Technology, Trade Policy And Competitiveness: `Learning' in East Asia & Its Lessons for India

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May 1996

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Paper preserted at the Workshop on the " Future Directions for the Indian Economy: Technology, Trade and Industry ", Indian Institute of Science, Bangalore, January 19-20, 1996. The Workshop was jointly organised by IISc and the Institute of Ecoonomic Growth, Delhi.

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I. Liberalisation and Competitiveness of Indian Industry

1. The Context:

The long term rationale of the Indian economic reforms is clearly the attainment of international competitiveness. Whatever be the compulsions for macroeconomic stabilisation in the short term, success of the reforms will be not be decided by the achievement of macroeconomic balance. The broad architecture of the policy changes makes it clear that realignment of state - market relations directed at raising industrial efficiency is the main objective. The policy reforms, particularly those dealing with the external sector, have opened the economy to the processes of globalisation. There can be no doubt that these have the changed the rules of the game for Indian industry, and that its impact is being felt. External sector liberalisation, changes in the financial sector, and the signing of the GATT-WTO agreement have all contributed to an atmosphere of greater competition in domestic product and capital markets. Policy makers have drawn comfort from recent indicators of industrial production and export growth. There is little doubt that exports as a whole have grown much faster since the reforms. Between 1992-95, export volume has grown at 12.6% per year, which is more than double the world rate of 6.1%. The share of exports in GDP in 1994-95 was 9.2%, up from the 1990-91 figure of 6.2%. The rise in export share has occurred at a time when the GDP growth has itself increased. According to the Reserve Bank of India, " this is indicative of an outward orientation in the export sector, and a receding of the vent-for-surplus approach which characterised export activity in past years. "

It is, however, still too early to claim success for the reforms

as far as global competitiveness is concerned. It would be more accurate to state that India is at a cross roads. For several reasons, we cannot afford to be complacent. First, the industries which have shown higher than average export performance are mainly the following: readymade garments, textile yarn, fabrics, made-ups, chemical and allied products, and leather manufactures. These industries probably correspond to our static comparative advantage, but their long term growth potential is dubious. In world markets, these are products which are price sensitive and in which income elasticity of demand is not particularly high. Within garments, for example, Indian exports are concentrated in low value, unstable demand niches. In the more technology intensive industries like engineering goods, the export growth has been modest. It is precisely in the engineering industries that liberalisation has brought on a high degree of competitive pressure from imports. In 1994-95, imports of capital goods have grown at 18.2 %. These include such items as machine tools, electrical and non-electrical machinery, electronic goods, and transport machinery. Much will depend on how the engineering goods industry responds to competitive pressure. As noted in the literature, the industrial dynamism of East Asian countries, starting with Japan, has been founded on the ability to attain competitiveness in a shifting portfolio of industries, i.e., on the creation of dynamic comparative advantage, rather than on static comparative advantage. India's export effort needs a long term perspective. Second, India can ill afford to be complacent because the global environment for trade is likely to be highly competitive. India joins a large number of developing which have liberalised their trade regimes since the 1980's, and which will be competing in similar markets abroad. The competitive threat from East and Southeast Asia is likely to be strong. A recent study has examined the sources of export growth in 3 key Asian countries - S.Korea, China and Indonesia during the 1980's. The excess of export growth rates attained by these countries over the world growth rate of exports has been decomposed into three components - commodity composition, country composition and increased market share. The salient finding from this study is that very large percentages of export growth are accounted for by increased market share. These are 59% for S.Korea, 91% for

China and 63% for Indonesia. This implies that the recent export performance of these countries has been achieved to a great extent by displacing competitors in export markets. Indian exporters must therefore brace for international competition.

Third, once we have undertaken a significant trade liberalisation, the success of the reform process depends very crucially on the long term performance of exports. This is especially true because of the increase in foreign capital flows which the reforms have made possible. Regardless of whether these are in the form of debt or equity, they will have to be serviced eventually. Not surprisingly, among the conclusions of a major World Bank comparative study of 19 countries on trade liberalisation is that a crucial determinant of success and sustainability was a strong and sustained export performance. Most failures are associated with 'dismal' export performance. Therefore, on the globalisation and liberalisation route, there is no option but to attain international competitiveness.

2. The Need for Strategy

Four years have elapsed since the Indian economic reforms began under the present government. By now it is clear that its design lacks a coherent strategic perspective in so far as the production sectors are concerned. Policies are dominated by a short term outlook. This is evidenced by the policy makers' preoccupation with macroeconomic balances, the special status of the annual budget as the key policy economic statement of the government, the well known differences between the Ministry of Finance and the Planning Commission, and of course the content of the policies themselves. Broadly, the stated rationale is to replace the pre-existent malfunctioning interventionary sytem with a functioning market system, along with a cautious management of the macro aggregates. On industry and trade, the instruments and institutions of selective and discretionary intervention are being dismantled. By implication then, the market would decide which industries would thrive and which products should be exported. The key elements of our new trade policy, for example, are:

- A shift towards a generalised price incentive mechanism for export activity via a market based exchange rate for the rupee. This replaces export subsidies as the major form of export incentive. There are some export linked duty exemptions, e.g., for capital goods imports for exporters.

- Import liberalisation, with a reduction of tariffs generally, and drastic reduction of QR's and bureaucratic procedures. Both the peak and dispersion of tariffs have been reduced, negative lists pruned, OGL expanded, imports decanalised and procedures simplified.

The major point to note here is the move to a system in which the anti-export bias inherent in the pre-existent stucture of protection is removed, and the support extended to exports is general and broad based, rather than particularistic and selective. This is very much in line with the standard, orthodox neoclassical prescription, and a similar philosophy underlies our approach to industrial policy. If markets function well, the flexibility afforded to the private market agents, along with the competitive pressures of the marketplace would drive the economy towards efficiency. The best case scenario under our present approach rests on the effectiveness of competition. The key issue at hand is whether competition is a sufficient means for achieving internationally competitive positions in relation to dynamic comparative advantage.

The exceptional success of the East Asian economies with respect to exports is well known. Though the overall global circumstances in which these countries made their entry into world markets was much more favourable than it is today, there are nevertheless some enduring lessons to be learnt from their experience. The most basic of these is that national economic strategy in relation dynamic comparative advantage has played a fundamental and decisive role in this process. Market ideologues have frequently sought to downplay this strategic aspect of Japanese, South Korean and other national policies. However, the weight of evidence has discredited such views. The Japanese strategy, for example, has been to move rapidly to upscale its export basket

by increasing capabilities in the high growth, high technology sectors. Dynamic comparative advantage did not come in a spontaneous market -led sequence of shifting points of static comparative advantage. On the contrary, it required the adoption of policies which went contrary to the cost based logic of short term comparative advantage. The Japanese, under MITI guidance, estblished industries which were capital- and technology-intensive. This policy at the time appeared to conflict with comparative advantage. As noted by a leading MITI official of the time,

" From short run viewpoint, promoting their development would seem to conflict with economic rationalism, but for a long range viewpoint, these are precisely the industries where the income elasticity of demand is high, technological progress is rapid, and labour prodictivity rises fast. " (Ojimi, cited in Scott)

This is a succint statement of the Japanese industrial strategy during the high-growth phase, and it indicates that the Japanese were prepared to face the costs of deviating from short run market rationality for a long run payoff. A similar account could be given for S. Korea, which as detailed by Amsden, for a time deliberately " got prices wrong ". (See also Rodrik). While these countries succeeded in their gamble, in India unfortunately we have not been able to carry through our strategic objectives, nor able to modify and make mid-course corrections in an optimal fashion. Our efforts have been plagued by lack of strategic flexibility and implementation capacity. We could not " get our interventions right ". While the present market orientation in our reforms is understandable in this context, ours is a radical, reactive response to government failure which ignores the strategic underpinning of East Asian success. Of course, the circumstances have changed and now the global situation affords less opportunity for strategic manouever, but it should be noted that even today strategy in Japan and Korea animates policy, while it has significantly shifted its scope and content in response to the new rules of the game. These experiences suggest that if we aim at high growth and sustained international competitiveness, we need to abandon our passive ' market knows best ' policy stance and adopt a strategic perspective.

3. Technology and Productivity

At the root of competitiveness lies productivity, and the success of the Japanese drive for dynamic comparative advantage can be seen from the by the following evidence. In just 12 years, 1967-79, Japanese labour productivity relative to the US,(i.e, US = 100) in targeted industries rose sharply. In precision machinery, equipment and instruments, for example, the figure rose form a mere 26 to 134, in steel from 62 to 208 during this period. (MITI, cited in Scott). The point to note is that these figures were much higher than the average for all manufacturing, which also rose but more modestly. This strongly suggests that Japan actually created comparative advantage in selected industries within a relatively short time frame by a deliberate effort. Though the Japanese achievement is exceptional, it has nevertheless served as a dramatic example in the entire region, which others like S. Korea have sought to emulate. In the Korean case, the long term trends in the composition of the export basket can be summarised as follows. There is a sequential trend in the share of different commodity categories, with the emphasis shifting from (1) labour-intensive goods, to (2) other capital intensive goods, then to (3) capital- intensive and skill-intensive goods, and on to (4) capital- and technology-intensive and high-wage goods, and finally towards research-, capital- and high skill-intensive goods. (B. Song). In this context, we should view the present Indian export performance, as a pragmatic retreat towards static comparative advantage.

Technology is a crucial ingredient of the drive for competitiveness. For all late industrialisers, the acquisition of technology and technological capability compels them to face the issue of technology transfer from abroad. In order to seize the opportunities for long term growth, " Japan adopted policies to control the entry of technologies into Japan, thus reducing their cost. It prohibited direct foreign investment, denying them another means of entry. It left the owners of patents with the choice of selling to the Japanese, through MITI, or see them go unexploited in Japan." (Scott). Thus, free international markets

had little to do with technology transfer into Japan. However, technology flows are only a component of a broader set of policies that must be undertaken. It is clear that while some degree of protection and government involvement may have been necessary to enable technological capacity to take root in East Asia, technological learning requires much more. The Indian example is frequently cited as a case in which learning was less than commensurate with the cost incurred.

Recent research on the determinants of technological capability has drawn attention to the important role of both institutions and infrastructure. (See C. Freeman, from which this following characterisation is derived). In the East Asian case, the following features have contributed to technological learning:
(a) The availability of large numbers of qualified engineers; (the proportion of engineering students in S.Korea, Singapore and Taiwan exceeds that in Japan and OECD .)
(b) The promotion of a wide range of technical and scientific activities within industry and commerce itself. The share of R & D done within government institutions has declined while firm level in-house R & D has increased. In East Asia as a whole, more than 50% of R & D is done within industry. In S. Korea, this figure is approximately 80 %.
(c) The development of a high degree of synergy between the private sector R & D , and publicly organised scientific and technical services. These include information and abstracting services, data banks, scientific libraries, standards institutions, advisory and consultancy services, research associations and professional bodies, and patent offices. The establishment of a synergistic network of such organisations reduces the cost of R & D at the firm level.
(d) The establishment of effective feedback systems within the firm, which link the R & D activity with other functions. The attainment of competitiveness is ultimately tested in the market place. For products to sell, apart from technology, other important characteristics are quality, design, delivery and marketing. Therefore, it is not sufficient just to have R & D within the firm. There must be integration of R & D with other functions. The so- called Japanese style of management is

characterised by a horizontal structure allows a high degree of information flow across functions. This is frequently contrasted with the vertical hierarchical structure of American organisations. In this context, it is worth quoting Akio Morita, Chairman of Sony: " ..to make a business out of a new development ... requires that you keep updating the product and staying ahead of the market. Our research director once mentioned the importance of cross talk between R & D and the business side, sales and marketing, and this is what we always tried to stimulate. " (p 272).

(e) The East Asian countries have invested aggressively in new physical equipment and software which have the potential of enhancing learning. The rapid build up of state- of- the- art telecommunications networks, and of stocks of computer hardware and software is aimed at facilitating competitive positions in activities using information and communications technologies.

(f) Finally, the East Asian example also illustrates that technological competence does not necessarily involve the ability to make advances at the " technological frontiers ". Productivity is improved by the ability to make minor changes to given technologies. (Lall, Rosenberg). Modifications to equipment, materials, processes and designs lead to continuous productivity gains. This is particularly important in adapting imported technologies to local conditions. Some of these may not even involve formal R & D.

Technological Effort and National Priorities

The achievement of dynamic comparative advantage requires the focusing of technological effort on national priorities. These priorities relate both to micro-level orientation of technological effort, as well as the ability to address macro-level priorities. The Japanese have been successful at both levels, often blending the two effectivly. Micro-level effort here refers to that addressed to developing competitive products to create/capture high value niches in global markets. Macro-level orientation refers to the ability to incorporate such features as scarcities of key factors, such as capital or energy into firm level effort.

The Japanese experience shows that technological effort was not by any means delinked from the material conditions and resource endowments facing Japan. Broadly, the technology effort has conformed to social-level economic rationality. For example, in the early stages of industrialisation, the Japanese adapted Western textile technology to " stretch " their scarce capital resources, and employ more labour. This was emulated later in Taiwan and S.Korea (Rosenberg). How was this achieved ? In Japan, part of this is explained by competitive internal environment. But part is due also to a cultural trait of flexibility and pragmatism which goes beyond market signals. (Okita).

Some view this has originating from a long history of having to deal with a harsh, resource scarce environment, and one prone to periodic natural disasters, from which people would have to start all over again. In the Japanese mindset, technology is strongly associated with, and influenced by the struggle for survival. The rapidity of Japan's technological response to the energy crisis in developing new energy saving products is a case in point. It was was much more impressive than in other OECD countries. (Morita). This displays that mechanisms exist in Japan, whereby it was quickly recognised across the board, by both consumers and producers, that energy saving was a national priority. It is this propensity for collective goal setting that made energy saving products profitable in the market place, creating a virtuous circle of technological response and profitabilty. Thus, " in 1973, every maker of home appliances went to work to cut power consumption, and in fact they competed with each other to see who could produce products using the least power; low power consumption became a major selling point and a new point of competition." (Morita, p. 257) While cultural traits cannot be transplanted, a key lesson here is the importance of creating institutional mechanisms to transmit strong social signals, market as well as non market, so that the macro-level technological priorities are clearly understood. The ability to positively influence both consumer ideology and producer motivation in line with these priorities will only make the task of markets easier, because deviation of tastes and consumption

priorities from the national macro-level configuration would add to costs. The ability to set national objectives at various levels, and broad acceptance of these objectives by the economic agents and their willingness to translate them into production and consumption targets is the hallmark of the Japanese approach to technology and industry.

Such systemic synergy is sadly lacking in India, and it is an area where attention is needed. The Indian R & D system is often criticised, particularly for its lack of integration with industry, and also for its inability to focus its technological priorities. (Desai, Chandrasekhar). The major part of R & D relating to industry takes place within government. About 66% of the R & D done in industry, energy, transport and communications is done within the public sector. The role of the CSIR as the dominant organisational mode for industrial research has declined over time. A major reason is the well known and oft repeated view that there is very little feedback and linkage between the public R & D system and the felt needs of industry. In part, as argued by Desai, it can be explained by the nature of bureaucratic competition within the science and technology system which has led to the fragmentation/departmentalisation of research organisation. Even the R & D that is being done within industry itself is believed to be either of dubious value or under serious threat from external competition arising from post liberalisation pressures. We can observe a somewhat paradoxical situation wherein the share of industrial R & D in GNP has steadily risen. The falling share of the CSIR in R & D spending has been made up by the rising shares of government corporations and private companies. These aggregates are, however, deceptive because what actually has happened is that the firm level R & D intensity has declined. A larger number of firms are carrying out R & D at lower levels of intensity, both within the public sector as well as the private sector. This is explainable in terms of prevailing incentive structure for R & D. According to Desai: " Companies are more likely to be allowed to import technology if they said they were doing R & D. R & D expenditure was thus not entirely expenditure designed to generate technology, but a

commission that it was useful to pay for for technology imports; and companies tried to pay the minimum commission they could. " (p. 215). We shall deal with the issues relating to technology transfer in the post liberalisation in a subsequent section.

In connection with the focusing on research relevant to industry, it may be useful to briefly examine the broad design and evolution of the Japanese policy system. (See Goto and Wakasugi). The share of government in R & D is fairly small, compared to the other major industrial countries. Only about 25% of research funds come from the government, while the rest comes from the private sector. The share in other industrial countries is approximately double of this magnitude. It is also worth noting that flow of research funds in Japan is vertical, i.e., almost all of the government funds going to R & D goes to public sector organisations, such as national or public research organisations, or to the universities. Only about 2 % of private sector research activity was funded by the government in the early 1980's. This had the predictable result of forcing private sector Japanese R & D to be highly responsive to market signals, and projects that could show immediate results in the market received emphasis. The government has also used a variety of measures for signalling the desired direction of technology. These include :
(a) Preferential tax measures, aimed at promoting investment in R & D, and also at promoting import of foreign technology. (b) Subsidies and research contracts to firms for conducting R & D activity. By the mid 60's, the emphasis of policy had shifted from promotion of imported technology to promotion of indigenous technology. These subsidies were designed to partly finance technology effort in selected areas, playing the role of " pump priming" of R & D activity in Japan. At times, these measures served to accelerate activities in which private firms would have entered on their own - a typical example of market reinforcing intervention.

It is interesting also to examine the role played by the Japanese public research system in generating research relelvant to industry. The public system, comprising of national, public or private non-profit organisations, carried out the following

acitivities: (Goto and Wakasugi)
(a) basic research on topic closely related to industrial technology; (b) testing the adaptability of technology for industrial use using large scale equipment; (c) transfering technology to small and medium size firms; (d) development of anti-pollution technology, where substantial externalities inhibit private research; and (5) research on industrial standards, testing methods and norms.
It can be seen that these activities are strongly oriented towards applied research. In fact, less than 20 % of the activities of the public research organisations are devoted to basic research. Strong ties with industry ensure that the research is relevant to the requirements of the latter, and is highly complementary with the research carried out directly by the private sector. The basic contribution of the public system, in the assessment of Goto and Wakasugi, has been to provide information to private industry about the technical feasibility of certain emergent developments. They have also assisted in the pursuit of collective research by private firms by providing a nucleus and leadership. Besides this, there are, as in India, a number of special purpose, mission - oriented R & D organisations for such activities as nuclear power,space and energy. The structure and functioning of the Japanese R & D system thus indicates a very systematic organisational approach to the focusing of technology effort towards industrial productivity. The nature of the pecise focus has gradually evolved as Japan has matured technologically. The effective use of market signals, competitive pressure, as well as non-market collective interest mechanisms have been used in a harmonious and complementary fashion.

Technology Transfer and Competitiveness

For most developing countries, the major route to technological competence is through international technology transfer. The present reforms have opened the way for freer flows of technology from abroad. The major effects of policy changes in relation to trade and technology imports have been: (a) removal of phased manufacturing programmes designed to encourage rapid import

substitution ; (b) tariff reduction and import liberalisation; (c) easier inflow of technology imports, within some limits of total cost; (d) the possibility of overseas firms to have wholly owned subsidiaries in selected industries. All these changes have substantially altered the incentive structure in relation to technology. It greatly reduces the bargaining power of local firms and opens them to foreign competition. Supporters of the reforms have emphasised the potential benefits of the new competitive environment. They point to the " loss of the fear of dependence" and to the many gains for Indian firms from joint ventures, strategic alliances, restructuring and mergers. In Desai's optimistic assessment, " the efficiency of R & D will increase as unncessary and cosmetic R & D is reduced, as R & D comes to be used as a weapon in intensifying competition, and as R & D combines with greater inputs of foreign technology cooperatively obtained. " (p. 218).

Similarly, the changes in the policy towards FDI have been lauded by Bhagwati and Srinivasan for their potential for substantial technology diffusion, dissemination of better management practices, and the stimulation of local firms towards producing higher quality products for the export market.

Yet there are fears. A recent comparative study of Indian and Korean engineering industries found that the 1980's liberalisation phase, when technology flowed in more liberally, Indian firms actually suffered an erosion of R & D capability, as short run profits led to marketing mainly assembled imported kits. Design activities were drastically cut back. (Jacobsson and Alam; Sen). This has tended to erode the long term technological competence in these industries, which requires a wide array of skills - not just operational skills, but also those relating to R & D, production engineering, and design capabilities. The relationship between trade and FDI liberalisation, and technology transfer is therefore rather complex. The ensuing competitive pressure can have effects on technological capability which are mutually contradictory. Much depends on the prior build up of technological capacity, and the market strategies of firms. This is illustrated by the divergent

experiences of S. Korea and India in the 1980's. The Korean liberalisation in this period was accompanied by a marked intensification of technological effort. There were sharp increases in the share of R & D in GNP, and in the share of private sector in total R & D spending (which more than doubled in this period to reach 84 %). This type of response can be attributed to the prior learning experience of the firms. As Jacobsson and Alam state in a major conclusion of their study: "... it needs to be emphasised that import liberalisation can only have a positive effect if there has been a prior building up of firms with resources of the type and character which make the entry into.... international industry seem to be within reach of the firms... That is, the response capacity of firms and industries to a trade liberalisation depends on their previous learning experience. "

The experience of the ASEAN countries with respect to technology transfer is illuminating, and urges caution with regard to the ease and depth of technology transfer associated with FDI. (See Yamashita). The countries of this region have been among the fastest growing exporters in the last decade, and this has been accompanied by large flows of FDI. Japan is now the largest source of foreign investment in this region, along with machines, parts materials and management style. FDI has flowed from Japan in two phases. Phase 1 took place in the 1960's and 70's. Phase 2 followed the appreciation of the yen in 1985, and is characterised by a sharply increased flow. Technological development can be said to occur in the following 9 'stages' (Yamashita): (1) operational technology, (2) repair and maintenance technology. (3) quality control, (4) production management (process management and component procurement), (5) technology renovation and new technology introduction, (6) moulding tool development, (7) design, (8) new product development, and (9) equipment development. Detailed surveys of Japanese firms in Thailand, Malaysia and Singapore carried out during 1987-88 by Yamashita and associates revealed that the incidence of technology transfer declined with the 'stage'. Figures are available for each of these host countries. Between 63 and 78 per cent of the firms surveyed believed that they had

transfered operational technology, roughly 55 per cent had transfered maintenance capacity, between 46 and 58 per cent their quality control methods. Thereafter, the incidence of technology transfer declines sharply. In Thailand, for example, 21 per cent of the Japanese firms reported having transfered process management skills, only 6 per cent reported having transfered capabilities relating to technology renovation and for moulding and tool development. For design, the Thailand figure was 8.5 per cent; in new product development and equipment development, these were only 4.3 and 2.1 per cent respectively. The pattern in the other countries is broadly similar. The picture which emerges is significant. Technology transfer at the higher levels of skills is rather limited, in spite of high levels of FDI, and significant export growth. For this reason, the entire issue of technology transfer in the ASEAN countries remains a source of tension between Japan and the host countries.(Sato; Takeuchi). Incidentally, the Japanese tend to view themselves as having been more willing to transfer technology and skills as compared to European and American firms, because they (the Japanese firms) tend to rely more on training personnel rather than on (incomplete and superficial) written manuals favoured by the latter. As might be expected, the Japanese explanation for the lack of technology transfer at the high end of skills is the low absorptive capacity in the host countries.

The contrast between Phase 1 and Phase 2 with respect to technology transfer is also quite instructive. It shows that as the yen appreciation and the more liberal FDI policies in the host countries made FDI more attractive, and Japanese firms responded in a rush to use the ASEAN region as an export base, the effect on technology transfer was <u>negative</u>. This finding is contrary to the notion (implicit in the views expressed by Indian reform advocates) that there is a normal positive correlation between liberaliation, FDI and technology transfer. The ASEAN experience has been that Japanese exporting firms have tended to opt for such measures as induction of automation and robotics in the labour- and skill- intensive operations, rather than to transfer the requisite technology to locals. Moreover, the ability to set up fully owned subsidiaries in the liberalised

environment has prompted them to import into ASEAN countries entire ancillary networks, either as subsidiaries or as integral parts of these firms. Thus, there has been a considerable decline in training activities involving locals. This is particularly true in the more technologically sophisticated products such as TV sets. The Japanese firms' logic has been that the competition in export markets requires attention to quality, and that given the low existing skill levels and technology absorbing capacity of local firms, it would take too much time to upgrade local skills. Consequently, the role of local workers has been confined to the more routinised and peripheral activities of processing and assembly, and in packing.

This experience contrasts with the Korean ability to learn from its contacts with Japan. The Korean case also shows that the relationship between technology transferers and acquirers becomes more competitive and strategic, as the acquisition and learning of technology gathers pace. The 'donor' country firms soon realise that their market dominance in certain industries (and industry clusters that utilise the core technology) are threatened by potential competition from learners. Their technology transfer policies thus can take on the strategic objective of blocking such technology capability build up. (For an argument along these lines based on the Korean example, see Young-Ho Kim)

The lesson from both these examples is clear. In the absence of adequate local technological capacity in place, there is a potential conflict under liberalised conditions, between achieving short term boosts in export earnings and technology transfer. Policy must be alive to this conflict, and devise an adequate strategic response. In general, the overall scenario facing the less developed countries with respect to technology acquisition has become more difficult . (For a discussion of the global strategic environment in this context, see Ernst and O' Connor).

While in the preceding discussion, we have sought to dispel a complacent view of the technological learning potential generated by liberalisation, it is necessary to take note also of some of the positive trends. Siddharthan has marshalled evidence to suggest that in India, the relationship between technology transfer and indigenous R & D activity is complementary rather than competitive. He cites econometric evidence from his own work, and that of others to argue that access to foreign technology actually spurs in-house effort, particularly among private sector firms. Industries where this has happened include textiles, industrial machinery, automobiles and electronics. To some extent these statistical associations based on 1980's data may be spurious, as in the case of 'cosmetic' R & D alluded to above. However, Siddharthan cites 2 micro-level case studies, where very substantial adaptive R & D activity has occurred with the aim of modifying imported technology. These case studies pertain to motorcycles (Hero Honda Motors Ltd.) and to car air conditioning systems (Subros Ltd.). These case studies show that with a competitive environment, and a maturing consumer expectation based on external exposure, companies may be expected to undertake R & D for modifications intended to capture market share in the domestic market. There may also be some export benefits arising from this in markets where Indian-type conditions with respect to road conditions and power quality hold. It is difficult to judge from this, how far the learning involved is sufficient to make an impact on global markets. As Siddharthan notes, " these modifications are not in the basic designs and have not resulted in the creation of new products." (p.233). (To this extent, this evidence does not quite contradict the conclusions of Jacobsson and Alam cited above.)

The evidence available on the technology and competitive strategies of Indian firms in the post 1991 period is still rather scattered and fragmentary. Some related evidence can be gleaned from a recent study by Gopalan and Venkataramana on the manufacturing action plans of 132 firms in Hyderabad and Visakhapatnam. The firms operate in a broad spectrum of

manufacturing industries, viz, consumer durables, consumer non-durables, industrial capital goods, raw or semi-finished goods, parts for finished goods, industrial supplies and consumables, natural resources, and defence equipment. The majority are concentrated in industrial cappital goods, raw/semi-finished goods, and parts for finished goods.

The findings of the study, based on data collected in 1995, are interesting. Among the small firms in the sample, the competitive priorities mentioned are reliable quality, dependable delivery and changing production plans quickly. The current action plans stressed relate to managerial innovations dealing with worker motivation. Competitive priorities ignored relate to technology. These include ability to change designs, introduce new products, and offer low prices. In the case of the medium size firms, as well as the large scale firms, again this study finds that competitive priorities ignored are exactly similar. Thus technology related to new product development do not appear to have penetrated the manufacturing action plans of small and medium firms. The differences across size class, relate to other aspects of business strategy. For example, the larger firms are looking to produce " high performance " products, and the ability to offer a "broad product line". There is a higher concern in the large firms for quality, i.e., action plan include ISO 9000 , and TQM. It is however heartening to note that the more successful of the large firms tend to stress efficiency boosting plans like manufacturing lead-time reduction, value analysis/ product redesign and integrating information systems in manufacturuing an across functions. Thus, it is possible that over time the successful firms will begin to have a positive demonstration effect.

4. Conclusion

This paper has examined the major issues relating to the technology dimensions of competitveness confronting India, as it globalises its economy through a trade and FDI liberalisation policy package. Drawing from a wide range of available evidence

from East Asia, the paper has argued for a strategic approach, rather than a passive market orientation approach. The outstanding success of Japan and S. Korea was based on the ability to create dynamic advantage in high value, fast growing industries. Their approach to technology has been based on the build up of technological capability, while remaining open to market competition. There has been a remarkable strategic focus in technological effort to increase industrial productivity. The relation between the public and private components of technological effort has been synergistic. The contrast with India has been highlighted, to draw out the implicit lessons. The paper also examines evidence related to the Indian, Korean and ASEAN experience with respect to technology transfer to show that the link between liberalisation, FDI, export growth and technology development is complex, and can go counter to the build up of technological capacity. The paper closes with an assessment of the positive and negative aspects of the limited evidence concerning the technology posture of Indian firms in post 1991 period. While some indications are encouraging, the attainment of international competitiveness will require much more of both strategy and effort.

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