5

Technological Performance and Support

5.1 Introduction

Technological effort in manufacturing may be formal – research and development (R&D) in facilities separate from production, devoted to analysing the underlying basis of product and process technology and developing new technologies – or informal, at all points of the system as part of production – shop-floor layout and maintenance, process optimisation, quality management, industrial engineering, procurement, raw material adaptation and so on. Both are important to competitiveness. In developing countries, it is clearly informal forms that predominate, though productivity raising efforts are very important in all countries. Formal R&D efforts are mainly concentrated in the advanced industrial countries, but they also become important in developing countries as the industrial structure evolves and more complex processes are adopted. R&D is needed, not to 'innovate' but to absorb new technologies and keep up with technological trends.

Informal technological effort is vital to the building of competitiveness at all levels of development and for all types of industries. It is the enterprises that gain greater efficiency that succeed in competitive markets, and it is countries that produce a larger proportion of efficient firms that become major exporters. Mastery, adaptation and improvement of technology require conscious effort and investment. They involve risk and waiting, even if the technology is well-diffused elsewhere. They require the creation of new skills and information, by investments in training, searching for new technical knowledge and experimentation. Much of the effort takes place within individual firms, but a vital part depends on drawing upon other firms and upon institutions that provide inputs that industrial firms cannot. It is now widely accepted that the success of the NIEs has been driven by such investments in building technological capabilities, and that government policies have been vital in giving firms the signals to invest in capabilities and providing support for training and technology development.

The official technology support system plays a vital role in enabling firms to undertake the kinds of technological effort that they cannot manage individually. It provides the basic infrastructure of technological activity, a common 'language' for firms to base their technology (for instance by setting common standards), information that is not otherwise available and a means of undertaking research and troubleshooting on a contract or shared basis. For SMEs, clearly, an effective technology support service can be an invaluable input into technology upgrading. As shown later, the NIEs, even the *laissez faire* Hong Kong, mounted comprehensive measures to help SMEs, generally with generous financial support and subsidies.

5.2 Comparative Technological Performance

Table 7.1 shows R&D expenditures in Mauritius in comparator countries as a percentage of GDP for the most recent available year. Korea is included in the comparison, since it has the highest R&D expenditures in the developing world (and ahead of most OECD countries with the exception of the few technological leaders). Bangladesh is left out because there are no data available, but the figures are likely to be very low. Total R&D is shown separately from that performed by productive enterprises. It is the latter that is most significant for industrial performance, since total R&D includes work on non-manufacturing activities and even when it is ostensibly on industry, tends to be fairly isolated from industrial needs.

Table 5.1 **R&D Expenditures as Percentage of GDP in Mauritius and Selected Asian Countries**

	Total RD	Enterprise RD
Mauritius	0.37	0.01
Singapore	1.0	0.6
Taiwan	1.7	0.8
Korea	2.1	1.8
Malaysia	0.4	0.2
Thailand	0.2	0.03
India	1.0	0.2
Sri Lanka	0.18	0.02

Source: UNESCO (1995).

The table shows that Mauritius has the lowest proportion of R&D financed by productive enterprises in the group (though its total R&D is higher than Sri Lanka and Thailand, because of R&D in sugar). Singaporean enterprises spend 60 times more on R&D as a proportion of GDP than Mauritian ones; the Singapore government also invests a lot in R&D, and targets areas for development, such as biotechnology in the 1990s, setting up public sector research institutions, attracting the best people worldwide and encouraging link-ups with industry. It also gives strong incentives to MNCs to set up R&D facilities in the island. Note that Thailand also performs very little enterprise R&D (0.03%), but has managed considerable diversification, based on FDI-driven assembly activities; however, the lack of local technological capabilities is now restricting its ability to diversify and upgrade its industrial structure. Malaysia is slightly better, since over time, assembly has deepened into more complex activities that require local research into process design (Lall *et al*, 1994).

The export-oriented Tigers, Korea and Taiwan, with the deepest local technological bases and strongest indigenous enterprises, invest most in R&D: this is what drives their export engine into more and more sophisticated activities. It is interesting nevertheless to note the differences between them. Some 80% of Korean R&D comes from enterprises compared to around half for Taiwan. The difference is due to the industrial structure: Korea is dominated by the government created chaebol, Taiwan by SMEs. The former are large enough to internalise the risk and investment involved in massive R&D, while the latter depend heavily on official institutions to do their R&D for them. For this reason, Taiwan has the most effective technology extension and contract research service anywhere in the developing world.

While the low levels of R&D spending by Mauritian enterprises may not be a cause for concern at this time, two things have to be borne in mind:

- Given the rapid pace of technological upgrading needed, the private sector should invest more in R&D as it moves into more complex technologies.
- The SME sector should be supported by effective technology support, including design and development services, by public institutions.

5.3 Technological Capabilities in Mauritian Firms

About half the garment industry in Mauritius operates at the low-quality segment and the remainder at the medium-quality segment (World Bank, 1994.a, pp. 13-15). In the former (T shirts and garments using synthetics), skill, equipment and design requirements are minimal; competitiveness depends mainly on price, i.e. on low wages and low margins. These firms are suffering the most from the erosion of wage advantages and in the long-term they are not expected to survive in this segment. In the medium quality segments, competitiveness "is a function of design, quality and delivery, as well as price. Since the

1980s, these requirements have prompted progress in international technology, notably the computerisation of design, cutting, sewing/stitching and production/organisational techniques" (World Bank, 1994.a, para. 2.25). How do Mauritian firms rank in respect of these technological advances? To sum up the findings of the World Bank (1994.a) survey of technology:

CAD: A number of medium and large Mauritian firms have adopted computer-aided design and manufacturing. Computer aided cutting is rarer, since it is much more expensive; however, some large firms have made the necessary investment; wider application of this technology is, however, needed if quality is to be raised in general.

Sewing and stitching: Computerised sewing and stitching reduces labour costs, cuts defects, realises more complex designs and compresses switch-over time. The bulk of Mauritian firms still rely on outdated basic sewing machines, where they cannot really compete with cheaper labour. The move to more expensive machines is constrained not just by the high cost, but also by the work culture (the need to work night shifts to justify the cost) and the need for maintenance services.

Automation of peripheral activities: Pressing, folding and packaging are generally manual, though their automation could yield significant gains in productivity at prevailing wage levels.

Production organisation: Work-flow organisation and production control have a critical impact on efficiency and costs in the garment industry, especially in large firms with complex production lines. Most firms in Mauritius follow the traditional 'bundle' rather than computerised routing systems, leading to creasing, soiling, long through-put times and high in-process inventories. One firm which adopted automated conveyors achieved considerable productivity gains. However, the systems are skill and management intensive, and their adoption would necessitate significant upgrading of both. On the shop floor, traditional 'taylorian' assembly lines are common, with each worker engaged in a narrowly defined task and with minimal training and skill requirements. This system requires a large number of sequential work stations (e.g. 10-15 for shirts), which slows down the production cycle, increases quality control problems and raises inventory requirements. It is also relatively inflexible when new production runs are needed. In modern organisation systems, workers are involved in several operations, with shorter turn-around times, better quality control and greater flexibility. This calls for higher levels of skill and motivation than is presently available in Mauritius: achieving it would call for much more training and education effort.

Quality management: This, according to the World Bank, "needs dramatic improvement". Average reject rates in Mauritius are around three times higher than in developed countries, despite the use of considerable numbers of QC personnel on the line. Few firms have good systems that would prevent the defects from arising. As will be discussed in Section 5.4.1, the spread of ISO 9000 accredited quality management systems is greatly to be welcomed in this context. Foreign buyers arrange for pre-shipment quality inspection tests of products, but do not provide other quality control services. The International Wool Secretariat provides quality inspection for the Woolmark label and its visiting experts also provide advice: their help has improved the pass rate for Woolmark licenses in Mauritius from 60% in 1988 to 95% in 1992.

Management information and production control: Cost accounting and 'early costing' are not common, but need to be increasingly used to allow firms to quantify precisely the profitability of various products, to target costs that need to be decreased and to discontinue unprofitable lines. Computerised inventory control is necessary to speed up response and cut costs. Computer integrated manufacturing techniques are necessary to monitor work in progress, assist production planning and check operator performance.

Our enterprise-level survey sheds recent additional insights into the nature of imported

Table 5.2 **Contractual Technology Imports in Textile and Garment Enterprises**

Category	No. of licences over last 5 years	No. of times foreign technical consultants were used in last 5 years	Expenditures on foreign technical consultants in 1995 (% of sales)
SMEs	0	0.5	0.23
Large & giant Firms	1 (a)	5.8	0.41

Notes: (a) Trade-mark.

technology and technological capabilities in large & giant firms (above 251 employees) and SMEs (below 250 employees) in the textiles and garment industry. The discussion falls under three main headings: contractual and informal technology imports, process technology and product technology.

Contractual and informal technology imports. In the NIEs, formal technology contracts have been a crucial means of acquiring technology from abroad and upgrading local technological capabilities. However, this was less so of the Mauritius sample. Table 5.2 provides information on two forms of technology contracts (foreign licences and foreign technical consultants) used by the sample firms.

There was only one licence in the sample and it was held by a large, foreign affiliate rather than an SME. The use of foreign technical consultants was more widespread but large & giant firms (5.8 times in the last five years) made significantly more use of them than SMEs (0.5 times). As a percentage of sales in 1995, the large & giant firms (0.41 per cent) also spent nearly double that of the SMEs on foreign technical consultants (0.23 per cent). The best firm, a majority-foreign owned firm, used foreign technical consultants 21 times in the last five years and spent 1.6 per cent of its sales on foreign technical consultants in 1995.

The MNC affiliates also obtained regular technical assistance on all aspects of textile and garment production from their parent companies; four MNC affiliates said that they received at least three visits from their parent's technical staff in 1995. Of these, one affiliate received 12 such visits and another 9 visits. There was also some evidence of use of more informal sources of technical assistance in the sample. Some large local firms and MNC affiliates said that they received technical assistance from their foreign buyers. One garment MNC affiliate said it was involved in a stable, long-term marketing arrangement with a well known fashion house in Europe which bought 40 per cent of its output in 1995-96. In an attempt to ensure that the affiliate's quality conformed to the demanding international standards in the medium to high quality segment of garments, it insisted that the affiliate set up a dedicated production line for its order and it stationed five technical personnel in the Mauritius plant for the duration of the order. By the end of the order, the affiliate's average reject rate fell to 0.5 per cent and there was a general improvement in its process technology. There were similar instances of technologically dynamic buyer-seller relationships involving large local firms, but such relationship seemed to be less common in SMEs.

Process technology. Process technology can be considered under several headings such as quality control, maintenance, inventory control. We shall focus largely on quality control, maintenance and improvements to equipment and processes because of the lack of data on inventory control and improvements to equipment and processes in the sample firms. Table 5.3 presents information on average internal defect rates for the main products, the number of ISO9000 certified firms and the share of full-time maintenance manpower.

The data suggest that there has been an improvement in quality control efforts in both large & giant firms and SMEs since 1993, as evidenced by the fall in defect rates. However, large

Table 5.3 **Quality Control and Maintenance in Textile and Garment Enterprises**

Category	No. of firms recording defects	Av. internal defect rates for main product (a)		No. of ISO 9000 certified firms (b)	Full-time maintenance manpower (% emp.)
	1996	1993	1996	1996	1996
SMEs	8	8.0	3.9	0	1.8
Large & giant firms	10	6.9	2.6	2	2.4

Notes: (a) Internal defect rates are the % of finished products which are rejected at final inspection.
(b) Apart from these, 4 large firms and 1 SME was in the process of ISO 9000 certification.

and giant firms (2.6 per cent) still currently record lower defect rates than SMEs (3.9 per cent). In addition, more large and giant firms have moved into comprehensive quality management by adopting the ISO 9000 quality management standards to enhance their export competitiveness than SMEs; 2 large and giant firms have been certified and another 4 are in the process of obtaining such certification. One large garment MNC affiliate, which had ISO 9000 certification, had a full-time quality control team of 350 people (equivalent to 6.1 per cent of total employment). In contrast to the large and giant firms, the SMEs seemed to pay less attention to quality management. Most SMEs tended to rely on final inspection only rather than a comprehensive quality management system and employ only one or two full-time personnel. In some cases, the entrepreneur did *ad hoc* checks on finished goods and reject rates were not recorded. Only one SME was in the process of obtaining ISO 9000 certification. A few of the SMEs that the mission interviewed seemed unaware of the existence of the ISO 9000 system and its many advantages, including the improvement of quality, more rapid productivity growth and increasing the attractiveness to foreign buyers. One SME said that the cost of implementation was too high for it to adopt.

Moreover, large & giant firms seemed to have better maintenance capabilities than SMEs. Nearly all the large & giant firms had a regular routine for maintenance and servicing of equipment, a maintenance shop with specialised equipment and a relatively high ratio of maintenance personnel in employment (2.4 per cent). For instance, one large local textile firm had a maintenance department of 100 technicians and a textile affiliate had one with 61 technicians. By comparison, with some exceptions, the SMEs tended to undertake repairs when their equipment broke down, had a lower ratio of maintenance personnel in employment (1.8 per cent) and lacked a maintenance shop with specialised equipment.

Product technology. There is considerable variation in the emphasis paid to product technology in the sample firms. At one end are the large and giant firms which use foreign buyers for their new products and designs and have attempted to create independent design capabilities by hiring trained designers and investing in computer-aided design (CAD) systems. On the other are SMEs which rely heavily on foreign buyers or local local firms for products and designs, but typically lack independent design capabilities. Table 5.4 provides information on the number of firms with product designers and the number of major new products introduced per firm in 1993-96. The data indicate that more large and giant firms have full-time designers than SMEs and that large and giant firms have created more new products than SMEs.

The mission was particularly impressed by the acquisition of design capabilities in large local firms. For instance, one large local garment firm had set up a fully-equipped design centre with the latest CAD facilities from Japan and employed two overseas trained designers and 10 assistants. The firm said that it was able to offer several styles of a particular garment for foreign buyers to choose from. This was by no means an insolated case.

Another large local garment firm had a CAD system and a nine-strong in-house design team. Such design capabilities seem to put Mauritius garment firms ahead of rival garment exporters in competitors like Sri Lanka, Bangladesh and Vietnam. Recent studies of garment firms in Sri Lanka found that even large local firms tended to rely heavily on foreign buyers for new products and designs and have not invested very much in creating independent design capabilities (see Box 5.1).[39]

Table 5.4 **Designers and New Products in Textile and Garment Firms**

	No. of firms with full-time designers 1996	Average number of new products introduced per firm 1993-96
SMEs	2	1.3
Large & giant firms	8	3.2

Box 5.1 Industrial Technological Capabilities in Exporting Enterprises in Sri Lanka

After liberalisation in 1977, Sri Lanka's manufactured exports grew at 20.7% per year in 1980-95. By 1995, the country's per capita exports were US$ 153.1, the highest in South Asia. Much of the export growth was due to the rapid expansion of a single dominant export, garments, while the other manufactured exports (including technologically sophisticated items like electronics and engineering products) have grown relatively weakly and account for small export shares.

A recent study relates the pattern of export growth and upgrading to enterprise-level technological factors in the three Sri Lankan industries (garments, electronics and light engineering). The study found that operating capabilities in all three Sri Lankan industries seem to be quite good at low levels of technological sophistication. However, the ability to develop new products is weak and none of the firms appears to undertake process-centred R&D activities. Industrial engineering as a distinct category does not exist. There are few inter-firm linkages (in the form of supplier or subcontracting relations) or linkages between firms and technology institutions.

The study also highlighted industry-wise differences in technological capabilities in the sample firms which seem to be related to their export performance.

- *Garments* firms, which have shown the strongest export growth, seem to have the best technological capabilities. They are quite efficient at selecting technologies, quality control and maintenance. They have good linkages with technology institutes (particularly the Clothing Industry Training Institute) and have initiated some sub-contracting relations with smaller local firms. However, their ability to design new products seems to be weak and they do not conduct any process (or product) centred R&D activities.
- *Electronics* firms, which have grown relatively slowly, have demonstrated fairly efficient quality control and maintenance capabilities. However their ability to select new technologies, design new products and strike local linkages, is weak. Furthermore, they have only just begun to undertake, on a very small scale, some product-centred R&D.
- *Light engineering* firms, which have grown relatively slowly, have shown reasonable capabilities to select technologies and some ability to design new products. However, basic process engineering capabilities in the form of quality control and plant layout changes seem weak. In addition, there has been little attempt to strike local subcontracting linkages or make use of technology institutions.

Source: Wignaraja (1997a).

In general, while a few large garment firms in Mauritius are adopting best practice management techniques, the industry as a whole lags behind – a major competitive handicap as it moves into the higher value added segments of activity. Many of the techniques and systems are fairly costly, and almost all require upgrading of management, operative, supervisory and maintenance skills. It would seem that all but the largest firms would need government assistance in restructuring and investing in these new techniques and skills. Many governments in East Asia have launched special textile programmes to fund their industries in precisely such efforts.

The main gap is for the smaller enterprises which are presently low level subcontractors for foreign buyers or for large local firms. These firms are rapidly 'going under' whereas they could form the backbone of a long-term response strategy. As noted below, the fostering of flexible specialisation in the form of industrial districts would seem to be one important way forward for upgrading the Mauritian garment industry, but the tendency has been the opposite, with the larger firms doing much better than small ones.

5.4 Technology Support Institutions

5.4.1 MSTQ: MSB

The Mauritian Standards Bureau (MSB) is the official body in charge of MSTQ (metrology, standards, testing and quality) services in the country. There are also a number of other testing laboratories in the country, some within the larger companies and others in the local SGS (*Societé Generale de Surveillance*) office and Industrial Wool Secretariat. MSB was set up in 1975 under the Ministry of Commerce and Industry, and was made into a corporate body in 1993. It has a total staff of 63, including some 30 scientists, engineers and technicians. Its recurrent budget in 1995-96 was Rs. 15 million ($800 thousand), of which its own earnings contributed Rs. 3 million (20%).

The MSB was assisted by a World Bank project on 'Technical Assistance to Enhance Competitiveness': this component consisted of a loan of $3.5 million plus $1.4 million from the government. This allowed its equipment to be upgraded, a new purpose-built headquarters to be set up and its staff trained. A twinning arrangement was made with the Singapore Institute of Standards and Industrial Research (SISIR) to upgrade its expertise. The project and the twinning arrangement have greatly enhanced its capabilities.

There are 6 divisions in the MSB:

- Standards development division: which plans, co-ordinates and supervises the formulation of national standards. It has formulated 96 standards, mainly for products aimed at the national market. It is also the repository for international standards, and participates in technical committees of the International Standards Organisation (ISO).
- Quality assurance division: which operates the Bureau's certification marking scheme and national quality system certification scheme, giving a two year renewable licence when a producer meets its quality tests. This division certifies firms with ISO 9000 quality management systems, but to prevent conflict of interest does not give consultancy services.
- Metrology division: provides calibration services and is the repository of national standards of measurement for mass, length, voltage, force, pressure and temperature.
- Engineering division: with three sections on civil engineering, electrical and electronic engineering and mechanical engineering. These divisions provide specialised testing services, technical advice, and help to the quality assurance division.
- Chemical division: which deals with chemical technology, food and agriculture and fibre technology. As with the engineering division, this provides testing services and technical advice.

- Documentation and information centre: which has a collection of over 125 thousand standards from 400 standards bodies around the world on CD ROM. It is also the designated enquiry point for standards, technical regulations and conformity assessment procedures in force in Mauritius under WTO rules.

The Bureau finds that while some (mainly the largest) firms are quality conscious and use its services, most have to be educated in modern concepts of quality awareness. It took some 3-5 years to persuade firms of the importance of getting ISO 9000 certification; there are now 25-30 firms in Mauritius with the certificate of which 9 were certified by the MSB; practically all the certificates are held by large firms, in textiles, food processing and services. The cost of maintaining an ISO certificate with MSB comes to around Rs. 25-30 thousand per year, and is generally higher for large companies. The total cost of obtaining consultancy services, hiring a full-time person and setting up the system comes to Rs. 200-300 thousand for a large firm. While smaller firms need to spend less, even so the costs are high enough to deter most SMEs from aiming to obtain ISO 9000 certificates. However, it is becoming increasingly important in export markets to obtain this certificate even for SMEs, and is important for the government to promote it among them with appropriate incentives.

In testing, the MSB provides services mainly to the textile, chemicals, food and mechanical engineering industries (around nearly 2000 tests and 156 calibrations were done in 1994-95). The quality assurance and testing services of MSB are self-financing, and the degree of dependence on the government has been diminishing over time. The Bureau plans to reach 50% self financing overall soon. The World Bank project has helped it greatly to improve its capabilities to meet the needs of the industrial sector. It competes in the market with private testing laboratories. It is planning, with World Bank advice, to set up a National Accreditation System for testing and calibration laboratories (there are currently over 25 private laboratories interested in accreditation). The quality of some of the private testing laboratories is questionable, and this accreditation service would seem to be a matter of some urgency. The World Bank (1994.a) also noted that there is a lack of testing services in industries such as electronics, and may be deterring inward investment.

MSB runs training programmes on quality management, with the participation of a Scottish firm (Quality Consultancy Services), jointly with MEF, which is its designated local partner in quality training.

We were able to gather some information on the intensity of linkages between the sample enterprises and the MSB from the enterprise survey. Our data showed that of the 34 sample firms, 9 (i.e., 26.5 per cent) had used the MSB at least once in 1995. This included 5 firms in textiles and garments, 2 in food products, 1 in electronics and 1 in chemicals. We also asked firms to rate the usefulness of the quality of service provided by the MSB on a scale of 1 to 5 (where 1 is not useful and 5 was very useful). The results of the average ranking of the quality of service provided suggested that the MSB was rated by the sample firms as useful (4) and three firms rated it as very useful (5).

In general, the mission was favourably impressed with MSB's facilities and dedication, and the growing quality awareness among the larger Mauritian firms. The government has already adopted rules whereby all public purchases have to specify Mauritian standards in their tenders. The only area of possible concern is the expense involved for SMEs in getting ISO 9000 certification and the possible need for government assistance in this (under the Technology Diffusion Scheme, they can get 50% of the cost of technical consultancy). If the idea of promoting flexible specialisation in clusters is go any further, a scheme to promote quality management skills in the SME sector will have to be promoted and financed.

5.4.2 Helping SMEs: SMIDO

There are around 4,500 SMEs in Mauritian manufacturing (units that use production equipment of up to $300 thousand), employing 30,000 workers and contributing around 6% of GDP. The institution charged directly with assisting the technology upgrading of SMEs in Mauritius is SMIDO (Small and Medium Industry Development Organisation), which started as the Small Industry Development Organisation in 1983, and took its present name in 1993 when it was made autonomous. The mission of SMIDO "emphasises consolidation, modernisation and enhanced competitiveness of the SMEs with a view to creating a modern, strong, efficient and export-oriented SME sector in the country."

All countries, developed and developing, have in place schemes to meet the special needs of SMEs for information, skills, finance, management training, market information and technology support. Among the Asian NIEs, the Taiwan case is perhaps the most interesting because of the central role of SMEs in the industrial and export growth of the Taiwanese economy. Box 5.1 describes some ways in which the Taiwan government helps its large number of SMEs.

SMIDO has strong private representation, with half its Board composed of private sector representatives. It provides extension services, training, information, marketing assistance and export support for SMEs, encourages subcontracting and provides common facilities. Most of its emphasis is on promoting SME exports, and to this end it helps them in various dealings with the bureaucracy and arranges for buyer-seller meetings (it has also taken Mauritian firm representatives to African countries, with some modest success in creating orders). It is setting up a Subcontracting Exchange and Industrial Partnership Centre (SUBEX) with UNIDO assistance, though at the time of the mission it had not raised the finance needed ($556 thousand). The exchange will start by promoting subcontracting within Mauritius, and after about 4 years is expected to become privately owned. SMIDO is building up a database on contractors, by equipment available, expertise, capacity, technological specialisation and quality of product.

SMIDO has 35 technical and administrative staff (of which, 12 are graduates). It operates a common facilities centre to provide hands-on training and use by SMEs and for the manufacture of spares. While some of SMIDO's budget is earned, nearly 95% comes from a government grant. This is not surprising in view of the nature of its functions and responsibilities, and SME support agencies everywhere receive considerable subsidies (the case of Hong Kong

Box 5.2 Taiwanese Support for SMEs

Taiwan has around 700,000 SMEs, accounting for 70% of employment, 55% of GNP and 62% of manufactured exports, and has an impressive set of programs to support them. In 1981, the government set up the Medium and Small Business Administration to support SME development and co-ordinate the several agencies that provided them assistance. Financial assistance was provided by the Taiwan Medium Business Bank, the Bank of Taiwan, the Small and Medium Business Credit Guarantee Fund, and the Small Business Integrated Assistance Centre. Management and technology assistance was provided by the China Productivity Centre, the Industrial Technology Research Institute (ITRI) and a number of industrial technology centres (for metal industry, textiles, biotechnology, food, and information). The Joint Services Centre of the Ministry of Economic Affairs acts as a source of information on SME assistance. The government covers 50-70% of consultation fees for consultancy services for SMEs. The Medium and Small Business Administration has a fund for

SME promotion of NT$10 billion. The "Centre-Satellite Factory Promotion Program" of the Ministry of Economic Affairs integrates smaller factories around a principal one. This program involves vendor assistance and productivity raising efforts, and a rational sharing of tasks between participating enterprises. By 1989 there were 60 networks with 1,186 satellite factories in operation, mainly in electronics.

ITRI was established to do R&D considered too risky for the private sector. While it was to cover a range of industrial technologies (metals, chemicals, energy, and aerospace), electronics has been its principal focus. Its Electronics Research & Service Organisation (ERSO) division accounts for two-thirds of the Institute's $450 million budget. ERSO develops new electronics technologies and diffuses it to industry. It licenses out its technologies and sets up joint-venture companies with funding provided by the government and technical support from its engineers (with private partners taking the majority stake). Its laboratories set up private manufacturing enterprises: six major IC manufacturers in Taiwan are such spin-offs, including the most successful IC makers. In addition, as noted above, the government enters into a joint ventures directly, as with Philips to set up wafer fabrication.

Other institutions include the Institute for the Information Industry (III), complementing ITRI's work on hardware by developing and introducing software technology. The Taiwan Handicraft Promotion Centre supports handicraft producers, particularly small ones with export potential. The Program for the Promotion of Technology Transfer maintains close contact with foreign corporations that have developed leading-edge technologies in order to facilitate the transfer of those technologies to Taiwan. The China Productivity Centre (CPC) is well known for its efforts to promote automation to cope with rising wages and needs for precision and quality. The CPC sends out teams of engineers to visit plants throughout the country and demonstrate the best means of automation and solve relevant technical problems. Over two years the CPC visited over 1000 plants and made over 4000 suggestions for improvement. It also carried out more than 500 research projects on improving production efficiency and linked enterprises to research centres to solve more complex technical problems.

The government encourages private industry to contract research to universities. Half of the National Science Council's research grants (about $200 million per year) funds such contracts, with enterprises providing matching funds. There are four main R&D institutes in Taiwan concerned with manufacturing. The *China Textile Research Centre* was set up in 1959 to inspect exports, but over time expanded to include training, quality systems, technology development and directly acquiring foreign technology. The *Metal Industries Development Centre* was set up in 1963 to work on practical development, testing and quality control work in metal-working industries. It later established a CAD/CAM centre to provide training and software to firms in this industry. The *Precision Instrument Development Centre* fabricates instruments and promoted the instrument manufacturing industry, and had moved into advanced areas like vacuum and electro-optics technology. *ITRI* has already been referred to above. The government set up a science town in Hsinchu (in which it invested US$500 m. in the 1980s), with 13,000 researchers in two universities, six national laboratories (including ITRI) and a huge technology institute, as well as some 150 companies specialising in electronics. The science town makes a special effort to attract start-ups and provides them with prefabricated factory space, five year tax holidays and generous grants.

Source: Lall (1996).

Productivity Council is noted below). Over time, as SMEs upgrade and establish themselves in export markets, and the institutional structure develops, the subsidy element is likely to decline, but there is no urgency to raise self-financing at this time.

SMIDO appears to be too small to be able to satisfactorily discharge its mandate. It has only 7 officers to give technical extension: clearly not enough to meet the technological needs of the SME sector. It admits that its common facilities need to be upgraded and its library improved. It needs its own testing laboratory. It also needs to build up a design capability to help SMEs make better, more competitive products. The mission could not assess how pro-active the organisation was in terms of reaching out to its constituency and helping them identify and resolve their technical and skill problems. Apparently a number of studies have been carried out on how to upgrade technology in SMEs in Mauritius, but implementation seems to be lagging.

5.4.3 Diffusing Technology: TDS

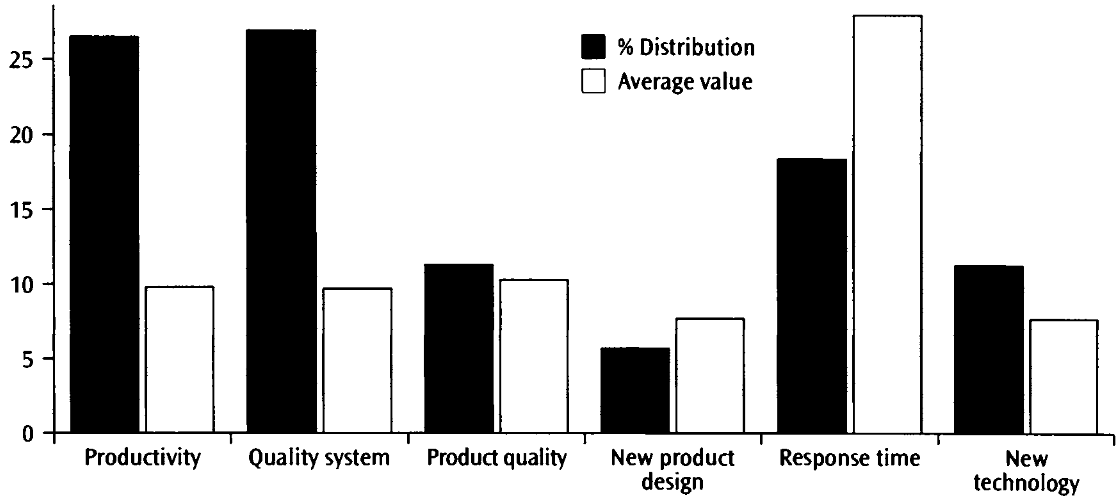
The Technology Diffusion Scheme (TDS) was set up under the World Bank project to grant private firms (51% or more privately owned) half the costs of buying services for raising competitiveness – improved productivity, quality and design services, and information on new technologies. The total funding was $2.7 million, to be disbursed with a four-year period (i.e. until May, 1998). It was expected that 350 EPZ firms would use the scheme, at an average of $10 thousand per grant; in addition, around 50 non-EPZ firms were expected to use the grant to around $5 thousand each. The scheme was to also cover supporting enterprises in manufacturing and trading, that is firms selling at least half their output to these activities, including export services. The TDS was set up under the Ministry of Industry and Industrial Technology, but is managed by a private sector contractor.

The reasoning of the scheme was that "in the face of labour shortages and increased international competition, and resultant pressures to enhance value-added and productivity, there is growing demand for technology support services in the areas of productivity, quality and design." A number of institutions in the country, such as EPZDA, MSB, SMIDO, and MEPZA provide technology support services to their respective constituencies, but there is a need to promote their use and acceptance by industry. The World Bank project intended to create a market in technology services by lowering the cost of purchasing these services for some time. The strong demonstration effects created would spill over to other firms. Firms receive one grant per service (i.e. a firm could receive more than one grant to cover different services), and thereafter would have to pay the full market cost of the service. The scheme covers both local and foreign consultants.

- The qualifying activities for the scheme were as follows:
- Labour or capital productivity, to reduce costs per unit of output;
- Product quality, uniformity and reliability;
- Product design, including grading, counter sampling, packaging design and modifications;
- Improved response time to orders;
- Introduction and adaptation of new technologies.

As of end July, 1996, 339 firms were interviewed by TDS, 129 applications were approved, 12 were in progress, 3 had withdrawn and 7 rejected. Money had been disbursed on 61 projects for the sum of $624 thousand, an average of $10.6 thousand each. Most projects were small – there is only one with a grant of over $50 thousand. EPZ manufacturing firms accounted for 57% of the grants and other manufacturing 28%. The total sum approved was $1.4 million (37% of the total), with slightly over half the duration of the project completed. This means that approvals were running behind schedule, but this

Fig 5.1: **Distribution and Values of TDS Grants**



may have been expected in view of the time needed to get the process launched for the first time. The rate may speed up as firms become familiar with the scheme and its benefits.

The scheme registered 120 consultants of 169 that have been in contact with it. Of the 129 approved projects, 53% are with Mauritian consultants and 47% with foreign consultants; however, the value of the contracts placed with foreign consultants is somewhat higher (51.7%). By types of project approved, productivity improvements and quality system (mainly to introduce ISO 9000) each account for 29% of the number of projects (and 26.5% and 26.9% of the value of grants); product quality for 12% of the number of projects (11.3%); new product design for 8% (5.7%); response time 7% (18.4%), and new technology 16% (11.3%). The highest value of grants per project was for response time ($28 thousand) and the lowest for new technology ($7.7 thousand). Figure 5.1 shows the relative distributions of total project grants (%) and the value per project ($ thousand) by these activities.

According to preliminary indications, the TDS has been very successful. The initial expectation was that it would generate $2 of additional sales or exports for every dollar of grant support given (based on experience in other countries); in fact, it has generated between $9 and $22. More detailed data collection and analysis are needed, however, before any firm conclusions can be reached. The predominance of smaller projects is probably welcome, since the market for technology services is unlikely to involve very large sums.

The original TDS scheme is about to end soon, and it would seem desirable to make a thorough assessment of its achievements to see if it should be renewed in its original or some new form. This assessment would hinge on whether the objective of stimulating the creation of a new market in technology services has been achieved in the first four years, whether the grants have in fact been as rewarding as the initial figures suggest and whether renewing them would help in further developing the consultancy services sector. It may also look at which form of technology service is most in demand and most conducive to competitiveness.

5.4.4 Productivity Enhancement: EPZDA

The Export Processing Zone Development Authority started in 1992 to provide productivity, quality, design and other services to EPZ firms in order to improve their competitiveness. The timing of its inception reflected the government's belief that EPZ activities in Mauritius had 'matured' and that the impending new challenges to exporters required a more coherent response. It was aimed at helping mainly the smaller EPZ firms, which account for the bulk of its numbers (there are only 13 enterprises of the total of nearly 500 with over 1000 employees each); within these, needless to say, its main focus is on the garments subsector.

EPZDA has a staff of 25 persons, of whom 7 are at the management level. It draws upon other organisations for specialised services and expertise, including international ones like UNIDO (during 1995-96 it used around 10 consultants). It also publishes a bi-monthly magazine, *Industry Focus*, which provides information and analysis on issues of productivity, benchmarking, exports and competitiveness of Mauritian firms.

The activities of the EPZDA, as described in its *Annual Report 1994-95*, are as follows:

a **Productivity improvement programmes:** EPZDA provides free audits and evaluations and helps firms to reorganise their plant. It has two main instruments: in-plant continuous programmes and modular productivity programmes. The former is to thoroughly reorganise a factory, the latter to tackle key areas where companies need improvement. The in-plant programme, developed in conjunction with UNIDO, was intended to train EPZDA consultants on productivity enhancement, produce manuals and conduct seminars, increase productivity in selected garment factories, build up a library on sewing machine attachments, prepare the setting up of a CAD/CAM facility, and promote female entrepreneurs. Most of these objectives were achieved by end-1994. The modular productivity programme, funded jointly by the EPZDA with CDI and EDF, provided 12 modules to improve productivity, from work measurement to sewing techniques, work place engineering, layout, cutting practices, labour cost control and quality control and general management. Eleven companies had benefited from this programme by 1995, with significant increases in productivity, ranging from 10% to 60% (with one failure where there was a lack of management commitment). The increases in productivity came from the following:

- Changing garment process technology, reducing throughput times;
- Better utilisation of equipment in sequential format, reducing rejects at each stage;
- Reduced handling times;
- Streamlined floor layout;
- Improved sewing skills by training.

The cutting room productivity programme improved fabric usage in garment firms by means of a 11 week in-plant consultancy programme in organisation and fabric optimisation. Five companies were involved in this programme, and enjoyed savings in fabrics from 1% to 6% in addition to other benefits like improved storage, housekeeping, better recording and reduction of time losses. This programme received the 50% grant under the TDS.

b **Quality enhancement:** EPZDA conducted a survey in 1993-94 of the quality of cotton yarns used and fabrics knitted and finished in Mauritius. The findings were used to sensitise firms on the importance of quality in terms of the quality of raw materials and in knitting/dyeing processes. The Institut Textile de France is providing follow-up action and consultation. One of the important findings of the survey was that "middle management and technicians needed substantial training to upgrade skills", and an action plan for training and consultancy has been formulated.

c **Creativity, design and product development:** EPZDA organised workshops with French collaboration on fashion design and marketing. A Trend Forum was also organised to develop design skills and expose local firms to the latest styles and colours as well as marketing on a continuing basis.

d **Sensitisation and information dissemination:** A number of activities are organised in addition to the publication of Industry Focus. Meetings are arranged with industrialists as well as between them and the government. A CAD demonstration was arranged.

e **Technology Resource and Documentation Centre:** EPZDA provides various information services, including international electronic mail, data banks, WWW and so on.

f **Training:** Courses are provided for the textile and garment industry, for instance in 1994-95 on in-plant work study course in clothing and production planning and control course for textiles and garments.

g **R&D projects:** In the absence of a technology institution catering for the R&D needs of industry, the EPZDA also has the task of carrying out R&D for EPZ firms. Much of this work is an extension of the productivity improvement efforts noted above rather than technology development proper. Two projects are contemplated, on textile effluent discharge and fabric waste reprocessing.

EPZDA is clearly making a positive and valuable contribution to raising the competitiveness of the export sector. Its combination of productivity improvement efforts, consciousness raising, input of foreign expertise and hands-on assistance to exporters, is needed to make Mauritian industry, in particular the small and medium sized firms, aware of their competitive needs. It is starting to meet some of the most pressing needs of quality and productivity enhancement. However, as with some of the other support organisations in Mauritius, EPZDA does not have the size, resources or capabilities to deliver the whole array of services needed (on a sustained basis) to help exporters to enter and stay at higher segments of the market. What seems to be needed (this view is endorsed by EPZDA) is a full-scale *Productivity Centre* in Mauritius. Such centres have served valuable functions in raising the efficiency of export-oriented SMEs in many East Asian NIEs (see Box 5.3 on the Hong Kong Productivity Council, and also Box 5.2 on SME support in Taiwan).

A Productivity Centre in Mauritius can become a central agency in mounting a competitiveness strategy for the next century. It could become the repository for knowledge and expertise locally, and, with due financial backing, could provide the entire package of services and finance that small exporters need to manage the transition from low to medium levels of quality. At this time, a great deal of resources are spent on flying in expensive foreign experts in all fields; a productivity centre would be able over time to supplant these with domestic expertise, both in-house and by fostering a private consultancy capability in areas where there are presently weaknesses.

The EPZDA has been planning to set up a Textile Institute for some time (World Bank,1994.a), and this seems to be very desirable for developing design capabilities (as mentioned in the previous chapter); however, a comprehensive service, with a focus on out-reach to SMEs (such as Taiwan's China Productivity Centre), would be a complementary institution. To make it effective, a *Productivity Fund* should also be considered to provide firms with credit at special terms; as noted above, many restructuring measures can be quite expensive and time-consuming. In addition, the Centre should have as a major component a R&D arm that can undertake technology development on behalf of industrial firms and develop new products and processes. This vital function is currently going by default: only some large firms have R&D departments while the vast bulk of the industrial sector does no R&D at all. A contract research services would seem to be increasingly needed as the technological status of Mauritian enterprises improves. This service does not, of course, have to be housed in a Productivity Centre: in Singapore and Malaysia, the standards bodies

Box 5.3 **The Hong Kong Productivity Council**

Despite its *laissez faire* approach to industry, Hong Kong provides strong technical support to its SMEs through the *Hong Kong Productivity Council* (HKPC). HKPC was the first support institution of its kind in the region, started in 1967 to help the myriad small firms that constitute the bulk of the industrial sector. Its focus has been to help firms upgrade from declining labour-intensive technologies to more advanced, high value-added activities. It provides information on international standards and quality and gives training, consultancy and demonstration services on productivity and quality to small firms at subsidised rates, serving over 4,000 firms each year. Its on-line information retrieval system has access to over 600 international data bases on a comprehensive range of disciplines. Its technical library takes over 700 journals and has over 16,000 reference books.

The HKPC acts as a major technology import, diffusion and development agent for all the main industrial sectors in the economy. It first identifies relevant new technologies in the international market, then builds up its own expertise in those technologies, and finally introduces them to local firms. Successful examples of this approach include surface mount technology and 3-D laser stereo-lithography. HKPC has also developed a number of CAD/CAM/CAE systems for the plastics and moulds industry, of which over 300 have been installed already. HKPC provides a range of management and technology related courses, reaching some 15,000 participants per annum. For firms unable to release staff, it organises in-house training programmes tailored to individual needs. To help the dissemination of information technology, the council has formed strategic alliances with major computer vendors, and provides specially designed software for local industry, consultancy and project management in computerisation. HKPC provides consultancy services in ISO 9000 systems, and has helped several firms in Hong Kong to obtain certification. It assists local firms in automation by designing and developing special purpose equipment and advanced machines to improve process efficiency.

HKPC is a large organisation, with over 600 consultants and staff, a laboratory and a demonstration centre that can show the application of new technologies (in CAD/CAM, advanced manufacturing technology, surface mount technology, micro-processor technology, rapid prototyping and so on). In 1993-94, it undertook 1,354 consultancy and technology assistance projects, trained over 15,000 people and undertook 2,400 cases of manufacturing support services.

Because small firms experience difficulties in getting information on, and adopting, new technologies, and are exceptionally averse to the risk and cost involved, the HKPC has always had to subsidise the cost of its services. Despite the growth in the share of revenue-earning work and its withdrawal from activities in which private consultants have appeared, the government still contributes about half its budget. It is important to note that technological information market failures and the need for subsidised services occur even in a highly export-oriented economy, with highly developed financial services, like Hong Kong.

The Hong Kong government also supports local design capabilities. It joined the private sector in starting a school of design, and financed the Hong Kong Design Innovation Company because private sector design services were lacking and local firms were not aware of their value. After four years of operation (mainly on government financing) this value has been recognised, but the HKDIC (now under the HKPC) is still not financially self supporting. Nevertheless, the growth of garment design capabilities in Hong Kong has helped its exporters to upgrade their products and start to establish their own brands in international markets.

Source: Lall (1996).

combine industrial research with their MSTQ functions.

5.4.5 Conclusions

The Mauritian technology system has many strengths. In particular, its institutions have a sense of purpose and dedication, and are fully aware of the nature and complexity of the problems facing them if they are to move the manufacturing sector to a higher plane of competitiveness. The personnel are well-trained and motivated, and open to ideas and expertise from the outside. The industrial sector itself is feeling increasingly the need to upgrade itself; only a handful of the larger firms are in a position to upgrade on their own, the remainder will need strong and sustained institutional support.

The existing institutional system is not, however, geared to providing such support at the level and intensity that is clearly going to be needed. The size and resources that the institutions command are not adequate to the challenges facing them. There are functions that no institution is currently filling – the most prominent among these is research, development and design. Productivity raising and technical extension for SMEs are being addressed but not fully. There is no institution capable of formulating comprehensive strategies and delivering the entire package of finance, training, information, extension and marketing support that firms need. It would seem, therefore, that the government should both strengthen existing institutions greatly and also set up new ones that can meet the whole array of needs.

5.5 Promoting Industry Clusters

5.5.1 The Nature of Industrial Clusters

Industrial clusters or districts are geographically concentrated groups of firms, generally SMEs, that are specialised in one activity (or closely related group of activities), and where the firms are vertically, laterally and diagonally linked to each other. Firms specialise in particular stages of the production process, and their needs are met by the proximate presence of related industries in the vertical value chain (see Table 5.7 below). Industrial districts offer several advantages of 'clustering' or agglomeration (Porter, 1990). Downstream industries benefit from the vicinity of suppliers, having more rapid and preferential access to their inputs and machinery; and co-ordination with local suppliers increases their ability to introduce new technologies and make their technological needs felt. Horizontal co-operation between related firms or industries allows them to share or co-ordinate activities (such as R&D, technology, distribution, marketing, services), while intense competition stimulates more rapid innovation and diffusion of new technologies. For SMEs clustering can reduce the individual costs and risks of various critical activities while retaining the flexibility and initiative of small size. Such flexibility and specialisation are increasingly important for competitiveness in high quality segments of activities like garments.

As far as skills are concerned, industrial districts promote mutual training, learning by doing and incentive to work. Information about demand and supply of skilled labour is increased by the aggregation of specialised industries in the same area. Skilled workers seek employment and concentrate in the industrial districts in which their skills are required and better appreciated, where it is likely that they will find a good market for their labour. The transfer of technology is eased by economies of scale and scope and the ease with dealing with a concentrated group of users. Internal technological upgrading is faster when accumulated know-how and technical skills are shared and the feedback from buyers and suppliers is diffused. In marketing, clustering favours the emergence of specialised traders with knowledge of distant markets. Finally, clustering can lead to the development of specialised producer services in technical, financial and accounting matters.

While the benefits of industrial districts have been discussed since the days of Marshall, recent interest in Europe also focuses on the benefits of

Table 5.5 **High Technology and Other SMEs in the UK**

	High technology SMEs	Non-high technology SMEs	Significance Level of d differences
Employment growth % (1987-90)	99.2	70.3	***
Sales growth % (1987-90)	233.1	146.2	*
Innovation rate (a)(% firms)	76.2	57.8	***
Technological expertise (b)(% firms)	83.4	50.7	***
R&D employment % total, 1990	19.6	10.0	***
Size: Sales 1990 (£ million)	2.05	3.32	**
% of new firms (post 1980)	66.1	46.9	***
Exports (% sales), 1990	13.4	9.5	***
Subcontracting (% sales) 1990	15.4	22.7	***
Niche markets (c)(% firms)	52.5	41.8	**
Collaboration (d) (% of firms)	49.5	28.5	***

a Innovation rate measured by number of firms that have introduced major new products or services in last 5 years.
b Technological expertise considered 'very important' to firms' success.
c Niche markets are defined as 'fewer that five serious competitors'.
d Formal or informal collaboration/partnership with other organisations.
Source: Cambridge University Small Business Research Centre SME Survey, 1991

clustering for promoting innovation as well as flexibility and adaptability. It has been noted that several clusters of *technology-intensive* SMEs has emerged over time, with enormous benefits in terms of networking, information sharing, 'collective learning' and the use of technology institutions. High technology SMEs have also been more able than other SMEs to create exports, employment, growth and innovation. Table 5.5 shows some data on the UK on high-technology and other SMEs.

In general, a well-functioning industrial district will have greater flexibility, technological strength, marketing capability and skill base than a group of SMEs that are not organised on 'cluster' lines. However, co-ordination within an industrial district involves more than geographical proximity: it requires *close and prolonged relationships of trust* among the entrepreneurs, supported by commonly accepted *codes of behaviour*, with appropriate rules and sanctions. It is a means of 'internalising' beneficial externalities that result from agglomeration, and is based on a fine balance between individualism and co-operation, sharing and the individual pursuit of profit. The promotion of successful clusters is thus not a straightforward task, since it involves more than setting up an infrastructure of industrial estates. It requires the provision of facilities that SMEs can share and draw upon collectively, such as marketing, technology or training, and incentives for them to act in groups rather than individually.

5.5.2 The Case for Industrial Districts in Mauritius

The best known industrial clusters in the world are in Northern Italy, where firms in high-skill fashion products have achieved international competitiveness, high employment, and growth in times of economic crisis (Goodman and Bamford, 1989, Schmitz and Musyck, 1994, Pyke, Becattini and Sengenberger, 1990). The experience of several developing countries has also been positive. Brazil, for example, has become the third largest exporter in the world of leather shoes, and more than two-thirds of its exports come from one industrial district, which has attracted a number of export agents, design consultants, specialised producer service units, and runs weekly papers and bimonthly technical magazines specialised in the shoe and leather trade. There are also successful clusters in India (in cotton knitwear and diamond polishing industries), Indonesia, South Korea and Pakistan (Nadvi, 1994, Schmitz, 1995, Pedersen and Sverisson, 1994).

To date little work seems to have been done on the nature of intra-firm linkages and clusters in Mauritius. Our firm-level survey sheds some light on the nature of local supplier and subcontracting relationships in the country. The data confirm the mission's impression that the *local supply base in key industries is weak*. As expected, the average local content is high in natural-resource based industries like food products (26-50 per cent) but very low in others like textiles and garments (1-25 per cent), electronics (1-10 per cent), and chemicals (1-10 per cent). Garment firms complained about the lack of accessories (particularly for fashion clothing), electronics firms about the absence of a local plastics industry (particularly with precision injection moulding facilities) as well as other component industries, and chemical firms about the gaps in ancillary chemical industries. Evidence also suggests that quite a high proportion of local incoming raw materials, accessories and components are defective. One chemical firm reported that, on average, 10-12 per cent of its raw materials were defective in 1995 while the average for three textiles and garment firms was 5 per cent in 1995. Enterprises, particularly MNC affiliates, emphasised that the prospects for sustaining the growth of high-end garments and developing electronics and chemicals from Mauritius depended crucially on a well developed, reliable system of local suppliers.

Table 5.6 **Quality of Subcontracting in Enterprises (a)**

Industry	Price	Quality of output	Delivery deadlines
Food products	2.5	2.8	2.3
Textiles and garments	2.2	2.5	2.2
Chemicals	3.0	2.0	1.0
Electronics	2.8	2.5	2.8

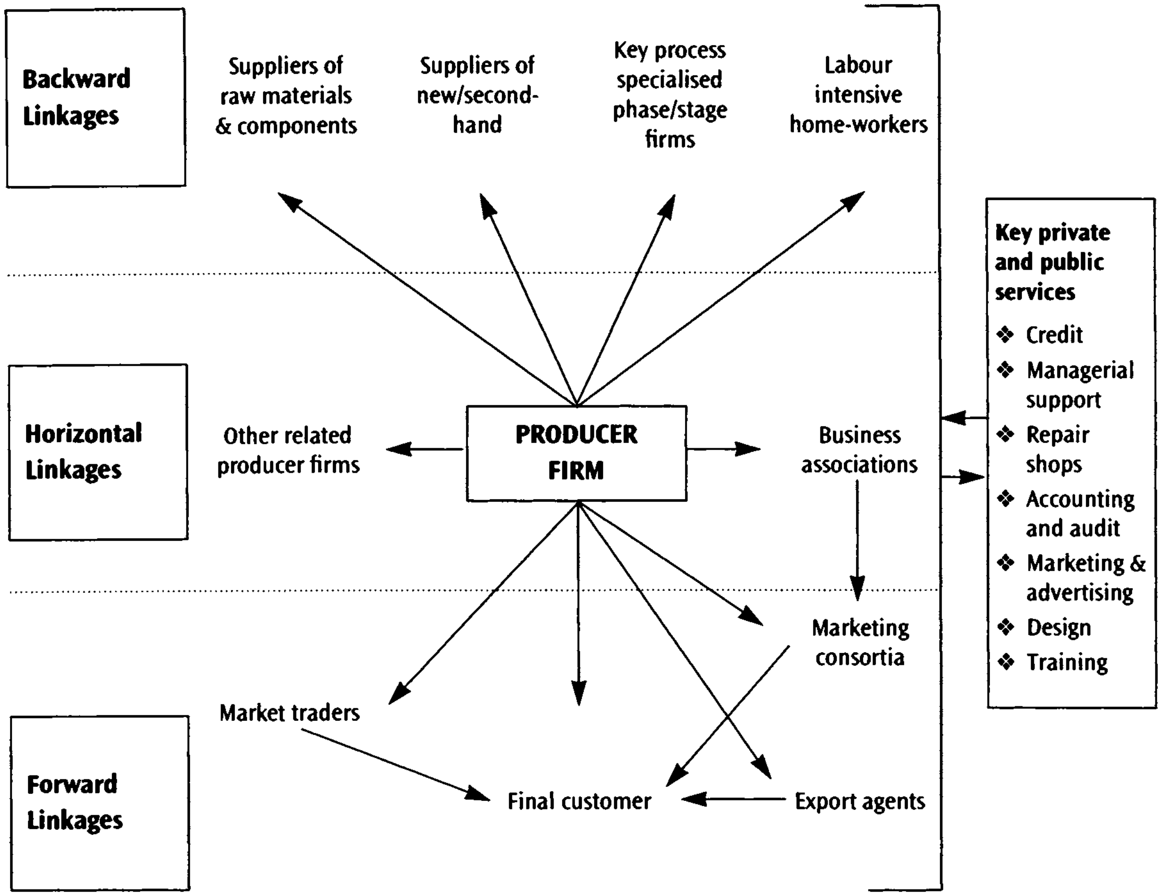
Note: (a)The ranking system is as follows: 1 is very poor and 5 is very good.

There is some sub-contracting activity in the sample. Of the 34 sample firms, about one-third seemed to undertake intermittent sub-contracting to SMEs. In textiles and garments, subcontracting included activities like dying of fabrics, embroidery and sewing. In electronics, it included the manufacture of some parts; for instance, one firm subcontracted the making of dials on instruments to an SME. In food products, some firms get their labels printed locally.

Table 5.6 provides information on the sample firms' ranking of the quality of service provided by their subcontractors. The findings are quite striking. There were concerns expressed in all four industries about the prices charged, the quality of output, and delivery deadlines. Subcontractors in chemicals perform best on price (but worst on delivery and quality of output) while ones in food product perform the best on price and ones in electronics the best on delivery deadlines. It is significant to note that the subcontractors in textiles and garments do not perform particularly well on the basis of price, quality or delivery deadlines. Two large garment MNC affiliates had subcontracted orders to SMEs previously, but finding that the quality of output was below international standards (and the SMEs were unable to meet tight deadlines) had stopped subcontracting to SMEs altogether. Similarly, one large local garment firm reported that the quality of subcontractors output was very irregular; it rejects 20 per cent of its subcontractors' output on an average order. The evidence suggests that subcontracting arrangements in all four industries are typically arm's length relationships that rarely involve significant transfers of information, skills and technology. The net result is that there are few spillovers of technological capabilities from large firms to SMEs.

In Mauritius, SMEs, scattered around the island, do not constitute 'industrial districts' in terms of network characteristics. They tend to be isolated from each other – there is no division of tasks among them, no exchange of ideas, information, skills or goods, and no long-term relationships of co-operation and trust among

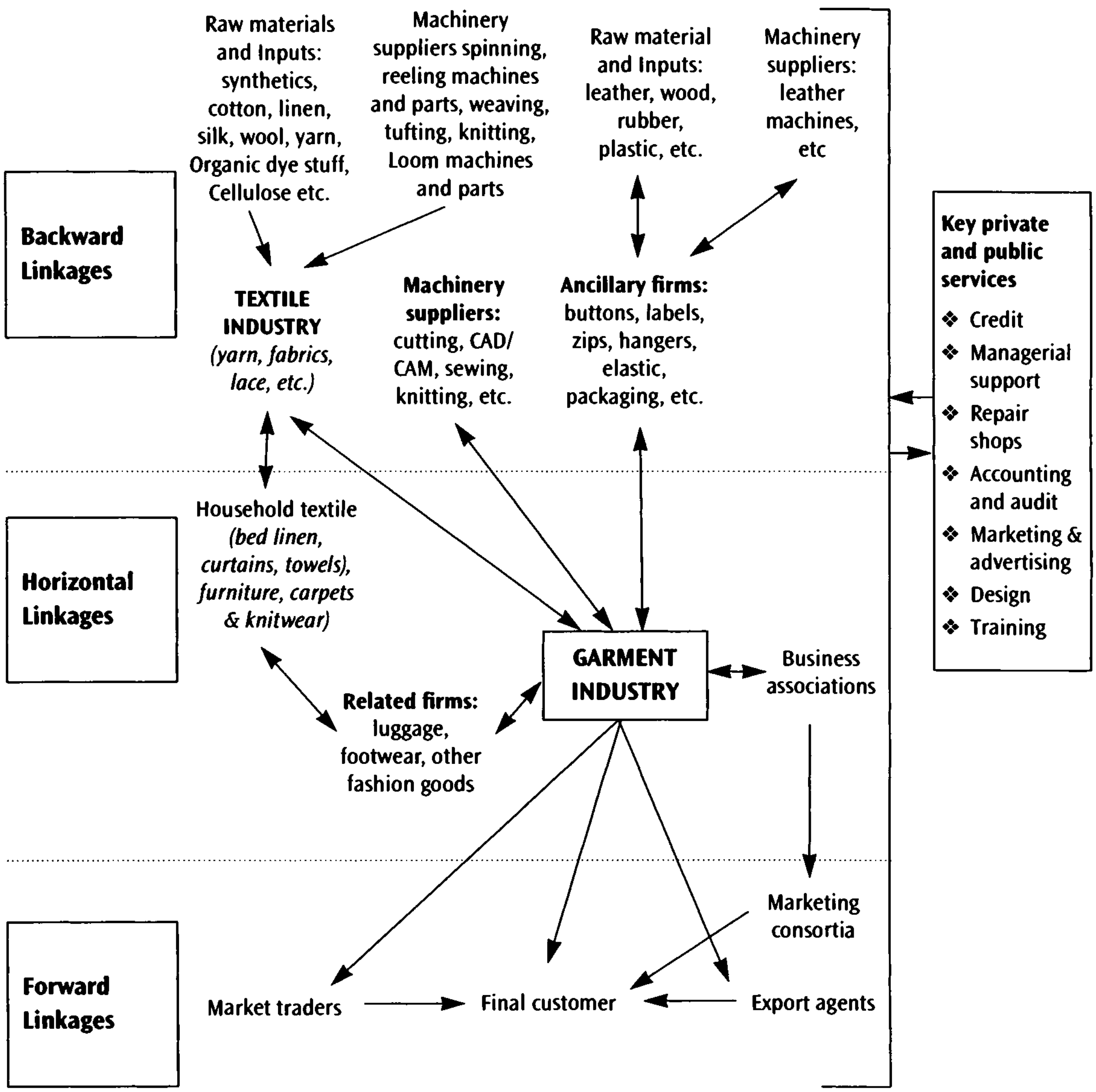
Table 5.7: **Production and marketing Chain**



entrepreneurs that can lead to specialisation. They do not pool skills, knowledge, services and intermediate goods, and, partly as a consequence, suffer from high costs, risk, credit and marketing problems. In the clothing sector, subcontracting mainly takes the form of contracts with foreign buyers, who provide the design, specifications, production schedules, quality control and other types of technical assistance, and all the marketing. This is common throughout the developing world in this industry, and provides an invaluable entry point for exporters: however, the linkages run from buyers to individual contractors, with little development of clusters between the latter. Domestic garment subcontracting, from large to small firms, also exists, but the latter are mainly firms with simple equipment undertaking low quality activities (World Bank, 1994.a, para. 2.49). There is little of the development of skills, technological capabilities and specialisation that marks industrial districts in more advanced countries; as noted, institutional support is weak. These are the firms that have been worse hit by the recent intensification of competition. Yet experience suggests that such districts, if they could be fostered, could become a major source of competitiveness enhancement in the country.

The Mauritian government is keen to promote subcontracting, but has no coherent strategy for the promotion of industrial districts. The World Bank (1994.a, para. 6.46) notes that subcontracting is held back by the regulatory framework (in particular the structure of indirect taxes and duties and the duty drawback mechanism), which deters links with non-EPZ firms, and the lack of awareness among firms of

Table 5.8: **Production and marketing Chain for Garments**



the benefits of inter-firm co-operation. This lack of awareness is also related to the virtual absence of industry associations, which generally play a crucial role in fostering linkages and clusters.

Table 5.7 and 5.8 above show the potential links that this industry can have with the rest of the economy. The input suppliers to garment firms are textile producers (led by fabrics, but also including yarn, lace, ribbons and so on) and accessory firms producing buttons, labels, zips, packaging, and the like. Garment firms would not be the only ones benefiting from the presence of such ancillary industries, since they can provide inputs to other industries as well, e.g. household textiles, furniture and carpets would also benefit from the production of yarn and fabrics. Moreover, these can share some services with related industries such as footwear or luggage. The latter are not export activities in Mauritius at this time, but a cluster based development can allow them to grow, sharing some common skills and facilities with garment firms.

The accessory industry also offers considerable scope for raising beneficial linkages. If it could by upgraded, garment firms could be more flexible and efficient. Items could be more quickly to order according to buyer design. Documentation, charge payments, insurance and inventories would all be reduced. Defective products could be changed quicker. Labour-intensive ancillaries would generate employment. Some ancillaries (like labels) would benefit other industries as well.

While efficient industrial districts cannot be created by an 'act of will' by the government, both public institutions (especially at the local level) and private industrial associations can have a very important role in fostering industrialisation where small firms already exist (Humphrey and Schmitz, 1996). Joint public/private initiatives can support and develop industrial clusters, especially with the provision of credit, technical support services, and training (both of entrepreneurs and of workers). Industrial districts generally have institutions (generally under the local government) that supports them, and the provision of common technical facilities, educational institutions or infrastructure have been particularly important. However, it is fundamental that entrepreneurs and workers are actively involved in the design, financing and implementation of the schemes supporting industrial clusters. In fact, the cases in which attempts to foster clusters have not worked have been where there was little or no private sector participation. In some cases, as in Korea, clusters have formed around a large firm that sets up close subcontracting relations with SMEs and helps them to form an efficient pattern of specialisation.