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Technological change, employment generation and multinationals: A case study of a foreign firm and a local multinational in India

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Other studies dealing with the above subject are Working Papers Nos. 14, 16, 17, 19, 21, 23 and 25 which are listed in the Annex.

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I. Conceptual and Methodological Issues

The analysis of the employment implications of industrialisation is fraught with analytical and empirical difficulties.[1] All these difficulties arise for the narrower investigation of the employment generated by multinational enterprises (MNEs).[2] In fact, some problems are exacerbated by the case study approach - the indirect effects of one particular investment are probably even more difficult to isolate than those of entire sectors.

One of the fundamental difficulties lies in the implicit use of the 'counter-factual' hypothesis approach: what would have happened had the particular event in question not taken place? The actual situation has to be compared to an hypothetical "alternative situation". In the present case, the direct and indirect employment effects of an MNE's activities have to be compared with the alternative of the investment not being undertaken at all, being undertaken partly or wholly by a local enterprise, or being undertaken by a different MNE. The net employment effects of the actual MNE's presence can be assessed only after the employment generated by its alternatives have been allowed for. For obvious reasons, such an

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1 For an early review see D. Morawetz, 'Employment implications of industrialization in developing countries: a survey', Economic Journal, 1974, vol. 84, pp. 491-542.

2 See S. Watanabe, 'Multinational enterprises and employment-oriented "appropriate" technologies in developing countries', ILO, Multinational Enterprises Program, W.P. 14, 1980.

exercise is empirically intractable.[1] The lack of meaningful data on which to base any sort of alternative situation leads most researchers to deal only with the actual situation. Possible alternatives are mentioned but not quantified.

In view of the inherent difficulties of measuring the net employment effects of MNEs, it seems reasonable to stay within the realm of meaningful statistics. However, this does not by any means resolve all the problems. Difficulties arise in the definition and measurement of a whole range of actual employment effects. This range can be simply illustrated by the following table:

STATIC	First Round (Direct Employment)	Second Round (Linkages)	Third Round (Multiplier and Revenue)
DYNAMIC	First Round	Second Round	Third Round

'Static' employment effects can be defined as those arising from the initial choice of technology. Much of the literature on technology and employment has in fact focussed on this, particularly from the viewpoint of explaining the "inappropriate" choice of techniques in the manufacturing sectors of developing countries.[2] The 'dynamic' employment

1 For a longer discussion of the methodology and its problems see S. Lall and P. Streeten, Foreign Investment, Transnationals and Developing Countries, London: Macmillan, 1977.

2 See Frances Stewart, Technology and Underdevelopment, London: Macmillan, 1976 and the review by Sanjaya Lall, 'Transnationals, Domestic Enterprises, and Industrial Structure in Host LDCs: A Survey', Oxford Economic Papers, 1978, Vol. 30, pp. 217-48.

effects, defined as those arising out of subsequent product and process innovation, new product introduction, diversification, and market expansion, have been relatively ignored. Yet many of the studies in the present series[1], including the analytical framework provided by Watanabe[2], stress the overwhelming significance of the dynamic effects of MNE employment generation. Let us now consider the three 'rounds' of employment effects.

a) <u>'First round' effects</u> refer to the employment directly generated by the MNE within the firm. The static and dynamic effects are relatively easy to comprehend in theory. The static effects depend upon two things: the nature of the technique chosen and the displacement of employment elsewhere by the entry of the MNE. In practice, the effects of both are difficult to evaluate. The appropriateness of technology choice in developing countries is a subject on which most has been written without a definitive answer being reached. Early analysts tended to assume, relying on a neo-classical framework where factor substitution was easy and costless, that a wide range of techniques was available 'off the shelf' to prospective investors in developing countries. Thus, it was argued that overly capital-intensive methods were chosen because factor prices were distorted, information flows were imperfect or engineering considerations dominated economic ones. MNEs were

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1 See, in particular, M.L. Possas, M.C. Coutinho and M.S. Possas, 'Multinational enterprises, technology and employment in Brazil: Three case studies', ILO, W.P. 21, 1982, and L. Lim and Pang Eng Fong, 'Technology choice and employment creation: A case study of three multinational enterprises', ILO, W.P. 16, 1981.

2 Watanabe, op. cit.

singled out for special criticism because they were taken as providing the most direct conduit to unadapted capital-intensive technologies in the developed world. Later writings came around to the view that a large number of modern technologies, particularly in the sorts of sophisticated industries normally frequented by MNCs, were in fact rather 'rigid'. They could not, in other words, be substantially adapted to labour-abundant conditions, at least not without great losses in efficiency.[1] Certain ancillary operations like storage, transport, packaging and the like were adaptable, and the evidence suggested that adaptations did in fact take place. There was no ground for concluding that MNEs behaved very differently from other firms in similar activities as far as technical adaptations were concerned.[2]

The argument that the core technology was transferred more or less intact from developed countries, both by MNEs and local firms, receives substantial support from the evidence gathered by other studies in this series. In the longer term, however, the dynamic effects on employment generation of these technologies may be quite significant. These can take several forms:

- The adaptation of the original process to use of local raw materials, components, equipment. This may not be more labour using directly, but by permitting higher rates of growth will enable greater employment generation (the indirect 'second round' effects are considered later).

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1 See an interesting paper by D.J.C. Forsyth, N. McBain and R.F. Solomon, 'Technical rigidity and appropriate technology in less-developed countries', World Development, 1980, Vol. 8, pp. 371-98.

2 Lall, op. cit.

- The delaying of introduction of automation where labour-cost considerations make this economical. A conscious, growing technological 'lag' as compared to the developed countries, based upon the import and use of only those improvements which suit local conditions, can be an important method of technical adaptation to Third World conditions.

- The introduction of new products and processes which lead to the expansion of the firm, and so provide (probably the most important) the means to sustained employment growth together with higher productivity.

- The diversification of the firm into completely new activities, based either on freshly imported or locally generated technologies, which further enables the firm to grow.

The dynamic first round employment effects of MNCs seem to deserve far greater attention than they have so far received, and the present paper will stress them. The means used to achieve dynamic growth - innovation, imaginative entrepreneurship and efficient management - are, of course, the lifeblood of economic growth more generally, and our study will try to throw some light, at the microeconomic level, on these important issues. It may be noted that almost none of the dynamic effects is based on a costless shift along a well-known production function in response to changes in factor prices. We use instead a conceptual framework where each firm is fully familiar only with its own technologies, and any change, whether to simply change factor proportions or to introduce new products and processes, is an act of innovation.[1] The analysis of dynamic effects is, in other words, the study

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1 For a fuller exposition of this 'evolutionary' approach to technical change, see R.R. Nelson and S. Winter, 'In search of useful theory of innovation', Research Policy, 1977, Vol. 6, pp. 36-76.

of 'minor' as well as 'major' innovation.

Having said this, however, it must be admitted that the precise quantification of even the first round effects is very difficult. While the description of direct employment by individual firms is obviously straightforward, the interest of the analysis lies less in these figures than in the degree to which the initial technologies - core and ancillary - were in fact adaptable and the extent to which they were adapted; the nature and determinants of subsequent technical innovation; the success of the firm in expanding its sales relative to its major competitors, both at home and in international markets; and the influence of government policy on all these. Given the nature of the available data, the analysis must at best be tentative and impressionistic.

The introduction of government policy as a variable creates several complications, especially in a country like India where the industrial sector is subject to a large battery of regulations.[1] Since this study is on India, it is worth spending some time on this question. At the most pervasive level, all industrial firms in India operate within an extemely protectionist and inward-looking environment. On the one hand, this induces them to substitute raw materials for imports to the maximum extent feasible, and so to create local employment both within the firm and within its local suppliers. On the other hand, the complete protection behind which firms operate induces large areas of inefficiency and

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1 For summary descriptions see J.N. Bhagwati and T.N. Srinivasan, Foreign Exchange Regimes and Economic Development: India, New York: National Bureau of Economic Research, 1975, and S. Lall, 'India's Technological Capacity: Effects of Trade, Industrial and Science and Technology Policies', in M. Fransman and K. King (ed.), Indigenous Technological Capability in the Third World, London: Macmillan (forthcoming).

high cost, discourages exports, and leads to large technological lags behind world frontiers. In turn, this restricts industrial and export growth - it is well known that among the newly-industrialising countries India has had the poorest performance in both these respects.

There are other Indian policies which inhibit dynamic employment creation by MNEs. The tight controls on the growth of large firms under anti-monopoly rules, and the even tighter controls on firms with over 40% foreign equity participation, obviously holds back market-determined growth by the largest and most efficient producers. The policy of distributing industrial licenses widely (and licenses are required for imports and investment not just in the initial stages, but also for expansion, change of product lines, mechanisation and diversification) leads to a fragmentation of capacities, usually far below levels deemed economic by world standards. What is worse, it tends to freeze market shares, preventing dynamic firms from freely outcompeting inefficient ones.

The Indian government also has stringent policies to protect local technology generation. Science and technology policies make it difficult for firms to gain easy access to changing technologies abroad. Even when access is granted, tight controls on rates of royalty permitted (2 to 3% of sales, net of tax on royalty remittances) have been observed to lower the quality of technologies sold to India. Technology inflow via direct investment is also tightly controlled - in the 12 years 1969-1980 the government only approved some $100 m.

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1 For a recent and penetrating analysis of India's policy regime as far as trade performance is concerned, see Martin Wolf, India's Exports, Oxford: Oxford University Press, 1982, for the World Bank. For a comparative analysis of Indian policies, vis-à-vis other NICs see Bela Balassa et al., Development strategies in semi-industrial economies, Baltimore: John Hopkins Press, 1982

worth of new foreign direct investment. If this is compared to $113 million approved for direct investment abroad by Indian firms, making one of the world's poorest countries a net capital exporter, or to the $2 billion plus received each year in the recent past by Brazil (net of dividends and reputation, while the Indian approvals figure is gross), the true magnitude of the restriction becomes more apparent. Thus, a comparison of India's technology imports (by means of direct inward investment, licensing and imports of capital goods) with those of other NICs shows that it has the lowest dependence on foreign technology.

As with import-substitution policies, those technology-substitution policies can be a double-edged sword. On the one hand, they can promote the build up of local technological capability. The evidence of India's technology exports shows that a broad-based capability does exist in certain stable technology industries.[1] This capability also reveals itself in substantial technological activity to adapt imported products and processes to local market needs and raw materials. On the other hand, much of the technological effort may be considered socially wasteful, to the extent that it is undertaken in response to policy-created shortages of raw-materials, know-how infrastructure and services.[2] In much of manufacturing industry,

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1 See S. Lall, Developing Countries as Exporters of Technology: A First Look at the Indian Experience, London: Macmillan, 1982.

2 On the motives for industrial research and development in India, see A. Desai, 'The Origin and Direction of Industrial Research and Development in India', Research Policy, 1980, Vol. 9, pp. 74-96.

where technologies internationally are changing quite rapidly, indigenous efforts fail to keep up in the competitive race, reinforcing the lags induced by absolute protection. This reflects itself, again, in poor growth and export performance of the economy as a whole.

Finally, dynamic first round employment effects are also influenced by Indian government policies towards small-scale industry. We had noted earlier that first-round employment effects have to be considered net of employment displacement in traditional (generally small-scale) producers of competing products. Needless to say, the fact that certain activities are displaced over time by others is not a particular matter for concern - indeed, such displacement is essential to economic development. Attempts to hold back the progress of market-determined economic transformation may, over the long term, lead to a diminution of employment opportunities rather than the preservation of employment, even when the more modern activities are less labour intensive. However, the Indian government has adopted the policy of protecting small-scale industry by a variety of measures. Over 800 products are earmarked for sole production by the small-scale sector; many others are accorded preferential tax treatment for small-sector firms when they compete directly with large-scale firms. This policy has undoubtedly created a widespread and dynamic small-scale sector, but equally undoubtedly there are industries where it has created inefficiency and stifled growth. To the extent that particular MNEs fall within the scope of this policy (and one of our firms does), the dynamic effect on employment generation could be negatively affected. The methodological problem raised is similar to those raised by the other forms of government intervention: how are we to evaluate how the MNE would have performed in a more 'natural' setting (i.e. with a more neutral policy regime)? No easy answers are possible.

To sum up this portion of the argument, the evaluation of 'first round' or direct employment effects of MNE activities faces certain difficulties in any situation. These difficulties arise from assessing the appropriateness of the technology used, the nature of dynamic growth effects and the calculation of employment displacement. However, in countries where the economic environment is conditioned by pervasive government intervention the analysis is even more difficult because the natural evolution of economic factors is not allowed to occur. In India, the high degree of regulation has clearly affected MNE performance in a variety of ways. Some have promoted the net generation of employment (e.g. import substitution of inputs or the preservation of small-scale industry) and others may have restricted it (e.g. the inhibitions placed on MNE growth or promotion of exports). Even the employment promoting measures, to the extent that they have gone against market forces, may have been socially inefficient. These possibilities raise all sorts of methodological problems which we can note but not correct in our empirical studies.

The differences between the policy regimes of different developing countries included in this series of studies must also be noted. Singapore, at one extreme, with a highly export-oriented, market-based regime, exhibits quite different patterns of MNE behaviour[1]: technological flexibility is

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1 Lim and Fong, 1981, op. cit.

extremely limited in both the short and long terms because of the need to constantly match world standards of efficiency; growth is very rapid,as are related productivity increases; local purchasing develops over time as supplier capabilities begin to match international ones in terms of costs and quality. Brazil is more similar to India because of its emphasis on import-substitution and maximising local purchases; however, it differs from India in the freedom it allows to MNEs, the greater degree of outward-orientation, and its heavy reliance on imports of advanced technology.[1] This permits a somewhat greater degree of technological activity and adaptation in the long term than Singapore, but does not protect local 'learning' to the same extent as in India, where heavy protection and intervention permit more innovation, but at the same time bias it in certain directions which may be socially wasteful and reduce its ultimate value.

b) <u>'Second round' effects</u> refer to employment generated via purchases of various goods and services from the local economy. The problems involved in making quantitative estimates of employment generated by such linkages, at the industry level (by the Leontieff input-output matrix) or at the firm level (by attributing a certain amount of suppliers' employment to purchases by the firm in question) are formidable.[2] Nevertheless, the economic significance of backward linkages in employment creation cannot be overstressed. In many instances, the second

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1 See Possas <u>et al</u>., 1982, <u>op.cit</u>., and Balassa et al., 1982, op. cit.

2 See S. Lall, 'The indirect employment effects of multinational enterprises in developing countries', ILO, W.P. no. 2, 1980.

round effects outweigh the first round ones. What is perhaps equally important, these inter-industry linkages also entail a variety of other relationships whereby skills, technologies, information and capital are transferred, production co-ordination is achieved in uncertain and narrow markets, and prices are negotiated when free competition is not feasible.[1] Thus, second round effects can not only raise employment levels, they can also raise the skills and productivity of labour employed, its stability of employment and its sustained growth over long periods.

We have already remarked on the very important role that official policies can play in affecting the extent of local purchases. Large countries pursuing import-substitution strategies generally impose local content requirements on all industrial investors, reinforced by tariff and quantitative restrictions on imported inputs. Such policies force the pace of local purchasing, thus boosting local employment, industrialisation, and the accompanying 'learning' of skills and technologies. Small countries with liberal economic policies cannot resort to such measures because of their constant need to maintain international competitiveness, but even here, as the Singapore study shows, the extent of local purchasing grows over time.

It may be worth reiterating the point made in the previous sub-section, that the forced increase of local employment behind heavy protectionist barriers may not always be in

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1 These aspects of linkages are analysed in S. Lall, 'Vertical Inter-Firm Linkages in LDCs: An Empirical Study', <u>Oxford Bulletin of Economics and Statistics</u>, 1980, Vol. 42, pp. 203-26.

the long-term national interest. There are some cases where the dynamic 'learning' effects of production and various associated externalities render protection desirable: in these instances, government intervention is clearly desirable to move the country to its true dynamic comparative advantage. In others, the protected industries remain perpetually inefficient, imposing penalties on their users, raising final production costs and slowing down economic and export growth. It is not sufficient, therefore, to merely describe the extent of employment generated in vertically linked industries. The social efficiency of linkage creation is also a crucial consideration which needs to be considered.

An empirical study such as the present one, however, has limited aims and resources. It would be well beyond its means to undertake a proper social cost-benefit analysis of linkage creation. Even if the resources were available, the application of cost-benefit techniques suffers from many well-known drawbacks.[1] But in a case study of India it is well worth it to be, at the very least, forewarned about the issues.

Static second round effects refer to the employment generated by local purchases at the time of initial entry (though perhaps the correct definition may be to include purchases made after the initial stipulations on local content have been met). Dynamic effects would include subsequent increases in local purchases arising from firm growth, diversification,

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1 See S. Lall and P. Streeten, 1977, op.cit., chapter 10.

innovation and entry of export markets. Needless to say, employment effects would have to be netted out for employment lost as a result of switching suppliers, changing the make/buy ratio, or changing sourcing to imported materials (this last option is effectively ruled out in India).

Dynamic linkage creation is of special interest because it generally involved the firm in question in an active (and so costly) process of locating new suppliers, creating and transferring technologies, designs, skills and sometimes finance to them, and ensuring that supplies are not disrupted. The nature and extent of such linkage creation depends upon the firm's own process of innovation and diversification - as with first round effects, the initial static choice is a less interesting issue than subsequent efforts to modify, improve and innovate.

c. <u>'Third round' effects</u> refer to employment generated as a result of the spending of extra incomes and revenues created by the firm.[1] The ramifications of these effects is so broad and diffuse that most empirical studies do not attempt to quantify them at all. Indeed, such quantification would involve a fully-developed macro-economic model, with all its attendant problems and weaknesses. In any case, this was clearly out of the question for this study and we exclude all third round effects here.

Let us conclude this chapter on methodological issues. The evaluation of employment effects of MNEs faces a host of

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1 For a fuller analysis see Watanabe, 1980, <u>op.cit</u>.

difficult problems. A limited, micro-level, empirical study of this sort cannot attempt to resolve them. Nevertheless, it is more valuable to collect small pieces of knowledge, being aware of the limitations of the analysis, than not to conduct empirical research at all. Many of the broader issues raised in this chapter will be raised again in the following chapters, even though clear, quantifiable answers are not forthcoming.

II. Background to Indian Case Studies

This paper presents two case studies, both interesting in quite different ways. The first deals with the more usual case of a foreign MNE affiliate in a developing host country (case A). In this instance, case A is an affiliate of one of the world's largest food-processing and soap manufacturing multinationals based in Europe. The affiliate has long been established in India, and today is one of the five largest firms in the country's private sector, and by far the largest foreign affiliate in the country. There are several points of interest about case A besides its size and importance: it is one of the few firms permitted to retain a majority shareholding because of its diversification into 'core' industries and its impressive export performance. Its exports comprise not only its own products but also those of the small scale sector, and it is one of only five firms in India to be given official recognition as an 'export trading house'. In fact, in recent years it has emerged as the second largest exporting house in the private sector in India and the largest single exporter as one manufacturing unit - a remarkable achievement, especially in view of the difficulties of mounting a significant export effort in an inward-looking regime like India's. The firm also has a significant R & D establishment conducting basic applied research into products and processes. Among officially 'recognized' R & D establishments in industry, it is the largest in the private sector. More significantly, its research efforts, while conditioned by the inward-looking regime, have resulted in highly 'efficient' innovations which are cost-effective in international terms.

Perhaps the most interesting aspect of Case A, however, is the fact that the industry it belongs to - primarily soaps and detergents in India - has substitutes in the small-scale, informal manufacturing sector, which presumably generates more direct employment per unit of output. Some analysts of MNEs have in fact singled out the soap industry as an example of MNEs displacing local firms, transferring 'inappropriate' products, 'distorting' local tastes, reducing linkages and causing negative net effects on local first and second round employment effects.[1] Case A allows us to evaluate these criticisms in the Indian context.

Case B deals with a quite different case: employment generation by an <u>Indian</u> firm which has itself become multinational by setting up joint ventures abroad. The topic of Third World MNEs has attracted growing attention in recent years, with a

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1 See, in particular, S. Langdon, 'Multinational corporations, taste transfer, and underdevelopment: A case study from Kenya', <u>Review of African Political Economy</u>, 1975, Vol. 2, pp. 12-35.

great deal of discussion of what the technological basis of their 'monopolistic advantage' may be.[1] The current conventional wisdom on this (as expressed, say, by Wells, 1981 and forthcoming, op.cit.) seems to be that it lies in their ability to adapt technologies to the smaller-scales and labour-abundance of developing countries, and thus carve out a technological niche for themselves which developed country firms cannot challenge without substantial costs. Thus, affiliates of Third World MNEs would be smaller and more labour intensive than those of developed country MNEs, using generally more 'appropriate' technologies and generating more local linkages.

Some research conducted in the head-offices of Third World MNEs by the present author (see Lall and others, forthcoming, op.cit.) finds this to be an overly facile view of the technological strengths of these firms. Certainly, a number of them have assimilated and improved upon technologies which are now out-of-date by developed country standards. This renders these technologies somewhat less automated and more suited to smaller scales of production - however, the real technological effort of the firms has gone, not into descaling or seeking labour-intensive technologies, but into up-scaling, raw material substitution, product development and imitation of foreign technologies. Their technological edge lies, then, in the

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1 See L.T. Wells, Jr., 'Technology and Third World multinationals', ILO, W.P. 19, 1981, and his forthcoming book, Third World Multinationals, M.I.T. Press; S. Lall, ' The Emergence of Third World Multinationals: Indian joint ventures overseas', World Development, 1982, Vol. 10, pp. 127-146, and S. Lall et al. (forthcoming), The New Multinationals, London: John Wiley/IRM.

<u>uniqueness</u> of their innovation process from the point where they started. General knowledge of small-scale operation is not a sufficient competitive advantage, since developed country MNEs have even greater experience of small-scale operation (more, of actual descaling) in a large number of affiliates in various developing countries, and have adapted equally well to local operating conditions. In fact, Case A of this study shows how technology generated in India is transferred abroad by the parent firm and used in several other developing countries.

There are also many examples of Third World MNEs, especially in process industries, where the technology provided is practically identical to that provided by developed country firms. This stands to reason. In industries where technologies are 'rigid' for engineering reasons, and where MNEs are unable to undertake much adaptation to suit the conditions of host developing countries, firms from these developing countries which assimilate the technology are also unlikely to change its parameters significantly. Thus, the employment effects of MNEs in these industries is unlikely to be very different, wherever they hail from.

Firm B does not in fact fall into this category. It produces trucks, an assembly industry where a large variety of engineering activities are involved in the production of components, affording somewhat greater scope for technological adaptation. Our case study will thus enable us to evaluate some of the current hypotheses regarding the technological strategies of Third World MNEs.

At first sight, it may seem surprising that an Indian firm is able to invest abroad in a sophisticated industry like truck manufacture. The case study will touch on some of the basic weaknesses of a Third World firm, especially from the Indian policy regime, in such complex engineering activities. But we should also note the strengths of the company. It is the largest private corporation in India in terms of sales. It is widely regarded as the premier firm in the country in terms of engineering excellence and quality control. It is part of the biggest conglomerate group in India, which in general has the reputation for technological progressiveness and sound management. Firm B has deliberately not sought official recognition for its R & D activities, but these are by far the largest in the country's private sector, more than double (in terms of annual expenditures) than those of firm A, which has the largest 'recognized' R & D establishment. The conglomerate group to which B belongs has an export house which has the largest export volume in India's private sector (with firm A coming second); firm B itself is the largest exporter in the engineering industry's private sector.

We have no intention of comparing firms A and B directly. Their industrial specialisations are so different that meaningful comparisons of technological adaptation and employment generation are not possible. Here we may simply note some general similarities: their large size; their reputation for managerial excellence; their technological prowess; their efficiency in exporting from an environment which discriminates against efficiency and exports; and their high level of local linkages (imports are minimal for both). We may also note some broad differences:

firm A has been much more constrained in its activities than firm B, both because it is a foreign affiliate and because its main activity is not in a 'core' sector industry according to the Indian definition; firm A has drawn freely on foreign technologies while firm B has opted to depend to a large extent on its own technology; firm A has a strong multinational orientation (though its management was completely Indianized decades ago) with close links abroad, while firm B is intensely nationalistic in outlook: and firm A comes into direct conflict with small-scale producers (though it also has extensive vertical linkages with them) while firm B does not have small-scale competitors for its products.

Table 1 sets out a few salient figures on these two companies; more detailed data are given in the relevant chapters below. Most of the differences in capital-intensity and other propensities are probably accounted for by the difference in nature of activity. We cannot comment on these at any length here.

Table 1

Main Features of Two Indian Sample Firms

Firm and products	Ownership	R&D Spend-ing 1980-81 Rs. m. ($ m.)	Sales 1980-81 Rs. m. ($ m.)	Net Fixed Assets 1980-81 Rs.m. ($ m.)	Employ-ment ('000)	F.A. per employee Rs. '000 ($ '000)	F.A./ Sales %	Exports as % Sales 1980-81	Imports as % Sales -980-81
A: Soaps & deter-gents, (65%) edible fats, dairy products, chemicals animal feeds, personal products	51% Foreign (European)	30.2 (3.8)	4813.0 (603.8)	730.7 (91.3)	9.4	77.7 (9.7)	15.2	14.0	3.6
B: Trucks (80%) excavators, etc.	Indian	67.0 (8.4)	6160.2 (770.0)	1426.1 (178.3)	39.5	36.1 (4.5)	23.2	8.5	8.4

Source: Company balance-sheets and interviews.
Note: Exchange rate in 1980-81: $1 = Rs. 8.

III. CASE A: A Foreign MNE in India

III.a. Historical Background

Firm A started operations in India by the turn of the last century as an importer of soaps from the parent company in Europe. For 3-4 decades the firm continued as a distributor of parent company products, adding vanaspati (vegetable-oil based cooking medium) to its major products. During this period the firm started to build up a substantial distribution and sales network, practically the first such network in a country where rural and small urban markets had been neglected This network is today the most comprehensive in the country, reaching into every centre with a population of over 5000: the parent company regards the Indian affiliate's sales system as one of the most efficient and cost-effective in all its global operations. Firm A is, in fact, the largest private sector customer of rail transport in the country (it pioneered the use of containers in Indian rail transport): and so effective is its distribution system that the government has sought its co-operation in distributing birth-control devices as part of its population programme, as well as choroquine for the prevention of malaria.

The firm entered into manufacturing operations in India in 1932, when it set up the manufacture of soaps and vanaspati near Bombay. The product range was diversified away from consumer products in the 1960's and 1970's, partly under government pressure to invest in 'core sectors' if the firm was to be allowed to maintain foreign majority control. The present composition of sales is: soaps and detergents 65.6%; food (vanaspati and dairy) products, 20.3%; and chemicals, animal feeds and personal products (toothpaste and cosmetics), 14.2%. The firm also manufactures soap and food processing and packaging machinery in small quantities, mainly for its own use. Of these products, synthetic detergents (introduced in India in 1959) animal feeds and chemicals are regarded as 'core' industry products, and expansion here is much easier than in other areas.

Firm A now has 11 major manufacturing facilities in India, as well as 12 small satellite units for the manufacture of animal feeds. It is setting up 3 wholly export-oriented units in one of the free-trade zones in India, which will boost its export performance even further when they come on stream (note that the restrictions applied to domestic expansion for consumer goods manufacture do not apply to export operations).

The Indian operation comprises (in terms of sales) only between 1-2% of the total sales by the parent multinational. The MNE has some 220 'principal subsidiaries' engaged in manufacturing, selling and service operations throughout the world, of which about 170 are in the developed world. The composition of output between the rich and poor worlds differs within the firm - this is relevant to our discussion of technical choice and we shall return to it later.

Firm A exported Rs. 176 million worth of products in 1977, increased this to Rs. 670 m. in 1981 and plans to further raise it to Rs. 1000 m. by 1984 (when the three export-oriented plants come on stream). This is one of the most impressive export performances in the country, and, in terms of exports of a manufacturing firm's own products, Firm A is probably the largest exporter in India. The firm exports a wide range of its products to developed and developing countries, but much of its recent thrust is aimed at the Soviet Union, which is a large market for soaps and personal products. It also acts as an export agent for other manufacturers, many of them making products (like leather footwear, carpets, garments and engineering goods) not directly related to the firm's own production. The firm seeks out foreign markets, helps manufacturers to improve quality, provides knowhow and sometimes finance and helps in obtaining obtaining scarce materials. Many of its clients are small-scale firms: in 1980, the firm exported Rs. 27 million worth of goods for 85 small-scale units. This aspect of its activity has earned the firm the status of a 'Trading House', one of 5 in India and the only foreign affiliate in the group.

The firm claims that its close connections with its parent company (and, in turn, the parent company's interest because of its controlling share) have been of great value in promoting exports. Despite these close links, the firm began 'Indianising' its management by the Second World War. By 1961, the chairman was an Indian - the first such of all foreign affiliates in India and the first 'native' chairman in that MNE worldwide. By now, the top management and technical personnel are almost entirely Indian, and one of its previous Indian chairmen sits on the main board of the parent company.

From the 1960's onwards, the Indian government had started to exert increased pressure on all MNEs operating in the country to dilute foreign equity and to give majority control to local shareholders. This policy was formally enshrined in the Foreign Exchange Regulation Act (FERA) of 1973, under which only those MNE affiliates which were engaged in what the government regarded as 'high-technology' activities, or exported significant portions of their output, would be allowed foreign majority holdings. All other companies were to bring down foreign shares to 40 per cent or less.

Most MNEs operating in India chose to dilute their equity and to become part of the 'Indian' corporate sector than to comply with these stringent requirements. The promotion of export-oriented activities, in particular, was fraught with all sorts of difficulties on which we have remarked earlier: high cost inputs, fragmented production facilities, bureaucratic regulations, infrastructural bottlenecks, lagging indigenous technologies, poor labour relations and inward-looking management attitudes.

Firm A responded to government requirements in a variety of ways. It reduced foreign equity participation over time, from 85% in the 1950's to 51% in 1980. It fought hard, however, to retain foreign majority shareholding, and succeeded because it had set up manufacturing facilities in 'core' (high technology) sectors like inorganic chemicals and, more recently, agricultural stimulants (discussed later), and had mounted a very impressive export effort. We have already given some data on its export performance - what is worth reiterating is that this was achieved in an environment which made any sustained export activity difficult or unprofitable, or both.

Besides the usual restrictions an expansion faced by a foreign affiliate in India, firm A was handicapped by the fact that the government sought to preserve one of its major products, laundry soap, for manufacture by the small scale sector (the employment effects of this policy will be discussed later). Organized sector (or large-scale) manufacturers of laundry soap, of which firm A is the largest, have been prohibited from further expansion in this product. Their current production is also subjected to various competitive disadvantages like higher excise duties and nonavailability or more expensive provision of imported intermediates (tallow and edible oils). It is important to bear in mind that under a different policy regime, which gave greater freedom to market forces and did not place artifical barriers to the growth of foreign enterprises, the performance of firm A would have been much more impressive.

A final background note on the company's recent performance: Sales have risen (in current values) from Rs. 1.3 billion in 1972 to Rs. 4.8 billion in 1981, a 3.7 fold increase. Profits before tax have risen in the same period from Rs. 97 m. to Rs. 412 m., a 4.2 fold increase, despite the diversification of the firm into exports and long-gestation, high risk,'heavy' industrial activities, away from its established strengths in the home market-oriented manufacture of light consumer goods. In 1981, the firm paid Rs. 205 m. in taxes to the government. Of the remaining profits, it ploughed back 63 per cent into the business and distributed 37 per cent as dividends. In 1981, the firm had 90.3 thousand shareholders as compared to 16.2 thousand in 1972.

III.b. First Round Employment Effects

Let us start with a description of actual employment levels in firm A. Table 2 gives a broad breakdown of employment at three convenient reference periods.

Table 2

Total Number of Employees in Firm A

Years	Management	Technical and Clerical	Workmen	Total
1960	339	1562	4677	6578
1970	406	1605	4909	6920
1980	564	1819	7059	9442

In 1981, total personnel costs came to Rs. 225 million, or 5% of the value of sales and 31% of value added in that year. The firm has extensive training schemes. For managers, it operates a 1½-2 year training programme in all relevant disciplines. For lower levels of sales, clerical and production workers there are schemes operated at the centre and all the plants. The total cost of these schemes is difficult to evaluate, but a rough estimate puts it at Rs. 5 million per annum. First round employment effects one considered in these sub-sections: static effects, dynamic effects and displacement effects. Let us take them in turn.

III.b.1. Static First Round Effects

The static employment effects of technical choice by the firm manifest themselves in two ways: choice of when a product is to be introduced into India, given that the parent company has introduced and successfully commercialised it in the developed world; and the choice of the manufacturing process to be used, given the product. It is obvious that an MNE affiliate has considerable discretion in both choices. Given the very low levels of income in India (in relation to the mass-consumption nature of firm A's traditional products), the peculiarities of local climate and custom, and the exigencies of government policy, the profile of the Indian firm's production is bound to differ from that of its affiliated firms in richer countries. Thus, certain sophisticated products (like frozen foods) are not produced in India at all; some products are introduced into India much later than in the developed world (e.g. synthetic detergents came to India about 15 years after Europe); some products (like bar detergents) are produced only in the Third World and not in the richer countries; and some products (like luxury soaps) are made to lower specifications in India. In turn, the choice of products to be manufactured locally can influence the employment generated, to the extent that older or simpler products use older and more labour intensive techniques.

As far as the choice of process technologies is concerned, the evidence from firm A tends to confirm that, for technologies imported from abroad, there is little or no initial adaptation to the core manufacturing processes. However, adaptations occur over time by a deliberate process of <u>holding back</u> increased mechanisation and automation in India relative to the advanced world, or by <u>selective introduction</u> of greater mechanisation to those elements of the manufacturing process where its productivity effects are crucial, and not to others. In the ancillary operations, moreover, certain functions may be kept extremely labour intensive because given the low cost of labour relative to capital, it is possible to combine efficiency with economy. In firm A, for instance, certain parts of the distribution system (e.g. containerisation of rail transport) have been made very capital-intensive because of efficiency considerations, while others (like final delivery by hand-carts) have been kept very simple in order to minimise costs. Hand-cart delivery costs only 20% of equivalent delivery by motorised vans, and there is no loss of effectiveness of distribution.

Firm A has also introduced a number of technologies which were innovated in India. While a fuller consideration of these is kept for the next sub-section on dynamic effects, we may note here that this may mean greater labour intensity of <u>some</u> operations. In the development of core process technologies the maximising of cheap labour utilization does not figure as an influence on the designers of the technologies. Attention focusses on the chemical properties of the process, wastage, utilization of by-products, energy consumption, and the like, so that any increased labour-intensity, if it does occur, probably is a by-product. However, the important employment effects of innovation arise in <u>other</u> ways - by stimulating growth, raising incomes, promoting the use of local raw materials, increasing exports, and so on - rather than via a static choice of technique. Firm A also has a small production facility for capital goods, mainly for its own use. The pattern of technical choice for the design of this equipment follows the sequence described in the last paragraph: <u>delays</u> in the introduction of greater mechanisation, to take account of cheaper labour and smaller production runs in India. This leads to greater labour utilization in the firm's units which use those machines (and those which buy them outside the firm).

The combination of all these factors - product choice, technological delays and selectivity, use of very labour-intensive methods in some ancillary operations - means that the overall capital intensity of production is much lower for the MNE in India than in the developed world. The available data only permit a crude comparison, but they are very suggestive: total net capital per employee in India by firm A was about £3 thousand in 1976, as compared to much higher values of capital employed by affiliated firms in richer and higher wage economies: £11 thousand in Europe, £15 thousand in the U.S., £7 thousand in Latin America and £4 thousand for Asia as a whole (including India).

To conclude, it is true that the initial choice of core production technique for a given product does not depend greatly on relative factor costs. Nevertheless, lower labour costs and smaller scales of production, combined with different income levels and market characteristics, do combine over time to lead to considerably greater labour intensity of total operations in developing countries.

III.b.2. Dynamic First Round Effects

We have already touched upon one important form of innovative effort involved in changing imported technologies to suit local conditions over time: the delaying and selective introduction of new technologies innovated in the developed countries. It should be stressed this comprises a deliberate technological strategy which should be counted as a form of 'minor' innovation. We now move on to consider the innovative process more broadly.

There is a very active process of 'minor' innovation in existence in newly industrialising countries,[1] which manifests itself in several forms. At the plant level, it can occur in quality control, plant layout, equipment modification and product adaptation. At higher levels, it can occur in product and process design facilities, pilot plants, laboratories and in independent science and technology facilities. In appropriate cases, it may also occur "in the field", in agricultural, transport and distribution activities.

A firm like the one under consideration has had diverse innovative efforts for a considerable period of time in many of these locations. At the plant level, production-engineering type of activities have been in existence more or less since the inception of manufacturing activity in India. Formal R & D activities came much later. A conscious effort to start long-term research into the company's products and processes started in 1960. In 1967 a large research centre was set up at the cost of Rs. 62 million ($8.3 m. at the current exchange rate) just outside Bombay. The parent company operates 14 research centres throughout the world. The one in India is still its only major reserach facility in the Third World. All the laboratories of the MNE exchange information freely, with no royalties paid or received by individual affiliates. Firm A's R & D centre employs

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1 For further discussion see F. Stewart and J. James (ed.), The Economics of New Technology in Developing Countries, London, F. Pinter: 1982.

275 people, of which 45 are research managers 110 are researchers and the rest technicians. Over 50 of the research staff have doctorates, several of them with foreign training and work experience.

The R & D centre has taken out about 80 patents on new products and processes since its beginnings in 1967. It trains scientists employed by the parent firm in other developing countries. Many of its technologies have been transferred to and successfully utilized in countries like Brazil, Sri Lanka, Indonesia and Malaysia. In terms of the allocation of its work, 70% of the R & D budget is spent on work of immediate commercial interest to the firm, 15% on matters of long-term potential business interest and 15% on basic or pure research with no commercial application. Firm A also maintains a separate development unit, with about 15 scientists, in its largest production unit.

The parent company follows some pattern of specialisation in research work in each of its major laboratories. Each laboratory can assign work to another, according to the field of knowledge and experience which is required. The Indian centre specializes on tropical products and processes, and has received several projects from the parent company. While the role of such 'global' R & D has been increasing in recent years, all the projects undertaken have some bearing on the company's Indian business.

An interesting aspect of the Indian affiliate's research activity is that the patents taken out are owned by the affiliate rather than the parent company. While basic research information is transmitted freely to other affiliates of the parent company, the Indian affiliate generally retains the right to undertake the final commercialisation of the technology in India. If there is a possibility of conflict over export markets, the Indian affiliate uses its innovations to raise its own exports rather than have the markets exploited by other affiliates.

The allocation of R & D projects is determined on the basis of future financial benefits expected from the innovation. Apart from the 30% which is spent on long-term and basic research, each project has to yield a net benefit calculated at a 4% royalty rate on increased sales anticipated. Since 1974, when this accounting method was introduced, the benefits of R & D have been 1.5 times the cost involved. This confirms the general impression that firm A's R & D is highly effective and commercially successful.

For reasons given earlier, it is difficult to calculate the employment generating effects of local technological efforts by any firm. These efforts feed into the growth and diversification of the firm, and so cannot be evaluated simply in terms of rendering known technologies more labour-intensive. Instead of trying to quantify internal employment generation by innovation, therefore, it will be more useful to describe briefly the nature and results of the technological work undertaken by Firm A. Clearly, such a description can only be partial and impressionistic, since the process of technical change is multi-faceted and continuous - we could not investigate it at great depth for a firm as large and diversified as the one in question.

Firm A's major technological work can be divided into two broad groups: the development of new products and the discovery of indigenous processes for the manufacture of existing products; and the development of new raw materials to substitute for imported, scarce or expensive materials. The first phase of research in the firm, roughly 1960-70, was mainly concerned with import substitution (for raw materials) and the development of new products for export markets. The second phase, 1970-75, concentrated on new product introduction to diversify the firm's product lines and to enable it to enter 'core' industries. The third phase, 1975-80, was more truly innovative in the normal sense of the term, concerned with the development of energy-conserving catalysts, plant nutrients, and so on.

Let us start by considering the development of new products and processes. The simplest way to do this is to describe the historical evolution of the firm's manufacturing activities in India. This is shown in Table 3. The origin of the technologies utilized in each activity is also shown.

Table 3

Evolution of Firm A's Production and Technological Sources

Product	Year of Introduction	Source of Technology
Soaps and Vanaspati	1931	UK (Parent Co.)
Chemical Detergents	1959	UK (Parent Co.)
Dairy Products	1966	UK (Parent Co.)
Perfume-Based Chemicals	1967	India (Own R & D)
Catalysts	1967	UK (Parent Co.) and India (Own R & D)
Bar Detergents	1969	India (Own R & D)
Various Personal Products	1960's & 1970's	UK (Parent Co.)
Sal oil (Cocoa Butter Substitute)	1977	India (Own R & D)
Ossein & Di-Calcium Phosphate	1977	India (Own R & D)
Sulphuric Acid, Industrial Phosphate	1979	UK (not Parent Co.)
Plant Nutrient Chemical	1979	India (Own R & D)

When soap manufacture was introduced in India in the 1930's, the production technique, essentially small-scale batch production with relatively low levels of mechanisation, was the same as used in Europe. In the late 1940's continuous manufacturing processes, with capital intensive technologies, were adopted in Europe, but the Indian operations continued with the batch methods. This was partly because of smaller scales in India and partly because of lower labour costs. In 1954, the stamping and wrapping of soaps was mechanised.[1] Over time, continuous processes were introduced to the manufacture of soap itself, as scales of production grew and the newer technique offered advantages in terms of space and steam (energy) saving, more efficient by-product (glycerine) recovery, lower wastage and ultimately lower production costs. A number of modifications were introduced to imported technologies to improve their cost efficiency, and Firm A claims that its operations are more economical than those of major local competitors, which also imported continuous processes from abroad.

Similarly, chemical detergent technology was initially imported in unadapted form from the parent company (as noted above, it was introduced several years later than in Europe), and subsequently somewhat improved to raise yields. The important innovation in this area came when detergent bars were introduced in 1969. This technology had to be developed in India because bars were not used in the developed world. In developing countries, shortage of water, use of buckets, traditional washing habits,

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1 However, even today the level of mechanisation in wrapping remains lower in India: the machines there have a speed of 120 units per minute as compared to 300 per minute in Europe.

all created a large demand for bar detergents. Firm A's technology is now being used by affiliated firms in Indonesia and Philippines, with Malaysia and Brazil showing a keen interest. Interestingly, 'sophisticated' detergents like washing machine powders and biological powders have not yet been introduced to India. The powders in use also had to be formulated differently from Europe because of differences in fabrics and stains, and the use (in India) of cold water for washing.

As far as food products are concerned, firm A has improved imported processes for the manufacture of vanaspati (again, continuous processes were introduced much later than in Europe). The firm is now working on methods of making edible oils out of non-edible oils, and expects to have units in production by 1985-6. The shortage of edible oils has been a major policy (and foreign exchange) problem for the Indian government, to which further reference is made below. A process innovation peculiar to the Indian firm has been the revival and adaptation of an old, discarded method for the preparation of hydrogen, using coke rather than electrical power (which is erratic and scarce). As noted earlier, many sophisticated convenience foods made by the parent firm in the West have not been introduced to India. In fact, foods comprise about half of the parent company's turnover as compared to one-fifth of the turnover of the Indian affiliate - the difference lying precisely in the far lower demand in India for processed foodstuffs. One of the failed innovations (in commercial terms) of firm A was in dehydrated peas - the Indian consumer was simply not ready for the product and it was withdrawn.

An innovation worth special note because it created a completely new use for a local resource, sal seed,[1] and led to substantial exports was the use of sal oil as a substitute for cocoa butter (used in chocolate manufacture). Firm A found that the peculiar structure of sal oil made it suitable for this use, and pioneered its collection (from forests in remote hilly areas), processing, purification and incorporation in chocolate (sal oil is the final product for firm A, since it is not itself a chocolate manufacturer). The second round employment generation, to which we return later, was considerable; exports of sal oil are now reaching Rs. 100 m.; and by-products have found use in soaps and animal feeds. The firm has 7 patents on sal oil, and its process remains superior to those of other local firms which have worked out competing technologies. It expects sal oil to develop into a 'major material of international commerce', since potential seed availability is some 100 times current collections. A new export-oriented facility for sal oil is currently being built.[2]

In the field of personal products, one which we may mention is a skin lightening cream which was entirely innovated in India. The firm manufactures this product from the first (fine chemical) stages, and expects to develop it into an important export product. In fine chemicals per se, the firm

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1 Sal wood is used for making railroad sleepers. Prior to firm A's innovation the seeds had no economic use at all.

2 This plant will use a new separate process - the SAREX treatment - to produce 5000 tonnes of sal fat plant per annum. Industrial chromatography will be used to remove impurities from the fat to a greater extent than hitherto possible.

has developed a number of processes for synthesising chemicals like citronella , geraniol, styrallyl acetate, phenyl ethyl alcohol, and so on, leading to considerable import-substitution.

Finally, in the product innovation field the discovery which the firm claims to be the most significant is that of a plant nutrient, which raises cereal yield by 25-40% and vegetable yield by up to 100%. The nutrient has been successfully tested in field trials in India for 8-9 seasons, and 100,000 acres of land are under test now. It has also been tested in the UK, and is being tested in Australia as well as in various countries of South East Asia. The nutrient, branded as 'Mixtatol', has such widespread implications for agricultural productivity that its potential benefits are truly immense. The Indian government, finally convinced of its viability, has granted a license to firm A to manufacture it on commercial scales.

The principles on which Mixtatol is based were discovered in 1977 by an American scientist, using alfalfa grass. His publication led firm A's R & D director to look for this element in local material. It was found that sludge from rice bran oil (which the firm was manufacturing for other purposes, see below) had the requisite properties, (the sludge itself was a waste product), and a viable process was developed and patented world wide. To date this process is the best one known, more efficient than that developed by Cyanamid Corporation of the U.S., which followed up the initial discovery in that country.

Apart from these major innovations, the firm's R & D has led to several other innovations in the chemical and catalyst fields. In 1978-81 twelve new processes were commercialized by the firm. New areas of research like 'tissue culture' and bacterial fertilizers have already yielded success. Research is being started on immunology and birth control, and future areas of work may include microbiology, in which the parent company has an active interest.

Let us come now to innovative efforts directed at import substitution of materials used by the firm itself. The most important achievements here have been the substitution of local 'non-conventional' oils for use in soap manufactures. Conventional soap manufacture depends on the use of tallow and palm/coconut oils. Tallow is difficult to obtain in India and its price has shot up in recent years. Palm and coconut oil became increasingly scarce as the supply of local edible oils fell far behind its demand. With the need to economise on the imports of edible oil, the government restricted its availability and raised its prices. During the 1960's, therefore, the major incentive for local research was to discover substitutes for these oils in non-conventional, preferably non-edible, oils.

Firm A started by looking at all possible oil-bearing materials available locally, and later narrowed the search to castor, rice bran, sal, 'neem' and 'mowrah'. It required considerable effort to bring any of these to usable standards, because each had undesirable or unappealing physical characteristics. In 1968, the firm used 6000 tons of non-conventional oils for soap making; by 1981 this had reached 75,000 tons, accounting for 75% of the firm's needs of such oils (the rest being provided by conventional local oils like ground nut). Other large soap manufacturers followed firm A in using non-conventional oils, but firm A pioneered the field. It remains the only one in India to use castor oil for soap manufacture, with castor providing 40% of its purchase of non-conventional oils. We have already seen how sal oil succeeded in a completely different direction and became a major export product.

The firm is also having success now in the exploration of rice-bran oil. This provides a raw material which is 30-40% cheaper than existing materials, and is more active in lower concentrations. The firm has set up a semi-production plant to make 800 tons of this oil per annum. Its commercial promise is such that the parent company may use it world wide in soap manufacture. Firm A has taken out 2 patents on its refining process, and already buys 60% of India's total production of rice bran oil (which was 10,000 tons some 10 years ago, and is 145,000 tons now).

There is no doubt that these innovations enabled the firm to survive and grow in difficult circumstances when its critical material supplies were threatened. They also brought a number of unused or underutilized local resources into productive use, and so generated substantial second-round effects. By its extremely effective and imaginative R & D efforts, firm A also led local competitors into greater use of local inputs, though it claims that its own technologies remain the most efficient in the country (the firm certainly dominates the quality end of the market for most of its products). And there were highly beneficial by-products of its search for material substitutes, as with sal oil.

These benefits have to be set against the fact that the substitute materials for soap manufacture remain qualitatively inferior to, and much more costly than, palm oil. Firm A's exports of soap are based on imported oils, since local oils will not permit competitive price and quality levels to be attained. In a different policy regime, with less stringent controls on imported inputs, soap manufacture may have been more profitable and dynamic in India (the country still has one of the world's lowest per capita consumption of soap), and exports of soap may have been larger. At the same time, non-conventional oils would have been unutilized, and some export products would not have developed. It is not for us to say whether the social benefits outweigh the costs; purely in terms of local employment generation, the actual strategy followed probably wins out because of second-round linkages with agriculture.

In sum, the innovative efforts of firm A to survive, expand and diversify in the Indian environment had considerable success. As such, they enhanced employment opportunities within the firm and outside it. It is important to note, however, that, apart from the strategy of delaying mechanisation, none of the innovative efforts were specifically aimed at maximising the use of labour. Our case study confirms the findings of many others, that employment growth comes from successful growth rather than from factor substitution.

III.b.3. Employment Displacement

Let us now turn to the vexed and difficult issue of the displacement of traditional, small-scale producers by modern, large-scale manufacturers like firm A (and its large Indian counterparts). Does large-scale manufacture lead to employment reduction in the long and short terms? What are the efficiency and welfare implications of the use of modern methods of production in competition with traditional methods?

Clearly, we do not have the time to discuss these issues in any detail. We can only make a few selected points.

By way of background, there are 5200 units in the small-scale soap sector in India, and 44 large scale units, providing 67% and 33% respectively to total soap production. The government has banned the expansion of the large scale sector, and also accorded the small-scale sector fiscal privileges and access to imported tallow.[1] The small-sector specialises almost entirely in the manufacture of laundry soaps; toilet soaps require technologies and scales outside its competence.

The quality of laundry soap made by small units is distinctly inferior (in terms of 'total fatty matter' content) to that of the large scale sector, and it is likely that to some extent the two sectors serve distinct, non-overlapping markets. To the extent that this is so, free competition will not affect units serving rural and low-income consumers, and there is no employment displacement by the large units.

To the extent, however, that arbitrary intervention by the government has held down competition from large scale units, and so preserved employment in the small-scale sector, a number of other points have to be considered. First, consumer welfare is diminished, to the extent that he is forced to buy inferior products against his preference. To argue that the preference structure itself is 'wrong' is neither objectively justifiable (in terms of the 'washability' of the products) nor methodologically correct (it is unforgivable arrogance on the part of an economist

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1 See the Indian Soap and Toiletries Makers' Association, The Soap Industry, Bombay, (no date given).

to say that consumption patterns are wrong).

Second, apart from direct employment generation, which presumably is greater in the small-scale sector,[1] we have to take indirect employment and other effects into account. Thus, small-scale units have not developed the technology to use non-conventional oils as substitutes for tallow and edible oils: they use much greater foreign exchange for their production, directly by importing tallow and indirectly by using up local edible oils. Concomitantly, the large scale sector generates far more employment in the input sector of non-conventional oils. At a rough estimate, the indirect employment generation is 2-3 times the employment in the small-scale sector. The small-scale sector is unable to recover a valuable by-product (glycerine) from soap manufacture, and the country has had to import glycerine at the margin. Finally, the large-scale sector has the demonstrated capacity to export its products, while the low quality products of the small-scale sector find no market abroad.

More generally, this issue raised the perennial problem of dynamic innovation and industrial growth threatening the survival of unviable, inefficient units. If the small scale units have a genuine niche in the market they can efficiently fill, then they need no protection. If they are, on the other hand, uncompetitive in large areas of their production, it is inefficient for the country as a whole to protect them. If the competitive process leads to a reduction in employment (and

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1 The small-scale sector producers produce 15 tons of soap per employee per annum as compared to 23 tons in the large-scale sector.

this is not clear, if second round effects are counted), the same process will generate higher growth and employment in the long term.

In this case, therefore, we are not convinced that there is a genuine displacement effect which has occurred (or would occur if intervention were to be removed).

III.c. Second Round Employment Effects

We have already said enough about second round employment effects to indicate that they are very large and significant for firm A. The firm buys most of its inputs locally. It has pioneered the use of previously unexploited raw materials. It has one of the most extensive marketing and distribution networks in the country. On all counts, therefore, it has generated linkages and employment in vertically related sectors of activity. For obvious data constraints, we are unable to separate out static from dynamic second round effects.

III.c.1. Backward linkages

By their very nature, it is practically impossible to assign precise employment figures to purchases by a particular firm. In 1981, the total value of raw materials consumed by firm A came to Rs. 274.5 million, of which 73% was locally purchased. The breakdown of (total) raw materials consumed was as follows:

Oils and fats	Rs. 1590.9 m.	(57.9%)
Dairy products	Rs. 53.3 m.	(1.9%)
Animal feeding materials	Rs. 121.1 m.	(4.4%)
Chemicals & Perfumes	Rs. 965.7 m.	(35.1%)
Others	Rs. 16.5 m.	(0.6%)
	Rs. 2747.5 m.	(100)

As far as industrial purchases are concerned, no estimates are available of employment generation. A very rough estimate of employment generation by the collection of minor oil seeds (160 thousand tons per annum) would be about 4 million during the collecting season (which is short). Similarly, the spraying operations for the testing of the plant growth nutrient generate over 100,000 jobs during the spray-period, 3 to 4 times a year.

Another form of backward linkage by firm A results from its purchases of finished products for export. In 1981, the firm bought the following finished goods:

Agriculture products	Rs. 3.7 m.
Marine Products	Rs. 22.7 m.
Textiles	Rs. 82.9 m.
Footwear	Rs. 4.9 m.
Carpets	Rs. 16.0 m.
Others	Rs. 13.6 m.
Total	Rs.143.8 m.

These purchases, of which roughly one-quarter comes from small-scale industry, also generate substantial employment. Certainly, in the absence of firm A's export promotion activities, a large part of these activities may not take place at all.

The firm also buys over 50% of its packaging material and promotion items from the small-scale sector. The firm estimates that its total purchases from this sector generate about 740,000 man-days of employment per annum.

III.C.2. Forward linkages

The distribution of firm A's products requires 90 carrier firms to move 300,000 tons of material by road, using some 800 trucks during the course of one year. According to estimates by the road carrier industry, one truck generates employment for 7 persons, leading to total employment of 5,600 people by firm A in trucking.

The firm has 3,600 distributors in the country. These hire sellers, retailers etc. to bring the firm's products to the final consumers. There are about 10,000 people indirectly engaged in these final distribution operations.

The firm uses 45 forwarding agents to clear and dispatch its products. These firms, independent of firm A, employ about 1 thousand people.

III.c.3. Other linkages

The firm has launched an integrated rural development programme in one district of Uttar Pradesh. It has stationed 25 agricultural graduates there permanently, and also sends all its management trainees to the villages to work on a selected development project for 2 months. There are 35 villages covered by this programme, which deals with agriculture, animal husbandry, health, bio-gas, and so on. It is estimated that 200-400 families are involved in activities related to the programme.

The data relating to second round effects are extremely patchy, and the few examples given above (which are very rough estimates) are only intended to provide some impressions of the magnitudes involved. We would not dare even to hazard a guess at total second-round employment effects, and simply conclude that they are very large and diverse.

IV. CASE B: An Indian MNE at Home and Overseas

IV.a. Historical Background

Firm B was officially registered in 1944 as a manufacturer of locomotive engines. It was started by one of the largest private business groups in India, which acted jointly with the government to launch this line of business. By 1962, locomotive manufacture was entirely phased out. However, in 1954 the firm obtained a license from Daimler-Benz (D-B) of West Germany to start on the manufacture of 5 ton trucks. The foreign company also took a 14% equity share, on a non-voting basis, which continues to this day, but the technical arrangement came to an end in 1969. The Daimler-Benz trademark was also withdrawn, and the firm launched its own brandname and essentially cut all technical links with its licensor.

Firm B is now entitled to produce 56,000 vehicles a year, and has just received permission to increase its capacity to 87,000 vehicles. It remains predominantly a truck manufacturer, with 80% of its sales coming from this product. It specialises in a 7½ ton vehicle (upgraded from the original 5-tonner introduced by Daimler-Benz), but has launched a larger 13-ton vehicle recently. In terms of the production of one type of truck, it is probably one of the largest manufacturers in the world (Daimler-Benz, the largest in Europe, makes 120-150 thousand vehicles of several types, and most developed country firms make 7-10 thousand of one type of truck). It is also the largest private sector firm in India in terms of sales, and one of the leading exporters of engineering products.

The main plant of firm B is located in Jamshedpur, in

Bihar. This is a highly vertically-integrated facility, with its own foundry, forge and other works, inheriting the German tradition of internal manufacture, in contrast to the British, U.S. and Japanese customs of high reliance on bought-out components. The firm set up a new plant in Poona, which is in the throes of a massive expansion. This plant is less vertically integrated than Jamshedpur, and has much more modern process technologies, including transfer lines. A remarkable feature of the firm's policy of in-house manufacture is that it produces all the specialized machine tools and transfer lines it needs for truck manufacture, and so has a highly developed technological base in equipment design and manufacture.

The firm accounts for nearly two-thirds of the heavy truck market in India, and, along with its major competitor Ashok Leyland (a subsidiary of British Leyland), enjoys a long waiting list for its products. The value of its sales have risen (in current terms), from Rs. 19 m. in 1950, to Rs. 374 m. in 1960, Rs. 1362 m. in 1970 and Rs. 6097 m. in 1980-81. Its payroll accounted for Rs. 585 m. in 1980-81, profits for Rs. 244 m. and dividends for Rs. 61 m. Because of various government incentives, the firm has paid no taxes in the past 5 years. Exports came to Rs. 524.3 m. in 1980-81, rising from Rs. 140 m. in 1974-5 and Rs. 373 m. in 1977-8. In the period 1961-2 to 1980-81, a total of 28,214 trucks and buses were exported, mainly to Asia and Africa.

Firm B has invested overseas in Malaysia and Singapore. The Malaysian venture was launched in 1975 and commenced production in 1977. It was set up to assemble 1000 kits per annum provided from India, and the Indian firm held 29% of the equity. The firm provided its equity in the form of capital goods, 80% of which were provided by the firm itself. All the production technology, plant erection, management, training and marketing was provided by the Indian firm. The affiliate employed 200 persons, of whom 3 were sent from India.

The Singapore venture started in 1972, at the express invitation of Lee Kwan Yew, who had visited the Indian plant. He asked the firm to set up a training institute in Singapore and also to invest in an export-oriented manufacturing operation there. The training centre (employing 65 locals and 45 Indians), was a great success, and is widely regarded as one of the best of its kind in South East Asia. The manufacturing facility, which started later, was commercially not very profitable, but it was in a new and very sophisticated technology - precision instruments for use by the electronics industry - and has opened up new avenues for diversification by the Indian company. Nearly 90% of the equipment for this venture was imported from the developed world, and Indian technicians were sent to Europe for special training. Thus, there was practically no transfer of Indian manufacturing technology, though clearly the firm's experience of making larger tools for the auto industry provided the necessary base. This affiliate, in which the Indian firm has a 23% share, employs 65 people (of which 25 are Indian). It has recently agreed to supply technology back to India in a joint manufacturing venture with the state government of West Bengal.

The expansion of the firm in India has been delayed for long periods by the government's licensing system and controls over large Indian companies. Its recent expansion is due to a realization on the government's part that road transport is a critical bottleneck in the economy, and that the firm's excellent record entitles it to a share of the growth. It would have been logical for the firm to diversify in a major way into other areas of automotive production particularly passenger cars, but regulatory policies have prevented this.

IV.b. First Round Employment Effects

Total employment in firm B was around 39,500 in 1982, having risen steadily from 29,990 five years previously (earlier data were not readily available). In 1982, blue collar employees numbered 22,500. The firm employed 4,450 technically qualified personnel in that year, of whom 2,750 were diploma or certificate holders in engineering, 1,500 were degree holders in engineering and 200 were post-graduate trained engineers.

The firm runs extensive in-house training programmes, with some 1200-1300 people being trained per annum. There are three major schemes for new recruits: a 2-4 year scheme for skilled workers, a 2 year scheme for diploma-holders in engineering and a 2 year scheme for graduate engineers. There are several schemes to upgrade workers at all levels, including unskilled ones.

The firm's philosophy is to take young recruits, train them and retain them for long periods. Large scale recruitment of senior workers is discouraged at all levels. Because of attractive salaries and good personnel management, the turnover rate for workers is extremely low, about 2-3% per annum.

The in-house training scheme of firm B is reputedly one of the best in the engineering industry in India. Its value is enhanced by the fact that the larger of its two plants (in Jamshedpur) is located in one of the most backward areas of the country, necessitating a greater effort to bring workers up to requisite levels of skill. It was the excellence of the training facilities which impressed Singapore's prime minister and led him to invite the firm to establish a training institute in his country.

A final note on skill implantation by firm B. The major selling point for its trucks, both in India and abroad, is the rigorous and meticulous quality control exercised on every component of the vehicles. The lack of such control is precisely what has led two of its Indian competitors (not the British Leyland affiliate, which also has an excellent reputation) to sustained loss of market shares, and to a lack of demand for their product when there is a long queue for firm B's vehicles. Given the sheltered home market, the fact that firm B has set the highest standards of quality for itself and sought to prove itself on world markets is a testimony to the skills and enthusiasm it has created among its employees.

IV.b.1. Static First Round Employment Effects

Since firm B is a local firm essentially concentrating on one model of one product, some of the considerations (i.e. new product introduction) which were noted for the previous case are not relevant here. The model which was originally licensed by Daimler-Benz was a 5-ton diesel truck with a rather old-fashioned engine even by the standards of the time:

it used a pre-Second World War pre-combustion technology which had been displaced by direct injection in Germany by 1950. The changes made to this technology will be described in the next section.

The initial process technology came as an unadapted turnkey 'package' from D-B, together with its philosophy of high in-house procurement, management practices, quality control and so on. The natural tendency to high vertical integration was reinforced at the start by the absence of a supplier/subcontractor network in the area where operations started, and by the fledgling nature of the engineering industry in India at the time. However, we place a lot of emphasis on the corporate philosophy introduced by D-B, since firm B's major Indian competitor, Ashok Leyland (British Leyland's subsidiary) started production soon after (in 1958) and retained its British traditions of much more buying-out. This has meant that, by 1977-8, firm B bought out only 35% of its parts and components, as compared to 59% for Ashok Leyland.[1]

It is possible that the larger size of firm B enabled it to digest larger in-house production economically, but interviews confirmed that the firm had always viewed greater internalization as a desirable strategy. In terms of technical choice, this meant that firm B was highly capital intensive in relation to Ashok Leyland. In 1976-7, for instance, gross fixed assets per employee came to Rs. 67 thousand for firm B and Rs. 49 thousand

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1 For a more detailed analysis of the procurement policies and linkages of these two firms, see S. Lall, 'Vertical Inter-Firm Linkages in LDCs: An Empirical Study', Oxford Bulletin of Economics and Statistics, 1980, Vol. 42, pp. 203-26.

for Ashok Leyland. As a percentage of sales, gross fixed assets were 71% and 26% respectively. Possibly as a result of this, firm B consistently showed lower profits (related to sales or to net worth) than Ashok Leyland in the 1970's ; however in the 1960s, the two were about equal in this respect.

After the initial implantation of W. German core technology, a considerable amount of effort was spent in assimilating and 'indigenizing' it. In this case, indigenization meant the rapid increase in local production/procurement of imported components, not the adaptation of imported techniques to absorb more labour (as the following section will show, the thrust of technological effort lay in improving product design, changing processes to make them more capital intensive and, later, upscaling the technology). Thus, imports declined from 45 per cent of total input requirements in 1956 to about 5 per cent by the mid-seventies, rising again to 17 per cent by 1980 (as new engines were introduced). However, as with firm A and most other firms of which we have knowledge, the labour-intensity of technologies rose relative to the developed countries by the process of delayed and selective mechanisation. While precise data are not at hand to prove this, it is likely that capital per employee in firm B today is far lower than D-B in West Germany.

IV.b.2. Dynamic First Round Employment Effects

Firm B spent Rs. 67 million ($ 8.4 m.) on R & D in 1980-81, just over 1 per cent of the value of sales. The R & D establishment, the largest in the country's private sector employed about 800 people, of which about 100 were fully qualified engineers. By area of work, 200 people were employed in truck design and development, 200 in machine tools, tooling and material handling equipment, and the rest in testing, photo-type shop and other activities. Formal R & D was started in the late 1960's, as the collaboration agreement with D-B drew to a close. However, considerable technological activity had preceded this, as the original technology was implemented, absorbed and 'indigenised'.

The quality control section, which now employs 2100 people in total, was the originator of in-house technical development. Production engineering staff also launched into process improvement and adaptation soon after the plant became established, and minor changes, some 400-500 a year (requiring some changes of tools) are now standard. The component procurement department, which deals with relationships with local suppliers, became an important agent of technological transmission to other firms, and we shall return to it below. Formal R & D was set up to formalise, centralise and build upon the fund of engineering expertise built up in the firm in its formative years. After its establishment, it proceeded to fulfil the specific research needs of the firm.

These specific needs were stated by the firm to be: the continuous indigenisation of all manufacturing processes, the adaptation of the vehicle in the best possible manner to Indian roads and driving habits, and the up-grading of the product to make it conform to international standards. To this end, firm B has built up the in-house capability to design and engineer every component of the vehicle, and so to launch new models without relying on foreign technology. It has also sought to internalize the design and manufacture of all the major capital goods required for its production units. In fact, one of the conditions it imposes on specialized capital goods suppliers from abroad is that full designs and drawings be provided with an imported piece of equipment. This ensures that it is only bought once, and subsequent needs are met by imitated (and sometimes improved) in-house machines.

Firm B closely monitors technological changes taking place internationally, but the prime focus of its own R & D remains the needs of the Indian market. Thus, foreign technological changes are imported or copied only to the extent that they are relevant to Indian conditions. Process mechanisation is, similarly, only introduced when it is cost effective under Indian operating conditions. As with firm A - though under very different industrial conditions - there is a deliberate strategy of technological delay and selectivity, which leads to lower levels of mechanisation than in a similar plant in the developed world.

The final result is that the truck produced by firm B is a rugged, well-built, basic truck which is technologically 'intermediate', but very well suited to rough use, poor maintenance and consistent overloading. The weight-to-horsepower ratio is much lower than is acceptable in Europe, leading to lower performance and perhaps a loss of fuel efficiency; driver comforts are rudimentary; noise or emission controls are not as stringent as in Europe. Despite this, or perhaps because of this, the vehicle has found a good market in developing countries.

The major product changes made by firm B's own R & D are described below. This excludes a large number of changes made to the vehicle chassis, axle, brakes, gearbox and so on to adapt it to heavier payloads and longer life.

1971 - Replacement of precombustion engine by direct injection engine, for the model 1210.

1975 - New model of truck with semi-forward cab.

1979 - New model adapted for Malaysian timber-carrying needs.

1980 - New, larger vehicle with 10-ton capacity, engineered by firm B with engine licensed (agreement 1969-74) from D-B.

1982 - Engine for 1210 model converted to use hardened cylinder liners. Though technology for this is not new, its engineering has to be extremely precise and is complex. Even D-B has not moved over entirely to this technology, despite the several advantages it offers in terms of efficiency and maintenance.

1982 - Turbocharging added to the 10-ton truck engine. Knowhow for turbocharger manufacture bought from KKK of W. Germany for lumpsum fee in 1978. Adaptation of engine done by firm B.

1982 - Developed new 4-cylinder (i.e. smaller) engine in-house, but final application not yet decided.

Various years - Developed special applications for basic vehicle, e.g. dumpers, tippers, water sprinklers, coal carriers, etc. Hydraulic technology for many of these had to be developed in-house.

1981 - Developed rear engined bus, of which 50-60 were produced exclusively for Singapore. The Indian market is not yet ready for such sophisticated vehicles.

1982 - Developed LPO single-decker bus with a very long chassis, based on the 1210 truck.

1980 - Developed own power-assisted steering.

In addition to these specific product changes, firm B has developed the capability to design and manufacture whole range of gearboxes with full synchromesh. It claims to be able to develop engines with full domestic content (of materials and components) as well as all the tools and dies required.

This capability has enabled the firm to enlarge its market share in India, enter export markets, and increase its production capabity in a tightly regulated environment where imported components and equipment are difficult, expensive and time-consuming to get. As with firm A, therefore, dynamic first round effects have enabled employment generation to take place without any specific attempt to increase. The labour intensity of existing technologies (on the contrary, new investments have invariably been more capital-intensive).

Changes in process technology are more difficult to identify, but, as mentioned above, occur more frequently. Firm B claims to have made important technological advances in forging, thin-walled castings and S.G. iron castings. It has assimilated sophisticated hydraulic technologies (first utilized in its machine tools) to the extent that it could modify its other main product, excavtors, to hydraulics from cable-drive on its own.

In sum, firm B exhibits an admirable degree of technological development and independence. It has drawn occasionally on foreign licenses to supplement its technology - for a larger engine, for turbo charging, for excavator design - but has consistently tried to, successfully, assimilate and build upon the imported technology. Its dynamic employment generation effects depend crucially on this capability.

We must not however, ignore the limitations which such capabilities face in the larger international context. Firm B can imitate and adapt certain technical changes under way abroad. It does not have the capability to initiate major automotive innovations or even to match 'frontier' innovations by the leading automotive manufacturers in the developed world. Technical innovation in this sector is now very expensive. The cost of developing, testing and tooling up for a completely new truck engine is currently in the region of \$500-600 m.[1], equal to the entire turnover of firm B. Even a large, well-established multinational like British Leyland is unable to mount such an enormous effort, and will license new generation engines from Continental European producers like Renault or IVECO. The impetus to innovation provided by the rise in fuel prices has given rise to large changes:[1] companies in the league of firm B cannot hope to keep abreast of such changes without recourse to

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1 For a more detailed discussion see the sectoral study prepared by the present author for the Centre on Transnational Corporations, Transnational Corporation in the Automotive Industry, New York, U.N., 1983, Sales no. ST/CTC/38.

imported technologies. Scales of production are also moving to a plane where components have to be manufactured in the millions and shared across the whole model range and even between several different manufacturers.

In a different policy environment, therefore, a highly competent firm like the sample company in India may cease to exist as an independent entity. This would not mean that truck manufacturing would not occur in India. On the contrary, in a multinational enterprise framework, with greater specialisation in manufacture and more easy access to the latest technologies, employment may well be much larger. This is the experience of Brazil, which pursued an active export-promotion strategy in the auto industry. It now makes some 9 times more commercial vehicles than India and earns over 8 times as much foreign exchange from their exports - and the industry is practically completely dominated by foreign MNEs.[1] In fact, firm B's exports are now coming under severe pressure in S.E. Asia from aggressive Japanese competition. Its advantages of 'intermediate' technology are getting eroded as countries move up to better roads, higher incomes and more demanding specifications.

This takes us somewhat beyond the narrow focus of this paper, so we need not pursue these issues here. However, their mention is clearly necessary, since the impact of government industrial policy is so pervasive and important in the Indian context.

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1 ibid.

IV.b.3. Employment Displacement

The products of firm B do not displace directly any existing industries in India, so we may ignore this effect here.

IV.c. Second Round Employment Generation

The automotive industry is traditionally one of the largest generators of second-round employment effects in the manufacturing sector. Its sheer size and high reliance on bought-out components of enormous variety ensure that a large number of suppliers depend upon it for custom and sustenance. This is also true of firm B. Given the Indian context of complete import-substitution, it has generated powerful backward linkages of several types.[1] Let us consider these briefly.

IV.c.1. Backward Linkages

The truck division of firm B bought from a total of 1600 independent suppliers in 1981. About 80% of these suppliers were small-scale manufacturers, which together supplied 10% in terms of value of bought out parts and components. The total value of indigenous raw materials and components consumed by firm B in 1981 came to Rs. 2,533.3 million. ($317 million.) It is impossible to guess the employment generated among these suppliers because of sales to firm B. Almost all of them sell to other auto firms, so that any estimate would be arbitrary.

What is of great interest is perhaps the complex and pervasive nature of linkages that exist between firm B and its suppliers. These linkages help the suppliers to set up operations, reach satisfactory levels of quality, introduce

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1 See S. Lall, 'Vertical Inter-Firm Linkages in Developing Countries', 1980, op.cit.

new technologies, and plan future capacity expansion.

Firm B has several divisions under 'material procurement' to deal with its suppliers. The 'Ancillary Development Department' (ADD) is entrusted with the function of locating new suppliers and developing them until they become regular suppliers. In a developing country like India, this 'search and develop' function is of vital importance in generating indirect employment. It involves initial screening of applicants, rendering of technical, managerial and sometimes financial assistance and bringing products up to the very rigorous standards demanded. Some component suppliers take 2 years to bring to requisite standards, after months of product-testing, engineering advice and even R & D effort. The ADD, employing 90 full time staff, then hands over the supplier to the regular procurement department.

Once the material procurement department takes over, quality control tests are run periodically but less frequently. The intimate technical relationship between buyer and seller continues, nevertheless, and every time a new component is to be purchased the ADD steps in again with its full battery of tests. The larger suppliers, which generally have direct recourse to foreign technology through foreign equity or licensing, offer design assistance to firm B as well as receiving technical specifications from it. Smaller ones tend more to receive a one-sided flow of know-how from firm B. They are also less able to extract high prices from it.

The full complexity of linkages between firm B and its suppliers cannot be discussed here, but we may quote from the earlier study (Lall, 1980, op.cit.) on this subject:

"\.... The effects of linkages on the suppliers depend on the size and technological nature of the firm. Technologically dissimilar suppliers in general benefit mainly in having assured markets and information on the future plans and product changes of their customer. By their nature, they do not take or give much by way of technical information. Their sharing of revenues with the buyers depends on their relative size and dependence on the latter, with smaller firms faring worse than larger ones. Technologically similar large suppliers gain from assured markets and information. They also have strong and mutually beneficial technical linkages, while in terms of revenue they fare rather well. Technologically similar small suppliers have more of a trade-off. On the one hand, they do receive considerable technical, informational and other types of help from the principals, and often owe their existence to them. On the other hand, they do not do well on pricing and other distributional linkages: any rents that arise from their activity are probably exploited by the buyers." (P.223.)

As far as employment effects are concerned, however, there is little doubt that the efforts made to establish linkages create substantial employment, raise the productivity of those employed, and maintain them in employment over long periods. An interesting feature of linkages in India is that they are very rarely broken. The buyer is very reluctant to drop a supplier for short-term financial gain. It is only when a supplier fails to come up to requisite quality standards that it is dropped - and that after several efforts have been made to transmit quality-control information.

Second-round employment generation is also promoted indirectly. Suppliers which were originally established by firm B are encouraged to sell to other firms in order to reduce their dependence on one customer. As they grow in size, they are sometimes able to tap export markets, on their own or as spares suppliers for firm B's exports. The large home market provided by firm B is crucial to this sort of expansion.

IV.c.2. Forward Linkages

Firm B could provide no estimates on employment generated by the sales, service and operation of its products. The numbers are undoubtedly large, but we cannot conduct any substantive discussion here.

IV.c.3. Firm B as a Foreign Investor

We have already mentioned above the employment generated directly by firm B's investments in Malaysia and Singapore. No estimates are available for second round employment effects in these countries, though some linkages have been established in Malaysia for simple components. The firm has expressed its willingness to further the host country's objective of building up local content, and presumably its Indian experience will prove valuable in setting up local suppliers in a relatively unindustrialised country like Malaysia. The prospects for linkages in Singapore are, given the high technology nature of the operation, far more limited.

Within the affiliates themselves, firm B has plans to reduce the number of expatriate Indian personnel as quickly as technical considerations permit. The Malaysian operation already has an expatriate content of 1.5% in its employment. The Singapore venture has more (the training institute has 41%

and the precision tool project 40%) but these are also due for phased reduction as local staff get adequately trained.

It is interesting to remark on the experience of technological adaptation by a Third World MNE as compared to a developed country MNE. They are very similar. Besides the obvious need to adapt to the small scale of assembly operations in Malaysia, firm B made no specific adaptations to its manufacturing technologies for the truck plant. The product itself was 'intermediate' in the sense already discussed, but otherwise the assembly process was identical to firm B's 'best practice' at home. Whether or not it was less mechanized than its competitors' plants in Malaysia we are unable to say.

In Singapore, the technologies involved were highly sophisticated and were new to the investing firm. The question of adaptation does not arise. The investment gave the firm access to the most advanced and capital-intensive processes available in the world at that time.

We may close this section by harking back to some of the recent literature on Third World MNEs (see Chapter II). This literature had suggested that the technological edge of Third World investors lay in their experience of small-scale and labour-intensive operations. Thus, they would, by implication, generate greater employment (in more 'appropriate' products and processes) in host developing countries; they would also generate greater local linkages. The example of firm B suggests that they are not always small-scale - in its domestic operations, firm B is a substantial sized producer (by world standards) of a single model of truck. More relevant is the fact that its technological edge has derived, not from efforts to descale or demechanize its technologies, but to upscale, mechanize, adopt and improve them. Certainly, firm B may not be as capital intensive or as large in overall terms as counterparts in Europe, U.S. or Japan - this is a trite observation hardly worth noting - but the thrust of its dynamic innovation has been the opposite of descaling or demechanization. It is the unique nature of its innovation process, conditioned by its home environment, which has given it a technological edge internationally.

We may also note that this edge, based mainly on 'minor' product innovation, is subject to considerable threat from advanced country MNEs. Unless firm B can buy competitive technologies from the developed world, or enter into a collaborative arrangement with a firm from a developed country, in the longer term it may be forced to withdraw from its truck assembly operation abroad.

V. CONCLUSIONS

The conclusions can be brief. Each section and case study has its own summary. Let us simply reiterate some important points of this country study.

First, there is little doubt that in the initial stages imported technologies are adapted little to the factor endowments of developing countries. This applies to imports associated with direct investment as well as licensing.

Second, adaptation does take place over time to render technologies <u>relatively</u> less capital intensive, by a process of technological delay and selectivity. In countries like India, with high levels of protection, this process may have gone further (rather than, say, Singapore) because of the absence of competitive threat to outdated technologies by imports or the need to export. However, society may not necessarily have benefitted from such an industrial strategy, since a number of inefficiencies have resulted from it.

Third, apart from the above, the active technological thrust of innovation in affiliates or local firms in India has been away from descaling and demechanisation. The stimuli have been to adapt technologies to local conditions, to raise the level of productivity by increasing capital intensity, to introduce new products and enable the firm to grow and diversify. These dynamic effects of innovation and growth are much more important than the static ones of initial choice of technique as far as employment generation is concerned.

Fourth, second round employment effects, operating via linkages with other local firms, are very significant in generating employment. These linkages are also based upon substantial innovative (and organisational) efforts on the part of the principals, and lead to the sustained growth and technical improvement in the related firms. However, it is practically impossible to quantify second round employment effects.

Finally, the specific nature of the highly regulated and inward-looking Indian environment has had pervasive effects on technical choice, technological change and long-term growth and employment generation. To some extent, this must set the Indian case study apart from the others, and generalizations from it must be drawn with extreme caution. As noted throughout the study, the beneficial effects of the Indian regime - the stimulation of innovation, the maximum use of local inputs, the relatively slow pace of mechanisation - must be weighed against its broader undesirable effects on export growth, productivity increase and competitive cost reduction.

While any case study suffers from the inherent limitation of its narrow focus, to the extent that we can draw lessons about 'appropriate' technology generation by MNEs, our first example suggests the following: affiliates of MNEs, in activities which permit such adaptations, tend to respond to local conditions in developing countries. Products and processes are adapted, even at high innovation costs, to local market needs and material availabilities. The ready access to sophisticated foreign technologies is not necessarily used to shift local activities in an 'inappropriate' direction. On the contrary, foreign knowledge might be selectively used to supplement local innovative efforts (the fruits of which are often exploited abroad by increased exports). Of course, other country studies show that not all industries are so readily amenable to adaptation in their use of inputs or in the decentralisation of their R & D activities. It must be remembered, moreover, that the strategy of firm A <u>in India</u> has to some extent been unique even for that multinational firm. Only large host countries with highly skilled scientific manpower can hope to evoke that kind of response from MNEs.

The study of the Indian multinational also reveals a very impressive technological effort in a sophisticated engineering field. Much of this effort has gone into assimilating and translating complex technologies to local needs, particularly by selective product improvement. This has also involved the setting up of extensive linkages with suppliers and a considerable transfer of skills and technologies to them. As a multinational, these two attributes - product adaptation and the ability to create linkages - are perhaps the strongest points of this firm. In such a high-technology, scale-intensive industry, however, there appears to be a real danger of 'appropriate' technologies losing their viability in international markets.

The general impression received by this author from these case studies (and others conducted on the process of technical change in the Third World) is that, given the policy regime, there is no apparent difference in the adaptive responsiveness of foreign and local firms. The most significant policy decisions must, therefore, revolve around the extent to which different types of industrial activities lend themselves to adaptation, and the extent to which adaptation should be pushed if international competitiveness is to be retained. Well advised governments would try to retain competitiveness and maximise dynamic employment effects rather than insulate local industry and push for short term employment generation.

ANNEX

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