6.1 INTRODUCTION

FDI-led industrial restructuring that occurred during the period of Thailand’s rapid economic growth until the 1997 crisis is observed to have led to Thailand’s presence in a range of scale-intensive and differentiated industries, evidently reflecting an accumulation of production capabilities. However, as we have seen in the earlier chapters, the evolving industrial structure has essentially followed the changes in the pattern of FDI inflows, which shifted according to accessibility to ‘cheap’ production bases and varying growth patterns in world trade. Sectors with declining FDI inflows have shown an inability to sustain their earlier export performance. This does point to the fact that the accumulation of production (consisting of acquisitive and operative) capabilities has not been accompanied by any significant upgradation to higher levels of technological capabilities, involving design, research and technology development. Thailand’s poor performance on this front clearly reveals that very little attention was paid to creating a vital S&T infrastructure to support and sustain the FDI-led growth in the manufacturing and service sectors or to direct it in new directions. While technology capability development was not part of Thailand’s national policy focus until after the mid-1980s, in the increasingly competitive environment that prevailed even after, the Thai government failed to give the priority it required.

6.2 BASIC SCIENCE AND TECHNOLOGY (S&T) FRAMEWORK AND PERFORMANCE

Although the establishment of the Ministry of Science, Technology and Energy (MOSTE)\(^1\) in 1979 can be considered the starting point in the country’s establishment of the basic infrastructure for science and technology (S&T) development, until the Fifth Plan period (1982-86), there was no explicit recognition of the role of S&T in Thailand’s economic and social development plans. Along with the industrial restructuring programme that was to be initiated, the Fifth Plan had included a specific plan on S&T recognising the need to strengthen the country’s scientific and technological base and capability, in order to accelerate the use of S&T to improve production efficiency. This and the two subsequent plans contained a separate chapter

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\(^1\) The name was changed to Ministry of Science, Technology and Environment in 1992.
on S&T development plan (STDP) which called for compilation of basic data and policy formulation, promotion of foreign technology transfer, development of R&D capability, and mobilisation of S&T personnel. Specifically, the role of the state in strengthening S&T institutions and technical assistance from abroad was emphasised. A number of international cooperative agreements were signed, the most significant one being the US$ 49 million S&T Development Project with the US, which laid the foundation for forthcoming S&T institutions. For the first time, the expenditure on research and development (R&D) was targeted at 0.5% of GDP and the production of S&T personnel was to increase to 10% per year.

With the rapid economic growth of the late eighties, there was recognition of the continuing weaknesses in S&T policies and implementation. The Sixth Plan (1987-91) thus called for building the mechanism to coordinate S&T works, developing S&T personnel at all levels, and formulating a long-term national S&T policy. While the target for R&D expenditure was again set at 2% of government budget or 0.5% of GDP, sectoral technology targets were identified as biotechnology, materials, and electronics. Thus, three national technology centers: the National Center for Genetic Engineering and Biotechnology (BIOTEC), the National Metal and Materials Technology Center (MTEC), and the National Electronics and Computer Technology Center (NECTEC) were established under the MOSTE. The main functions of these three national centers are: (a) to study and monitor the status, problems and demands of each industrial sector; (b) to support R&D of strategic importance; (c) to facilitate the dissemination and transfer of technology and information to industries; and (d) to support human resource development (HRD) within the three industrial sectors. Meanwhile, the Science and Technology Development Board (STDB) was meant to support other industrial development activities, such as the standards, testing and quality control (STQC) program, the technical information access centre (TIAC) program, and the diagnostic/research design service (D/RDS) program. However, in spite of targets set under the Plan, the spending for R&D in the Sixth Plan (1987-91) were disappointingly low at 0.8-0.95% of government budget or just about 0.2% of GDP.

By the early 1990s, the shortage of S&T personnel and the strain on infrastructure became serious. As Thailand’s comparative advantage began to decline due to the rising land and labour costs and infrastructure shortage, for the first time, the STDP attempted to link S&T development with industrial development needs. At the same time, the utilisation of FDI for technology transfer continued to be encouraged. R&D target was increased to 0.75% of GDP, with the government providing 0.5% and the private sector 0.25%. The number of S&T personnel was to be increased as well.

However, in the Seventh Plan (1992-96) period too, in spite of the emphasis on international competitiveness, R&D expenditure averaged only 0.15% of GDP. In fact,
ironically, Thailand’s R&D expenditure as a percentage of GDP shows a declining trend from 0.21% to 0.12% between 1987 and 1996. It is abysmally low when compared to NIC standards, which are about 2-3% of GDP. Thailand’s performance has also been severely lagging behind in comparison to its competitors in the ASEAN. Malaysia had the highest figure among ASEAN countries with a ratio of 0.34% (of GDP) in 1994, and even Indonesia and the Philippines had R&D expenditures around 0.2% of GDP.  

This clearly shows that despite beginning to address the issue of indigenous technology capability development in its policy documents since the mid-1980s, in real terms, Thailand’s efforts on this front severely lagged behind what was required in its attempt for industrial catching-up. Below, we look at some of the problem areas involved in technology development in an attempt to understand the related issues more clearly.

6.2.1 Review of Overall Technological Efforts

As we have seen, since the 1960s, the government’s policy has been to rely heavily on FDI as a means of acquiring foreign technology. Along side, the purchase of foreign technology through licensing contracts, turnkey projects, know-how agreements, or technical service contracts has also been relied on. These strategies did not, however, result in an effective transfer of technology or absorption.

Technology balance of payments is considered as one of the indicators of international technology transfer. It includes trade in techniques, transactions involving industrial property, services with a technical content, and financing of R&D in foreign countries. For the entire period 1970-85, total payment on technology fees was only around 13.7 billion baht. However, following the period of rapid export-led growth,

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2 The figures are taken from the National Science and Technology Development Agency (NSTDA)’s Thailand Science and Technology Profile, 1999.

3 The study by Atchaka and Brimble in 1992 observed that many Thai firms, especially those producing consumer goods for the domestic market have been involved in technical and brand name licensing agreements with foreign firms. Some of these firms used to export only a small percentage of their production. The footwear sector is an example of an industry dominated by Thai firms, which manufacture primarily for export by licensing foreign brand names. But, many joint ventures in the electronics and automotive industries also pay technology fees to their foreign partners. However, information on technology licensing arrangements is limited. There are also a number of Thai exporting firms, which acquire technology by contracting foreign experts to help run their factories at the initial stage. The success of such arrangements also depends very much on the capability of the Thai firm in absorbing the technology. See Atchaka and Brimble, 1992, p. 49.

4 As mentioned above, apart from direct technology licensing contracts that involve no equity participation, it is common for joint ventures to pay technology fees to foreign partners who own rights over technologies. However, it is not clear whether Thai firms or joint ventures are the major licensees. Ibid.

5 See Atchaka and Somsak, 1986, Table 4. Japan was the single largest technology source. However, figure on technology receipts is not available for this period, as records have been kept only for technology payments and not for receipts. The latter would have been negligible in this phase.
total payment on technology fees had increased manifold to almost 324 billion baht during 1992-97 alone, while the total receipt was only about 24 billion baht.

Table 6.1: Technological Fees Classified By Categories: Receipt and Payment from 1992-97

<table>
<thead>
<tr>
<th>Year/Item</th>
<th>Royalties</th>
<th>Technical</th>
<th>Total</th>
<th>Royalties</th>
<th>Technical</th>
<th>Total</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>7123</td>
<td>23058</td>
<td>30181</td>
<td>239</td>
<td>2469</td>
<td>2708</td>
<td>-27473</td>
</tr>
<tr>
<td>1993</td>
<td>10806</td>
<td>33603</td>
<td>44409</td>
<td>66</td>
<td>2085</td>
<td>2151</td>
<td>-42258</td>
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<tr>
<td>1994</td>
<td>11354</td>
<td>39910</td>
<td>51264</td>
<td>103</td>
<td>4143</td>
<td>4246</td>
<td>-47018</td>
</tr>
<tr>
<td>1995</td>
<td>15691</td>
<td>37716</td>
<td>53407</td>
<td>15</td>
<td>4043</td>
<td>4058</td>
<td>-49349</td>
</tr>
<tr>
<td>1996</td>
<td>18169</td>
<td>46330</td>
<td>64499</td>
<td>637</td>
<td>3658</td>
<td>4295</td>
<td>-60204</td>
</tr>
<tr>
<td>1997</td>
<td>24857</td>
<td>55100</td>
<td>79957</td>
<td>1214</td>
<td>5758</td>
<td>6972</td>
<td>-72985</td>
</tr>
<tr>
<td>1992-97</td>
<td>88000</td>
<td>235717</td>
<td>323717</td>
<td>2274</td>
<td>22156</td>
<td>24430</td>
<td>-299287</td>
</tr>
</tbody>
</table>

Source: Thailand Science and Technology Profile 1999, NSTDA, MOSTE.

However, these figures may underestimate the total cost of technology imports, given the fact that technology payments, especially those involving FDI, are undervalued. Payments on machinery imports serve as an additional indicator, then, in terms of the extent of "embodied" technology transfer. The table below shows the machinery balance of payments in terms of exports and imports of machinery from 1980-97. During 1992-97, the total value of imported machinery was more than 3145 billion baht, while the value of exported machinery was only 1202 billion baht.

Table 6.2: Thailand's Machinery Balance of Payments, 1992-97

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<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>IMPORTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-electrical machinery</td>
<td>148210</td>
<td>174116</td>
<td>200666</td>
<td>268111</td>
<td>287789</td>
<td>264099</td>
<td>1342991</td>
<td>326108</td>
</tr>
<tr>
<td>Electrical Machinery &amp; Parts</td>
<td>91315</td>
<td>120934</td>
<td>150353</td>
<td>188565</td>
<td>188456</td>
<td>229517</td>
<td>969240</td>
<td>468392</td>
</tr>
<tr>
<td>Computer</td>
<td>8527</td>
<td>9514</td>
<td>12826</td>
<td>15723</td>
<td>16308</td>
<td>16768</td>
<td>79666</td>
<td>23526</td>
</tr>
<tr>
<td>Computer component</td>
<td>28161</td>
<td>29454</td>
<td>40158</td>
<td>49866</td>
<td>55858</td>
<td>78526</td>
<td>282023</td>
<td>150719</td>
</tr>
<tr>
<td>Integrated Circuits</td>
<td>15288</td>
<td>23539</td>
<td>35900</td>
<td>46603</td>
<td>50008</td>
<td>54104</td>
<td>225442</td>
<td>139609</td>
</tr>
<tr>
<td>IC components</td>
<td>21447</td>
<td>25189</td>
<td>31921</td>
<td>46852</td>
<td>51595</td>
<td>68931</td>
<td>245935</td>
<td>178220</td>
</tr>
<tr>
<td>Total Machinery Imports</td>
<td>312948</td>
<td>382746</td>
<td>471824</td>
<td>615720</td>
<td>650014</td>
<td>710245</td>
<td>3145297</td>
<td>1289114</td>
</tr>
<tr>
<td>EXPORTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mach.&amp; Mechanical Appliances</td>
<td>70421</td>
<td>90802</td>
<td>118018</td>
<td>160937</td>
<td>196343</td>
<td>2640333</td>
<td>900554</td>
<td>711271</td>
</tr>
<tr>
<td>Integrated circuits &amp; Parts</td>
<td>28619</td>
<td>35550</td>
<td>45307</td>
<td>58149</td>
<td>58483</td>
<td>75742</td>
<td>301850</td>
<td>204551</td>
</tr>
<tr>
<td>Total Machinery exports</td>
<td>99040</td>
<td>126352</td>
<td>163325</td>
<td>219086</td>
<td>254826</td>
<td>339775</td>
<td>1202404</td>
<td>918522</td>
</tr>
<tr>
<td>Machinery BOP</td>
<td>-213908</td>
<td>-256394</td>
<td>-308499</td>
<td>-396634</td>
<td>-395188</td>
<td>-372270</td>
<td>-1942893</td>
<td>-373292</td>
</tr>
</tbody>
</table>

Source: Based on Bank of Thailand data, using the classification given in NSTDA's Thailand Science and Technology Profile.

6 Firstly, foreign firms do not have to compulsorily register with the Bank of Thailand for bringing in capital or for taking remittances out of the country. Secondly, in many cases, in order to avoid showing the actual sums involved in technology-related payments, payments on many technology transactions may also be disguised in payments as machinery imports. Such conditions could be part of the terms in technology contracts.

7 'Embodied' here involving both embodied technology and embodied technology payments, as mentioned in the earlier footnote.

8 Although there were declines in machinery import payments during 1998-99, given the past trends it is evident that this is entirely attributable to the industrial demand slowdown soon after the crisis and does not reflect any improvement in Thailand's technological self-sufficiency in machinery industries.
Therefore, payments on technology transactions and machinery imports clearly point towards a very high degree of and continuously increasing dependency on foreign technology in Thailand’s export-led industrial growth. This points to the continuing underlying problems in Thailand’s technological capability development policies and programs.

6.2.2 Perceptions on Technology Transfer

It was in 1983 that the government had set up a Technology Transfer Center (TTC) under MOSTE, to promote and facilitate technology transfer from abroad and to enhance its contribution to economic and technological development. TTC’s activities have concentrated primarily on disseminating information and giving advice to small Thai firms in negotiating for fair technology transfer agreements. However, it is not empowered to remove unfair clauses in technology contracts. Further, due to budget constraints, its services have been limited and much scope exists for improving information supply and contract negotiation assistance. Similarly, although the Bank of Thailand requires submission of technology licensing agreements from firms that want to remit technology fees, it only checks that the fees are in accordance with the contracts and is not concerned with the nature of the agreement.9

Although the lack of an institutional mechanism to screen, register and monitor FDI and technology transfer has since long been recognised, there has always been concern on the part of the policymakers too that such a movement may have a negative impact on the investment climate as perceived by potential foreign investors.10 Although the BOI has a stated policy to promote Thai partnership in FDI projects to enhance the benefits to Thai investors, as we saw in Chapter III, this was directed only towards foreign firms that wanted to sell in the domestic market. On the other hand, the BOI pursued a liberal policy towards FDI in export-oriented activities. Further, the joint venture criterion was clearly not applicable for foreign firms that did not want to obtain BOI privileges. Apart from the BOI’s incentives, which were partial at best, no other government measures specifically promoted the creation of joint ventures that would have increased the benefits to local technology development.

The government made no attempt to directly require or accelerate technology transfer. BOI has also had no direct requirement on technology transfer from foreign affiliates. Eventually, the Sixth Plan (1987-91) called for a national committee on technology transfer, to issue laws and procedures to ensure that technology transfer supports the development of local technology. Accordingly, in the late-1980s, the BOI

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9 Atchaka and Brimble, 1992, UNCTC, opcit.
submitted a proposal to the Joint Public Private Coordinating Committee (JPPCC), to formalise technology transfer procedures and to empower the BOI to remove restrictive clauses and unfair terms from technology transfer agreements.\textsuperscript{11} It included measures to monitor the transfer of technology in order to ensure that the Thais derived maximum benefit from it. However, due to concerns by the private sector that contract registration would cause delays in the importation of technology, this proposal was shelved.\textsuperscript{12}

Seemingly, the domestic private sector has been willing to agree to the terms of technology contracts in return for short-term export success, reflecting the lack of a more long-term approach to competitiveness and growth. The latter essentially originates from a nationalistic and self-sufficient approach to industrial development. It could therefore be argued in Thailand’s case that domestic private capital failed the state as much as the state failed domestic private capital. Both of these could be argued as arising from a lack of long-term and independent outlook regarding the country’s development.

BOI’s attention to the technology transfer issue in promoted projects remains limited to the number of foreign experts who are allowed to come in and stay on every year. Promoted firms have to first obtain approval from the BOI for creating working positions for foreign skilled technicians and experts in their company. However, more often than not, BOI promotional status have actually made it easier for foreign-affiliated firms to bring in expatriates or personnel from their parent companies, who are then handed over many of the important technological and managerial functions. The BOI argued that since BOI’s Foreign Experts Services Unit takes the decision on a case-by-case basis every time a new foreign employee needs to be appointed or when an existing person’s stay has to be extended or replaced, this reduces the number of foreign experts who are allowed to continue to stay. Further, a copy of the company’s plan for transferring technology to Thai technicians/workers and report concerning plans to send Thai workers abroad for training are to be submitted along with the application, for the latter to be considered. This procedure is therefore claimed to induce training and transfer of technological and managerial skills to local personnel. However, BOI still does not believe in having a follow-up mechanism to ensure that the training programs and the transfer of skills to Thai workers and technicians do infact take place.

Traditionally, the BOI’s incentive system also did not provide any incentives to encourage firms to invest in improving productivity, training labour, or for undertaking

\textsuperscript{11} Technology transfer contracts often include clauses, which restrict exports by Thai buyers or force the buyer to purchase raw materials and machinery from the technology supplier. Although most buyers are aware of the disadvantageous nature of these terms, they have to accept the terms due to lack of information on alternative technology sources or on contractual arrangements and legal matters. See for instance, Atchaka and Brimble, 1992, UNCTC, p. 55.

\textsuperscript{12} See Atchaka and Brimble, 1992, UNCTC, p. 17, and IDE, 1990, p. 60.
R&D activities. Most of these weaknesses in the incentive structure originate from the fact that the BOI essentially limits itself to the process of granting promotion with little follow-up activities. In 1989, although the BOI did begin to issue criteria for promoting research and development (R&D) related projects, the response from the private sector was found to be disappointing, again reflecting a lack of willingness on the part of the private sector to undertake technological enhancement activities necessary to improve productivity. Thus, importation of technology through licensing and other means has remained to be freely carried out by the private sector. Clearly, this will only increase further, as technological progress moves at an ever more increasing rate. What is essential is to increase local technological capabilities for ensuring that Thai firms are successful in negotiating fair technology transactions and benefit from them properly and build upon the imported technology.

In the absence of any governmental pressure, foreign subsidiaries and joint ventures rely on R&D conducted by their parent firms and therefore, do not have any incentive or scope for starting R&D locally. Until the early nineties, the import duties on testing and laboratory equipment to carry out R&D activities were also high, making them less attractive, and prohibitively expensive in the case of medium and small firms which are mostly outside the purview of BOI's promotional privileges. This certainly did not encourage firms to take up R&D activities to raise their innovative and adaptive capabilities. Currently, BOI provides corporate income tax exemption for 8 years, and eight years' import duty exemption for machinery and equipment for R&D. However, as we shall show in the case of electronics industry in the late nineties, even in many large companies that claimed to have their own R&D units, these mostly involved quality control and testing, or very minor product or process adaptations, rather than actual research into new product or processes.

It has also been pointed out that in general, a large number of indigenous as well as foreign-affiliated firms do not perceive the value of technology-related activities, especially where the benefits are not immediately discernible or measurable. In fact, the TDRI study had reported in 1992 that the lack of a proper perception and attitudes on the part of entrepreneurs concerning human resource development, maintenance practices, R&D activities, and modern management practices, was widespread.

This lack of willingness or inability on the part of industry to invest in R&D also gets reflected in the proportion of total R&D expenditure in the country that is financed by industry. While in NICs such as Singapore, Taiwan and Korea, industry

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13 See TDRI, 1992, p. 85.
14 See the discussion in the company case studies presented in Chapter IX.
15 There are several ways in which gross expenditure on R&D (GERD) can be sub-divided. Two main indicators are: (1) GERD funded by industry (state enterprise and business enterprise), government,
finances more than half of the total R&D expenditure,\textsuperscript{16} in Thailand industry (state enterprise and business enterprise combined) financed only 18.5\% of the total R&D expenditure in 1996. With the share of total R&D expenditure financed by industry at 43\% (figure for 1991), Malaysian figure also showed a clear contrast to the situation in Thailand. Similarly, the proportion of gross R&D expenditure performed by industry was also low at 22.5\% for Thailand in 1996, while it was 48\% for Malaysia.\textsuperscript{17} Again, business enterprise expenditure on R&D (BERD) was very low at 0.03\% of GDP for Thailand in 1996, while it was 0.16 \% of GDP for Malaysia in 1994. Business enterprise R&D personnel as a percentage of total R&D personnel was also only around 14\% for Thailand, while it was 37\% for Malaysia.\textsuperscript{18} All these clearly point towards the Malaysian government's more successful S&T development policies as well as the private sector's more long-term attitude towards industrial development, in contrast to the short-termism prevailing among Thai entrepreneurs.\textsuperscript{19}

Again, the proportion of business enterprise expenditure on R&D (BERD) financed by industry was also relatively low at about 75\% for Thailand, because the government financed almost 25\%. In Singapore, the percentage of BERD financed by industry was 87\%, and by government was only 6.4\%, while 2.8\% came from other national sources and 3.2\% came from abroad. Japan or Korea did not have any BERD financed from abroad while the proportion financed by industry was as high as 98\% for Japan and 96\% for Korea (1995).

Thus, the Thai private industrial sector has clearly not been forthcoming in technology development efforts. There is an evident contradiction in this lack of long-term strategies for technology development in Thai entrepreneurs when considered against the so-called dynamism of the private sector, which has been credited as one of the major factors behind Thailand's exceptional growth performance. Clearly, Thai private sector has been dynamic and enterprising only in a limited sense. Success stories of innovative performances are available; however, these remain scattered. The private

\textsuperscript{16} In Korea, the share of gross domestic expenditure on R&D (GERD) financed by industry was exceptionally high at 76.3\% in 1995. The figures are taken from Thailand Science and Technology Profile, 1999, NSTDA, MOSTE, Bangkok. See Table 1 on p. 2.

\textsuperscript{17} The percentage of gross R&D expenditure undertaken by industry was 58\% for Taiwan, and 74\% for Korea (for 1995).

\textsuperscript{18} Figures are taken from Thailand Science and Technology Profile, 1999, NSTDA, Table 1.

\textsuperscript{19} Malaysian S&T Policy focused on the promotion of scientific and technological self-reliance. Further, the second Industrial Master Plan (IMP2), which was formulated along with the Seventh Malaysian Plan (1995-2000) to chart the industrialisation path for the country up to the year 2005, was based on a cluster-based industrial development approach, rather than sectors. See Mashhor, Nik Ibrahim Wan, 1997, "Science and Technology Policy in Malaysia: an Overview", APEC, MOSTE and NSTDA, 1997, Technology Foresight, 110.
sector has not been forthcoming on technology-related planning and investment for long-term competitive strength, on a larger scale.

Another side to this has been the increased private sector participation in economic policy formulation since the eighties, discussed in Chapter III. By the late 1980s, the participation of the private sector in policy formulation had increased significantly, especially with regard to short-term measures to alleviate economic problems facing the private sector. The adoption of short-term measures were encouraged by the euphoria that came out of the export boom and the belief that such high export growth rates would continue, in spite of the various weaknesses in the production structure. Such over confidence was further fed by the increased availability of cheaper capital subsequent to financial sector liberalisation. While this phase was a crucial phase for Thailand’s industrial restructuring, in the sense that government and the private sector should have channelled a large amount of resources towards production upgradation-related investments, the government opted for the easier way out of the emerging capital squeeze situation by liberalising the capital account. As we have seen in the previous chapters, following the fall in export revenues, this easy accessibility led only to explosive levels of short-term external borrowing by the private sector for working capital needs and for speculative purposes. Although the government also began attracting FDI into basic, engineering and other scale-intensive industries, deeper technological absorption within the country from these activities requires even higher levels of indigenous capability development, than is currently available.

6.2.3 Human Resources and Skill Development

The shortage of medium and high-level skilled people that emerged in Thailand has become a serious obstacle in the path of further catching-up. According to TDRI (1992), the general shortage of S&T personnel, and particularly engineers, was one of the most acute problems faced by all industries by the early nineties itself. While at one level, this put increased pressure on wages, at a much more critical level, this inadequacy in technical human resources has been expected to affect not only the acquisitive, adaptive and innovative capabilities most, but to a lesser extent, even, operative capabilities.

The UNESCO data on enrolments at three main educational levels (primary, secondary, and tertiary) and in technical subjects (natural science, maths/computers, engineering, and 'core technologies') at the tertiary level show that Thailand lags far behind the NICs in terms of secondary and technical education and in providing high level technical manpower. Two other common indicators for S&T personnel are total

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R&D personnel in 10,000 labour force and total research, scientists and engineers (RSE) in 10,000 labour force. Although Thailand’s total R&D and RSE personnel increased between 1987 and 1996, in terms of their number in 10,000 labour force, Thailand’s numbers at 2.97 and 1.75 were significantly lower than those of Malaysia’s 9.0 and 2.9 (in 1994). Further, education expenditure on R&D (HERD) as a percentage of GDP was already 0.08 % for Malaysia (in 1994), while it was only 0.03 % for Thailand even in 1996. Further, the percentage of government expenditure on R&D that went into the promotion of industrial development was only 8% in 1996 and ranked only fourth after agriculture, forestry and fishing (44%), health (19%), and social development and services (11%).

Government’s total R&D personnel classified by socio-economic objectives in 1996 also showed that development of agriculture, fishery and forestry accounted for the largest share (48%), followed by health (23%), and social development & services (14%). Promotion of industrial development accounted for only an abysmally low 5% share. The distribution of R&D personnel in higher education by fields also clearly revealed that R&D personnel in industrial technology-related areas were lagging behind in growth. In 1996, agricultural sciences ranked at the top with a share of 31%, followed by social sciences (23%). Engineering and technology R&D personnel in total higher education R&D personnel accounted for only around 16%, and was closely followed by medical sciences (14%). In terms of higher education expenditure on R&D, agricultural sciences had the highest share (30%) again, but was followed by engineering and technology (23%) and social sciences (18%).

Thus, a serious gap emerged by the end of the decade, in terms of supply of engineers and scientists at the bachelor level. Demand has been consistently 50-80 percent higher for graduates in engineering and science, both at the bachelor and higher levels. In 1997, Thailand was producing about 12,000 engineers and 6,000 scientists at the bachelor level per year, while the demand was projected to be for some 17,000 engineers and 10,000 scientists, even after considering the fact that the growth of the economy would not be as high as in past years. Thailand also require some 35,000 more technicians per year. Together they form the bulk of the workforce required for value-added production. At the higher level, Thailand was producing 600 master degree graduates in engineering, and 1,000 master graduates in science per year, but there was requirement for 1,900 engineers and 1,700 scientists at the post-graduate level.

In addition to these problems of manpower shortage, problems of quality in Thailand’s education system have also been pointed out in the literature. While the

21 Based on data given in Thailand Science and Technology Profile, 1999, NSTDA, MOSTE, Bangkok.
22 Based on data provided in NSTDA, 1999, opcit.
23 Based on Prof. Yongyuth Yuthavong, Director of NSTDA. See Bangkok Post, October 24, 1997.
schooling system suffers from deficiencies and uneven levels of quality and access, the tertiary level educational institutions tend to have outdated curricula, insufficient practical training, and little contact with the evolving needs of industry. Most of the local S&T community’s activities, in particular R&D programs, are conducted either for academic interest or for state and public benefits. While the latter could be beneficial in the long-term, it is equally important to have effective linkages between the S&T community and industrial firms in order to meet the immediate and medium-term needs of the industrial sector. This has failed to emerge because, as has been observed, on the one hand, industrial firms tend to doubt the ability and effectiveness of universities and public technical institutes to solve practical industrial problems, on the other hand, the latter lack sufficient opportunities to gain experience.  

Although the industrial sector itself provides a considerable amount of training to overcome skill shortages, the extent of training is limited to meeting operational requirements rather than to technological upgradation. Again, it has been found that it is mainly the larger and foreign-owned firms that undertake employee training, not SMEs. However, a study in 1994 on the impact of FDI on technology diffusion has shown that job mobility even during the peak of export-led growth was an insignificant channel of technology diffusion, because workers of foreign-affiliated firms rarely moved to Thai firms. The direction of worker mobility in FDI firms was mostly to other foreign-owned firms or joint-venture firms. Another study, Wisarn and Bunluasak (1995) also arrived at the same conclusion that the degree of turnover rate in foreign firms was much lower than that in Thai firms. In changing jobs, workers from foreign-affiliated firms rarely moved to Thai firms or set up their own companies. Further,

24 See for example, TDRI, 1992, p. 85.
25 See Lall, 1998, opcit., p. 12. A study by Koasa-arid (1991) on TNC hiring and localization policies in Thailand found that on-the-job training is a major form of skill acquisition for unskilled and semi-skilled workers in foreign firms. Foreign firms also tend to invest more to train high-level staff than low-level staff. (For small foreign firms, local and foreign training are usually outside the firms due to high costs of in-house training. On the other hand, larger firms may have training conducted in-house, outside the firms, or overseas.) The study also found that the US and European firms usually limit overseas training to senior technical staff, whereas Japanese firms send a larger group of technicians and engineers to train in Japan before the start-up of a factory. Quoted in Atchaka and Brimble, 1992, UNCTC, p. 54.
26 See Wisam Pupphavesa and Bunluasak Pussarungsri, 1994, FDI in Thailand, TDRI, Bangkok. This finding was based on turnover rate and job mobility direction among foreign-owned firms, joint-venture firms, Thai firms, workers setting up their own companies, and others. The same study also found that technology transfer through sub-contracting arrangements to local suppliers was limited to the basic knowledge level. (Again, FDI does not significantly contribute to the export of total manufacturing products, except in export-oriented industries such as electronics industries.)
27 Takeuchi (1991) has provided some examples of spin-offs, wherein Thais who worked in Japanese joint ventures had begun independent operations. But, these were in press manufacturing (supplying parts for automobile and electrical appliance producers), plastic parts, and assembly of printed circuit boards, all of which involved relatively low levels of skill management. See Takeuchi, Johzen, 1991, "Technology Transfer and Japan-Thai Relations", in Yamashita, ed. 1991, Transfer of Japanese Technology and Management to the ASEAN countries, University of Tokyo Press, p. 217-228.
workers from Thai firms tended to move to FDI firms rather than to other Thai firms, due to the higher salaries, job security, and other fringe benefits associated with working in foreign firms. Thus, this study also ruled out the possibility that job mobility from foreign firms to Thai firms is a significant channel of technology diffusion. In fact, the direction of job mobility suggested a "brain-drain" process rather than a diffusion of technology.\textsuperscript{28} Thus, in-firm training by foreign-affiliated firms may not induce technological diffusion or deepening, in the absence of wider skill-enhancement programs on the part of the government to improve the overall technological absorption capabilities of the larger population.

On the government side, the creation of the Metal Working and Machineries Development Institute under the Ministry of Industry with assistance from the Japanese government was set up in the early nineties to provide technical services and personnel training for the metal industry. There are also other programs such as that of the Technological Promotion Association and the Engineering Institute of Thailand, which provide continuing education to upgrade skills and technical knowledge to practicing technologists. Examples of public-private cooperation include the apprenticeship program at the King Mongkut Institute of Technology (KMIT), North Bangkok, in collaboration with firms in the metal industry, and the custom-made evening courses offered to foreign subsidiaries by KMIT-Lat Krabang. Such scattered attempts need to be and can be successfully replicated across several industries. However, there has to be effective support from the government in articulating and meeting training and technological needs. Although the initiatives taken by the Department of Vocational Education (DVE) in the early nineties in the conversion of courses to meet the immediate needs created by rapid industrial expansion and the establishment of new industries have been considered significant, the vocational training system's overall structure is not geared to the practical needs of the manufacturing industry for overcoming the evident market failures in this area.

Having examined some of the weaknesses in Thailand's overall technological and human resource development policies that have hindered its progress in industrial upgradation, we look at policies related to supporting industries and SME development. As seen in the conceptual framework in Chapter II, industrial diversification and upgradation requires government policies to facilitate the development of competitive supporting industries by the domestic private sector.

6.3 SUPPORTING INDUSTRIES AND SME DEVELOPMENT POLICIES

In general, the intermediate products, parts, and components segments of the engineering industry (where the latter encompasses fabricated metal products, electrical

\textsuperscript{28} See Wisarn and Bunluasak, 1995, p. 169.
and non-electrical machinery, and transport equipment) are considered as supporting industries. Most of the supporting industries are in the engineering sector, with the exception of products that go directly towards the final consumer. It is well established that the existence of efficient, broad-based, and technologically dynamic supporting industries is a vital prerequisite for enabling systematic and balanced industrial development. They also act as carriers of technological change.

Studies on supporting industries in Thailand have classified them, especially those in the engineering industry sector, into three broad categories. The first group consists of large factories with high investment, good management systems and utilising modern technology, with some joint ventures. The second consists of factories that produce components and parts ranging in quality from medium grade to high grade, using engineering design and production. The third consists mainly of small-scale factories characterised by family enterprises, with little or no technical staff, and which generally concentrate on the production of parts, mainly for agricultural processing and in repair works. It is the third category, which dominated Thailand’s supporting industries in the late eighties.

This was a direct outcome of the fact that until the late eighties, there were no government policies that applied specifically to supporting industries. Even in the late eighties, the Ministry of Industry and the manufacturers’ organisation in charge of drafting and executing policies for industrial promotion were not strong enough to deal comprehensively with industrial matters, and were thus slow in establishing a well-coordinated SME policy. Although in the Fifth and Sixth Plans, an industrial promotion policy on promoting small and medium-scale industries was emphasised along with promotion of regional industries (as well as export industries, engineering, and agro industries), the implementation of the policy through the BOI and the Department of Industrial Promotion (DIP) of the Ministry of Industry (MOI) have not been effectively coordinated. There is no central organisation handling and implementing the specific proposals for the promotion of SMEs.

The Department of Industrial Promotion (DIP) has been carrying out SME promotion activities mainly by providing technical services to small and medium-scale enterprises. However, since the beginning, the BOI’s incentive system tended to be

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29 Typical categories include: material processing; separate manufacturing operations such as foundry shops, heat-treatment shops, and electroplating shops; production of moulds and dies; production of parts and components; production of accessories; production of packaging items; and service industries (e.g. those which undertaken repair work, testing and calibration services, etc.) Based on Samart Chaisakul, Chuta Manasphaibool and Mikimasa Yoshida, 1989, Thailand’s Economic Development in the 1980s, IDE, Tokyo.

30 See for example, Samart, Chuta and Yoshida, 1989, IDE, opcit., and JICA, 1995, etc.

31 In 1987, 96 % of the total basic metals and engineering industries were cottage and small-scale industries, with medium-scale and large-scale industries accounting for only 3% and 1% respectively. See Samart, Chuta and Yoshida, 1989, opcit., p.104.
biased against small-scale projects due to the minimum size of capital investment that was required for most promoted activities.\textsuperscript{32} It is only during the Sixth Plan period that the BOI lowered the minimum investment for receipt of promotional incentives. To promote the engineering industry as a supporting industry, it also began to provide incentives as applied to indirect exports. However, existing supporting industry firms, which are mainly SMEs, could not easily use most of these incentives. They faced severe competition from the large volumes of subsidised imports of parts and intermediate goods for use in the fabricated metal, electrical and electronics, and automobile industries. In addition, in order to promote and improve supporting industries, instead of effectively supporting existing SMEs in the supporting industries and enhancing their technological and managerial capabilities to enter into successful sub-contracting relationships with final producers,\textsuperscript{33} the government again attempted to attract companies from abroad through the BOI. This has created further problems related to unfair competition for the existing local supporting industry enterprises that do not enjoy any preferential treatment.

As discussed in the conceptual framework in Chapter II, an important channel by which technology transfer and diffusion associated with FDI takes place in an economy is through the development of effective linkages between final producers and local supporting industry firms. However, due to the above mentioned promotion policies of the BOI, a large number of Thailand's supporting industries have also come to be dominated by foreign-affiliated firms. These have in turn been able to dominate the supplier networks of end-user foreign-affiliated firms. Thus, linkages with foreign-owned production facilities through sub-contracting relationships have eluded the indigenous supporting industry firms on a broad enough scale to enable rapid technological progress and diffusion. Below, we examine the issues related to the lack of effective linkages.

6.3.1 Linkage Development Policies

Although development plans have included policy statements on the need for the development of small and medium-sized firms and supporting industries since the mid-1970s, these were not effectively implemented or coordinated among different

\textsuperscript{32} The specification that a promoted project must be a limited company, cooperative or foundation also reduced the likelihood of small-scale entrepreneurs being included in the promotion programme. The explicit use of the size of investment or employment as a criterion for granting corporate income tax exemption in 1983 further accentuated this bias against small-scale activities. See Atchaka, 1986, op.cit., p. 26.

\textsuperscript{33} Sub-contracting arrangements offer large volume of assured sales, the marketing capability of buyers, stability in income, and technology transfer to indigenous suppliers, especially SMEs, which enable them to achieve economies of scale and scope. By providing a stable income, sub-contracting arrangements also reduce the financial risk associated with investing in R&D and may enable supplier firms to invest for developing new technologies.
government agencies. Almost until the early nineties, the dominant attitude within the policy circles remained that local industrial technology and component manufacturers would get automatically upgraded as long as foreign direct investments were allowed to come in unimpeded. For such an outcome, the integration of the foreign investment into the domestic economy had to materialise through increase in local content by effective linkages with indigenous supporting industries.

However, the manufacturing sector's heavy reliance on imports of raw materials, parts and components is seen to increase continuously especially since the rapid growth years of the late eighties. This clearly reflects the continuing weaknesses in the country's intermediate and supporting industries. Despite the existence of many programs to support the development of small and medium-sized supplier enterprises, supporting industries have been seriously lagging behind, causing producers based in Thailand searching for subcontractors to source from elsewhere through importing. This is due to the existence of a combination of policy weaknesses, which continued to mitigate against local entrepreneurial development in several industries even in the nineties. Several studies carried out since the mid-eighties had recognised the constraints and problem areas and suggested policy recommendations. Studies in the nineties had reiterated many of these.

Some of the major constraints in linkage creation were related to the anomalies in the tariff structure and business tax. Rationalisation of the tariff structure has been a long stated policy of the government, but the import duties on completely-knocked-down (CKD) kits have been frequently lower than the import duties on the individual components. While on the one hand, this penalised companies wishing to increase domestic value-added by engaging in sub-contracting relationships, on the other hand, it was a disincentive to domestic producers of parts and components. In the case of promoted firms, until the general tax reductions on machinery imports in 1991, promotional duty and tax exemptions on imported machinery and raw materials had also clearly encouraged them to be import-dependent and discouraged the domestic production of machinery and intermediate products and led to the establishment of assembly-based industries. These biases against domestic production of intermediate producers were reinforced by the previous business tax system, under which business enterprises had to pay tax on the gross value at each intermediate transaction. Thus, producers of manufactured goods that involve several stages of production were heavily burdened. Such companies used to find it much more profitable to go in for imports and obtain duty exemptions, or carry out backward integration, rather than undertake domestic purchases. Thus, the multiple taxation system was seen to widely deter

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34 Weaknesses in the BOI incentive structure are discussed in detail in Chapter VIII, in the context of the electronics industry.

Although a task force was set up in the Ministry of Finance around the mid-1980s to study the introduction of a value-added tax (VAT) which requires tax to be paid only on the difference between what businesses obtain as price for their output and what they pay for their input purchases, the VAT was introduced finally only in 1992 after much delays due to opposition from both within the government and from the private sector. The total tax burden according to VAT is lower and is more beneficial in inducing investors to produce components locally. Although exemption from corporate income tax is the same for both exporting and domestically selling firms and is dependent on location of firms rather than market orientation\footnote{If they locate factory in Zone 1, they can get three years’ income tax exemption, for Zone 2 it is three or seven years’ exemption, while for Zone 3 it is offered for eight years. This structure applies whether the firms are exporting or selling domestically. Source: Duangchai, 2000.}, there seems to be some effect in having changed business tax into VAT, as the latter is more beneficial in inducing investors to produce components locally. Since VAT is only the difference between what they obtain as price for their output and what they pay for their input purchases, the total tax burden comes to be lower. However, for an exporting firm business tax or VAT do not make much difference in the short-run. In either case, exporting firms have been exempt from any such tax at least during the tax-exempted period, and therefore this transition into VAT cannot seem to make any difference. On the contrary, VAT drastically reduces the burden on a firm selling domestically if it wants to purchase domestically, as it is not eligible for tax reduction/exemption otherwise. However, it may be argued that the delay in implementing VAT along with the various other problems faced by indigenously-owned firms in linkage creation meant that by the time VAT came into force, Thai firms have clearly lost a lot of time in catching-up. By then, assembly-based industries like electronics had become completely dominated by foreign presence and it became difficult for indigenous firms to penetrate the supplier networks consolidated around foreign firms.

In the case of promoted firms, BOI’s long-delayed reform ending the discrimination against indirect exports was introduced in the early nineties, and promoted firms selling to domestically established exporting firms also became eligible for export-promotion incentives. As we shall see in the detailed analysis of electronics industry performance, this also failed to make a significant impact. Further, in the early nineties, the Bank of Thailand was still insensitive to the issue of backward linkage creation for encouraging domestic supporting industries. Only direct exporters had
access to concessionary credits offered by the Bank of Thailand, who did not generally pass this credit down to their suppliers. Thus, indirect exporters faced problems in obtaining finance. Another factor has been the problems faced by indirect exporters in moving intermediate goods between firms operating under different tariff regimes offered by the BOI. The tariff regimes vary depending on firms' commitment to export and whether they operate in an export-processing zone or not. This is supposed to be relieved by the setting up of bonded warehouses and export processing zones.

The issues involved in effective backward linkage creation were recognised explicitly for the first time in a study conducted by the Foreign Investment Advisory Service (FIAS) for providing advisory assistance to the BOI, in order to increase the benefits of FDI to the national economy through the transfer and diffusion of technological and managerial skills from foreign investors. It was clearly pointed out that the government had a very important 'positive' role in helping develop the supplier-buyer relationship in backward linkages, facilitating the externalisation of production by remedying market imperfections such as lack of information, or by enhancing the technical and managerial capabilities of domestic firms with a potential to enter into subcontracting arrangements with foreign investors.

Recognising the ever-growing need for the parallel development of supply industries to ensure international competitiveness of export industries, BOI began giving serious consideration to the need to strengthen backward linkages between large export-oriented assemblers/producers and local subcontractors only much later. This finally became conceived in the special unit for industrial linkage development established by BOI in 1992. The establishment of a BOI Unit for Industrial Linkage Development (BUILD) to devise policies and programs to strengthen linkages between large, export-oriented projects and local suppliers and subcontractors was one of the 'new' activities for the BOI. Its initial activity was to work with six major multinational electronics producers to establish more linkages with local components and parts suppliers. BUILD was also expected to lobby for policy reforms such as simplification of customs procedures and the promotion of indirect exporters.

The BUILD unit initially focused on developing information on Thailand's supplier base in industrial parts and components, in order to stimulate domestic consumption of parts and components for parts. The ASEAN Supplier Industry Database (ASID) database was, however, formally launched only on April 7, 1999. It consists of 10,000 supplier companies from all over the ASEAN countries, out of which

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38 See FIAS, 1991, Impediments to Backward Linkages And BUILD - Thailand's National Linkage Program. A Report by the FIAS (a joint facility of IFC and MIGA), Washington, for the Office of the Board of Investment, p. 3.
7000 are suppliers with a manufacturing base in Thailand. This includes purely Thai-owned firms, joint ventures as well as fully foreign-owned firms.\textsuperscript{40} Out of these 7000 companies, 600 were involved with BOI in the BUILD program as of end 1999. The BUILD program is essentially about assisting the member firms to develop their technological abilities to become sub-contracting suppliers for companies doing final assembly. The BUILD does this by providing match-making services between buyers and suppliers, and coordinating their requirements for finance and technical expertise with the various government agencies involved in such efforts such as the NSTDA, MOI, SIFO, IFCT, etc.\textsuperscript{41} BUILD also works quite closely with Metal Working and Machinery Industries Development Institute (MIDI) under the Department of Industrial Promotion (DIP) of the Ministry of Industry, which provides technical assistance to small firms.

However, successful linkages between foreign producers and indigenous suppliers are still very rare. Further, where sub-contracting relationships do exist, the level of technology transfer was observed to be still limited to low to middle levels of technological capability development in the sub-contracting firm. For example, a 1995 study by Wisarn and Bunluasak, based on five sub-contracting relationships between buyers and suppliers, found that while all suppliers gained a basic level understanding of all three types of technology - product, process and quality control; only three out of the five firms achieved the middle level of technology for all three types. Out of these, only one firm claimed to have gained a higher level of technology capability, including knowledge regarding product design, process operation and adaptation skills, and improvement in product/process performance.\textsuperscript{42}

The easiest parts which Thai companies could manufacture for companies still remain plastic and metal parts. The attempts to develop backward linkages still are affected by the anomalies in the tariff structure. Although there has been some improvement in this tax structure, the government was still facing some difficulties in streamlining their tax structure and procedure. The delays and rigidities in customs procedures have also often been accused of causing unnecessary delays due to which producers of intermediate products (who had to import some of their own inputs) have

\textsuperscript{40} It was impossible to get an estimate of how many of these do not involve foreign investment, as many firms consider many aspects of the company information secret, thinking it will get the government tax authorities' attention or competitors' attention or so. Thus, many companies have not given their ownership pattern, product profile etc. in the database. Now, BUILD has begun a process of separating out firms with good record in cooperation and classifying them as 'most reliable' suppliers, implying that when foreign investors approach them seeking information about suppliers, firms in this list will be the ones which benefit. Information is based on a discussion with Dr. Wisan, Head of the BOI BUILD Unit, Office of the BOI, Bangkok, April, 2000.

\textsuperscript{41} For example, NSTDA has contacts with foreign institutes to send their experts to Thai companies.

been unable to meet prices and delivery deadlines set by their buyers. This was also found to encourage export-oriented firms to import intermediate products, which could have otherwise been subcontracted. ⁴³

6.3.2 Local Content Policies

One of the commonly used policies in effective linkage creation by several technologically successful developing countries has been that of local content requirements. Meeting government requirements on local content has been an important push factor for foreign enterprises to buy from local suppliers. However, in Thailand, most policymakers believed this to be an impediment to industrial efficiency and export potential. ⁴⁴ Clearly, in the absence of local industrial technological capability development, imposing a local content requirement would have indeed become a constraint on productivity and competitiveness considerations. Thus, at one level, the relentless demand for foreign capital and technology ensured that local content requirements were not imposed. At another level, the absence of local content requirements provided an easy option in obtaining imported parts and components to developing local technological capabilities. As we saw, this was reinforced by the export promotion regime, which enabled duty-free imports of inputs and raw materials.

In Thailand, local content requirements were imposed by three agencies, namely, the BOI, the Ministry of Industry, and the Ministry of Agriculture and Cooperatives, with the objective of promoting domestic industries. Local content requirements had previously been in force to protect domestic entrepreneurs in only three key industries: milk and dairy processing; car engines; and motorcycle manufacturing.

Among industries, it is the Ministry of Industry (MOI) that was in overall charge of local content policy. Thailand had a local content requirement only for auto industry, which was announced in 1971 and came into effect in 1974. There were a number of local automotive parts producers (both Thai-owned and joint ventures) in products like battery, seat, suspension parts, brake etc. when automobile assembly started in Thailand in the sixties. The government found it appropriate to impose local content rules on assemblers in order to promote the local auto parts industry. Since 1987, for example, minimum local content for all passenger cars was set at 54%, for petrol pick-ups at 60%, for diesel pick-ups at 72% and for large trucks at 45%.

⁴³ See FIAS, 1991, p. 18 for a detailed discussion on the customs procedures which discouraged linkage creation in various assembly industries.
⁴⁴ See Atchaka and Brimble, 1992, p. 19.
However, there was no stipulation that the local purchase had to be from domestically owned firms; it could be from any firm established locally.\textsuperscript{45}

The generous protection and local content requirements in the automobile industry did foster the development of a large automobile parts sector dominated by either small domestically controlled firms catering to niche markets or medium-sized Japanese-Thai joint ventures. It was estimated that there were over 1200 automobile parts firms at the end of 1996. Thailand’s 1996 motor vehicles sale accounted for 40\% of total ASEAN sales, and all major automobile manufacturers had set up assembly plants in the country to cater to its fastest growing and most development market in Southeast Asia. It was only after the crisis hit in 1997, that the industry had begun to suffer from decreased demand, following the crisis-induced economic recession. While no major assembler pulled out of the market, it was estimated that by February, only 600 of the 1200 automotive parts firms (end-1996) were still in business.\textsuperscript{46} To compound their problems, the government removed local content rules in 2000.\textsuperscript{47} From 2000, the removal of local content requirements became effective not only for new projects, but for existing projects as well.

6.4 CONCLUSION

When compared to the public policies of the I-tier NICs, Singapore, Korea and Taiwan, which have been the most successful in technological capability development, governmental support to directly stimulate the development of technological capability in industry can be said to have been nearly nonexistent in Thailand until almost the nineties. On the other hand, Thailand’s private sector, which has been responsible for most of the country’s economic growth phenomenon, has also been equally negligent when it came to indigenous technology development. Thus, while the Thai government has launched various initiatives to boost science and technology since the early 1990s, the results are meagre to date.

Rapid export growth in the past was led mostly by the grabbing of the opportunities opened up due to a combination of regional and international factors by the Thai private sector released from the limits of the domestic market size, and in

\textsuperscript{45} Interview with Khun Piphat, Industrial Economics Office, MOI – Pick ups have received the strongest promotion by the MOI local content policy which was imposed through the BOI for promoted firms especially in pick up engines. Currently, Thailand exports- mainly Mitsubishi and Ford- one-ton pick-up trucks to many countries.

\textsuperscript{46} See Brimble and Sherman, 1999, p. 21.

\textsuperscript{47} The Thai government had initially agreed in 1996 to a complete abandonment of the local content rule by June 1998 (ahead of the WTO schedule), under agreement to General Motors (GM), when a proposed plant by GM with an investment of US$750 million was to begin its operations. However, since GM’s plant could finally begin its operation only in 2000, the local content rule was also abandoned only effective from January, 2000 as per the WTO schedule. Interview with Ministry of Industry Official, 2000.
alliance with FDI. In spite of a growing recognition that such rapid growth would be unsustainable in the absence of major structural changes in the production structure and that this called for concerted governmental and private sector efforts on a number of production and technology enhancement-related fronts, government’s attention in the early and mid-nineties remained focussed on continued liberalisation of the economy internally and externally, abdicating the crucial role of a monitor and regulator. On the other hand, the Thai private sector also failed to develop a ‘technology culture’. Thus, in spite of the fact that Thailand may be credited with having built up considerable capabilities in terms of mastering and using imported technologies, the growth in FDI-led export production has failed to deepen technological development beyond operational capabilities. Clearly, Thailand’s case exemplifies that FDI-led production does not by itself enhance technological development in the country or lead to sustainable growth.

As we have seen, the call for investment in S&T development is not new in Thailand. There have been several studies, which have specifically advocated the need for industrial technology development since the mid-late eighties. However, it has also been pointed out that convincing both private and public sector to invest in specialised scientific and technological activity, i.e. R&D for the industrial sector, has not been an easy task. Industrialists are concerned with profitability and competitiveness, but are reluctant to take risks where returns are not guaranteed. Convincing politicians to allow more budget for an expensive activity that often shows no tangible results is just as difficult. The result of this dilemma in Thailand has been an overall low investment in R&D activities. Ultimately, it was with the major export slowdown in 1996 that industrial restructuring began to receive the attention of policy makers again. However, it is important to keep in mind that Thailand has missed valuable time in the race in catching-up, given the fact that investment in S&T has a considerably long maturity period.

In order to provide more empirical support for the analyses carried out so far, we now take the analysis in the present study to a disaggregated level in the following chapters. As the industry with the distinction of having attracted the greatest amount of manufacturing sector FDI inflows and has dominated Thai manufactured exports, the electronics industry is taken up for detailed industrial and firm-level analyses in Chapter VII, VIII, and IX.

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48 Lall, 1998, p. 14, has also used the term.
49 For example, see Lall, 1998