we made early in this study, namely, that

(a) liberalization measures **per se** cannot impart the level of dynamism that is necessary to catapult a low level economy, technologically speaking, into an internationally competitive one; this transformation requires among other things, fundamental alterations in the production structure of the economy;

(b) there is a disjuncture in the authority structure of the Indian society inasmuch as the state (which has brought into being and/or legitimized different forms of organizational enterprises in the economy) **has not been able** to get its economic programme implemented effectively through these enterprises. In other words, the role of the State in general and more important, the need for the State to interact at a more intense level with business in particular, given the domestic and global environment facing the country are hard questions that need to be faced.

VII. PERSPECTIVES ON EMPLOYMENT AND EDUCATION

An important thing to note about the country going global is that while domestic economic concerns such as unemployment, inflation and the like will not go away, increasingly, international and transnational political issues will tend to upstage them. Among the

fundamental changes that have occured in the world economy (elaborated in detail, among others, by Peter Drucker[45] and of immense importance to the economy of the LDCs are:

(a) the fact that the primary product economy has been 'uncoupled' from the industrial economy. For all non-farm commodities (various products, minerals or metals) world demand is shrinking. The amount of raw material needed for a given unit of economic output has been dropping. In 1984, for every unit of industrial production Japan consumed only 60 per cent of the raw materials required for the same volume of industrial production in 1973, that is, eleven year earlier;

(b) in the industrial economy itself, production has been delinked from employment. Restructuring of the production process has led to a progressive decline in blue collar employment.

A trend already discernible elsewhere in the world is the farming out of activities that do not offer opportunities for advancement into fairly senior management and professional position. The Corporation in stock market jargon is being 'unbundled'. Again the Japanese have shown the way as far as the feature of unbundling is concerned.

The large Japanese manufacturing companies maintain short term earnings (and employment security for their workers) and long-term investments in the future by 'out-sourcing'. They buy from outside contractors a far larger proportion of their parts than western manufacturers usually do. Thus they are able to cut their costs fast and sharply when they need to, by shifting the burden of short term fluctuations to the outside supplier.

The manner in which labour is enmeshed with the industrial structure is crucial.[46] In the American system the rise of big business was consequent upon the development of managerial hierarchies

and scientific management (read Taylorism) which brought in collective bargaining and the welfare state. In Britain the existence of a powerful trade union movement, prior to the establishment of big business, limited the power of management to reorganize work according to the principles of mass production.

In Japan, however, the intense class struggle that took place was resolved by the establishment of welfare capitalism within the firm; by and large the company relinquished the right to fire workers in exchange for a company union and no resistance to organizational change. The form of the resolution of the class struggle during the critical stages of the development of industrial capitalism has had a powerful effect both on the definition of manager and worker and on the terms of relation between the firms and the government. The occupational pinnacle for a blue-collar worker in America and Britain is foreman or front line supervisor, the ranks of management being closed. A career ladder for a worker in a Japanese factory, on the contrary, can progress from group leader to production supervisor upto production manager.[47]

The relevance of the above discussion to the Indian context lies in the following:-

(a) Technological dynamism implies restructuring of the production process to be effective which again demands that production processes be **flexibly** organized to adapt to changing technology.

(b) Flexible production processes mean changes in the quantity **and** quality of labour requirements; they are premised on a high degree of **horizontal mobility of skilled labour.**

(c) The component of labour making up organized sector employment in India is very small. Further, all official data sources bring out the **decline** and/or **stagnation in organized sector**

employment during the decade of the eighties (when economic growth particularly industrial growth has been relatively high as compared to the previous decades). This fact combined with the phenomenon of less labour requirement consequent upon (technological) restructuring of the production process cannot but lead to further retrenchment of labour.

(d) Hitherto, retrenchment from the 'organized' sector has always meant swelling the ranks of the 'informal'/'unorganized' sector, with its attendant evils of low wages, no enforcement of protective legislation - in short - exploitation of the highest order. Neither does the State take care of the retrenched workers.

(e) Even the most powerful of the trade unions in the country work in a rather uncoordinated fashion. It has been noted elsewhere that for any given amount of union power, unemployment is lower if unions and employers coordinate their wage bargaining either across industries or nationally. What works worst of all is strong but uncoordinated unions.[48]

(f) The historically defined antagonistic relationship that characterize Industry and Labour makes it difficult for the Indian industry to break with Taylorism. Under the changed economic environment this break is imperative in order to compete on the basis of superior products, higher quality, more reliable delivery times and shorter product development time. The potential for improving the conditions of work has not been systematically pursued by the trade union movement. For example, unions could seek greater job security for their members in exchange for an agreement to develop real production flexibility based on the skill-centred factory.

The data that we have assembled from several official sources document how remarkably **resistant** to change have been precisely

those areas that need to be transformed. **The data on employment and education of labour in general and of child workers in particular also show how far removed from ground realities are our policy makers and planners. No assessment and/or estimate has been made of the labour (and kinds of labour) requirements of the new industrial liberalization measures. More serious, there is no evaluation of the existing educational/skill level of the population in general and of labour in particular to even gauge how far this labour will be able to take advantage and/or even adapt to the emerging situation.**

We begin with an overview of the position occupied by the labour force (sex-wise and age-wise) using the standard Census definition of work; we then move on to a discussion of the educational level of the population, particularly of the working population. Sex-wise and age-wise data relating to child population and to scheduled castes and scheduled tribes point to the multi-dimensional level of the problem that needs to be examined to understand why labour is where it is in the conventionally defined work force of the census.

Tables X and XI give an idea of the :

(i) composition of the (main) workers, sex-wise and activity-wise **within each social group.**

(ii) composition of (main) workers, sex-wise and group-wise **within each activity.**

That the bulk of the labour force is still concentrated is agriculture need not be laboured. What however needs to be highlighted is the fact that labour force participation rate are noticeably higher among scheduled caste and scheduled tribe population in general and of women in particular.

The dominance of technology today and its direct relationship to formal education has sharpened the significance of the debates

surrounding the inequities in educational access and achievement on the one hand, and on the other, by the structure and ideology of science and knowledge in general - the latter being currently shaped by the priorities of the production system rather than by wider social needs.

In what follows we have put together data from the Census indicating the educational level of the population in general and of workers in particular to bring out the continuing gaps in school attendance, achievement and literacy.

Tables XII, XIII and XIV give an idea of the high rates of illiteracy which still persists among the population and which gets more pronounced in the case of women, scheduled castes and scheduled tribes. A break-up of the **literate** population reveals that hardly 2 per cent of males and less than one per cent of females have managed to go upto and beyond the graduate degree. The educational level of the (main) workers of the population is even more dismal. While almost 50 per cent of male main workers are illiterate, in the case of women (main workers) illiteracy is almost 85 per cent. Since a majority of the workers are concentrated in the agricultural sector, either as cultivators and/or as agricultural labourers, we have provided details regarding their educational level. Needless to add, illiteracy is higher among the agricultural population. **Table XIV** details the educational level of the urban population in general and urban main workers in particular (We need not labour the fact of the urban population having better access to educational and other infrastructural facilities vis-a-vis the rural areas). The Census also provides (for the urban population only) the technical degrees/ diplomas obtained by industrial classification. Needless to mention is the abysmally low skill level of the population.

Tables XV-XVII provide details of the school attendance and levels of education of children by sex, residence and activity. They bring out quite starkly the fact that:

a) (i) almost 47 per cent of male children (both rural and urban) and 65 per cent of female children (both rural and urban) in the age group 5-14 years **do not attend school,**

(ii) the figure of non-attendance at school increases to 52 per cent for **male rural** children and 73 per cent for **female rural children** when broken down by residence.

b) Almost 97 per cent of male child workers (age 5-14 years) and 98 per cent of female child workers **do not attend school.**

c) Even among those **children not working,** only 58 per cent of male children and 37 per cent of female children **attend school.**

This then is the educational quality of the population in general and of children in particular as depicted by official data sources. The findings have important implications for development policy and particularly so in the current phase of the `opening up' of the economy where the emphasis is on the importation of sophisticated technology to make the economy internationally competitive. There are two crucial issues among others to be addressed here:

a) the abysmally low level of education, particularly skill level of the population which, in a different way, is corroborated by the observations made by Japanese experts of Indian workers:[49] "Workers in less developed countries are short of basic knowledge of science and technology - Almost all the Japanese experts I interviewed have experienced incidents[50] which were quite unforeseen by them, being used to working with well-educated Japanese workers, and they all maintain that the widespread dissemination of basic and secondary education among the local populace is a basic precondition for smoother technology transfer."[51]

b) the insulation of institutes of higher learning/teaching from industrial and manufacturing activities. As a former director of

IIT, Madras, put it:"...today engineering education has became a second-rate science resembling an applied physics course and completely devoid of its characteristic features and identity.— Two agencies that could have come forward and asserted themselves were the Indian industries, and, engineering professionals' societies. Both these agencies have been silent spectators of the gradual deterioration of technical education. The industries, which are user agencies of trained technical manpower, have also remained aloof."[52]

It needs also to be emphasized in this context that the pursuance of sex and class-neutral policies without addressing/correcting initial imbalances cannot but exacerbate existing inequities.

VIII. CONCLUDING OBSERVATIONS

Among the issues thrown up by our paper we would like to highlight the following:

a) The dismal performance of Indian organised industry is only partly due to bureaucratic rules and regulations and largely stems from an **inflexible production structure** that is unable to adapt rapidly to changing global and domestic environment.

b) The **quality** of **state intervention** in the economy has been **so poor** that it has not been able to compel the private sector to deliver the goods despite vast resources having been made available to this sector. There is hardly a proper evaluation of the performance of the private sector.

c) There is not even a conceptual realization that imparting dynamism to the industrial sector **ipso facto** implies that a **labour policy** be made an **integral part** of the industrial policy.

d) whether or not the new policies will generate employment is only one aspect of the problem (for which again there has to be

a comprehensive evaluation of the components of the policy); more important in our view is the existing pattern of employment and the quality of this employed/employable population in terms of its skill and educational achievements.

Without labouring the point further we may conclude thus:

The barrier to a dynamic growth of the Indian economy can, to a large extent, be traced to the inability to realize, accept and operationalize the fact that **technical change and productivity** (which lie at the heart of costs, competitiveness and economic growth) is more a production -related phenomenon rather than a market oriented one. In other words, the emphasis has to shift primarily to the restructuring of the production unit, its organization and internal governance structure so that strategies of continuous improvement in product and process can be pursued. A thorough exploration of each of these aspects would by itself require a full-scale study. Suffice it to mention here one aspect which in our view requires study(ies) of an in-depth and evaluative nature, namely the persistence of 'family control' of the firm in India. Unlike in the case of the Korean **chaebols** (the monitoring of whose functioning is politically obtained), the ineffectiveness of Indian intervention in the functioning of business **combined with** 'family control of the firm' has had deleterious consequences on the **growth** of the firm and the **development** of **organizational capability.** At one level, very often proprietary firms are wary of taking risks (involved in any expansionary strategy) in order to avoid becoming dependent, particularly on institutional creditors and shareholders. At another level, the practice of recruitment to the top management from within a closed circle not only constitutes the higher management as a social class apart, but, more important, has been instrumental in segmenting general management from technical specialists and lower level line managers.[53]

At the risk of making a sweeping generalization, it needs to be stressed that evaluations of past government efforts to promote

industrial development have been largely self-sewing and of minimal use in planning new efforts. If there is an important lesson to be underlined in all of the above, it is that, planning an adjustment to a new environment, and one particularly aimed at making the industrial sector compete **successfully** at the international level, is a **long term measure** and demands the **integration** and **simultaneous** tackling of several seemingly different components.

It would be pertinent at this juncture to call attention to a World Bank study of structural adjustment in a newly industrialized country, namely, the Republic of Korea. Important aspects of the adjustment programme emphasized in the study, include the fact that:

a) the adjustment was carried out in pre-announced phased manner over almost a 10-year period. This prevented import liberalization from forcing negative adjustment on domestic firms while at the same time pressuring them for removal of their x-ineffi-ciencies and for learning by doing. While adjustment in the form of closure of firms and industries that were simply unviable could not be avoided altogether, there was no major disruption, since the ogvernment not only provided firm-specific support, but also increased support for small and medium sized firms);

b) it also contained a comprehensive package stressing (apart from direct industry-related measures), the importance of the role of the labour market, social welfare measures including the emphasis on universal education, and economic management strategies which **operationalized** decisions taken;

c) the structural adjustment programme was well supported by macroeconomic policies which did not allow the key variables - the real exchange rate, real interest rate, public sector deficit and real wages to get too far out of line.[54]

An important issue that underscores the need to evaluate the problems of individual sectors if industrial policy is to have any meaning at all, is the fact that the process of innovation involves differing combinations of "proprietary and public forms of knowledge" that vary according to the conditions of different industries.[55] While software innovation may thrive in an economy of thousands of independent producers, aircraft innovation may require oligopoly, market power and government presence if not government regulation. Therefore public policy cannot afford to ignore industry-specific variations. "Studied indifference to issues of innovation in the name of `free markets' is also a policy".[56]

While the question of why and how technical change and productivity has largely eluded the Indian economy, may appear to be of historical interest, it is important since it belongs to the realm of political economy which is what determines the choices open to an economy. The issue of technology policy and the problem of the poor technological performance of the Indian economy has to be initially sorted out at the realm of political economy which involves a comprehensive package covering, among other things, complementary macro-economic and structural policies affecting inter-firm coordination, regional cooperation, financial allocation, labour reorganization etc. Any effort to isloate a particular factor or set of factors and assume that the country's stagnation in the technological field can be reversed by such approach is unlikely to be effective.

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50. The **Incidents** include instances such as the following: a worker **cleaned** with water anelectric appliance which happened to be soaked in sea water. In another example, a worker, while repairing an electronic component, wrapped an ordinary cotton cloth over a naked electric line inside it, which caused it to short-circuit many times until the Japanese experts detected the defective method"
    Quoted from Shoji Ito, 1992, op.cit.

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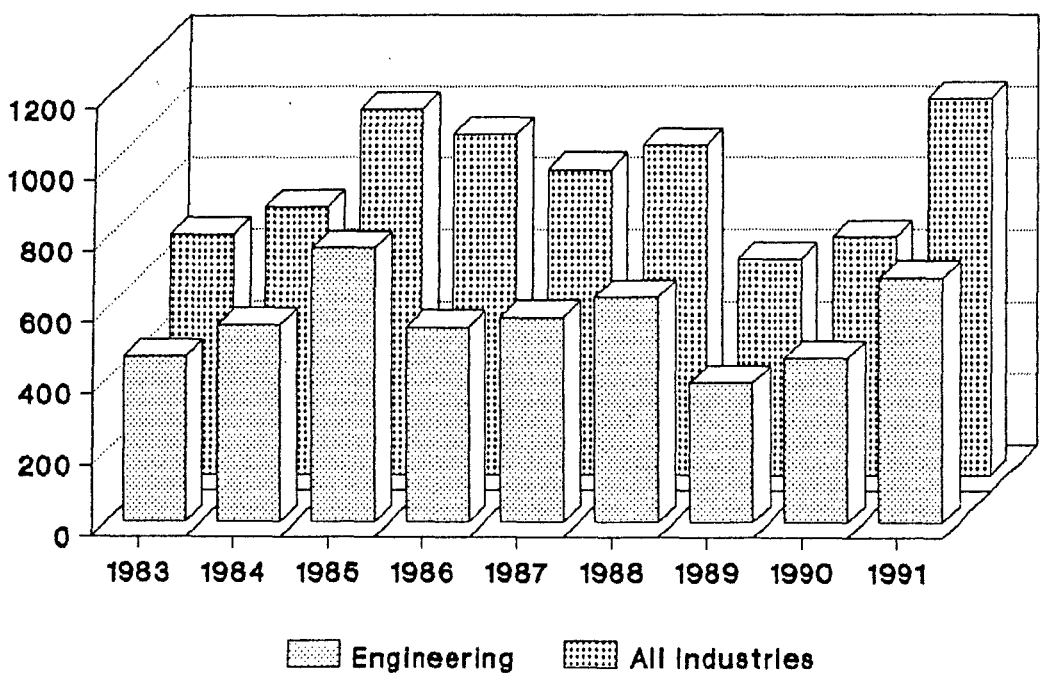
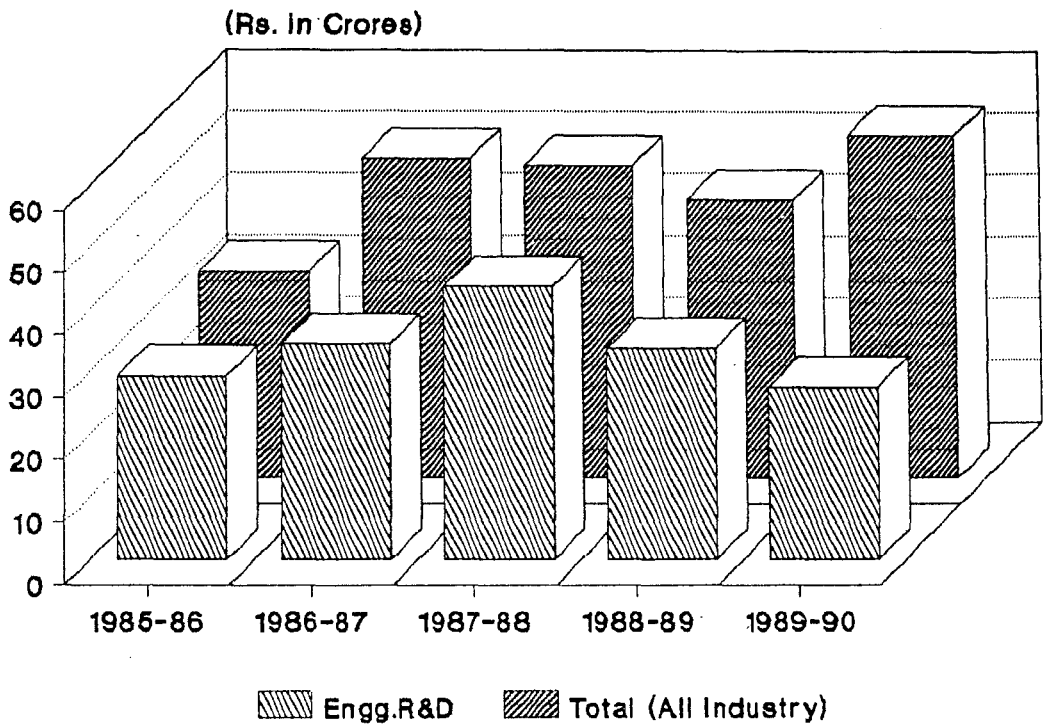
Graph 1 : Foreign Collaboration Agreements
(Engineering Sector)



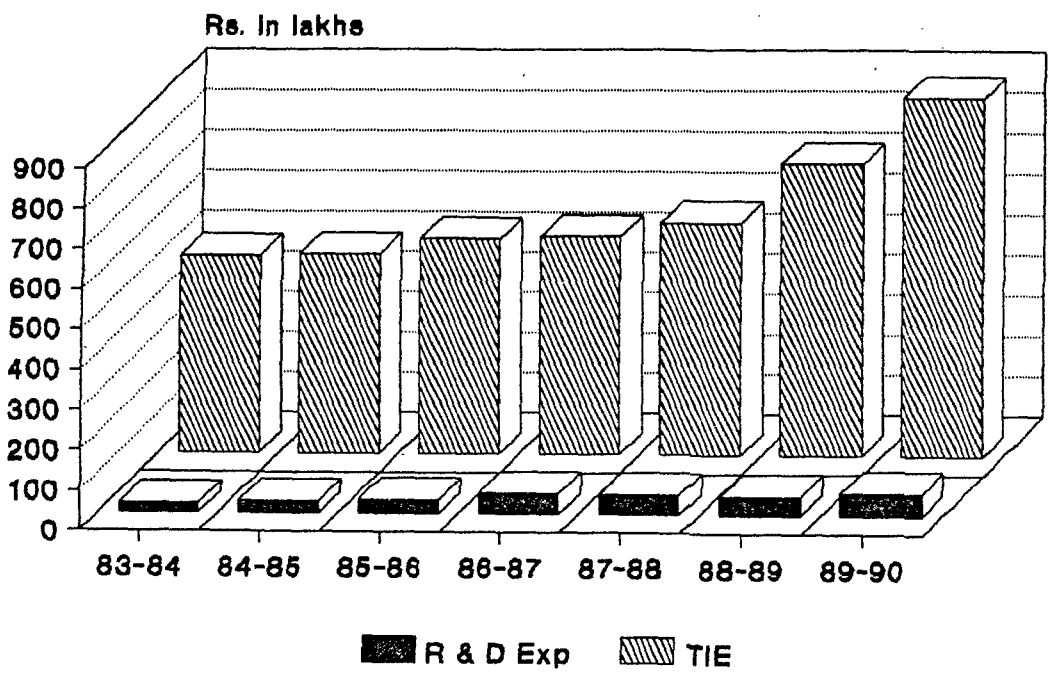
Source: Table III.

Graph 2 : Expenditure on Research and Development



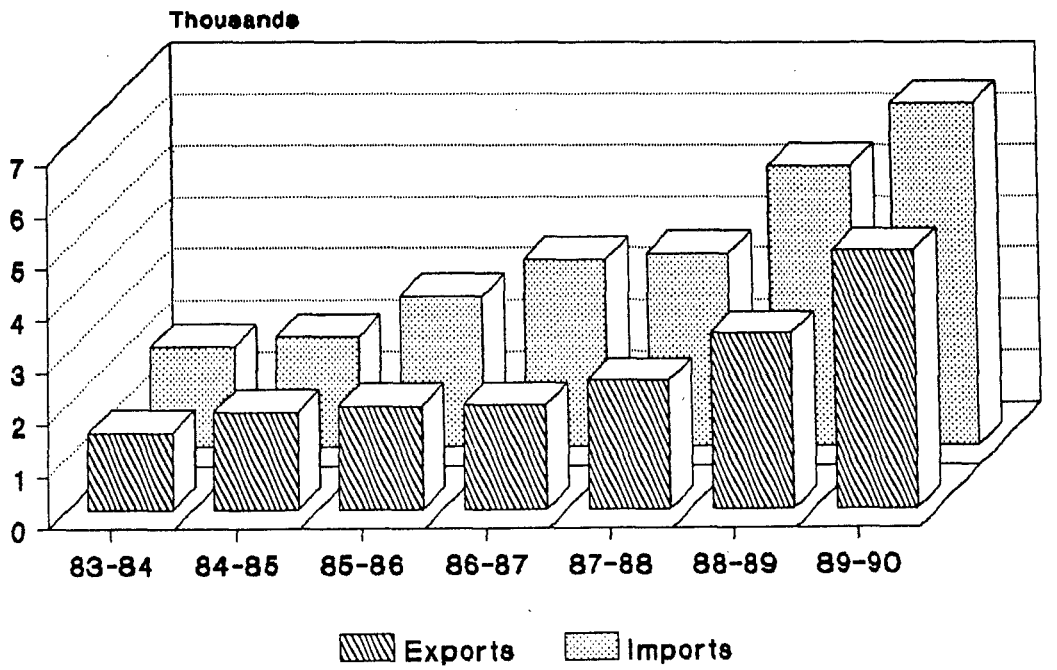
Source: Table VIII.

Graph 3 : Technological Performance of The Indian Corporate Sector: Some Indicators



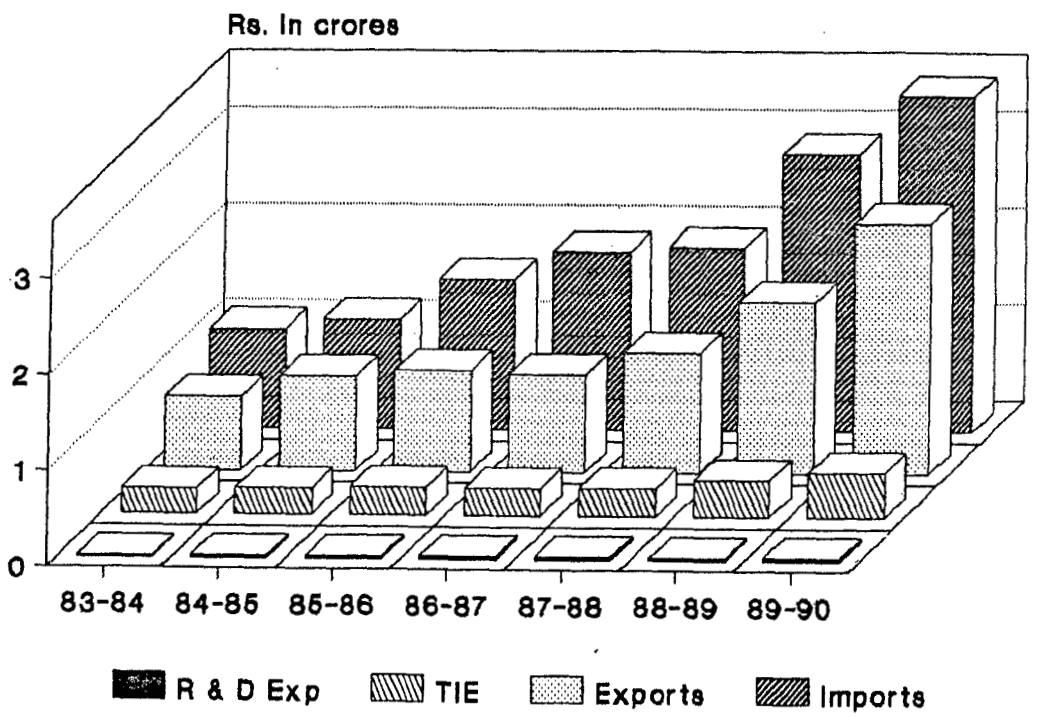
Source: Table XII

Graph 4 : Technological Performance of the Indian Corporate Sector: Some Indicators



Source: Table XII

Graph 5 : Per Firm Expenditure and Earning



Source: Table XII

Table I : Share of Engineering Goods in the Registered Factory Sector

Ind. Code	Indus-try Group	No. of facto-ries	Fixed Capital (FC) (Rs. Lakhs)	No. of Emp-loyees	Total Emolu-ments (Rs. Lakhs)	Value of Output (Rs. Lakhs)	Net Value Added (Rs. Lakhs)	Working Capital (WC) (Rs. Lakhs)	PC = FC+ WC (Rs. Lakhs)
ENGINEERING									
33 - Basic Metal & Alloy Ind.									
1979 - 80		5538	373161	556540	58414	593200	103038	137776	510937
80 - 81		5779	429465	578007	64511	718155	123425	189723	619188
81 - 82		6013	519227	589668	73863	925331	175682	230767	749994
82 - 83		5509	606055	603993	85719	1066940	180378	256642	862697
83 - 84		5888	702867	618140	98911	1076569	204274	244038	946905
84 - 85		5901	814118	669375	128514	1285454	186205	247456	1061574
85 - 86		6077	832275	596075	114078	1431846	235610	247862	1080137
86 - 87		6191	877660	614676	127680	1586840	219550	275696	1153356
87 - 88		6184	1027115	617278	141252	1777237	257097	324937	1352052
88 - 89		6203	1159147	617298	160701	2359127	410989	333543	1492690
Avg Growth Rate		1.33	23.40	1.21	19.46	33.08	33.21		21.35
34 -Mfe of Metal Pds & Parts									
1979 - 80		6230	22229	202118	14609	131397	31708	35788	58017
80 - 81		6457	27274	191498	15618	139382	33124	28856	56130
81 - 82		6563	28470	190802	17191	165219	36481	31101	59571
82 - 83		5884	33047	195989	18138	175848	38124	37990	71037
83 - 84		6054	43582	185307	22111	184642	44984	36881	80463
84 - 85		6078	43922	196547	26762	217054	49060	41546	85468
85 - 86		6307	47634	186774	26152	235135	52596	44256	91890
86 - 87		5978	50235	171254	26744	232715	52568	40748	90983
87 - 88		6390	67972	201214	34764	314657	71467	55726	123698
88 - 89		6335	95432	214149	42431	405472	98362	49926	145358
Avg Growth Rate		0.19	36.59	0.66	21.16	23.18	23.36		16.73
35 - Mfe of Machinery, Machine tools etc									
1979 - 80		6826	75296	420272	37046	296649	75563	76490	151786
80 - 81		7011	79207	401028	41407	358590	88845	85971	165178
81 - 82		7876	95934	415840	47926	425768	104975	97609	193543
82 - 83		7207	111509	432068	55957	480994	119065	112631	224140
83 - 84		7138	145088	446364	68008	534613	140225	137410	282498
84 - 85		7168	145988	429578	74064	594186	160892	131695	277683
85 - 86		7648	201424	439988	84119	689066	186269	164317	365741
86 - 87		7254	175691	404173	83836	710025	175515	162855	338546
87 - 88		7584	197554	437777	97603	838491	194546	191790	389344
88 - 89		7711	238937	437272	108194	974809	212293	282646	521583
Avg Growth Rate		1.44	24.15	0.45	21.34	25.40	20.11		27.07

Contd.

Table I : Share of Engineering Goods in the Registered Factory Sector (Contd.)

Ind. Code	Industry Group	No. of factories	Fixed Capital (FC) (Rs. Lakhs)	No. of Employees	Total Emoluments (Rs. Lakhs)	Value of Output (Rs. Lakhs)	Net Value Added (Rs. Lakhs)	Working Capital (WC) (Rs. Lakhs)	PC = FC+ WC (Rs. Lakhs)
	36 - Mfe of Electrical Mach. etc								
	1979 - 80	3277	62355	314127	32842	298013	69590	78214	140569
	80 - 81	3406	70770	317349	37294	361923	83392	92286	163056
	81 - 82	4229	77444	310387	38775	391835	89897	96074	173518
	82 - 83	3641	99941	336708	50509	474065	119729	120150	220091
	83 - 84	3661	115480	337162	57263	472518	129597	132240	247720
	84 - 85	3831	133341	353194	68418	556201	171076	142530	275871
	85 - 86	4066	147247	349996	72261	632948	148590	156286	303533
	86 - 87	3888	162802	335113	77890	701647	164460	176215	339017
	87 - 88	4241	217058	372711	95974	915895	217146	209827	426885
	88 - 89	4496	287675	376269	104644	1159595	265590	211389	499064
	Avg Growth Rate	4.13	40.15	2.20	24.29	32.12	31.29		28.34
	37 - Mfe of Transport equipment								
	1979 - 80	2867	133386	482005	46767	277857	73098	85212	218598
	80 - 81	2815	137391	484484	54258	336892	85563	102878	240269
	81 - 82	3339	151322	497645	65200	424070	110312	112287	263609
	82 - 83	2816	170506	505870	73978	476422	130914	118759	289265
	83 - 84	2815	183070	500061	82435	500683	139049	120560	303630
	84 - 85	3041	226829	521378	95677	583182	153558	115280	342109
	85 - 86	3267	246104	473478	97546	636496	152262	113661	359765
	86 - 87	3120	279285	483027	111704	760140	189592	128320	407605
	87 - 88	3318	317708	481482	122766	854150	188098	141635	459343
	88 - 89	3345	363556	507853	140831	1107548	233069	184527	548083
	Avg Growth Rate	1.85	19.17	0.60	22.35	33.18	24.32		16.75
	ENGINEERING (33+34+35+36+37)								
	1979 - 80	24738	666427	1975062	189678	1597116	352997	413480	1079907
	80 - 81	25468	744107	1972366	213088	1914942	414349	499714	1243821
	81 - 82	28020	872397	2004342	242955	2332223	517347	567838	1440235
	82 - 83	25057	1021058	2074628	284301	2674269	588210	646172	1667230
	83 - 84	25556	1190087	2087034	328728	2769025	658129	671129	1861216
	84 - 85	26019	1364198	2170072	393435	3236077	720791	678507	2042705
	85 - 86	27365	1474684	2046311	394156	3625491	775327	726382	2201066
	86 - 87	26431	1545673	2008243	427854	3991367	801685	783834	2329507
	87 - 88	27717	1827407	2110462	492359	4700430	928354	923915	2751322
	88 - 89	28090	2144747	2152841	556801	6006551	1220303	1062031	3206778
	Avg Growth Rate	1.51	24.65	1.00	21.51	30.68	27.30	17.43	21.88

Contd..

Table I : Share of Engineering Goods in the Registered Factory Sector (Concld.)

Ind. Code	Industry Group	No. of factories	Fixed Capital (FC) (Rs. Lakhs)	No. of Employees	Total Emoluments (Rs. Lakhs)	Value of Output (Rs. Lakhs)	Net Value Added (Rs. Lakhs)	Working Capital (WC) (Rs. Lakhs)	PC = FC+ WC (Rs. Lakhs)
Total (All-India)									
	1979 - 80	95126	2682963	7678271	537190	5225785	1086450	1105896	3788859
	80 - 81	96503	2990038	7714679	609651	6108403	1192877	1320840	4310878
	81 - 82	105037	3470259	7777868	677753	7367247	1455457	1505488	4975747
	82 - 83	93166	4100600	8009792	804609	8623768	1667368	1631988	5732588
	83 - 84	96706	4860554	7824121	921825	9353741	2013718	1850402	6710956
	84 - 85	96947	5484211	7871712	1066021	10556600	2088716	2232323	7716534
	85 - 86	101016	6008524	7471515	1108113	12015540	2326647	2379864	8388388
	86 - 87	97957	6723094	7441879	1229918	13304352	2555224	2180329	8903423
	87 - 88	102596	7847463	7785580	1408105	15397307	2833360	2755102	10602565
	88 - 89	104077	8909875	7743344	1572832	18434878	3463480	2724616	11634491
Avg Growth Rate		1.05	25.79	0.09	21.42	28.09	24.31		23.01
Share of Engineering in Total (%)									
	1979 - 80	26.01	24.84	25.72	35.31	30.56	32.49	37.39	28.50
	80 - 81	26.39	24.89	25.57	34.95	31.35	34.74	37.83	28.85
	81 - 82	26.68	25.14	25.77	35.85	31.66	35.55	37.72	28.95
	82 - 83	26.90	24.90	25.90	35.33	31.01	35.28	39.59	29.08
	83 - 84	26.43	24.48	26.67	35.66	29.60	32.68	36.27	27.73
	84 - 85	26.84	24.88	27.57	36.91	30.65	34.51	30.39	26.47
	85 - 86	27.09	24.54	27.39	35.57	30.17	33.32	30.52	26.24
	86 - 87	26.98	22.99	26.99	34.79	30.00	31.37	35.95	26.16
	87 - 88	27.02	23.29	27.11	34.97	30.53	32.77	33.53	25.95
	88 - 89	26.99	24.07	27.80	35.40	32.58	35.23	38.98	27.56

Note: (1) Engineering refers to the following Industry Groups
(a) 33 - Basic Metal and Alloy Industries
(b) 34 - Mfe of Metal Products and Parts except Machinery and Transport Equipment
(c) 35 - Mfe of Machinery, Machine Tools and Parts except Electrical Machinery
(d) 36 - Mfe Electrical Machinery, Apparatus, Appliances & Supplies & Parts
(e) 37 - Mfe of Transport Equipment & Parts
(2) PC = Productive Capital

Source: Annual Survey of Industries, Summary Results for the Factory Sector, CSO., New Delhi, various years.

Table II : Average Annual Growth in Selected Structural Ratios in Engineering Goods Subsectors (in %)

Avg. Annual Growth in	Between 1979/80 and 1988/89						
	Basic Metal	Metal Pds & Parts	Non-Elect Mech.	Elect. Mach.	Trans-port Equip	Total for Engr. goods	All Ind-dustries
1. Value of fixed capital per employee	20.01	33.91	22.78	31.68	17.63	21.69	25.48
2. Value of fixed capital per factory	19.70	35.80	20.10	26.25	14.85	20.38	22.61
3. Ratio of fixed capital to value added	-2.46	4.27	1.44	2.32	-1.61	-0.77	0.46
4. Ratio of emoluments to employment	16.45	19.35	20.08	18.45	20.65	18.81	21.15
5. Value added per employee	28.85	21.42	18.89	24.29	22.51	24.13	24.01
6. (Value added-emoluments) as a ratio of prod.capital	10.22	3.40	-2.37	2.60	4.41	4.09	1.34
7. Value added as a ratio of total output.	0.03	0.06	-1.61	-0.21	-2.22	-0.09	-1.07

Source: Computed from Table I.

Table III : Foreign Collaboration Agreements (Engineering Sector)

	Product group	1983	1984	1985	1986	1987	1988	1989	1990	1991 upto Feb' 92	Total (1983-Feb' 92)
1	Boilers and steam generating plants	2	3	13	5	1	2	11	7	7	51
2	Prime movers (other than electrical generators)	2	6	15			6	2	2	1	34
3	Electrical Equipment	129	157	205	175	183	183	99	88	184	1403
4	Transportation	39	63	101	53	39	38	30	22	73	458
5	Industrial machinery	115	138	152	108	132	141	59	75	190	1110
6	Machine tools	44	34	32	13	10	21	9	24	23	210
7	Agricultural machinery	2	2	3	3		3	3		5	21
8	Earth-moving machinery	8	4	11			4			7	34
9	Misc.mechanical engineering	35	44	45	47	50	68	26	88	34	437
10	Industrial Instruments	37	56	52	20	47	43	35	38	45	373
11	Metallurgical Industries	20	26	53	45	29	27	30	26	40	296
12	Consultancy	13	14	23	5	47	39	20	10	35	206
13	Telecommunication	7	3	36	37	16	23	37	69	19	247
14	Com.office & household equip.	9	3	20	10	7	10	18	7	9	93
15	Med & Surgical appliances	2	1	5	12	10	18	6	5	8	67
16	Scientific instruments			2	13	4	3	5		4	31
17	Maths & Surveying Inst			1	1		2	2			6
	(A) Subtotal	464	554	769	547	575	631	392	461	684	5077
	(B) All Industries	675	752	1024	954	856	923	605	666	1053	7508
	A as % of B	68.74	73.67	75.10	57.34	67.17	68.36	64.79	69.22	64.96	67.62

Note: Product groups making up the Engineering sector follow the categorization given by the CEI., in their Annual Handbook of Statistics.

Source: Basic Statistics Relating to the Indian Economy, Vol 1, All India, August 1992, Table 17.7, Centre for Monitoring Indian Economy, Bombay.

Table IV : Engineering Export Performance

(Rs. crores)

Year	Engg. Exports	Total Exports	Value of Prod	(2) as % of (3)	(2) as % of (4)
(1)	(2)	(3)	(4)	(5)	(6)
1979-80	737	6418	15971	11.48	4.61
1980-81	874	6711	19149	13.02	4.56
1981-82	1047	7806	23322	13.41	4.49
1982-83	1011	8803	26743	11.48	3.78
1983-84	1000	9771	27690	10.23	3.61
1984-85	1150	11744	32361	9.79	3.55
1985-86	1000	10895	36255	9.18	2.76
1986-87	1150	12452	39914	9.24	2.88
1987-88	1105	15674	47004	7.05	2.35
1988-89	1589	20232	60066	7.85	2.65

Source: 1. For col. (2) & (3): Economic Survey, Ministry of Finance, Govt. of India, various issues.

2. For col. (4): Annual Survey of Industries, Summary Results for the Factory Sector, CSO, various issues.

Table V : Exports to Value of Production - Select Industries

(Per cent)

	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1. Tea Plantations	15	12	12	13	11	11	11	12
2. Sugar	1	1	3	1	0	1	1	1
3. Tobacco	13	29	30	25	21	19	14	17
4. Cotton Textiles	3	2	3	3	3	7	6	9
5. Jute Textile	0	0	0	0	14	12	9	7
6. Silk and rayon textiles	0	1	1	1	1	1	3	2
7. Aluminium	3	4	3	2	3	3	5	8
8. Engineering	4	4	4	3	3	3	4	5
(i) Motor Vehicles	5	4	4	3	3	3	3	4
(ii) Electrical machinery,apparatus, applicences, etc.	7	6	5	4	4	4	5	5
(iii) Machinery other than Transport & electrical	4	5	5	5	5	5	6	8
(iv) Foundries and engineering workshops	1	2	2	1	1	1	2	4
(v) Ferrous/non-ferrous metal products	3	2	2	2	1	2	2	3
9. Chemicals	4	4	4	4	4	4	4	6
(i) Medicines and pharmaceutical preparations	5	4	5	5	5	4	6	8
(ii) Paints and Varnishes	0	0	0	0	4	4	4	3
(iii) Basic industrial chemicals	2	2	2	2	2	2	3	3
of which chemical fertilizers	0	0	0	0	0	0	0	0
10. Cement	2	1	2	1	1	1	1	1
11. Rubber and rubber products	2	2	3	3	3	5	5	7
12. Paper and paper products	1	0	0	0	0	0	1	1
Total (including others)	5	4	4	4	4	4	5	6

Source: Calculated from 'Finances of Public Limited Companies', RBI Bulletin, various issues.

Table VI : Exports to Imports Ratios - Select Industries

(Per cent)

	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1. Tea Plantations	2222	3515	2375	1407	1346	1476	1158	1063
2. Sugar	534	94	221	204	15	129	128	85
3. Tobacco	2379	1808	2820	2560	1585	1222	1310	1442
4. Cotton Textiles	67	61	77	46	49	145	93	161
5. Jute Textile	0	0	0	0	822	594	331	946
6. Silk and rayon textiles	1	10	17	7	11	46	55	52
7. Aluminium	129	158	126	56	71	18	110	181
8. Engineering	53	50	56	41	34	38	42	48
(i) Motor Vehicles	64	59	68	43	38	39	39	47
(ii) Electrical machinery,apparatus, appliances, etc.	87	80	62	44	41	42	50	44
(iii) Machinery other than transport & electrical	46	48	63	61	45	53	66	86
(iv) Foundries and engineering works	13	16	25	9	9	10	18	23
(v) Ferrous/non-ferrous metal products	26	21	25	21	21	24	12	26
9. Chemicals	57	54	49	42	41	45	37	49
(i) Medicines and pharmaceutical preparations	83	73	80	79	68	67	73	84
(ii) Paints and Varnishes	0	0	0	0	53	59	41	31
(iii) Basic industrial chemicals	24	22	17	14	14	20	18	25
of which chemical fertilizers	1	1	0	2	1	1	1	1
10. Cement	114	49	96	79	106	103	67	71
11. Rubber and rubber products	25	36	54	56	46	76	60	88
12. Paper and paper products	34	6	1	2	1	2	6	10
Total (including others)	81	76	88	68	55	66	62	75

Source: Calculated from 'Finances of Public Limited Companies', RBI Bulletin, various issues.

Table VII : Expenditure on Technology Imports Per Firm

(Per cent)

	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
1. Tea Plantations	8	10	11	14	20	22	28	52
2. Sugar	0	1	2	14	1	1	6	8
3. Tobacco	85	35	61	54	53	79	106	120
4. Cotton Textiles	20	9	15	27	41	43	55	37
5. Jute Textile	0	0	0	0	1	3	2	1
6. Silk and rayon textiles	0	7	15	19	15	19	17	13
7. Aluminium	69	64	49	71	57	58	70	103
8. Engineering	26	23	26	31	29	30	37	48
(i) Motor Vehicles	50	39	57	58	52	54	72	100
(ii) Electrical machinery, apparatus, appliances, etc.	29	24	27	21	27	23	28	32
(iii) Machinery other than transport & electrical	38	36	38	61	50	53	64	88
(iv) Foundries and engineering workshops	5	7	6	6	7	8	9	14
(v) Ferrous/non-ferrous metal products	7	4	6	4	9	9	11	14
9. Chemicals	23	17	18	26	27	32	52	72
(i) Medicines and pharmaceutical preparations	18	17	20	25	24	18	25	34
(ii) Paints and Varnishes	0	0	0	0	13	18	22	22
(iii) Basic industrial chemicals	18	17	20	28	36	48	75	106
of which chemical fertilizers	28	23	14	31	75	118	233	335
10. Cement	28	30	48	62	62	70	59	81
11. Rubber and rubber products	24	28	29	30	42	61	59	78
12. Paper and paper products	16	21	70	14	17	13	7	10
Total (including others)	22	26	27	29	28	29	38	46

Note: TIE refers to Total Import Expenditure made up of royalty, dividends, technical and consultancy fees, etc.

Source: Calculated from 'Finances of Public Limited Companies', RBI Bulletin, various issues.

Table VIII : Expenditure on Research and Development

(Rs.Crores)

Industry/ Industry Group	1985-86		1986-87		1987-88		1988-89		1989-90	
	No. Cos.	Exp. on R&D	No. Cos.	Exp. on R&D	No. Cos.	Exp. on R&D	No. Cos.	Exp. on R&D	No. Cos.	Exp. on R&D
I. Engineering	54793	14.67	547	17.29	541	22.02	541	17.06	541	13.83
i) Motor Vehicles	6019	6.76	60	7.50	66	5.39	66	4.76	66	7.26
ii) Electrical machinery apparatus appliances	12330	2.27	123	3.50	134	5.57	134	3.11	134	3.14
iii) Machinery other than transport & electrical	15825	4.95	158	5.67	135	9.94	135	7.95	135	2.44
iv) Foundries & Eng. works	10710	0.29	107	0.30	105	0.35	105	0.46	105	0.38
v) Ferrous/non-Fer. metal works	85 6	0.32	85	0.22	93	0.46	93	0.43	93	0.55
II. Total (for all industry)	194289	33.03	1942	51.22	1908	50.10	1908	44.61	1908	55.25
Engg.R&D as % of Total R&D		44.41		33.76		43.95		38.24		25.03
Per Firm R&D (Engg)		0.03		0.03		0.04		0.03		0.03
Per Firm R&D (Total)		0.02		0.03		0.03		0.02		0.03

Source: Reserve Bank of India, Bombay.

Table IX : Technological Performance of the Indian Corporate Sector: Some indicators

(Rs.Crores)

Year	No. of firms	R & D Exp	Exports	Imports	T I E	R & D Exp	Per firm Exports	Imports	T I E
1983 - 84	1867	23.52	1460.92	1915.06	489.65	0.01	0.78	1.03	0.26
1984 - 85	1867	29.43	1853.36	2102.00	495.01	0.02	0.99	1.13	0.27
1985 - 86	1867	33.39	1976.89	2888.35	532.78	0.02	1.06	1.55	0.29
1986 - 87	1953	50.90	1989.60	3586.30	539.20	0.03	1.02	1.84	0.28
1987 - 88	1953	49.70	2453.50	3708.00	575.30	0.03	1.26	1.90	0.29
1988 - 89	1885	47.00	3363.00	5415.50	721.40	0.02	1.78	2.87	0.38
1989 - 90	1908	55.20	4966.90	6636.60	885.60	0.03	2.60	3.48	0.46

Source: Computed from 'Finances of Public Limited Companies', RBI Bulletin, various issues

Table X : Composition of Main Workers by Sex and Social Group *within* each Activity

	Total Main workers		Cultivators		Agric Labourers		Household Ind.		Other workers	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
All Social Groups	177543406	44973168	77590670	14932165	34731846	20767858	5647030	2063890	59573861	7209254
of which:										
Scheduled Castes	28515377 (16.06)	9329191 (20.74)	9157641 (11.80)	1503487 (10.07)	11905029 (34.28)	6344331 (30.55)	913777 (16.18)	338725 (16.41)	6538930 (10.98)	1142648 (15.85)
Scheduled Tribes	14753619 (8.31)	7210069 (16.03)	8792565 (11.33)	3162200 (21.18)	3846309 (11.07)	3328589 (16.03)	185717 (3.29)	126148 (6.11)	1929028 (13.24)	593132 (8.23)

Note: Figures within brackets indicate percentages to totals

Source: Census of India - 1981 Series I India, Part III-A (i) General Economic Tables

Census of India - 1981 Series I India, Part III-A (ii) General Economic Tables

Table XI : Compostion of Main Workers by Sex and Activity within each Social Group

	Total (for All India)		Scheduled Castes		Scheduled Tribes	
Activity of Main Workers	Males	Females	Males	Females	Males	Females
Total Main Workers	177543406	44973168	28515377	9329191	14753619	7210069
of which	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
(i) Cultivators	77590670	14932165	9157641	1503487	8792565	3162200
	(43.70)	(33.20)	(32.11)	(16.12)	(59.60)	(43.86)
(ii) Agric Labourers	34731846	20767858	11905029	6344331	3846309	3328589
	(19.56)	(46.18)	(41.75)	(68.00)	(26.07)	(46.17)
(iii) Household Industry	5647030	2063890	913777	338725	185717	126148
	(3.18)	(4.59)	(3.20)	(3.63)	(1.26)	(1.75)
(iv) Other Workers	59573861	7209254	6538930	1142648	1929028	593132
	(33.56)	(16.03)	(22.93)	(12.25)	(13.07)	(8.23)

Note : Figures within brackets indicate percentages to totals

Source: Same as Table X and
Census of India 1981 - Series I, India, Part II-B, Primary Census Abstract Scheduled Castes
Census of India 1981 - Series I, India, Part II-B (iii) Primary Census Abstract Scheduled Tribes.

Table XII : Educational Level of the Indian Population - By Sex and Social Group (1981)

	Total Population		Scheduled Caste		Scheduled Tribe	
Levels of Education	Male	Female	Male	Female	Male	Female
Total Population	343930423 (100.00)	321357426 (100.00)	53489079 (100.00)	49811647 (100.00)	26007967 (100.00)	25558913 (100.00)
Literate (without Ed.level)	49644471 (14.43)	27763144 (8.64)	6629599 (12.40)	2514730 (5.05)	3099015 (11.92)	110347 (4.32)
Primary	46770288 (13.60)	26077285 (8.11)	5220109 (9.76)	1764630 (3.54)	1781300 (6.85)	539248 (2.11)
Middle	28860862 (8.39)	13340557 (4.15)	2600601 (4.86)	716843 (1.44)	899952 (3.46)	260962 (1.02)
Matric/Secondary	20385734 (5.93)	7510275 (2.34)	1314812 (2.46)	274543 (0.56)	401324 (1.54)	100052 (0.39)
Higher Sec/Inter	7425067 (2.16)	2395980 (0.75)	451944 (0.84)	63216 (0.13)	107081 (0.41)	22223 (0.10)
Non-technical diploma not equivalent to degree	108960 (0.03)	67196 (0.02)	4176 (0.01)	1380 (neg.)	976 (neg)	236 (neg)
Technical diploma or certificate not equivalent to degree	1052525 (0.31)	273952 (0.09)	50201 (0.09)	11465 (0.02)	14421 (0.06)	3696 (0.01)
Graduate degree and above	7037661 (2.05)	2317891 (0.72)	278361 (0.52)	32178 (0.06)	63769 (0.24)	13560 (0.05)
Percent Literate	46.90	24.82	30.94	10.80	24.48	8.00
Percent Illiterate	53.10	75.18	69.06	89.20	75.52	92.00

Note: Figures within brackets indicate percentages to totals

Source: Census of India - 1981, Series 1 India, Part III-A (i) General Economic Tables
Census of India - 1981 Series 1 India, Part IV-A (i), Social and Cultural Tables (Scheduled Castes)
Census of India - 1981, Series 1 India Part IV-A (iv) Social and Cultural Tables (Scheduled Tribes)

Table XIII : Educational Level of (Main) Workers : 1981

	Total Main Workers		Cultivators		Agricultural Labourers	
Levels of Education	Male	Female	Male	Female	Male	Female
Total	177543406 (100.00)	44973168 (100.00)	77590670 (100.00)	14932165 (100.00)	34731846 (100.00)	20767858 (100.00)
Illiterate	89890879 (50.63)	38027466 (84.56)	45340410 (58.44)	13172842 (88.22)	25931182 (74.66)	19176447 (92.34)
Literate (all levels)	87652527 (49.37)	6945702 (15.44)	32250260 (41.56)	1759323 (11.78)	8800664 (25.34)	1591411 (7.66)
Literate without Ed.level	19563591 (11.02)	1851092 (4.12)	9454068 (12.18)	646077 (4.33)	3344473 (9.63)	657252 (3.16)
Primary	2742359 (15.45)	2290354 (5.09)	11922999 (15.37)	790154 (5.29)	3636287 (10.47)	732378 (3.53)
Middle	16736611 (9.43)	851786 (1.89)	6417865 (8.27)	250303 (1.68)	1299923 (3.74)	171212 (0.82)
Matriculation/Secondary	13666459 (7.70)	849437 (1.89)	3282389 (4.23)	62417 (0.42)	437985 (1.26)	28308 (0.14)
Higher Sec/Inter/Pre-Univ.	4057226 (2.29)	222341 (0.49)	797852 (1.03)	6921 (0.05)	60334 (0.17)	1738 (0.01)
Non-technical diploma not equivalent to degree	80132 (0.05)	28024 (0.06)	11759 (0.02)	246 (neg)	1939 (0.01)	110 (neg)
Technical diploma not equivalent to degree	824398 (0.46)	178617 (0.40)	32721 (0.04)	299 (neg)	4307 (0.01)	317 (neg)
Graduate and above	5300520 (2.98)	674049 (1.50)	330607 (0.43)	2527 (0.02)	15418 (0.04)	364 (neg)

Note: Figures within brackets indicate percentages to totals
Source: Census of India - 1981 Series I India, Part III-A (i), A (ii) General Economic Tables.

Table XIV : Urban Population and Workers Classified by Industrial Category, Educational Level and Sex

(Percentage Distribution)	(1981)			
Educational Levels	Total Urban Population		Main Workers (Urban)	
	Males	Females	Males	Females
Total	83876403	73803768	40712501	5370183
(Urban population as % of total population)	24.39	22.97	22.93	11.94
Illiterate	34.17	52.18	27.10	57.03
Literate (without Ed.levels)	14.40	12.87	8.87	5.27
Primary	15.71	13.68	17.18	7.51
Middle	12.34	9.05	14.23	4.49
Matri/Sec	11.84	6.73	16.59	9.84
Higher Sec/Inter/Pre.Univ	5.00	2.52	5.56	3.14
Non-technical diploma not equivalent to degree	0.04	0.05	0.06	0.27
Technical diploma not equivalent to degree	0.70	0.20	1.12	1.73
Grad.degree other than technical	3.90	1.81	5.95	5.16
Post-Grad degree other than technical	1.0	0.50	1.68	2.30
Tech. degree/diploma ≡ deg or Post-grad				
(i) Eng. & Technology	0.04	0.01	0.71	0.06
(ii) Medicine	0.21	0.07	0.36	0.67
(iii) Agri & dairying	0.03	0.05	0.01	0.02
(iv) Veterinary	0.01	neg	0.02	neg
(v) Teaching	0.28	0.32	0.51	2.52
(vi) Others	neg	neg	neg	neg

Source: Census of India 1981, Series - I, India, Part III A (i) General Economic Tables, B-5, Part A (for Urban)

Table XV : School Attendance of Children by Sex : 1981

(5-14 years)

	Males (%)	Females (%)
1.Total Child Population (Rural + Urban) of which	93532864 (100.00)	86064380 (100.00
Total Attending School (i) (Rural + Urban)	49519942 (52.94)	29916843 (34.76)
Total Not Attending School (ii) (Rural + Urban)	44012922 (47.06)	56147537 (65.24)
2.Total Child Workers (Main + Marginal) (2 as % of 1) of which	8110810 (8.67)	5526555 (6.42)
(i) Total Attending School [1 (i) as % of 2]	261609 (3.23)	82047 (1.48)
(ii) Total Not Attending School [1 (ii) as % of 2]	7849201 (96.77)	5444508 (98.52)
3.Total Child Non-Workers (3 as % of 1) of which :	85422054 (91.33)	29834796 (93.58)
(i) Total Attending School [1 (i) as % of 3]	49258333 (57.66)	80537825 (37.04)
(ii) Total Not-Attending School [1 (ii) as % of 3]	36163721 (42.34)	50703029 (62.96)

Source: Computed from : Census of India, Series I - India, Part IV-A, Social and Cultural Tables, (Tables C-3, Part A, C-3, Part B, and C-4).

Table XVI : Economic Activity and School Attendance of Children By Sex and Residence

(5-14 years)

	Males		Females	
	Rural	Urban	Rural	Urban
1. Total Child Population	73050750	20482114	67101915	18962465
of which Attending School	48.34%	69.37%	27.48%	60.52%
Not Attending School	51.66%	30.63%	72.52%	39.48%
2. Total Main Workers	6696333	738865	3504569	252488
(2 as % of 1)	(9.17)	(3.61)	(5.22)	(1.33)
of which Attending School	0.49	0.61	0.20	0.36
Not Attending School	99.51	99.39	99.80	99.64
3. Total Marginal Workers	644063	31549	1721693	47805
(3 as % of 1)	(0.88)	(0.15)	(2.57)	(0.25)
of which:				
Attending School	33.81	20.30	4.17	5.11
Not Attending School	66.19	79.70	95.83	94.89
4. Total Non-workers	65710354	19711700	61875653	18662172
(4 as % of 1)	(89.95)	(96.24)	(92.21)	(98.42)
of which:				
Attending School	53.36	72.03	29.68	61.48
Not Attending School	46.64	27.97	70.32	38.52

Source: Computed from :
Census of India, Series I-India, Part IV-A, Social and Cultural Tables,
(Tables C-3, Part A, C-3, Part B, and C-4).

Table XVII : Educational Level of Child (Main) Workers - Rural + Urban, 1981

(Below 14 years of age)

	Urban Main Workers		Rural Main Workers	
	Males	Females	Males	Females
Total Child Workers	739102 (100.00)	252514 (100.00)	6698743 (100.00)	3505185 (100.00)
Illiterate	469128 (63.47)	195067 (77.25)	5342133 (79.75)	3117111 (88.93)
Primary	127725 (17.28)	25241 (10.0)	574730 (8.58)	168601 (4.81)
Middle	25681 (3.47)	4132 (1.64)	85659 (1.28)	22721 (0.65)
Matric/Sec.	3150 (0.43)	472 (0.19)	6920 (0.10)	973 (0.03)
Higher Sec./Inter/Pre Univ.	221 (0.03)	22 (neg)	437 (0.01)	32 (neg)
Non-technical diploma not equivalent to degree	26 (neg)	5 (neg)	36 (neg)	16 (neg)
Tech.diploma not equivalent to degree	8 (neg)	5 (neg)	47 (neg)	9 (neg)

Note : Figures within brackets indicate percentages to totals.

Source : Census of India 1981, Series I, India, Part III A (i) General Eco. Tables, B-5, Part A (for Urban), B-5, Part B (for Rural)

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