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CHAPTER 4

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CHAPTER IV. ENHANCING THE TECHNOLOGICAL IMPACT OF FDI

Tanzania is one of the few African countries to have consistently given priority to science and technology in its national development strategy. Since the establishment of the Tanzania National Scientific Research Council (TNSRC) in 1969, policy guidelines for the promotion of science and technology have been formulated and implemented at the highest level of government machinery.[9] Despite concerted efforts, however, the level of local technological capability has so far remained low. Technology policy needs reform to match reforms in investment and trade and to enhance the technological impact on FDI.

The recent FDI inflow into Tanzania, along with the surge in domestic investment induced by the shift to a market economy, has opened up opportunities for technology transfer, diffusion and learning through linkages and spillover effects. Some transfer of technology and skills is taking place (as shown in chapter 1). The challenge is to enhance these positive impacts by strengthening the ability of domestic enterprises to acquire, master, adapt and assimilate technology. Building a dynamic domestic enterprise sector is an essential condition for increasing the contribution of FDI.

A. Tanzania's technology policy framework

The Government's vision of the role of science and technology in national development strategy was first elaborated in its National Science and Technology Policy (NSTP) of 1986.[10] It reflected the policy orientation pursued at the time, the overall objective of which was to reduce dependence on foreign technology suppliers by regulating technology flows and promoting domestic technological capability.

The 1996 revision to align the NSTP with the shift from a planned to a market-oriented economy actually introduced very little change. As a result, the current NSTP still reflects many of the pre-liberalization objectives, the vision and priority areas. The structure and functions of science and technology support institutions have also remained unchanged. The only difference is that detailed and ambitious sub-sectoral activities – especially in the manufacturing sector, which were included in the 1985 policy document – are no longer retained as priority areas. Therefore, technology policy reform has lagged behind other policy reforms, especially those of investment-related policies. Officials in Tanzania recognize this inconsistency in the sequencing of policy reforms. According to a TIC senior official, for example, "the issue of technology policy and how it fits into the new investment environment has not yet been seriously addressed".[11]

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[9] For example, at present, the highest policy-making body on science and technology-related issues is the Ministry of Science, Technology and Higher Education (MSTHE), which also has the mandate to formulate and implement policies on higher education. In addition to providing the overall policy guidance on science and technology, MSTHE is also responsible for the coordination of a number of public sector support institutions, including the Tanzania Commission for Science and Technology (COSTECH).

[10] In 1986, the Tanzania Commission for Science and Technology (COSTECH) was also established replacing TNSRC, and with a wider and clearer mandate to promote science and technology in the country. Under the direction of MSTHE, it advises the Government on priorities in scientific research; the allocation and utilization of research funds; policies on R&D and transfer of technology; and the training and recruitment of research personnel.

[11] Interview with the Director of Investment Promotion/TIC, March 2001

The main objectives and features of the existing policy framework are:

- Building domestic research and innovation capacity through State funding of public sector R&D institutions. Up to 1 per cent of GDP was earmarked for expenditure on R&D, although in reality, annual total expenditure on it never exceeded half of the targeted figure. Moreover, R&D is conducted almost entirely in the public sector, either in specialized centres, or spread over a number of State enterprises and ministries. Independent studies of the country's R&D capacity show that it is de-linked from the private/productive sector and contributes little or nothing to technological adaptation and upgrading at the firm level (see for example, Mlawa, 1999). In effect, therefore, the present policy was primarily designed to promote a science-based, public-sector controlled R&D capability. Little attention has been paid to the technological needs and activities of enterprises.

- Centrally determined R&D priority areas. At present the Tanzania Commission for Science and Technology (COSTECH) identifies the priority research areas and deciding on allocation of State funding under the overall policy guidance of the Ministry of Science, Technology and Higher Education (MSTHE). A quick glance at the long list of research priority areas indicates that the choices of sectors and specific areas of research are not based on thorough analyses of the technology needs or problems of production enterprises. Nor are they based on a coordinated priority-identification exercise, for example with the priority sectors identified for investment promotion. The selection of priority technology areas of research is therefore supply-determined rather than demand-driven.

- Monitoring and regulation of technology flows with a view to encouraging the transfer of "appropriate" technologies. To implement this policy objective, the Government established the Centre for the Development and Transfer of Technology (CDTT), with the primary responsibility for "establishing rules and regulations for rationalizing the acquisition, evaluation, choice, coordination and development of technology; as well as conceiving policy measures that will facilitate an enabling environment for technology autonomy and sustainable development." The Centre is still operational with the same broad mandates. In principle, therefore, the existing policy still upholds a "regulatory" approach with a view to monitoring the types of technology imported. MSTHE believes that some of the existing technology regulatory mechanisms must be retained and strengthened as there is "a danger that import liberalization may encourage the flow of inappropriate technologies" into the country.[12] However, the new investment code provides for unrestricted technology flows, thereby overriding the mandates and functions of CDTT. Investors that qualify for benefits can now import machinery and capital equipment free of import duty. In effect, therefore, at present there is both confusion and a mismatch between investment and technology policies – giving potential investors conflicting signals about government intentions and policies. This ambivalence must be addressed urgently in order to ensure policy consistency and avoid presenting contradictory messages to potential investors.

- Local capacity in technology infrastructure. Over the past three decades, Tanzania has established a number of specialized technology-related institutions which provide support, mainly to State enterprises, in such diverse areas as technology selection, adaptation, innovation and assimilation, as well as productivity improvement, standard-

[12] Interview with high-level officials at MSTHE, March 2001.

setting, repair and maintenance, and training (box IV.1). Some of the institutions were established through an Act of Parliament, but most are attached to ministries or State enterprises. Nearly all are State-owned, many established and subsidized with donor support. Studies examining the impact of these institutions show that they have little contact with the private sector (see, for example Lall, 1999 and Wangwe, 2001). With liberalization and the privatization of State enterprises, the position and viability of some of these institutions have become unclear. It would seem, moreover, that those heavily dependent on donor support – the majority – were more affected as funding was cut or switched to other uses. Recent government efforts to encourage these institutions to sell their products and services to the emerging private sector have been unsuccessful. This is partly because of lack of confidence in the quality of goods and services provided by local support institutions, especially now that better technologies and services can be easily imported, and partly because the institutions themselves have little experience in marketing their services in an open and competitive market environment. However, this should not be interpreted to mean that the existing technology support institutions are irrelevant or have no role in the new liberal market environment. On the contrary, the core competencies and capability accumulated are relevant for the needs of Tanzanian enterprises. The problem seems to lie in two areas; first, lack of awareness of private-sector needs and of changing market conditions; and secondly, lack of resources, poor management and motivation, and uncertainty associated with the reduction in the State sector. Therefore, the immediate challenge facing the Government is how to build on existing technology infrastructure capacity to create a market-oriented and private-sector- focussed technology support system.

Box IV.1. Technology support institutions

A sample of the types of technology support institutions in Tanzania is presented below. The list is not exhaustive but indicates the diverse areas in which support institutions are present.

- Tanzania Industrial Research and Development Organization (TIRDO)
- Tanzania Bureau of Standards (TBS)
- Centre for the Development and Transfer of Technology (CDTT)
- Tanzania Industrial Studies and Consulting Organization (TISCO)
- Institute for Production Innovation (IPI)
- National Construction Council (NCC)
- Building Research Unit (BRU)
- National Radiation Commission (NRC)
- Small Industries Development Organization (SIDO)

In short, the present technology policy and the structure of the technology support system still reflect the economic philosophy and objectives pursued prior to liberalization. The policies pursued in the past paid little attention to the technological needs and problems of the enterprise sector, particularly private-sector enterprises. They failed to encourage linkages between local R&D capacity and the productive sectors. Instead of promoting local technological learning, as initially envisaged, regulating technology transfer from abroad may have restrained technological

development, as demonstrated by the country's continuing dependence on imported technology and skills.

B. The direction of policy reforms required

In line with Tanzania's Development Vision 2025 and investment policy reforms, it is imperative that the Government further reform the National Science and Technology Policy with a view to making it compatible with the current strategy of private-sector-led development.

Further reforms in the NSTP should aim to refocus the direction of policy objectives into the following areas:

- Technology activities at the enterprise level. Technological learning and technology upgrading in a host country take place only when domestic enterprises acquire the capacity to understand, use, improve and assimilate technologies that are transferred either as part of FDI and/or through direct imports. This, in effect, means designing technology policy that encourages and supports the efforts of local enterprises to upgrade their skill and technology capability. The specific policy measures may, for example, include direct fiscal incentives for enterprises acquiring more advanced technology and/or introducing a technical training programme; easing credit access for enterprises manufacturing and exporting higher-valued products or establishing backward linkages with foreign affiliates; providing information on technology; establishing specialized institutions to facilitate support in areas such as quality control, standards, marketing, inter-firm partnership, and other aspects essential for improving productivity and technological capability. It would also mean reviewing the current Government policy on R&D with a view to ensuring that support is performance-related and subject to effective linkages with the productive sector.

- Selection of priority technology areas for R&D must be based on enterprise needs and market demand structure – in other words, demand-driven prioritization of technology development policies and allocation of public resources. The current technology policy in Tanzania lumps scientific research and technology development together and pays little attention to technology upgrading at the enterprise level. This approach needs rethinking. Policy makers should bear in mind that the immediate economic priority in Tanzania lies mainly in technology upgrading by productive enterprises, rather than basic scientific research isolated from the productive sectors, and that most of the technological activities necessary for improving productivity and attaining competitiveness take place at the enterprise level. The current pattern of FDI inflows, especially its sectoral distribution, can be a useful indicator of the priority areas for technology and skills development. In addition, regular consultations with the enterprise sector can provide more relevant information on the technology needs of the productive sector in the country and can help identify the specific technology-related constraints and the areas on which State support through R&D should focus.

- In a market-based economy, compatibility and complementarity between technology and investment policies are essential requirements for enhancing the impact of investment on economic growth and competitiveness. This means that the existing regulatory measures implicit in Tanzania's NSTP must be revised. Institutional

mandates, such as that of CDTT, also need to be reoriented from regulatory to supportive functions. The focus should be on technology upgrading in domestic enterprises, including linkage promotion programmes aimed at increasing and deepening interactions between foreign affiliates and domestic enterprises. Such programmes, common in many developing countries, promote technology diffusion by increasing information flows in the enterprise sector and also through matchmaking. The latter involves identifying domestic enterprises that have the actual or potential capacity to forge backward linkages with foreign affiliates, and collaborating closely with potential or actual foreign investors to encourage their interest in setting up partnerships with domestic enterprises. As noted above, the Fiscal Stability Agreement that the Tanzanian Government has signed with a number of foreign investors in the mining sector could serve as a model in Tanzania.

- Building market-oriented and coordinated technology support infrastructure. This task would require streamlining and restructuring the existing technology support infrastructure. In some cases, there may be a need to close down ineffective technology institutions. In other cases, what is needed is simply a thorough overhaul of institutions and a clear definition of their objectives. In a few cases, for example, support institutions operate more like manufacturing units than providers of technology support services. A case in point is the Institute of Production Innovation (IPI), which was established in 1981, initially as a department and subsequently as an autonomous institution within the University of Dar-es-Salaam, to develop product prototypes and transfer technology to industry and also provide consultancy services to domestic firms. Despite the attractiveness of the concept of university and industry links and the focus on innovation, the interaction between enterprises and the Institute has been limited with the exception of a few well-publicized cases. Moreover, the Institute began to produce simple machines (sugar milling, oil processing, grain milling, solar heating) for sale on the market, which in essence means that it has become a manufacturing unit rather than a technology development centre as initially envisaged. Not surprisingly, local firms now regard the Institute as a competitor rather than as a technology support institution. Similar trends are observed in other support institutions, and this creates a poor image of public sector support institutions among local firms.

C. Conclusions and recommendations

1. Technology development and policy framework

The 1996 NSTP should be brought into line with the policy changes in other economic areas, particularly investment policy. The broad direction of changes required is outlined in Section B above. Giving a prominent role to private sector development and enterprise technological activities is the most important of the adjustments required in the technology policy framework. In addition, particularly in less developed markets, clearly defined and targeted policy measures tend to be more effective than generic policies. Therefore, where possible, the new technology policy framework should clearly identify policy instruments, the target audience, the desired outcome and the means of policy delivery.

Ultimately, the impact of technologies transferred by foreign affiliates is measured by the extent to which local technological learning takes place through the diffusion of technologies and skills to domestic enterprises. Although the market mechanism is often the most effective instrument for technology diffusion, in less developed economies such as Tanzania – where the market is still at an earlier stage of development – there is a need to establish a "subcontracting exchange" programme aimed at promoting linkages between foreign affiliates and domestic enterprises. Such a programme – to be managed jointly by TIC and COSTECH – would serve as a bridge between foreign affiliates in the country and domestic enterprises by providing information on prospective domestic suppliers and maintaining a register based on a technical evaluation of the capabilities of potential supplier firms.

In terms of technology transfer, the main focus of technology policy should shift from regulating technology flows to information provision to enterprises, particularly SMEs, on sources, costs and appropriateness of foreign technologies. In this respect, it is recommended that Tanzania set up, with the assistance of and in close consultation with relevant international development agencies such as UNIDO, a one-stop technology information unit. The primary objective of the unit would be to provide, upon request, information and specific advisory services on the sources, quality and appropriateness of technologies and equipment acquired by domestic enterprises. In the absence of private sector entities to provide such services, it is recommended that the Government, if possible in partnership with a private sector investor, establish the unit. Access to information and advisory services provided by the unit should be on a fee-paying basis. However, at the initial stage, the Government should consider the option of providing free information and advisory services to small-scale productive enterprises.

The new technology policy should identify specific incentives for R&D by private enterprises. In terms of fiscal incentives, serious consideration should be given to the possibility of granting tax deductibility for the amount of the enterprises' expenditure (100 per cent) and even more than the total expenditure in cases where new products are generated and commercialized. To assist in this process, the possibility of establishing a Technology Fund to co-finance enterprise R&D (for example, on a 50-50 basis) should be considered. The Technology Fund should provide resources as a conditional loan, to be repaid by successful ventures.[13]

The technical skills base of Tanzania is small and it needs to improve if the country is to continue to attract additional FDI and build competitive enterprises. As a matter of priority, the Government must launch a "skill strategy" aimed at creating competitive skills and easing the shortage of skills in areas that are potentially attractive to FDI. The stimulation of enterprise-level learning and training is a key area of policy intervention that needs to be undertaken as part of the new "skill strategy." This requires both concrete incentives that encourage enterprises to undertake in-house training and the launching of concrete campaigns to inform domestic enterprises, especially small- and medium-sized enterprises, of the benefits of, and the need for, employee training to be able to upgrade technology and cope with the intense import competition.

Enterprise-focussed technology policy requires an integrated and systemic approach to policy formulation and implementation. It also requires a network of support institutions, whether at the national or regional levels, that provide technical services and influence the technological behaviour of enterprises. An example of the type of National Technology and Innovation System

[13] While this raises the risk of losses if a large proportion of the projects fail, experience in other countries suggest that the risk is quite small. In addition to stimulating R&D activities by enterprises and the benefits that they would drive from it, enterprises would not deliberately take the risk if they are required to put up half of the capital required to initiate the project. Such a Fund could be initiated with the assistance of donors.

that Tanzania may need to build is presented in figure IV.I. It shows some of the key policies/actors/institutions that influence the process of technology upgrading and innovation by enterprises. The most important aspect of the system is the interactions among the various elements in the system and between them and the enterprise sector. Even if single elements of such a system are strong, the system as a whole may be weak either because of the failure of policies to stimulate interaction or because of lack of coordination between the various parts in supporting enterprises. Only by applying such a systemic perspective and formulating policies that stimulate interaction in the system and encourage the active participation of the private sector can technologically weak economies such as Tanzania be able to develop a dynamic enterprise sector and maximize the impact of FDI.

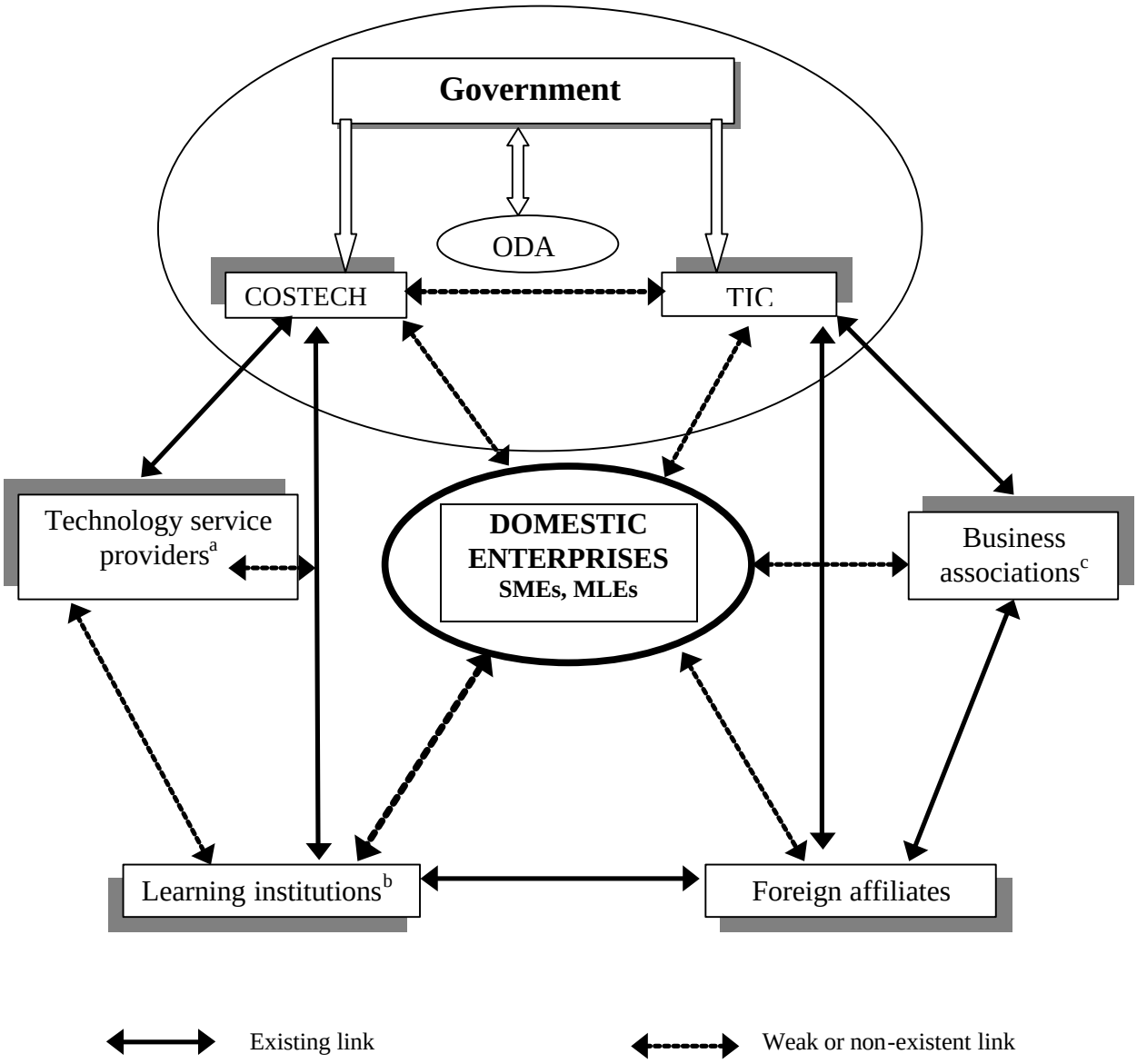
2. Technology infrastructure

Enterprises do not innovate or upgrade technology in isolation but in response to and interaction with technology suppliers, customers, other enterprises, but above all, specialized technology institutions that provide services in diverse areas such as quality control, testing, standards, technical training, finance, information, benchmarking and so on. In Tanzania, this infrastructure – consisting of a number of public sector institutions – has been generally ineffective in generating linkages with the private sector and in promoting technological capability. There have been some attempts to reform and improve the main institutions in recent years, but in the absence of active government support the results so far have been less effective.

In addition to revising its science and technology policy, Tanzania needs to strengthen its technology infrastructure by improving – on selective basis – the performance of existing institutions and building new capacities where essential services are missing. In the absence of credible private sector entities capable of providing technology-related services, public sector institutions will need to continue to provide out such services. To that end, it is recommended that the Government undertakes a major restructuring and overhaul of the existing technology-related institutions with a view to identifying those that provide essential services and need strengthening and those which are ineffective and should cease to operate. At the same time, the scope for private sector involvement in the provision of technology extension services and the means for promoting it should be explored.

COSTECH, for example, is one of the institutions that should be strengthened since it can be a vital agent of technological change and linkages between FDI and domestic enterprises. It was established in 1985 to manage science and technology policy and coordinate R&D activities in the country. Unfortunately, it has not been able to fulfil this role owing to resource constraints, lack of adequate skilled personnel and the difficulties in mainstreaming science and technology policies across sectoral ministries. It is essential that its capability be enhanced and its ability to implement technology policy greatly strengthened. This can be achieved by:

Figure IV.1. National System of Innovation of Tanzania



[a] National Centre for Development and Transfer of Technology (NCDTT), Centre for Agricultural and Rural Technology, Tanzania Bureau of Standards (TBS), Tanzania Engineering Manufacture and Design Organisation, Tanzania Industrial Research and Development Organization (TIRDO), Tanzania Industrial Studies and Consulting Organization (TISCO), etc.

[b] University of Dar-es-Salaam, Sokoine University of Agriculture, Institute of Technology, etc.

[c] Tanzanian National Business Council (TNBC), Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA), Confederation of Tanzanian Industries (CTI) and Tanzanian Private Sector Foundation (TPSF).

- Increasing the skills and resources available to COSTECH. One of the consequences of resource problems, for example, is that the salary levels of COSTECH staff are low, especially compared with the pay structure in the private sector, and this is affecting staff motivation and the ability of the agency to attract and retain skilled technical and management personnel.[14] If it is to serve as an effective agent of technological change, its resource problems must be dealt with urgently.

- Improving COSTECH's information processing and analysis capacity. Since it is an organization responsible for advising the Government on scientific research and technology priorities, access to reliable and "best practice" technology-related information is critical for it to perform its functions efficiently. At present, the information and analysis capacity available to it is inadequate and needs to be strengthened. The establishment of the information unit proposed above could help remedy this problem.

- Generating greater awareness about the need for technology upgrading and the critical role of technology policy for long-term growth and competitiveness within the private sector and among all levels of government. This will facilitate COSTECH's task in mainstreaming technology issues across all key agencies dealing with industry, finance, agriculture, health, education, mining, infrastructure and enterprise development.

Another important support institution, which requires special attention, is the Tanzania Bureau of Standards (TBS). The capacity to produce higher-quality products, especially to internationally recognized standards, improves competitiveness and assists in attracting FDI. Despite the operations of TBS, which currently focusses on metrology, standards, testing and quality functions, quality consciousness among Tanzanian enterprises is at present very low. Indeed, by mid-2000, only two enterprises (a soft drinks firm and battery manufacturer) had been awarded ISO 9000 certification. Most firms, especially SMEs, are not aware that such certification exists. It is recommended that TBS be reorganized with a view to strengthening its standards-setting and awareness-generating roles and upgrading its accreditation capacity to international standards while reducing its testing facilities and functions. At the same time, the Government should seriously consider encouraging the private sector to develop testing capacity. At present, about 70 per cent of TBS's budget comes from the provision of testing services; this suggests that the market exists for early entry by the private sector into this field of technology service.

For services relating to technology selection, the development of appropriate technologies, efficient use of energy, advice regarding the application of clean technologies and the provision of repair services for instruments, the most important support institution in the country is the Tanzania Industrial Research and Development Organization (TIRDO). Although it has existed since 1979, the consensus view is that its overall impact on technology development has been limited. Indeed, in recent years, the organization has been paying less attention to its core activity – which is to assist enterprises in upgrading and generating technology – and has been instead concentrating on equipment maintenance and repair services in order to generate income. About 58 per cent of the organization's revenue is now generated by selling maintenance services in the market. While this is commendable, it should be noted that there are a number of private sector enterprises that provide these services, and that the need for a public sector institution such as TIRDO to provide repair services is not clear. However, in the absence of private sector entities to help enterprises, particularly SMEs, to upgrade technology and select efficient technologies, there is a need for a

[14] This is a problem faced by all public sector technology institutions and needs serious consideration.

supporting institution like TIRDO. In restructuring TIRDO, therefore, the first task should be to ensure that it maintains and strengthens its core activities and generates demands for its services through a proactive marketing strategy. At the initial stages of the restructuring process, government support in terms of time-bound financial assistance will be necessary. Additional measures to be taken will include improvement in management and technical capability, developing competent after-sale services and strengthening linkages with private enterprises. The idea here is not simply to pump in additional funds or grants without clear objectives or strategy, but to suggest a well- planned and time-bound restructuring exercise to ensure improvement in performance and relevance to the needs of enterprises.

In order to enhance the technological impact of FDI in Tanzania, it is necessary to build the capacity of SMEs, which constitute the majority of private sector enterprises, to interact with foreign affiliates and acquire, operate, adapt and upgrade technology. In Tanzania, the Small Industries Development Organization (SIDO) is responsible for providing institutional support in diverse areas, including marketing, skills formation, credit delivery and transfer of technology. SIDO has established up to 14 industrial estates as well as three training-cum-production centres. As with TIRDO, there is a need for restructuring this institution to make it more focused and more relevant to the needs of enterprises. This again needs a strategic plan that looks at its approach, staff motivation and skills, and overall capability. The logic for SIDO to operate industrial estates – which could easily and perhaps more efficiently be owned and managed by private entrepreneurs – is not clear. The Government should encourage, through attractive incentives, private investors to take over and manage the industrial estates. SIDO's activities should focus on reaching SMEs with programmes of technology, training and marketing assistance and the promotion of subcontracting, especially with foreign affiliates.

Production-related innovation is carried out by the Institute of Production Innovation (IPI), as mentioned above. The recommendation for restructuring also applies to IPI, which has over the years drifted away from its initial objectives – that is, to develop product prototypes, transfer technology to industry and generally provide technical advice to enterprises. These are essential services badly needed by private sector enterprises. IPI recognizes the need to adjust to the new market system and has in fact tried to respond by manufacturing simple machines for sale on the market. However, this makes it a competitor of private enterprises rather than a technology transfer agency. It is recommended that IPI focus on its original objectives and develop an outreach campaign aimed at winning the trust and confidence of private sector enterprises and understanding better their needs and technology-related problems. Until it is able to establish credibility among private sector enterprises, government financial assistance will be necessary, especially for upgrading equipment, developing marketing capability and attracting skilled personnel.

For the immediate future, the best option open to Tanzania in dealing with technology infrastructure is to restructure and rationalize existing institutions by strengthening those that provide essential services not available in the private sector and phasing out duplicative and less essential services. The institutions mentioned above are only a few of numerous technology-related support institutions scattered across ministries and attached to major public sector enterprises. But the recommendations elaborated above should serve as a basis for other institutions as well.