

V. INITIATIVES IN ESCWA/ARAB MEMBER COUNTRIES

A. TECHNOLOGY INITIATIVES IN EGYPT

1. *Technopoles in Egypt*¹

Technological capacity building enjoys high priority in the Egyptian Government's long-term master plan aimed at encouraging the development of local technology-based industries. The establishment of technopoles is an important element of this plan.²

The avowed aim of technopoles in Egypt is to transform Egypt into a technology producing and exporting country on the basis of local capabilities. Thus, Mubarak City for Scientific Research and Technological Applications, hereinafter referred to as the City, was established in 1993, followed in 1995 by a plan for establishing four technology valleys in Sinai, Sixth of October City, Nag Hamady and Sohag. Only the first two have, however, been established.

(a) *Mubarak City for Scientific Research and Technological Applications*

The City was established in 1993 by Presidential decree. Its mission includes:

- (a) Advancement of technologies in the country;
- (b) Establishment of technology development units;
- (c) Personnel training in modern technologies;
- (d) Co-operation with national and international organizations in technology transfer.

The City is to incorporate twelve centres and institutes that will be established in successive stages. Frame 31 shows the names of these institutions. The first four were inaugurated in August 2000; the others are scheduled to open in the near future:

Frame 31. Institutes/Centres at Mubarak City for Scientific Research and Technological Applications

1. Genetic Engineering and Biotechnology Research Institute (GEBRI).
2. Informatics Research Institute (IRI).
3. Advanced Technologies and New Materials Research Institute (IATNM).
4. Technology Capabilities Development Centre (TCDC).
5. Arid Lands Cultivation Research Institute (ALCRI).
6. Laser Research Institute (LRI).
7. Environmental and Natural Resources Research Institute (ENRRI).
8. New and Renewable Energy Research Institute (NRERI).
9. Fine Chemical Research Institute (FCRI).
10. Pharmaceutical and Fermentation Industries Development Centre (PFIDV).
11. Small Scale Industries Development Centre (SSIDC).
12. Engineering Industries Development Centre (EIDC).

(b) *The Sinai and Qena technology parks*

The Sinai Technology Valley (STV) is a technopole that is being built by the Egyptian government on a site approximately 72 square kilometers in extent located in the northwestern part of the Sinai Peninsula,

¹ Based on a study by M.Y.M. Moursy entitled *Initiatives Undertaken to Promote Dissemination, Implementation and Development of Science and Technology in the Arab Republic of Egypt*, a paper presented at the Expert Group Meeting on Co-ordination of Technology Policies to Increase Productivity and Competitiveness Within the Global Context: Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

² Co-operation with European and other international firms is also an important element in this plan.

east of Ismailia.³ A South Korean firm has been engaged to build the infrastructure for the first stage (24 square kilometres), and the work is already under way.

The following fields will be the focus of the first stage of STV:

- (a) ICTs;
- (b) Microelectronics;
- (c) Biotechnology;
- (d) New materials;
- (e) Fine tools;
- (f) Renewable energy.

Another technopole is being planned for a 22-square-kilometre site in Qena Governorate in Upper Egypt. In the case of both these technopoles, universities and research institutes are being brought in with a view to creating stronger links between R and D institutes and the planned industrial community.

(c) *Northern Coast Technology Valley*

This proposed technopole is still at the study stage. The project is being considered by Alexandria Governorate, the Ministry of Higher Education, the Ministry of State for Scientific Research and the Social Fund for Development.

(d) *Pyramid Smart Village*

Pyramid Smart Village (PSV), which was launched in September 2000, will focus on technological activities in the field of information and communications technologies. The project will occupy a site of some 136,000 square meters. Its initial funding is 80 million Egyptian pounds (nearly US\$ 20 million). A semi-private enterprise, which is still to be created, will be responsible for developing and managing PSV. The Government of Egypt will contribute 20 per cent of the funding in the form of a grant of land, and the private sector is expected to invest the remaining 80 per cent.

2. *Technology incubators in Egypt*⁴

In the past few years, the idea of establishing technology incubators has been receiving serious consideration in Egypt. The idea was launched through lectures and expert meetings, involving both R and D institutes and SMEs. Technology incubators in Egypt are perceived as a significant micro-economic tool to foster the growth of start-up and early-stage enterprises and improve their chances of success in an increasingly competitive environment; they have been declared an effective means of:

- (a) Generating jobs;
- (b) Encouraging the growth and development of SMEs;
- (c) Disseminating new technologies for the development of products and processes;
- (d) Generating commercially viable technology-based enterprises;
- (e) Upgrading skills through training in new technology-based subjects and methods.

Egypt's technology incubators are to be launched in association with universities and research organizations, and they are to act as vehicles for the transfer of new technologies to the market. The following sections summarize the efforts that are currently under way with respect to the establishment of incubators in Egypt.

³ *Technology Parks - A Mechanism for the Progress of the Egyptian Technological and Information Community* (in Arabic). Prepared by Technological Development Programme, Decision Taking and Information Centre, February 1997.

⁴ Based mainly based on Moursy, *Initiatives...in the Arab Republic of Egypt* and a paper by N.A.M. Saleh entitled *Research and development institutes and industry—the Egyptian experience*, which was also presented at the Expert Group Meeting on Capacity-Building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

(a) *Egyptian incubator programme*

The Social Fund for Development in Egypt (SFD)⁵ has an Enterprise Development Programme through which it promotes technology incubators with a view to stimulating business and employment and creating a supportive environment for private enterprise. This, it is hoped, will contribute to national economic growth and community development

The Egyptian incubator programme was launched in 1995. Its objective was the development of a sustainable network of incubation-related facilities that would spur the competitiveness and productivity of SMEs. It was spearheaded by the Social Fund for Development, several R and D institutes and some private businesses.⁶ Eight locations have been selected for incubators in non-exploited areas characterized by the availability of technical infrastructure, a good business environment and an academic or industrial base to service projects (see table 12).

TABLE 12. LIST OF INCUBATORS THAT HAVE BEEN ESTABLISHED OR ARE UNDER CONSTRUCTION

Name of incubator	Type of incubator	Location
Tala Incubator	Business incubator	Menoufiya Governorate
Tabbin Institute for Metallurgical Studies Incubator	Technology incubator	Cairo Governorate - Helwan
Mansoura Incubator	Technology incubator	Dakahliya Governorate - Mansoura University
Sixth of October City Incubator	Technology incubator	Giza Governorate
Assiut Incubator	Business/technology incubator	Assiut Governorate
Ain Shams Incubator	Technology incubator	Ain Shams University - Faculty of Engineering
Aswan Incubator	Business/technology incubator	Aswan Governorate
Tenth of Ramadan Incubator	Technology incubator	Sharqiya Governorate

One of these is in operation, three are in advanced stages of development and four others are just getting started. The Tala Incubator has been functioning since 1998 (see the following section). Three others were opened in 1996 in locations reflecting distinctive local contexts. The first was Sixth of October City, with a broad industrial base and a wide distribution of local enterprises of varying sizes. The second is based at Tabbin, close to two research institutes focusing on metallurgy and environmental protection. The third is being set up on the Mansoura University campus, focusing on areas in which the university possesses significant strengths. Other locations are under study, notably in Upper Egypt, the Canal region and Sinai.⁷

(b) *The Tala Incubator*

Located in a refurbished building, the Tala Incubator required extensive, costly renovation work that was completed early in 1998. The renovated complex now affords satisfactory premises for business incubation. Legislative and regulatory frameworks required to make the Tala incubator successful are being developed.

The incubator scheme is supervised by a Governing Board/Steering Committee and a manager who supervises all its activities on a daily basis, besides seeing to financial and administrative matters. In general terms, the incubator manager together with the Board of Directors seek to facilitate access to:

⁵ <http://www.sfdegypt.org/>.

⁶ Social Fund for Development, *Technology Incubators- Feasibility and Design Study, Phase 1 Report*, Cairo, June 1997.

⁷ Social Fund for Development, *Role of SFD in Supporting and Developing Small Enterprises*, Department of International Co-operation and Information, SFD (Cairo: SFD, 1998), pp. 27-28.

- (a) Local technological capabilities;
- (b) Advisory support;
- (c) Management training;
- (d) Marketing and accounting services.

The Tala incubator had eight tenants in 2000, while loans for seven others are being processed by the bank. The current tenants operate in the following areas:

- (a) Sheet metal works;
- (b) Household appliance parts;
- (c) Rubber automotive parts;
- (d) Fibreglass products;
- (e) Computer training and applications programmes;
- (f) Aluminum foil products;
- (g) Milk processing and dairy products;
- (h) Assembly of electronic components.

Before a firm is admitted to the Tala incubator, it must submit a complete business plan, in accordance with accepted practice, demonstrating the economic viability of the business and its potential for future growth. Assessment of that potential is regarded by the Tala incubator management as crucial to the success of the incubation process, on the grounds that investment in facilities, time and skills will pay off only if incubated firms have the ability to grow and become substantial members of the business community.

Services such as counseling, training, information and marketing are readily available at the Tala incubator. The rationale behind the services provided by the incubator is proactively to support tenants as well as graduates even after they have left the facility.

The main challenges that the Tala incubator has overcome include delivery mechanisms, financial sustainability and the concept of a customer-focused project. Tenants at the Tala incubator state that they came to the incubator primarily because of the advantages of available space, a good location and suitable financial arrangements. They expected good guidance and counseling, and also product marketing assistance.

(c) *Biotechnology and information technology incubators' experience in Mubarak Science Park*

The Mubarak Science Park (MSP) is located in newly-built premises in Borg El Arab in Alexandria. It offers facilities for research in genetic engineering, biotechnology and information technology.

In its role as the leading exponent of enterprise development in Egypt, SFD has decided to team up with MSP to promote entrepreneurship in high technology. The Egyptian Incubator Association (EIA), the promoter of incubator programme in Egypt (see the following section), has also joined the team to manage and administer the collaborative initiatives.

Qualitative and quantitative studies on Egyptian market demand for biotechnology products were conducted, and various project profiles for those products were developed. This collaboration has resulted in the establishment of two incubators on MSP's premises, one specializing in biotechnology and the other in information technology. For each incubator, a three-party contract was signed, under which MSP offers space and facilities, EIA carries out management and SFD provides funding and conducts monitoring.

(d) *The Egyptian Incubator Association*

The Egyptian Incubator Association (EIA) was established in 1995 with specific objectives and a specific strategy (see frame 32). It was established after the incubation concept had been initiated in Egypt in 1992-1993 through a UNDP initiative, and a comprehensive study, including business plans, had been prepared for SFD. The project went through a year of limited activity due to administrative difficulties, but is now reported to be on track.

Frame 32. Egyptian Incubator Association strategy and objectives

EIA Strategy:

The overall strategy of EIA reflects its dual role:

First, EIA serves as the executing agency on behalf of SFD. This function involves planning for, and providing assistance in, the creation of different types of incubators suited to local conditions, such as open incubators, rural hubs and satellite incubators, and single-sector (e.g. biotechnology) incubators, as well as other forms of managed workspaces, such as technopoles.

Second, EIA serves Egyptian incubators and represents them at the national and international levels.

EIA Objectives:

Essentially, EIA is service-oriented, acting as friend and guide. Its broad objective is to promote new venture creation through managed workspaces. Specifically, EIA:

- (a) Stimulates the start and growth of enterprises through incubation/innovation centres;
- (b) Promotes innovation through technology parks and by other means;
- (c) Catalyses good practices through counseling, training, information and financing services;
- (d) Monitors, evaluates, and benchmarks incubator performance;
- (e) Strengthens national and international networking with research institutes, universities, banks, associations and the professional community;
- (f) Mobilizes national, regional and international resources in the technical, financial, business and political arenas.

Its main tasks are as follows:⁸

- (a) Conducting economic, engineering and social studies for SMEs;
- (b) Establishing and managing a network of SME complexes with support facilities by building up incubators, technology, science and industrial parks;
- (c) Managing incubators and technopoles until they become self-sustainable;
- (d) Offering vocational training for entrepreneurs;
- (e) Conducting human resources development programmes;
- (f) Establishing links with international organizations for technology transfer.

As the designated executing agency for the incubator programme, EIA possesses the necessary expertise in the area of science and technology initiatives, and plays a proactive role in establishing a nation-wide incubator network and performing a variety of new enterprise support activities. EIA has played a significant role in promoting exchanges of good incubation practices and stimulating technology transfer to its tenant companies. In addition, it encourages investment in start-up firms and marketing of their products.

In order to perform these tasks effectively and establish and operate eight incubators, EIA had to take active measures to strengthen its technical service capabilities. A major human resources development programme has been implemented, comprising training in incubator design and management as well as training for entrepreneurs and early stage business development.

⁸ <http://www.fei.org.eg/eia/about.htm>.

The EIA programme has encountered difficulties in co-ordinating the development and administration of integrated incubation projects. These have been mainly due to inadequate human resource skills on the part of project partners. Moreover, EIA and its project partners have encountered problems with ongoing project evaluation. There have also been difficulties in measuring the intangible (but none the less immediate) impact of incubation projects.

Even so, incubators in Egypt are perceived as significant micro-economic tools that can foster the growth of start-up and early-stage enterprises and improve their chances of success in an increasingly competitive environment.

Building on its achievements and the lessons it has learned during its first year of operation, EIA will focus in future on issues related to growth, competitiveness and sustainability. It will also address issues related to globalization and its impact on small business enterprises.

B. TECHNOLOGY INITIATIVES IN LEBANON

1. *Science and technology policy initiatives in Lebanon*

Lebanon's National Council for Scientific Research (NCSR), established in 1962 and directly linked to the Prime Minister's Office, drafted Lebanon's first science policy in 1966. Although Lebanon was one of the first ESCWA countries to embrace the concept of a national S and T policy, the draft document for such a policy, whose objectives are given in frame 33 below, was never formally approved.⁹

Frame 33. General objectives of Lebanon's science policy

A principal aim of Lebanon's first national science policy, as outlined in the draft policy document issued by the Council, was the rational development of Lebanon's scientific potential and the utilization of research results for improving social and economic conditions. Other objectives include:

- (a) Promotion of scientific research in areas related to reconstruction and development in industry, social and economic affairs, and public health and the environment;
- (b) Providing infrastructure support and resources for scientific research, including the establishment of laboratories and the supply of equipment, manpower training, and research grants and assistantships;
- (c) Rationalization of the utilization of natural, human, economic and cultural resources, beginning with relevant surveys, and conducting studies and research programmes aimed at the discovery of new resources and optimal methods for their utilization;
- (d) Retrieving Lebanon's cultural and scientific roles with a view to counteracting the country's limited natural resources, a task which will necessarily entail focusing on its human resources and on the promotion of scientific research as a means of improving productivity.

The science policy project document entrusts NCSR with responsibility for conducting surveys of Lebanon's resources in scientific research, analysing information concerning science policy developments at the global level as well as organizing programmes aimed at enhancing the capabilities of human resources in scientific research and information exchange with research partners abroad.

The document proposes that 1 per cent of Lebanon's GDP should be earmarked for implementation of the country's science policy, and that that figure should subsequently be gradually raised to 3 per cent.

Actions that should be taken with respect to policy implementation are outlined in the document. In essence, NCSR is to draft five-year plans constituting the basis for resource allocation and human resource training development.

An interesting feature of Lebanon's science policy document is that it addresses the issue of "un-directed" or basic research efforts. Such research is encouraged, and grants may be made available to Lebanese researchers for conducting it.

⁹ For more details, see an ESCWA study entitled *Science and Technology Policies in the Twenty-First Century* (New York: United Nations, 1999).

The original science policy was revised by the Board of Directors of NCSR in 1994. Comments and suggestions on the draft policy were invited from concerned ministries and institutions prior to its finalization. In 1995, NCSR produced a new draft national science policy, which was eventually submitted to the government for approval and adoption. Apart from a few amendments, the plan is essentially based on the initial policy.

The NCSR work plan for 1999 took its cue from the general guidelines of the new science policy. The intention is none the less to produce a five-year implementation plan, in collaboration with the concerned directorates and institutions, once the policy document is officially adopted.

NCSR's work on a national science policy for Lebanon has resulted in a number of recommendations, which are being discussed at national and international fora. Some of the main recommendations are listed in frame 34.

Frame 34. Recommendations to be considered at the national level in future stages of science policy work by NCSR in Lebanon

1. Securing steady budgetary support for the entire duration of the executive plan.
2. Enhancing co-ordination with concerned institutions in formulating relevant plans and the execution of those plans.
3. Raising awareness in private enterprise circles of the importance of technological innovations that may be achieved through support for domestic research activity.
4. Creating technical research centres within universities, along the lines of the recently established "Institut Universitaire de Technologie" at the Lebanese University, with a view to enhancing the level of research and specialized technical services made available to the private sector.
5. Encouraging universities to take the initiative in re-orienting their teaching and research programmes to build bridges towards national industry.

2. Educational and training initiatives

The Lebanese private sector is active in new technologies and has initiated projects and activities with academic as well as public-sector institutions. One recent technology-related initiative has been launched in February 2001 by LibanCell, a leading GSM service provider, under the name "LibanCell Educational Support Programme". In recognition of the crucial role of qualified human resources and capacity-building in development, this programme focuses on education and training as well as R and D in the telecommunications field.

Partnership with educational institutions is a cornerstone of the Educational Support Programme, with the aim of "developing the talents and capabilities of Lebanese youth and providing them with the background they require in order to excel in the field of communications technology."¹⁰ With this objective in mind, and with a view to getting partnership-building off to a good start, LibanCell decided to co-operate with the American University of Beirut (AUB) by contributing an amount of US\$ 200,000 during the year 2001 for:

(a) Providing scholarships to distinguished and needy graduates of AUB;

(b) Building two laboratories for the engineering school, the first being a traditional microwave laboratory and the second a laboratory dedicated to the development of innovative value-added telecommunications services;

(c) Supporting a graduate research programme in mobile telecommunications.

¹⁰ Press release issued by LibanCell (www.libancell.com.lb) on the occasion of the launch of its Educational Support Programme.

Other activities will be the object of further collaboration between LibanCell and AUB, including:

- (a) Offering courses and making presentations related to GSM and mobile telecommunication services at AUB;
- (b) Training AUB students at LibanCell.

This initiative is expected to spread to other universities and educational institutions, creating employment opportunities in the telecommunications sector in Lebanon, helping to reduce the brain drain from the country and slowing the exodus of young people with skills in new technologies.

Another educational initiative was launched in November 2000 by Saint Joseph University (SJU) and Cisco Systems, whereby the University was designated a “Regional Academy” under the Cisco Networking Academies Programme (CNAP). This world-wide programme is a non-profit educational scheme originated by Cisco to boost the capacity of higher education institutions, providing a networking laboratory setting that closely corresponds to its real-world counterpart.

Through this initiative, SJU will be able to offer its students courses in the latest networking technologies combined with the practical experience needed to enable them to make an immediate contribution to the development of Lebanon in a knowledge-based socioeconomic context. Students can thus obtain the conceptual and practical skills required for career opportunities in the expanding ICTs. Preparation for the “Cisco Certified Networking Associate (CCNA)” diploma will also be offered by SJU, which may eventually become a training hub in networking for other institutions in Lebanon.

Similar initiatives have also been launched in other ESCWA member countries, notably Egypt, Jordan, Kuwait and the United Arab Emirates, with private industry and educational institutions forging a mutually beneficial and lasting relationship. Private firms gain by making their products well known to future professionals in various fields of high technology, while students profit from the latest knowledge in an increasingly technology-dependent economy in which they will have to work and succeed. For the colleges and universities, these initiatives represent vital technology support and resources to supplement limited funds.

3. Case study of a technopole: BERYTECH¹¹

The private sector in Lebanon has also embarked independently on a number of technopole and incubation projects. Efforts by Saint Joseph University to establish a technopole (BERYTECH) are outlined below.

(a) Objectives

The BERYTECH project’s aims and objectives are set forth in frame 35. The project is open to universities as well as businesses interested in contributing to the realization of its aims and objectives. Along with its educational role, BERYTECH incorporates a wider national and regional vision for socioeconomic development through new technology inputs. In addition, the project’s initiator is seeking to create a socioeconomic dynamic that will increase competitiveness and attract high-added-value firms to the site.

(b) Activities

A primary function of BERYTECH is to provide the necessary environment and support services to help develop added-value activities. In this connection, BERYTECH offers the following outputs:

¹¹ Based on a paper by M. Asmar and F. Rahmé entitled *BERYTECH, a Technology Park in Lebanon*, presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

(a) Assisting entrepreneurs in the creation of their businesses; this is done in an incubator, a nursery and a company hostel where projects are followed up until they mature into firms that are sufficiently well developed to be listed on the stock exchange;

(b) Hosting and development of existing local small firms; this can take place in a wider selection of settings, such as rented offices offering a variety of essential services at competitive rates;

(c) Acting as hosts to large local or foreign companies; this can be done through real estate services providing shared or sole-occupancy rentals or full ownership of premises;

(d) Providing specialized professional training; this requires specific means and well-defined environments.

Frame 35. Aims and objectives of BERYTECH

BERYTECH aims at:

1. Helping Lebanon regain its leadership in fields where knowledge and human talent form the basis of business.
2. Encouraging entrepreneurship in high-added-value fields, especially among young graduates.
3. Bringing newly created companies and small and medium-sized technology firms together at a single location in order to create a clustering effect and enhance competitiveness.
4. Encouraging the return of Lebanese expatriates.
5. Attracting foreign investment and foreign companies.
6. Maintaining the leading role played by Lebanese universities in the region by providing educational institutions in Lebanon with a tool that promotes creative thinking and helps transform fundamental research into applied research.
7. Widening the scope of the university's educational role by helping young graduates integrate into the business world more effectively.
8. Ongoing improvements to curricula to match the needs of today's businesses.
9. Anticipating the needs of the workplace of the future.

Source: Asmar and Rahmé, BERYTECH.

(c) *Areas of emphasis*

BERYTECH's activities are currently focused on fields in which competitive advantage, expertise and human resources are generally available in Lebanon. These include:

- (a) Information technology;
- (b) Communications;
- (c) Multimedia and Web technology;
- (d) Banking and finance;
- (e) Water and environment;
- (f) Energy;
- (g) Health sciences;
- (h) Food industry;
- (i) Vocational training.

(d) *Services offered*

Attracting high-added-value firms requires the establishment of specific high-performance tools and the provision of advanced common services and utilities to tenant firms in a manner that takes into account their size and level of development.

BERYTECH aspires to provide tenant firms with a wide range of administrative and support services for their development, including high-speed broadband telecom facilities. Other conventional services that will be offered to tenant firms, start-up companies and staff are presented in frame 36.

(e) *Organization and management*

BERYTECH is located in the vicinity of SJU's science campus at Mar Roukos, adjoining the Beirut Higher School of Engineering, the Institute of Technology and the Faculty of Sciences. The main advantages of this location are:

- (a) The availability of common services (laboratories, restaurants, lecture halls and security);
- (b) The scientific status of SJU and the presence of a critical mass of experts, resulting in smooth "launching" and many aspects of post-launch and steady-state operations;
- (c) A quality environment, with little urban development and an unobstructed view over Beirut and the sea.

Frame 36. Services provided by BERYTECH to emerging/start-up firms and tenants

1. Identification of project originators among young graduates from all Lebanese and/or regional universities to help bring an influx of business to the incubator.
2. Permanent exchange between the business world and incubated start-up companies.
3. Selection of projects for incubation.
4. Support for the development of such projects in order to help them reach the nursery phase.
5. Nursery facilitation, with specialists who help with the tasks of defining projects and identifying targeted markets while creating links with potential partners, and others who provide assistance with administrative and financial tasks, training activities and the like.
6. Availability of services at the collective workplace in the following areas:
 - (a) Real estate (rent and maintenance, electricity, air conditioning and heating system);
 - (b) Logistics (furniture and micro-computing);
 - (c) Telecommunications;
 - (d) Secretarial services (reception, office services);
 - (e) Daily services (restaurant, courier services, security);
 - (f) Information (magazines, documentation, events).
7. Support for start-up firms in their consolidation phase in order to help them penetrate the competitive market by supplying:
 - (a) Assistance in finding investors to finance their development;
 - (b) Partnership with co-contractors and sub-contractors for technological development;
 - (c) Contacts with specialized organs, through the technopole contact network, to help some of them export their products or services;
 - (d) Assistance in finding space in the private rental facilities provided by the technopole.

Source: Asmar and Rahmé, BERYTECH.

Completion of the first phase of BERYTECH, during the fourth quarter of 2001, should make it feasible to pursue two lines of activity simultaneously: one relating to the social and economic vocation of the technopole, and a second aimed at creating adequate conditions for the profitable development of technology projects. BERYTECH's management structure is intended to reflect activities along these two tracks. It also seeks to support competitiveness while protecting the collective interest.

The BERYTECH organizational scheme capitalizes on its proximity to SJU and includes partners from the private sector. A Scientific and Strategic Committee has been set up to monitor the operations of the various components of BERYTECH.

(f) *Implementation*

BERYTECH will occupy a 55,000-square-metre site and will have a maximum of 1,000 employees. Construction is to take place in several phases, as shown in frame 37. The first two steps have been completed, and construction of the first building (nursery-incubator) has begun. Concurrently, partners are being solicited for the next phases.

BERYTECH is expected to exert a significant influence on technological capacity-building in Lebanon by fostering the emergence of a new entrepreneurship culture and the establishment of tools and modern facilities designed to attract foreign capital, thereby opening up new prospects for development and growth. The key to the project's success will be the building of a solid, sustainable partnership among educational and economic actors, including universities, industrialists, financial establishments and investors.

Support is also being sought from Lebanese authorities and from NGOs and international organizations, including ESCWA.

Frame 37. Phases in the implementation of BERYTECH

Implementation is being carried out in several successive phases, including:

1. Feasibility study.
2. Final decision and launch of the operation.
3. Initiation of talks with partners identified in the study.
4. Establishment of a temporary incubator in the existing premises.
5. Launch of the first phase of the nursery-incubator unit (2,000 m² of floor space in a 5,000 m² area).
6. Launch of the first phase of real-estate development project (10,000 m²).
7. Launch of the second phase of the nursery and the resource centre (2,000 m²).
8. Execution of the second phase of the park (40,000 m²) and the final phase of the nursery (1,000 m²).

*4. The Lebanese Technology Incubator Project*¹²

The Lebanese National Council for Scientific Research (NCSR) has plans for the establishment of a Lebanese Technology Incubator (LTI) to facilitate commercial technology applications by local start-up companies and small high-technology firms. The object of this scheme is foster partnerships between educational and research institutions on the one hand and small high-technology industries or businesses on the other.

Direct links will be established between R and D activities in the country and manufacturing enterprises in a bid to introduce new products and services to diversify the economy, in the process creating new jobs and tapping the technical and business-related resources of Lebanese universities and research institutions, to the ultimate benefit of Lebanon's system of innovation.

Furthermore, NCSR hopes that LTI will encourage co-operation between public institutions and private businesses and enhance synergy among various sectors of the economy. By identifying technology applications suitable for commercialization, offering a structured environment that will help entrepreneurs remain focused on their short- and long-term goals and providing access to financing in the early stages of new endeavours, this incubator scheme will greatly increase small firms' chances of success and lead to a more versatile and dynamic economy.

¹² Based on a presentation on the Lebanese Technology Incubator project by M. Hamzé and M. Mrayati at the Expert Group Meeting on Capacity-building for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

(a) *LTI's areas of expertise*

LTI will encompass industrial fields that reflect its strengths and will concentrate on technologies that will serve those fields, adding new ones as the need arises. The most important manufacturing industries in Lebanon at present are:

- (a) Agri-food industries, with estimated yearly production amounting to US\$ 1.4 billion;
- (b) Textile and garments, with production in the amount of nearly US\$ 796 million per year;
- (c) Metal fabricating and machinery, with estimated yearly production amounting to US\$ 715 million.

On the service side, tourism and banking are sectors in which Lebanon excelled in the recent past; new technologies, particularly information and communications technologies (ICTs) would be likely to contribute added value, greater competitiveness and productivity to these sectors as well.

Other technologies that have been identified as suited to Lebanon's needs include biotechnology and new materials. The former would help modernize the agri-food industry, while the latter would rejuvenate the textile, construction and light engineering industries and enhance their competitiveness and productivity.

(b) *Design and implementation of LTI*

The design of the incubator will address a range of functionalities and procedures in pursuit of the project's objectives. The design phase will be carried out in successive steps as a means of ensuring consistency and compatibility with the various areas of activity. Frame 38 contains an outline of the successive stages in the LTI design process.

Frame 38. Stages in the design of LTI

Mission statement: The incubator's mission, its affiliation and support from other organizations will be defined and a number of underlying assumptions set forth in this initial stage.

Services offered: All services to be offered to tenants, start-up companies and possibly other firms will need to be described at this stage. Personnel requirements will also be specified with a view to developing an accurate picture of organizational, physical and financial requirements.

Organizational structure: The organizational structure will be developed, taking into account relationships between the various components and their subunits.

Site and buildings: Initial requirements concerning the site and buildings will be put forward in the design phase, and detailed discussions on their compatibility with the services and organizational structure will be carried out with stakeholders.

Financial aspects: Initial cost estimates for the implementation as well as a preliminary business plan containing details of expenditure and income will be put forward on the basis of need to show self-sustainability after not more than five years of operation.

Admission and graduation procedures: Admission rules for projects and tenants as well as rules for graduation of start-up companies, or, alternatively, project failures, will be developed in the design phase.

Criteria for success: Performance criteria will be set for judging the progress of LTI and the accomplishment of its mission, so that corrective action can be taken if necessary.

Awareness and marketing: Awareness and marketing campaigns will be launched to publicize LTI and its potential in an effort to attract as many innovative project applications as possible for incubation.

Review and acceptance of design elements: Once the design elements have been completed, they will be reviewed by stakeholders and modifications effected before work on the following phase is initiated.

Implementation will proceed in successive stages leading to a fully functional incubator, as shown in frame 39.

Frame 39. Implementation stages in the LTI project

It may prove necessary for a number of steps that properly belong to the implementation phase to be initiated during the latter part of the design phase. This is true of, for example, discussions concerning LTI's charter and the development of its legislative framework. Actions aimed at the identification and recruitment of senior officers for LTI may also begin during the final stages of the design process.

Adoption of LTI charter: LTI will have a charter, setting forth its objectives and organizational structure. The LTI charter will be drafted at an advanced stage in the design phase. The draft will be subjected to intensive discussion by stakeholders, and should be adopted prior to the beginning of the implementation phase.

LTI tenants and technology areas: LTI projects and tenants will be identified during the final stages of the design process, as will their various fields of technology and their specific needs and expectations.

Legislative framework: Since LTI is a novel experiment in Lebanon, all legislative aspects will need to be studied and new legislative instruments devised and issued. This stage will also overlap with the final stages of the design process.

Financial plan: A detailed financial plan will be prepared during this stage on the basis of the earlier business plan, including, *inter alia*, identification of the project's funding sources. This plan will specify the rights and responsibilities of tenants and will include other matters of relevance for the management of LTI financial.

Agreements for venture capital: NCSR and other organizations, acting on behalf of LTI, will sign agreements with venture capital and financial institutions in order to ensure that the incubation scheme will function effectively once in place.

Construction of LTI: The necessary buildings will be erected on the site on which LTI will operate. Alternatively, existing buildings suitable for LTI's use will be identified. Any necessary additions and innovations will be effected.

Selection of personnel: Qualified personnel will be selected through appropriate procedures, having regard to the highest professional standards. Initial steps in this process may be taken in the latter part of the design phase. This will be especially important in the case of senior officers.

Governing body: A governing body will be designated with specific responsibilities and operating procedures. One of the governing body's first tasks will be to approve plans and procedures for accepting and graduating tenants at LTI, and to adopt rules to be followed in monitoring LTI's performance.

Management team: LTI's management will consist of one general manager and three or four sub-managers for its institutional components. The LTI management team will be assisted by locally recruited secretarial and other administrative staff. These management and support teams will be kept to a bare minimum.

Accepting tenants: Project applications will be evaluated and future tenants selected on the basis of high selection standards and in accordance with the incubator's admission rules.

Networking: A network of financing agencies, technological institutions, R and D centres, universities and other incubators will be set up to provide support for the functioning of LTI.

Auditing LTI's performance: An independent body/institution will be entrusted with responsibility for auditing LTI's operations, reporting annually on its performance in accordance with approved plans and carrying out periodic evaluations with recommendations for improving its performance. Reports by this body will be submitted to the governing body. Reports by the LTI auditors will be supplemented by quarterly reports submitted by management to the governing body.

(c) *Risks involved*

Typical risks associated with the establishment of technology incubators are shown in frame 40. The LTI design team appears to be cognizant of these risks. Contingency plans will also be prepared, to allow for the possibility that one or more of these risks may develop into a serious threat to LTI's viability.

Community support for LTI should also be enlisted and fostered as a cushion against the possibility of difficulties and obstacles.

(d) *Possible role for ESCWA*

ESCWA has been approached for help in setting up LTI. ESCWA is in a position to contribute in various ways, the most important of which are stated below:

(a) Conduct of a feasibility study with a view to the preparation of a project document for the LTI project, specifying the services to be offered by the incubator;

(b) Advisory services on the detailed requirements and specifications for the site, buildings, personnel and equipment;

(c) Organization of a seminar on technology incubators in general, and LTI in particular, in order to raise awareness on the importance of the project, and at the same time call for the co-operation of all concerned Lebanese parties, including universities, banks, funds and so on;

(d) Formulation of a training programme for LTI's manager and staff and for entrepreneurs and project leaders;

(e) Monitoring of performance and evaluating the implementation of LTI at the end of each phase, offering recommendations for the next phase;

(f) Promotion of collaboration with other UN organizations and agencies, particularly UNIDO, ILO, and UNDP.

Frame 40. Typical risks associated with the establishment of incubators

1. Low occupancy rate (fewer than five tenants).
2. Incubator staff with very little or no experience in their respective areas.
3. Construction and utility problems, forcing management to spend more than 50 per cent of its time on those problems instead of on tenant business development.
4. Inadequate development of networks that provide tenants with added value.
5. Long time to break even in the life cycle of the incubator, mainly because of high running costs that are not covered by incubator income.
6. Insufficient financing for the first five years of incubator operations, usually due to an overoptimistic business plan.
7. Insufficient technical support from NCSR and managerial support from advisors.
8. Poor choice of projects leading to a high rate of failure for start-up companies.

C. TECHNOLOGY INITIATIVES IN KUWAIT

Kuwait, in its successive socioeconomic development plans, has addressed important objectives such as economic diversification, job creation and improvement of the national innovation system. There have been projects for technopoles and incubators designed to contribute to the realization of these objectives, but so far none has been implemented. In the following sections, two such projects are briefly described: Kuwait Technology Park and Kuwait Technology Incubator, both of which are being promoted by the Kuwait Institute of Scientific Research (KISR). The design of the incubator has been completed and adopted, but the technology park is still under study.

1. *Kuwait Technology Park*

Plans for a technopole in Kuwait date back more than 15 years, but the concept has never attracted the support it needs in order to become a reality. A project for a high-technology park, however, appears finally to have aroused the interest it deserves.

A steering committee has been formed by the Higher Planning Council to carry out a feasibility study for the creation of a high technology park in Kuwait.¹³ Following several meetings and a two-day seminar, the committee presented the Council with a detailed plan for the establishment of a high-technology park, and explained the urgent need for such an initiative in Kuwait. The committee urged the concerned authorities to expedite the establishment of the park, on the grounds that it would be likely to enhance the country's economic situation.

This technopole is intended to:

- (a) Constitute an important reservoir of highly trained Kuwaiti human resources in various fields of S and T;
- (b) Facilitate technology transfer to local industries from both international and national S and T sources;
- (c) Develop a culture with distinct entrepreneurial traditions;
- (d) Maintain a well-established R and D infrastructure serving SMEs whose businesses depend on high technology.

It will be essential, however, for various economic actors to become involved in this project, including chambers of commerce and industry, universities, R and D institutions and government agencies in charge of S and T. This could be done by creating a consortium of concerned institutions that will support the project and provide input to enhance the detailed study and lead to the successful establishment of the technopole.

Constraints and possible difficulties to be taken into consideration in designing and implementing the Kuwait Technology Park include the following:

- (a) At present there is only minimal co-ordination among institutions engaged in S and T;
- (b) The national S and T strategy is in the process of being developed and cannot yet provide the necessary direction;
- (c) R and D efforts are quite often irrelevant to the needs of national development plans;
- (d) The few existing mechanisms for translating R and D results into commercial products are inadequate as a result of the weak linkages between R and D institutions and potential beneficiaries;
- (e) Current S and T efforts span a wide range of areas, incommensurate with the available resources;
- (f) The high turnover of R and D personnel reduces the chances of localizing results and expertise;
- (g) The local science culture is relatively weak, and there is a language barrier.

2. *The Kuwait Technology Incubator*

The Kuwait Technology Incubator (KTI) project was initiated by the Kuwait Institute of Scientific Research (KISR) and the Kuwait Small Project Development Company (KSPDC) with a view to contributing to the realization of some of the objectives of national development plans, such as upgrading of the national system of innovation, diversification of the economy and creating jobs. ESCWA was requested

¹³ Salah Al-Mazidi, *Initiatives for science and technology parks in Kuwait*, a paper presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

to provide advisory services in the planning and design phases of this project, and several missions were carried out for that purpose.¹⁴

(a) *Objectives and services*

The main objectives of KTI are stated in frame 41, together with the primary areas of service initially targeted by KTI.

Frame 41. Objectives and primary services of the Kuwait Technology Incubator

Objectives:

1. Create value-added technology based businesses in Kuwait.
2. Facilitate commercial application of KISR technology by local start-up or small high-technology firms.
3. Foster partnerships between R and D, educational institutions and small high-technology businesses.
4. Encourage local community public and private business participation.
5. Create new high-income job opportunities for Kuwaitis.

Main services:

1. Helping clients identify and license KISR technologies for commercial application.
2. Providing a means of tapping technical and business-related resources at KISR and Kuwait University.
3. Providing access to small amounts of bridge funding to help clients over the “hard spots” that appear in the early stages of a new endeavour.
4. Offering a structured environment that will help entrepreneurs to maintain focus on their short- and long-term goals.
5. Helping with legal, accounting, financing, marketing and secretarial tasks, the development of business plans and the negotiation of strategic partnerships.
6. Providing partial funding for the start-up stage of product development.

Source: Mrayati and Bizri, *Establishing the Kuwait Technology Incubator (KTI)*.

(b) *Planning and implementation*

The KTI committee formed by KISR-KSPDC has been given responsibility for producing an operational work plan for the KTI project. Following approval by KISR and KSPDC, an agreement between the two parties will be signed, spelling out the specific commitments and tasks to be undertaken by both partners with a view to bringing KTI into actual existence and, eventually operational status.

It has been agreed, in principle, that KISR will provide the site and the building and give KTI tenants the opportunity of using its laboratories and equipment, while KSPDC will offer seed money. The site occupies an area of 7,200 square metres, and the building has approximately 620 square metres of floor space, but some renovation will be required.

A regular programme will be established at KTI under which emerging/start-up firms will be entitled not only to office space but also to business advice, access to business contacts and shared services. Tenants will pay a monthly fee for the space and the services. An affiliate programme will offer the same services, at cost, to Kuwaiti firms located outside the incubator.

¹⁴ M. Mrayati and O. Bizri, *Establishing the Kuwait Technology Incubator (KTI)*, Report on mission to KISR and KSPDC, 16-23 June 2000, ESCWA.

(c) *Admission and graduation*

The basic admission criteria for both the regular programme and the affiliate programmes are set forth in frame 42. The aim is to attract projects that will lead to marketable products and successful start-up firms with high growth prospects.

Frame 42. Admission Criteria

KTI will accept applications, accompanied by business plans, from persons or companies with:

1. An innovative, technology-based product idea or business concept: Acceptable priority areas include software, computers or peripherals, telecommunications equipment, Web-based and multimedia products, biotechnology, energy-related technology, fishing technologies, or any other technology-related products or ideas. KTI will not generally accept service-oriented business models, and prefers firm that possess or are developing some form of proprietary technology.
2. The beginnings of a sound management and/or product development team: KTI can help tenant firms build complete managerial teams, but a core group of dedicated and capable individuals is desirable.
3. Working capital: KTI generally accepts companies which possess sufficient capital, through personal or other seed funding avenues, to be in a position to proceed with the proposed business.
4. A product which is less than 18 months away from marketing: KTI's purpose is to assist commercial enterprises, not to conduct research and development.
5. A desire to leverage the services offered by KTI: KTI will co-operate with a group of professionals and a network of industry experts dedicated to the success of ventures admitted to the incubator. As such, KTI will accept only future tenants that possess a real need for the services provided by the incubator and demonstrable receptiveness to the input provided by KTI (i.e. KISR and KSPDC capabilities).

Source: Mrayati and Bizri, Establishing the Kuwait Technology Incubator (KTI).

There are, however, priorities in the matter of fields of technology and application that must be taken into consideration in the evaluation of proposals. These may change over time, but at present, some of the technologies that enjoy top priority are:

- (a) Biotechnology;
- (b) Petrochemical downstream industries;
- (c) Water treatment and desalination;
- (d) New materials (for packaging and construction);
- (e) Information technology;
- (f) Fishing industries;
- (g) Environmental industries (treatment of petroleum-contaminated soil, water and the like);
- (h) Cooling industries.

The selection process for tenants and virtual incubatees will follow several steps, beginning with an evaluation based on the application. For each applicant who has obtained a positive evaluation result, a meeting is held in which the applicant makes a presentation of the project to a panel of experts. This panel constitutes an Admissions Board and will make its recommendation based on the collected information, requesting a second detailed presentation if necessary. A final decision will be made by the KTI Board of Directors on the basis of this recommendation.

During their stay in the incubator, tenants will receive any assistance that the incubator is capable of providing, including opportunities to network with outside firms and venture capital institutions, exchange ideas and co-operate on projects through seminars, conferences and meetings. Periodic monitoring meetings will review, assess and discuss achievements or failures to date and recommend any changes to the previous plan relating to product development, marketing, sales or other aspects.

At the end of the originally agreed incubation period, which will normally be less than two years, the business plan and current financial documentation will be reviewed by the KTI manager and the Admissions Board. At that time, the Board will decide whether the start-up firm is able to graduate and leave the incubator, or whether it is eligible to apply for an extension, remaining in the incubator for an additional fixed period.

KTI's aim throughout this process will be to establish productive high-technology companies whose innovative ideas and products will help diversify the Kuwaiti economy and create jobs.

3. *Other Kuwaiti incubators*

Other incubators are currently being studied in Kuwait. In particular, KSPDC is negotiating with the Public Authority for Applied Education and Training (PAAET) for the establishment of a technology incubator designed to help graduates of technical training institutes set up their own businesses based on innovative technological ideas. Both the Ministry of Education and the Waqf General Secretariat will be participating in the project. A study on this incubator is awaiting approval by government authorities.

D. TECHNOLOGY INITIATIVES IN SAUDI ARABIA

1. *Background – previous achievements*

During the past three decades, the Kingdom of Saudi Arabia has pursued ambitious social and economic development programmes. These development programmes have included industrialization and agricultural development, expansion of services and improvements to infrastructure. Furthermore, strong science and technology capabilities have always been regarded as a necessity for the Kingdom.

The most important achievements have been the following:¹⁵

(a) Expansion of scientific and technical training, with nearly 5,000 S and T university graduates and 17,500 technical and vocational institutes in 1999;

(b) The Applied Research Grant Programme, introduced in 1978, which had provided 572 million Saudi riyals for 1,054 projects as of 1999;

(c) Establishment of R and D centres and institutes, funding for which amounted to 0.25 per cent of GDP in 1997;

(d) Industrial strategic sites establishment, with some industrial cities created for hydrocarbon-based and energy-intensive primary industries (notably Jubail and Yanbu);

(e) Transfer of state-of-the-art electronics and communications technologies, mainly through the Economic Offset Programme instituted in 1985, in order to broaden the Kingdom's economic base;

(f) Dissemination of information technology (the use of computers had spread to nearly 78 per cent of the country's industrial firms and 92 per cent of its service firms by 1998) and the introduction of Internet services, with a gradual expansion of those services to schools through the Abdullah Bin Abdulaziz School Net Project (initiated in 2000).

It is worth noting, however, that SMEs in Saudi Arabia need assistance in carrying out not only innovative work but also much-needed research and technological development (RTD). In order to bridge the gap between R and D units and SMEs, liaison offices have been created at King Abdulaziz City for

¹⁵ A.A. Al-Rasheed, *Initiatives for S and T Capacity-building in the Kingdom of Saudi Arabia: Past Experience and Future Development*, a paper presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

Science and Technology (KACST) and King Fahad University for Petroleum and Minerals (KFUPM), and a new research grant programme has been initiated.

Furthermore, a new Saudi *Foreign Investment Act* was adopted in 2000. The purpose of the Act is to encourage multinational corporations to invest in the country, thereby contributing to national development and helping to meet the new challenges of globalization.

2. *Obstacles to successful initiatives*

In spite of the above-mentioned noteworthy achievements, the Kingdom still faces obstacles in its efforts to create more successful national technology initiatives. The most important of these difficulties and obstacles are the following:

- (a) A comprehensive plan for science and technology development has not yet been prepared;
- (b) The country lacks bridging institutions that link scientific and technical knowledge producing institutions with industrial firms;
- (c) Institutional channels and networks for policy and planning organizations are not effective enough to communicate with the knowledge- and technology-generating agencies;
- (d) There is a shortage of human resources with advanced training in scientific and technical fields, particularly in research and development;
- (e) Investment in science and technology, especially in R and D, remains insufficient and is mostly provided by government;
- (f) There is little interaction between industry and public research agencies: private firms on the one hand and research centres together with universities on the other do not understand their respective roles, and consequently both are deprived of the benefits of mutual collaboration.

3. *National science and technology strategy*

One of the most important initiatives in S and T during the past few years has been the development of a national S and T strategy in order to support and sustain social and economic development programmes in the Kingdom. This strategy includes long-term goals and objectives for the period 2001-2020 as well as four executive five-year plans defining priorities and describing detailed programmes and projects. Each of the coming four successive 5-year plans (the seventh, eighth, ninth and tenth) will be associated with a counterpart of the national long-term, comprehensive S and T plan for the period 2001-2020.

KACST, in collaboration with the Ministry of Planning, concerned public and private sector institutions and expert input from ESCWA, has prepared this strategy, which was adopted by the government in the first quarter of 2001.

The plan accommodates the diversity of scientific and technological fields and recognizes the complex relationships between those fields and their influence on economic sectors. It attempts to strike a balance between indigenous R and D and imported technologies, taking into account local capabilities for technology transfer and adaptation.

The plan has been designed in a flexible way to reflect the progress of social and economic development programmes and to meet changes that may arise from technological innovation, reorientation of goals, modification of priorities, and alterations to the scope or scheduling of various programmes. The plan is also based on reasonable expectations and realistic implementation schedules.

As a comprehensive plan, it encompasses broad missions, including heightening public awareness of the importance of and need for S and T, human resource development, expansion of R and D capabilities,

and acquisition/adaptation of technology. The objectives and priorities of the plan have been aligned with national objectives and priorities, while the various processes have been designed and organized in accordance with the requirements of the National Development Plan.

Among the new technologies, information technology (IT) has been given highest priority by the government. The Ministry of Planning has developed long-term planning (2000-2020) in co-operation with ESCWA, while focusing on IT training and education.

4. *Incubators in Saudi Arabia*

KACST intends to create, in collaboration with ESCWA, a S and T incubator in order to build a bridge to industry and transform ideas resulting from R and D into products. KFUPM has also taken the lead in establishing a business incubator aimed at improving and standardizing products and services in the industrial and business sectors.

Private firms have plans to establish incubators in the main cities, including one in Riyadh for ICT start-ups, a second in Dhahran, focusing on petrochemicals, and a third in Jeddah, to be oriented toward environment and desalination.¹⁶

E. TECHNOLOGY INITIATIVES IN JORDAN

The global trends towards globalization and a knowledge-based economy have led Jordan to modernize its telecommunications infrastructure, introduce the Internet (in 1995) and develop its ICT capacities by facilitating the acquisition of IT equipment (hardware and software) and enhancing training for the labour force. Jordan's main S and T capacity-building initiatives are currently in the ICT sector, and are presented in the following sections.

1. *National Information System*

(a) *Aims and objectives*

The NIS initiative¹⁷ was launched in 1996 with the aim of promoting socioeconomic development through enhanced managerial and organizational effectiveness. Its main objectives were to:

- (a) Establish a distributed system linking information collecting and generating centres in the public and private sectors;
- (b) Co-ordinate the activities of those centres through national networks;
- (c) Ensure the flow of information to users in the public and private sectors.

(b) *Design and implementation*

The National Information Centre (NIC) of Jordan¹⁸ was asked to establish and manage NIS. To that end, it identified the various information sectors, grouped information sources within each sector into a cluster (with one source acting as focal point for the sector), and organized the sectoral sub-networks composing the system by setting up unified procedures and standards. Detailed information remained at the source, while aggregate information was kept at the focal points. The NIS concept was thus based on a totally decentralized approach, with Internet technologies being used to facilitate public interaction.

¹⁶ Information obtained from Dr. Abdulrahman Mazi, a businessman and influential member of the Riyadh Chamber of Commerce and Industry who believes that incubators and other capacity-building initiatives are a must for Saudi Arabia if the country is to its share of the global economy.

¹⁷ <http://www.nic.gov.jo/nis2.html>.

¹⁸ <http://www.nic.gov.jo/>.

NIC conducted 12 studies to identify national needs in the information sector and set up 22 national committees for technical and co-ordination purposes. A national network was also built linking 113 institutions, mainly from the public sector, including all public universities, with the ability to access any published information and to transfer data when and where necessary. This network provides access to NIS's comprehensive information base, and over 10,000 hits are registered each month.

NIS went on line in 1996. Beginning on a modest scale, it has since grown to include a considerable number of institutions in the various sectors. Sixteen sectoral networks have been established in the fields of agriculture, communications, culture, economy, education, health, industry, labour, legislation, environment, political affairs, society and social conditions, transportation, population and human settlements, science and technology, and finally tourism and antiquities.

Forty-six training courses have been organized in various areas of information management and ICTs as part of a plan designed to meet the needs of national establishments. They were conducted by NIC in collaboration with some local institutions. Also, twenty-five workshops and seminars have been conducted in various fields in an effort to promote understanding and enhance co-operation among national institutions, while ensuring good implementation of unified procedures and standards as prepared by NIC. These guidelines and procedures for technical standards have been drafted by the NIC technical committee, which was established to facilitate unified best practices in various fields of information management and ICTs.

Once the project has been finalized and NIS fully established, decision makers and the public at large will be able to access comprehensive information within each socioeconomic sector or subject matter. Sectoral portals will also be established to facilitate access. The human factor remains critical for the success of this project, since well-trained ICT experts are needed, to say nothing of a fully aware public capable of using this national resource.

2. The Hashemite University Industrial and Technology Park

An industry and technology park is being established by the Hashemite University on its campus in collaboration with Hillwood Jordan, a subsidiary of the U.S. Hillwood Development Company. A memorandum of understanding has been signed between the two partners, stipulating that Hillwood Jordan will build a state-of-the-art park, bring in its expertise in development, marketing, management and operation as well as sales, logistics and leasing services.¹⁹

The memorandum also stipulates that the university will receive 4.5 million Jordanian dinars at the outset and a 13 per cent share in a joint firm to be established for developing and managing the park. The developer is required to complete the infrastructure and prepare the groundwork and facilities for clients by the end of 2001.

This multi-million dollar project is expected to generate thousands of job opportunities and attract capital venture investments to Jordan. Students and faculty at the Hashemite University should enjoy research opportunities resulting from the establishment of important firms in the park. Moreover, in-park training will be provided by teaching staff of the university.

3. CyberCity - an information technology park

CyberCity will be established by a consortium of international investors led by the Boscan Jordan Group in co-operation with the Jordan University for Science and Technology (JUST). It is designed as a technology park specializing in IT and located within a duty free zone. It will occupy an area of approximately 4.5 square kilometres located north of Amman, in close proximity to Amman's international airport, not far from the Syrian Arab Republic and Iraq and affording convenient access to Saudi Arabia. Its

¹⁹ M.W. Masri, *Initiatives for Science and Technology Capacity-building in Jordan*, a paper presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

aim is to promote ICT industries in Jordan and the region while also serving as a catalyst for co-operation between Jordanian academic institutions and the international business community.²⁰

CyberCity will have world-class infrastructure, including high-speed telecommunications, a complete network of utilities and access to a major transportation network, all implemented through international expertise. Technology incubators, commercial facilities, medical services, customs clearance bureaus and leisure and living facilities will all be available at the site.

Various incentives are offered to CyberCity investors and tenants, including tax incentives and duty-free exports to United States markets. Jordan's highly qualified workforce and competitive labour costs, the expertise available close by at JUST, and access to foreign markets should encourage international companies to establish operations in CyberCity.

4. *The E-Government initiative in Jordan*

The e-government initiative is one of an array of transformations that are aimed at moving Jordan toward the knowledge-based economy. The streamlining of government institutions will improve public services and government agency performance, thereby achieving greater social and economic efficiency. Within government agencies, staff will have a clearer understanding of procedures and responsibilities with on-line access to essential databases. E-government is also expected to enhance the efficiency of businesses, and hence reduce costs, by facilitating information acquisition and accelerating administrative procedures. A single business portal will offer all transactions and services required by industrial and commercial firms. Citizens will be able to save time, since all information needed for dealing with government institutions will be available to them in their homes.

In the interests of quick action, a task force has been formed to develop an e-government strategy for Jordan. It includes leading experts from the public and private sectors, with technical assistance provided by an international consulting team.

The e-government task force is focusing on four major areas of activity:²¹

(a) Government-to-Business (G2B) – covering a broad range of transactions and interactions including procurement, taxation, licensing and so on;

(b) Government-to-Citizen (G2C) – spanning the “birth to death” range of citizen services including civil registration, health, education and municipal services;

(c) Government-to-Government (G2G) – encompassing a variety of intragovernmental transactions such as inter-agency payments and permits;

(d) Creation of the legal, institutional, infrastructural and management frameworks needed for attainment of the strategic goal of e-government.

5. *The REACH Initiative*

The REACH initiative has been launched by the Jordanian Computer Society with the aim of developing the ICT sector in Jordan. Its purpose is to provide a national ICT strategy based on private sector leadership and partnership with the government.²² The main objectives of this initiative are to:

(a) Develop an internationally competitive ICT industry focused on software;

²⁰ Ibid.

²¹ Y. Nusseir, *ICT Initiatives in Jordan—Needs and Aspirations*, National Information Centre Report (Amman: National Information Centre, December 2000).

²² Ibid.

- (b) Attract foreign and local investment (about US\$ 150 million);
- (c) Generate high-value jobs (30,000 jobs by 2004);
- (d) Substantially increase ICT exports (US\$ 550 million by 2004);
- (e) Facilitate modernization of the public and private sectors;
- (f) Position Jordan favourably within the knowledge-based economy of the twenty-first century.

Six strategic areas have been selected with a view to attaining these goals and implementing sustainable interrelated action plans. These areas are:

- (a) IT industry development;
- (b) Policy and regulatory strengthening;
- (c) Human resource development;
- (d) Government co-operation and support;
- (e) Capital and financing;
- (f) Infrastructure improvement, especially in the telecommunications field.

Various workshops have been organized in the context of the REACH initiative, with the result that clearly defined recommendations have been formulated and a follow-up mechanism established.

6. Empowering rural communities with ICT²³

(a) Rationale

Substandard services are a feature of the southern and eastern parts of the country, which are thinly populated, with widely dispersed settlements. In particular, communication service standards are low, and consequently access to information and knowledge is more difficult than it is in urban areas. To narrow this gap, the National Information Centre (NIC) has taken the necessary steps to extend accessibility to the National Information System to these areas, thereby making access to information equally convenient in all parts of the country.

In rural areas and remote villages, ICT awareness and the availability of the Internet can enhance self-development and prosperity for individuals and communities, and enable them to take their first steps toward the knowledge-based economy. Another result will be a narrowing of the digital divide between the IT-deprived population and urban ICT users in Jordan.

Access to information will usher rural areas, which at present are information-deprived, into an accelerated developmental process. As an example, accessing NIS, which contains useful information about Jordan, will stimulate people and contribute to the formation of a democratic society in which all citizens are aware of local developments and global trends. Further into the future, it will facilitate access to governmental information and consequently simplify e-government processes.

(b) Project objectives

This initiative is aimed at the introduction of ICTs to various communities in Jordan, especially rural communities, in a bid to bridge the digital divide and enhance the development and prosperity of these communities in the information age. This will be accomplished through the establishment of IT community centres in every town and village, so that tools for accessing, locating and acquiring knowledge will be available everywhere in the country. In this context, access to the National Information System (NIS) and its vast reservoir of public information will be facilitated. Networking among communities will also become possible, facilitating exchanges of local information.

²³ Ibid.

(c) *Implementation*

Workshops will be organized to supplement awareness through printed brochures. Mass media material will be written with the help of local people as a means of sustaining development. Community centres will be established in one community at a time until all twelve Governorates have been served. Ideally, nearly 1,000 ICT centres are needed to facilitate training and e-supervision in local communities. Twelve centres are planned for the twelve Governorates, while four are currently functional. Funding remains the main obstacle facing this initiative.

F. TECHNOLOGY INITIATIVES IN OMAN

1. *Introduction*

Official statements by senior decision makers have shown Oman's determination to become part of the global knowledge-based economy. Oman has applied for and been granted membership of the World Trade Organization (WTO). Oman also appears to be intent on playing a regional role, partly in response to its strategic location at the crossroads of trade routes between the Far East, Africa, the Middle East, Central Asia and Europe and its position as a sea-road transport hub and an international industrial centre. Plans for the development and expansion of national port facilities are being prepared with an eye to these prospects.

There have been a number of official statements indicating that the government intends to emphasize the role of the private sector in national development. However, existing private sector enterprises are mainly "low-tech" concerns with limited access to and little need for high-tech inputs. On the other hand, public sector development efforts to date have focused on areas that relate to the country's natural resource endowment.

The need to diversify the economy, with emphasis on high-tech inputs, appears to be widely recognized. Moves to reform Oman's investment laws have been initiated with a view to making the country more attractive to foreign investors.

The need for national S and T policies in general, and for a policy on ICTs in particular, have recently been recognized. The main features of the sixth Omani Development plan (2001-2005), which has now been adopted, include:

- (a) Formulation of a national S and T policy;
- (b) Capacity-building in R and D;
- (c) Development of the necessary structural forms for capacity building in S and T, such as technopoles and technology incubators.

Moves aimed at the formulation of a comprehensive national S and T policy are being initiated by Oman's Ministry of the National Economy. The Ministry has recently created two committees, one with the mandate of formulating an R and D strategy for the country, and a second whose task is to set up a national IT policy and related strategies for the country.

2. *Oman's national IT policy initiative*

The Committee on IT policy and strategies is headed by the Minister of the National Economy in person, and has established²⁴ a technical team that has since been entrusted with responsibility for producing a draft national IT policy. The technical team is made up of twelve members representing the public-sector concerns listed below:

²⁴ This committee held its first meeting on 15 November 1999. The decision to set up a technical team was taken by the committee on that occasion.

- (a) Ministry of Finance;
- (b) Ministry of the National Economy;
- (c) Central Bank of Oman;
- (d) Royal Oman Police;
- (e) Internal Security Services;
- (f) Sultan Qaboos University;
- (g) Ministry of Defense;
- (h) The Royal Court;
- (i) Municipality of Muscat.

The absence of chambers of trade and commerce or other private-sector institutions is noticeable. Furthermore, it would be desirable for the Ministry of Education and Social Development to be involved as well. A technical secretariat has also been set up to provide backstopping support for this initiative.

The terms of reference for the team include the following elements:²⁵

- (a) Preparing a draft national IT policy and relevant implementation strategies and procedures;
- (b) Supervising efforts aimed at determination of the national IT status and plans aimed at IT improvements in terms of programmes, institutional structures and networks;
- (c) Recommending the establishment of working groups to be entrusted with responsibility for conducting specific studies required for the purposes of the national IT policy and formulating terms of reference and timetables for their work;
- (d) Putting forward draft decrees and instructions for co-ordinating these activities and setting up criteria for assessing the country's IT status and judging progress in future development efforts;
- (e) Assisting in the co-ordination of national IT development efforts undertaken by the country's ministries and government departments;
- (f) Formulating proposals for:
 - (i) National IT development projects, including a governmental IT network;
 - (ii) Training programmes.

The technical team has finalized a detailed report and submitted it to the national IT Committee. Future efforts are to be based on feedback from the Committee concerning the next phase of activities. Points addressed by the technical team in their first detailed report are shown in frame 43 below.

Frame 43. Framework for Oman's IT policy and related strategy

Vision: Oman's IT policy will seek to promote the transformation of the Sultanate and usher it into the era of the knowledge economy in the interests of comprehensive, sustainable national development. With this in mind, it is essential to implement IT and related scientific developments to the fullest possible extent in providing IT services to the public and private sectors.

Framework for action: An overall framework has been set up, with provision for reviewing both the initial vision and discrete elements in the framework on an annual basis. The main elements in this framework are:

1. Achieving national "electronic information connectivity" and access by Oman's inhabitants to the "electronic highway" by the year 2005.
2. Creating an environment that is conducive to e-commerce activities.
3. Providing e-government services.

²⁵ Ministerial decree No. 11/2000, issued in April 2000 on the basis of a decision by the Council of Ministers dated June 1998.

Frame 43 (continued)

4. Setting up plans and training programmes for human resource development in IT.
5. Promoting awareness of the importance of IT in the national and global economies and in supporting decision-making and simplifying procedures and knowledge transfer.
6. Creating communication channels and means for co-operation and co-ordination, both formal and informal, between governmental and academic institutions and private IT enterprises.
7. Organizing activities aimed at setting up national databases in areas such as vital statistics, human resources, the national work force and geographic information.
8. Adopting appropriate security measures in dealing with IT networks.
9. Facilitating the exchange of information and eliminating duplication in governmental data bases.
10. Reducing the cost of acquiring software and network licences through collective negotiation and purchasing.
11. Formulating national policies aimed at the promotion of IT industries in Oman and the export of IT products.

The technical team's accomplishments to date include:

- (a) Laying down a general framework for Oman's IT strategy;
- (b) Setting up six working groups (see frame 44) and identifying short-term goals for the activities of those groups, including terms of reference for the studies to be conducted by each working group;
- (c) Initiating co-ordination activity with the relevant government departments, including the Ministry of Trade and Industry and the Ministry of Social Affairs, Labour and Vocational Training.

It is also noteworthy that the technical team set up by Oman's National IT Committee is negotiating with major United States software companies, principally Oracle and Microsoft, with a view to acquiring collective licences for the use of their products.

Frame 44. Working Groups set up by Oman's Technical IT Team and their Tasks

Six working groups have been set up by Oman's technical IT team to deal with:

1. National networks.
2. Harmonization of concepts, terms and criteria and establishing a common basis for integrated IT development.
3. IT applications.
4. IT promotion and human resource development.
5. IT security.
6. IT software and "package" licences.

These working groups have been entrusted with responsibility for a broad range of tasks calling for focused efforts on numerous fronts, including:

- (a) Rationalizing technology transfer and dissemination;
- (b) Formulating specific IT application strategies;
- (c) Proposing appropriate institutional and legislative changes;
- (d) Laying down bases for monitoring IT capability-building;
- (e) Promoting IT awareness and human resource development.

The technical IT team has also identified a number of obstacles to the further development of IT capabilities in Oman, and has recommended specific actions aimed at improving the situation. The main difficulties include:

- (a) Absence of a comprehensive IT strategy for Oman, coupled to limited awareness of the dangers associated with lagging behind in building IT capability;
- (b) Weakness of IT infrastructural arrangements;
- (c) Meagre supply of qualified human resources;
- (d) Absence of bases for an IT industry in Oman.

The technical IT team has benefited from the results of efforts made in 1999 to tackle the year 2000 problem. This appears to have provided the team with a useful information base concerning the status of computer equipment and computer networks.

ESCWA provided some initial input for the work of this committee, mainly concerning operational methodology and areas of activity. ESCWA will probably be asked to provide further input as the process of formulating Oman's IT policy proceeds.

3. Capacity-building initiatives and economic diversification in manufacturing industries

Initiatives aimed at economic diversification have been undertaken by a number of Gulf countries. Industrial estates have been set up, often with generous government support. This approach has been successful in many cases, particularly in terms of import substitution and the creation of capabilities in more or less traditional processing technologies in a wide variety of areas. Capabilities in more advanced technologies appear to have remained enclosed within the confines of a limited number of offset projects, such as those undertaken by the Kingdom of Saudi Arabia.

However, manufacturing facilities set up expressly with a view to economic diversification have lacked organic links to national science and technology institutions, and this has tended to limit their ability to innovate. More fundamentally, intrinsic weaknesses in science and technology institutions and a general tendency to rely on mature processing technologies from external sources have been features of diversification efforts in the manufacturing sector. The extent of capacity-building in new technologies as a result of the drive toward diversification in this sector remains to be quantified through in-depth research, but there is reason to suspect that the above trends²⁶ are observable, not only in the case of small and medium enterprises, but even in the case of larger industrial complexes.

Oman's efforts in this connection are outlined in the following paragraphs.

4. Industrial estates in Oman

Oman has established a number of industrial estates, which are currently being run by the Public Establishment for Industrial Estates (PEIE). The PEIE mission statement includes the following elements:

- (a) Setting up industrial estates, in accordance with national development plans;
- (b) Leasing industrial plots and prefabricated buildings to investors and providing related services;
- (c) Issuing building permits to industrial enterprises set up on the estates;
- (d) Providing and developing public services and utilities, including water, electricity, gas, telecommunications, sewerage and the like in co-ordination with other government authorities;
- (e) Contributing to the promotion of goods produced on the estates through exhibitions and media campaigns;
- (f) Organizing training courses and seminars with a view to promoting awareness and know-how.

²⁶ I.e., reliance on external sources for mature technologies and poor links to national science and technology institutions.

PEIE provides industrial investors with infrastructure facilities, with a view to the ultimate establishment of a national industrial base. PEE receives no support from central government. At present it is self-sustaining, especially as regards administrative and maintenance services.

PEIE oversees five industrial estates, one in each of Oman's five Governorates (Rusayl, Suhar, Raysut, Nazwa and Buraimi). Other industrial estates are being set up in Sur and Mazunah. The first of them, at Rusayl, was set up in 1985; the others followed in 1992, 1994 and 1998. The total area of these estates is approximately 55 million square metres; the largest of them, in Sour, has some 40 million square metres allocated for industrial development. Table 13 gives some typical figures for the estate rental, basic utility and service charges levied by PEIE. The fact that tenants are being charged minimal rates is apparent.

TABLE 13. COST OF RENTAL AND SELECTED SERVICES/UTILITIES PROVIDED TO PEIE TENANTS

Item	Unit	Approximate cost of rentals and services/utilities (in US\$)
Industrial estate rental	Square metre per annum	0.65
Electricity	Kilowatt/hour	0.03 – 0.06*
Water	Gallon	0.008
Gas	Cubic metre	0.05
Permit issuance		26
Site plan		1.95
Insurance		13

* Depending on the season.

The industries hosted by the Establishment are of various kinds, and individual estates do not concentrate on specific areas of specialization. High technology is not a priority for the PEIE estates, although at least one of them is home to relatively advanced manufacturing facilities, including an optical fibre manufacturing plant.²⁷ In general, however, most production facilities established in the PEIE estates operate using technologies that are freely available on the market, with the sources of those technologies ranging from the United States to Europe and India. Patents and licensing arrangements apply to only a small percentage of them.

The idea of establishing an applied research facility was considered at one stage, but was soon dropped. Steps have also been taken to set up a training institute for staff employed by the estates' tenants.

5. Science Park Initiative at Sultan Qaboos University

The fifteen-year old Sultan Qaboos University (SQU) is the nation's principal academic institution. It comprises seven faculties: medicine, science, engineering, arts, commerce and economy, agriculture and education. In the fall of 2000, it had approximately 2050 undergraduate students. SQU offers postgraduate diplomas in computing and information systems, school management, education and accounting. It also offers Master's programmes in a number of disciplines, including science, engineering, agriculture, medicine, commerce and economy, and arts. In the fall of 2000, there were nearly 900 graduate students.

Conversations with decision-makers at the University reveals a keen awareness of national development needs, in addition to an academic institution's usual interest in human resource development.

As a result of recent restructuring, the University now has a Vice-Chancellor who was directly engaged in technological capacity building efforts in Ireland during the 1980s and 1990s. A special post of Director of Innovation Services has also been created to deal with industry, including in particular the development of science and technology parks.

²⁷ In association with Nokia.

University staff members appear to be engaged in current efforts aimed at national capacity-building in R and D and technology development. International funding of around US\$ 2.5 million is being made available for R and D activities at the University. In particular, the University is currently planning to set up a national science park. Its approach to this project has featured a focus on infrastructure building and a series of gradual steps toward its final objective, rather than a direct attempt to establish the necessary institutional frameworks. The argument put forward in favour of this approach is based on the need to identify actual national needs and optimal means of meeting them, while at the same time:

- (a) Further developing national university education;
- (b) Putting infrastructural elements in place;
- (c) Developing human resource skills;
- (d) Establishing regional and international links.

With these objectives in mind, SQU has applied to become a partner in the Sesame project, i.e. one of the users of a regional synchrotron radiation facility donated by Germany for scientific research in the Middle East region which is to be situated in Jordan. Its proposal to join the facility was given a third-place ranking by the project's directors, ahead of a number of countries with more highly developed scientific and technological capabilities, such as Egypt and Turkey. SQU hopes that joining its participation in this project will give it access to crucial instrumentation needed for research in a variety of frontier areas, such as genetics, new materials, semiconductors and environmental studies.

With respect to specific technology initiatives, the following key concepts underlie SQU's thinking:

- (a) It is essential for technology initiatives to be based on solid infrastructures, as otherwise they will be at risk of catastrophic failure after having swallowed up vast amounts of resources;
- (b) Business-related technology initiatives should be at least partly home-grown, as otherwise Oman would merely be hosting foreign enterprises; in other words, the artificial establishment of high-tech facilities would not be particularly useful for sustained socioeconomic development;
- (c) It is important to draw a clear distinction between frameworks for different technology initiatives, taking into account the prevailing investment climates in ESCWA member countries;
- (d) Initiatives aimed at specific sectors and technology areas stand a better chance of success than general all-purpose initiatives.

6. R and D at SQU

The research and development activity conducted at the University is problem-oriented and aims at tackling real-life issues in addition to enriching teaching activity. There is a tendency to regard students as entrepreneurs of the future. New lines of research are sometimes initiated in co-operation with major international firms, and the University tries to extract as much benefit as possible from such co-operation. As an example, Shell donated a virtual reality laboratory designed for the study of geological formations and the interpretation of oil field seismic and other physiochemical data. The University is seeking to utilize these facilities in studies on medical imaging for diagnostic applications in co-operation with developed-country laboratories. Once a viable infrastructure is set up, it will be feasible for relevant R and D to be done in Oman at lower cost than in Europe or the United States.

Linking capacity-building in science and technology to urgent national needs is an issue of common sense as well as socioeconomic and political considerations. Nowhere is this link more evident than in the area of water desalination²⁸ in the Gulf countries. Initiatives aimed at building scientific and technological capabilities in this area are under way in a number of those countries.

²⁸ This subject will be taken up in a study that is to be conducted by the Technology Section at ESCWA during 2001.

G. TECHNOLOGY INITIATIVES IN PALESTINE

1. Background

In reconstructing the Palestinian territories after a prolonged occupation, the Palestinian Authority has had to address basic problems such as job creation, poverty alleviation, rural development, infrastructure building and rehabilitation as well as education, health and social services. These sectors have been given top priority in Palestinian Development Plans (PDPs), to the exclusion of S and T, which is considered a luxury by some donor countries. The Palestinian Authority recognizes, however, that S and T is essential if Palestine is to move toward a knowledge-based economy. Accordingly, a Science and Technology Planning Unit (STPU) has been established in the Ministry of Planning to act as a focal point for development, planning and policy formulation in science and technology in the public sector. STPU's objectives are shown in frame 45.

Frame 45. Objectives of the S and T Planning Unit

The objectives of STPU are to:

1. contribute to the formulation of macro and micro national science and technology policies and strategies.
2. catalyse technology transfer into Palestine through various foreign aid programmes.
3. promote co-operation between local actors in the science and technology sector and their international counterparts.
4. facilitate the integration of Palestinian scientists and technologists abroad in various national science and technology programmes.
5. promote the integration of science and technology programmes within the Palestine Development Plan as a means of facilitating the necessary fund-raising for these programmes.
6. conduct a periodic research assessment exercise.

Source: M.M. Awartani, *Science and Technology Initiatives– the Case of Palestine*, a paper presented at the Expert Group Meeting on Capacity-Building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

Informal discussions among interested institutions for the organization of S and T in the Palestinian Territories have led to the emergence of a set of principles for a Palestinian S and T system, which have been adopted by some of the institutions in question. These principles are set forth in frame 46.

Frame 46. Principles governing the organization of S and T in the Palestinian Territories

1. The system should be intrinsically developmental and structurally responsive to national and sectoral development plans and strategies.
2. The Palestinian economy should be transformed to become a knowledge-based economy, and hence the system should place heavy emphasis on human resource development and the production of a critical mass of highly trained people in priority areas.
3. The system should enjoy political and government support at the highest level, but should not be government-controlled, although government is expected to play a significant policy, regulatory and co-ordinating role.
4. The system should capitalize on existing independent science and technology initiatives. It must work towards streamlining and synthesizing these scattered efforts with the purpose of achieving the much-needed critical mass and conforming to the priorities and plans of the national science and technology policy.
5. Palestinian universities, which played such a historic nationalistic, developmental educational and scientific role under the difficult years of occupation, should receive the support they need in order to develop and vitalize their research capabilities and research infrastructure, since they constitute viable research implementation agencies. In other words, both government and private sector should tap the research facilities and capabilities of academic institutions through an array of mutually beneficial partnerships.

Frame 46 (continued)

6. The system should make every effort to capitalize on the vast scientific and technological capabilities of Palestinian expatriates that can be instrumental in facilitating and speeding up the transfer of know how and technology.
7. Information and communication technology (ICT) should be one of the major priority areas of the system, owing to various political, economic and social considerations, and should play a central role in the development of a knowledge-based Palestinian economy.

Source: Awartani, Science and Technology Initiatives – the Case of Palestine.

Owing to the embryonic nature of Palestinian national science and technology institutions, national science and technology policies and strategies have not yet been formulated. However, some ministries have launched S and T capacity-building initiatives, as will be seen in the following sections.

2. National Scientific Research Policy Initiative

The Ministry of Higher Education's approach to policy formulation draws on the experiences of other countries, especially South Africa. Expert teams and interest groups from government, academia, civil society and the private sector have prepared a Green Paper on Science and Technology to provide a basis for extensive public debate on the main issues involved. Subjects discussed in the paper include organizational development of the Palestinian S and T system, funding schemes, research priorities, ways of applying research, legal frameworks, collaborative schemes and partnerships.

A Steering Committee headed by the Minister of Higher Education has been set up to formulate a national policy for scientific research and to guide the expert teams involved in preparing the Green Paper and provide co-ordination with other stakeholders.

Feedback on the Green Paper will constitute vital input towards the articulation of a White Paper on S and T, to be submitted to appropriate governmental and academic bodies for ratification. Once ratified, it will constitute the basis of a national policy on science and technology.

3. UNESCO Biotechnology Educational and Training Centre

In 1995, the UNESCO Biotechnology Educational and Training Centre (UNESCO BETCEN) was established by the UNESCO Biotechnology Action Council (BAC) at Bethlehem University. It aims at promoting the development of research in plant molecular biology and agricultural biotechnology in the Palestinian community and Arab countries in the area.

Three kinds of activities are planned in pursuit of these goals:

(a) First, organizing intensive lecture programmes, workshops and courses in various fields of plant biotechnology;

(b) Second, training of young Palestinian and Arab scientists in modern research techniques in plant biotechnology and agricultural biotechnology in the BETCEN laboratory at the University of Bethlehem and in the laboratories of other research institutes in the area;

(c) Third, conducting large-scale research projects in molecular biology, plant pathology, and biological control of agricultural pests.

Furthermore, BETCEN organizes intensive lecture programmes, courses and workshops in various fields of plant biotechnology with the aim of increasing the academic community's awareness of the great potential of biotechnology for developing a modern agriculture and an improved environment.

4. *University Information Technology Centres of Excellence*

Government, universities, international agencies, donor institutions and private sector firms have launched initiatives aimed at the development of the Palestinian ICT sector. As a result, there is already an enabling environment for the growth of that sector, and other factors are also contributing to its development, such as privatization of telecommunications, an adequate data communication system, an increase in computer and internet use and support and enthusiasm at the political level.

In particular, two distinct initiatives are being launched for establishing IT centres of excellence at Palestinian universities. These are regarded as vehicles for national capacity-building and human resource development in the ICT sector. Palestinian expatriates, businesses, non-governmental and international organizations, among others, are contributing to the establishment of these centres. The tasks they perform and the services they provide are listed in frame 47.

Frame 47. Tasks and services provided by university IT centres of excellence

The following tasks and services constitute the main objectives of the IT centres of excellence that are being established at various universities in Palestine:

- (a) Advanced education and training of high-quality IT graduates;
- (b) Intensive retraining for high-quality graduates in non-IT disciplines;
- (c) Provision of short-course programmes in specialized and focused areas;
- (d) Development of university faculty;
- (e) Training of trainers;
- (f) Consulting services;
- (g) Transfer of technologies and capabilities;
- (h) Research and development for local IT firms and universities;
- (i) Contributing to local and international IT initiatives;
- (j) University-industry collaborative links;
- (k) Promoting best practice techniques and fostering intellectual property rights;
- (l) Liaison with similar centres in the region and worldwide.

Source: Awartani, *Science and Technology Initiatives – the Case of Palestine*.

However, the sustainability of these centres will depend on their ability to generate income through their services to both local and international firms and stakeholders.

H. TECHNOLOGY INITIATIVES IN THE SYRIAN ARAB REPUBLIC

The Syrian government has been showing increased interest in S and T during the past few years. Although no official policy documents on the subject have been produced as yet, there have been various hints indicating that S and T is gaining importance and that initiatives are likely to be forthcoming. In addition, decision-making in the matter of S and T institutions has begun to be liberalized: one of the first decrees issued by the country's new leadership transferred decisions about university curricula from the Presidency to the Ministry of Higher Education.

1. *Policy initiatives*

For the first time in the Syrian Arab Republic, the government formed in March 2000 included a Minister of State for Technology Transfer and Development. A Minister of State for Administrative and Human Resource Development was also appointed with the aim of increasing productivity in public administration through continuing employee training and the introduction of IT tools for administrative and management tasks.

In its first declaration of policies and plans, moreover, the government emphasized that scientific and technological development, particularly information technology diffusion, was a major requirement for administrative reform and progress in the various sectors of the Syrian economy.

There have also been indications that the Ministry of Planning intends to issue a national strategy for S and T with a view to giving priority to fields of high technology deemed likely to enhance the country's economic and social conditions and developing a national innovation system. Harnessing S and T education and R and D for socioeconomic development is becoming a national priority. This may be expected to lead to more numerous and diverse research centres and other institutional forms for technology transfer in the Syrian Arab Republic, in accordance with the requirements of economic development needs and plans.

2. IT dissemination initiatives

In 1996, the Ministry of Education (MoE) joined forces with the Syrian Computer Society (SCS), a non-governmental association of IT professionals, to launch an initiative aimed at raising ICT awareness by training ordinary people in the use of PCs and basic software tools, and subsequently introducing them to more advanced aspects of ICTs such as networking, specialized software packages and the Internet. This initiative, known as the National Programme for IT Dissemination, is designed to reduce computer illiteracy among the general population and to make IT in general, and the use of PCs, software tools and the Internet in particular, more familiar throughout the country.

Computer laboratories in the secondary schools of most Syrian cities are open to the public in the evening for introductory courses in the use of PCs and basic application software. A token fee of two dollars is charged, while SCS and MoE jointly pay the cost of trainers' salaries out of their own budgets. This programme reaches all strata of society, from housewives to ordinary workers and from young children to the elderly. Over 175,000 people took the courses during the first three years, and the programme is still going strong. There are currently about 118 basic training centres, 32 self-training centres and 43 advanced training centres distributed throughout all fourteen Syrian Governorates.

The Syrian Arab Republic's four universities are also carrying out a similar programme for university personnel. Again, the basic idea behind the programme is to make use of the computer laboratories in all four (public) Syrian universities after regular class hours in order to diffuse IT knowledge among university staff members, including both professors and administrators.

3. Creation of information technology institutes and faculties in Syrian universities

IT education as a separate discipline was, until recently, restricted to two institutions: the Higher Institute of Applied Sciences and Technology (HIAST), a high-technology university, and the University of Damascus Computer Engineering Intermediate Institute (CEII), which produces programmers and computer technicians. Three new CEIIs were opened in 1999 and 2000 at the other three universities, each with a maximum intake of 100 students per year.

As part of the government's strategy to promote IT, an Informatics Department was established in 1998 within the Faculty of Science at each of the four Syrian universities. Two years later, a presidential decree²⁹ established new Faculties of Information Technology at all of them. These initiatives reflect growing awareness of the importance of moving toward a knowledge-based economy and the concomitant need for a growing supply of trained ICT graduates.

The new faculties accepted their first students in September 2000, after a five-year curriculum had been developed and the necessary teaching staff recruited, mainly among HIAST personnel. All the faculties were deluged with applications from prospective students—a clear indication of the need for higher education in the various fields of ICT and its importance for the country's economic development. Each faculty has room for a maximum of 150 students each year, but the University of Damascus started with fewer than 100 students and the other three universities with 50 each, owing to limited resources and computing facilities. The two existing computer science courses were transferred to years 2 and 3 of the newly created computer engineering faculties. Nearly 200 engineers are expected to graduate from all four faculties in 2003, followed by similar or larger numbers in subsequent years, leading eventually to a change in the ICT job market in the Syrian Arab Republic.

²⁹ Presidential decree No. 15 for the year 2000.

4. *Science and technology park*

The first Syrian technopole is currently in the feasibility study phase. HIAST has expressed interest in setting up a technology park, and asked ESCWA for technical assistance in defining the objectives of and designing the park. It would include an incubator as well as development activities leading to innovative products based on research conducted at HIAST.

The main objective of this park would be to enhance the Syrian Arab Republic's competitiveness and increase its productivity in technology-related industries through technological innovation, in the hope of improving the country's economic situation in a global market where more stringent quality criteria and standards are becoming mandatory.

I. TECHNOLOGY INITIATIVES IN THE UNITED ARAB EMIRATES

Over the past decade, the United Arab Emirates has been building modern infrastructure in an effort to attract foreign investment into the country, and investing in education and training for youth and adults alike in preparation for a move toward a knowledge-based economy. Four important initiatives are described below. The first of these has to do with human resource development, while the others are aimed at the development of state-of-the-art ICT infrastructure and work environments with a view to encouraging further investment in the country, with all the socioeconomic benefits that would ensue.

1. *Technology parks*³⁰

The United Arab Emirates is nowadays committed to the development of a skilled national workforce animated by entrepreneurial spirit. The Centre of Excellence for Applied Research and Training (CERT) was established over a decade ago, and now constitutes a hub for a network of 13 Higher Colleges of Technology. It has established a network of spin-offs that will undoubtedly help the country enter the knowledge economy era.

CERT operates two science and technology parks, one in Abu Dhabi and one in Dubai, providing access to world-class experts in technology through more than 20 multinational partners, including Lucent, Honeywell, Northrop Grumman, Daimler-Chrysler and Thomson CSF. These parks were established to foster the use of the latest technologies in the United Arab Emirates while building the technological infrastructure required for further sustained development. CERT has forged strategic alliances with a variety of multinational partners in pursuit of these goals, and also as a means to the emergence of a regional resource.

These parks harness multinational firms in the service of the country's economic and human resource development by setting up educational and business goals. They also provide an integrated solution through training, product development and consultancy services, thereby expediting the transfer of technologies to the region. The technology parks and their partners provide fertile ground for incubators to grow and for new businesses to carry out advanced technology projects that will be useful to the region as a whole as well as to the United Arab Emirates.

CERT also offers courses in a variety of fields, including engineering, business and health care. It provides professional advancement and lifelong learning opportunities for the United Arab Emirates community, the Gulf Region and, through its online courses, the rest of the world.

2. *Abu Dhabi's Business Incubator*³¹

At the Tridex 2000 defence exhibition in Abu Dhabi, the Abu Dhabi Chamber of Commerce and Industry (ADCCI), CERT and the United Arab Emirates Offsets Group signed a Memorandum of Understanding (MoU) for the establishment of a working co-operation arrangement with the object of setting

³⁰ Based on an ESCWA internal report on technology incubators in ESCWA member countries by M. Mrayati, Regional Advisor on Science and Technology, O. Bizri, Chief, Technology Section, and M. Farah, FEAO, Technology Section (February 2001).

³¹ Ibid.

up a mechanism for the development of SMEs in the Emirate. This initiative is expected to foster entrepreneurial spirit and facilitate the process of turning innovative ideas, funding, business and professional development into new business opportunities for national entrepreneurs.

The resulting Abu Dhabi-based group will:

- (a) Support individual national start-up firms;
- (b) Develop a full business support infrastructure, like any incubator;
- (c) Provide access to a managed source of sustainable funds for seed money and venture capital;
- (d) Create opportunities for nationals to invest in these emerging firms.

The MoU formalizes the Abu Dhabi Business Incubator Programme and establishes a project team to pursue the further development of the initiative. New entrepreneurs will be provided with a complete start-up business service designed to help them clarify and develop their business ideas, put concepts into a business plan format, arrange for seed funding and venture capital and obtain business and professional training. In due course, a full-fledged business incubator will be operating at the CERT Technology Park in Abu Dhabi.

3. *Abu Dhabi Innovation Centre*³²

CERT has signed another MoU, this one with a German firm, Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung, for the establishment of an innovation centre in Abu Dhabi with the objectives of (i) developing a sustainable technology base indigenous to the region, and (ii) applying existing technologies in innovative ways to further the region's economic development.

This initiative, co-ordinated by the Fraunhofer Institute for Software and Systems Engineering in Berlin and TecPlan Middle East in Dubai, is seeking to establish, with CERT, a series of spin-off business projects aimed at taking advantage of the opportunities arising from the quantum growth of information, communication and media technologies. The Fraunhofer Institute is a non-profit research and science organization specializing in these technologies and their application in start-up industries. It operates nearly 50 science and research institutes throughout Germany, the Far East and North America.

This initiative should help create an atmosphere in which the development of innovative technologies becomes a routine. Once the Abu Dhabi Innovation Centre is set up, the experience of working with scientists who have been innovating for half a century should enhance CERT's development and stimulate the Higher Colleges' own applied research capabilities.

4. *Dubai Internet City*

The Dubai Internet City (DIC)³³ initiative was launched by the Government of Dubai in October 1999. It aims at creating the infrastructure, environment and attitude that modern businesses need in order to operate globally and efficiently in a knowledge-based economy. It capitalizes on Dubai's established position as the Gulf's major trading centre by inviting international IT firms to set up shop at a free-trade zone complex being erected on Dubai's outskirts. The ultimate objective is to establish Dubai as a major regional hub for e-commerce. By promoting ICTs and Web-based businesses, DIC has created a cluster characterized by interaction among ICT developers, service providers, logistics firms, educators, incubators and venture capitalists at a single location.

The Chairman of the Dubai Internet City, Mr. M. Al-Gergawi, is on record as having stated that the proposed complex, which is being established at a cost of \$272 million to the Government of Dubai, will act as an incubator for e-commerce in the region.³⁴ It is estimated that private investors, representing approximately 200 firms, some of them from the Gulf Arab business community, will spend double the amount of the Government's contribution to set up their own businesses at the complex. Incentives being

³² Ibid.

³³ <http://www.dubaiinternetcity.com/>.

³⁴ http://www.dubaiinternetcity.com/w_new1.htm.

offered to companies include the right to 100 per cent foreign ownership, 50-year land leases and tax exemptions on both corporate and personal income.

The approach adopted by the Dubai authorities does not rely on big names in the emerging field of e-commerce. On the contrary, it rests on the premise that big names are not needed in the dot.com era, and that start-up businesses may be prime movers in that field. It is particularly with reference to the latter point that DIC intends to accommodate numerous incubators. The project is also expected to create demand for talent from countries everywhere between the Indian subcontinent and South Africa.

The technical infrastructure at Dubai Internet City has been designed to world-class standards in terms of capacity, reliability, cost and service. Businesses can look forward to a high bandwidth, low cost, state-of-the-art telecommunication infrastructure with redundant connections to Internet primary backbone providers. Tenants can expect a 24-hour set-up and service guarantee. Competitively priced broadband Internet access to all offices and homes will be provided through state-of-the-art technology. Top international companies will provide a full spectrum of technical infrastructure such as data centres and server farms. The latest in IP telephony and wireless technology is also available, as well as a full range of Internet services including web-hosting and domain name services.

DIC has plans for S and T parks, where R and D centres and technology/business incubators will be located in a potent mix of knowledge, talent and entrepreneurship. This will create a highly supportive environment where new ideas can be nurtured and novel products quickly brought to market.

J. TECHNOLOGY INITIATIVES IN YEMEN

1. *National science and technology strategy*

Yemen is in the process of defining its strategic vision for 2025, in which S and T strategies are expected to be prominent, as is the establishment of a national innovation system. S and T policy and strategy are expected to include the establishment of strong intersectoral links among education and training, R and D, production and services, besides supporting S and T activities like maintenance and standardization. The S and T system is also likely to be reorganized along lines conducive to more innovation and economic growth. The main elements of this strategy are expected to be as follows.³⁵

(a) *In the higher education sector:*

- Establishment of highly selective S and T institutes in focused technological fields of particular importance for the twenty-first century, regarding innovation as the key to economic development;
- More S and T students in universities;
- Creation of technology incubators in universities, institutions of higher education and community colleges, where young graduates can turn ideas into products;
- Incorporation of issues relating to the industry and service sectors into curricula.

(b) *In the research and development sector:*

- More R and D institutions and more funding for R and D, aiming at an objective of a total R and D budget in the vicinity of 1 per cent of GDP;
- Support for investment funds for SMEs, based on R and D output;
- Encouragement for risk capital investment in products resulting from local R and D projects;
- Establishment of technopoles in various regions and sectors of the economy.

³⁵ M. Mrayati, *Report on mission to the Ministry of Planning and Development in the Yemeni Republic, 6-15 December 2000* (Beirut: ESCWA, 2001) (in Arabic).

(c) *Transfer of technology:*

- A focus on new technologies with potentially high economic returns to Yemen, such as ICTs, biotechnology and new materials, with applications likely to increase the productivity and quality of various industries and services in the areas of agriculture, desalination, fisheries and tourism;
- More training abroad in selected fields of S and T offering high economic returns;
- Strategic alliances and joint ventures with foreign technology firms.

(d) *Science and technology services:*

- Establishment of telecommunication networks and wider use of the Internet;
- Construction of information networks and systems in various areas of industry, agriculture, science, culture and technology;
- Support for standardization and quality in Yemeni products;
- Encouragement for the private sector to assume a more important role in providing these services.

2. *National strategy and plan for information technology*

Yemen's Ministry of Planning and Development is in the process of adopting a National Strategy for Information Management and Information Technologies, the highlights of which are as follows:³⁶

(a) Making full use of information and IT as tools for enhancing efficiency in various socioeconomic sectors;

(b) Creating a full-fledged integrated economic sector for information and IT with a view to enhancing opportunities for job creation and developing human resource capacities in anticipation of the advent of a global knowledge-based economy;

(c) Building the ICT infrastructure needed to provide an appropriate environment for the development of the local IT sector and for the growth and expansion of interaction with other countries, both within and outside the region;

(d) Encouraging developmental projects aimed at the creation of small- and medium-sized technology clusters in the form of incubators or technology parks, and in the process making good use of available financing from international organizations and private sector investment.

This will be followed by a national plan for 2001-2005 that will seek to implement projects in line with the above-mentioned strategy, such as a National Information Centre, a National Information Network and a National Institute for Information Technology. It would also include steps for:

- Adopting, at the public sector level, methodologies leading to e-administration;
- Introducing IT in school curricula at various levels;
- Introducing IT at the university level;
- Encouraging private-sector investment in projects for the dissemination of IT in Yemeni society;
- Promoting the use of the Internet and e-commerce tools and methodologies by SMEs.

K. TECHNOLOGY INITIATIVES IN TUNISIA

1. *The national incubator project*³⁷

The Tunisian national incubator project, initiated in 1999 by the Agency for the Promotion of Industry (API) at the Ministry of Industry with the support of UNDP, has as its main objectives:

³⁶ A. Dewachi and M. Mrayati, *Advisory mission to the Ministry of Planning and development – Recommendations and proposals in the field of Information Technology, 6-21 December 2000* (Beirut: ESCWA, 2001) (in Arabic).

³⁷ M.R. Boussema, *Initiatives for science and technology capacity-building in Tunisia*, a paper presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

(a) The co-ordination of all incubator-related initiatives, with opportunities for exchanges of experience and information among the various participants;

(b) Promotion of the concept of incubation as a means of encouraging the development of other experiments along similar lines.

As an initial step, three pilot sites have been proposed, at Tunis, Sfax and Gafsa. All interested institutions (mainly universities, institutions of higher education and research centers) have established a (virtual) network to discuss the project and follow its progress in its pilot phase. Regular meetings are held every month.

On 19 October 1999, the Ministry of Higher Education and the Ministry of Industry signed a convention on the creation and promotion of incubators in the country. The convention stresses collaboration between universities and industries, on the grounds that this is an effective means of supporting the innovation process through entrepreneurial initiatives. It also defines the general context for establishing incubators at universities. An ad hoc interdepartmental committee has been set up to provide follow-up and evaluation for the project.

The convention stipulates that:

(a) The universities concerned shall place suitable premises at API's disposal to accommodate the incubators;

(b) The incubators shall be managed jointly by API and the university concerned, within the framework of a steering committee the membership of which shall be determined by the two parties;

(c) The operating budget and overheads shall be covered by API.

For each incubator, an agreement is to be signed between API and the university faculty concerned. In one instance, API and the Faculty of Engineering at the University of Sfax (ENIS) signed a specific agreement, in the summer of 2000, for the establishment of an incubator to be known as Sfax Innovation in a 600-square-metre space in a building at ENIS. The premises have been refurbished, and now shelter a number of technology-oriented start-up firms. Management is currently handled by API staff trained in Europe. The incubator is expected to evolve gradually into an autonomous structure.

After some delay, a similar incubator has been launched at the Faculty of Engineering of the University of Tunis (ENIT). Approximately 350 square metres of floor space have been reserved for the incubator. Other incubators are expected to be established shortly at Gafsa and Gabès.

2. *Technopoles*

The Technological City of Telecommunications is an established technopole specializing in telecommunications. A second technopole is under development at Borj Cédria, and there are plans for a third, to be located at Sidi Thabet. Several others are under consideration by the Tunisian Government.

In these technopoles, a number of innovative companies operating in various areas of high technology, advanced research centres, universities and incubators are concentrated at a single site.

(a) *Technological City of Telecommunications*

The Technological City of Telecommunications (TCT) is a 600,000-square-metre technology village operating under the supervision of the Ministry of Communications at a location near Tunis. TCT accommodates the following institutions and structures (frame 48 gives details about some of these institutions and structures):

- The Communications Technology Park;
- The Higher Institute of Communications (SUP' COM);
- The Higher Institute of Technological Studies in Communications (ISET' COM);
- The Telecommunications Research and Studies Centre (CERT);
- The Tunisian Internet Agency (ATI);
- A training centre;

- An incubator.

Frame 48. Institutions and structures located in TCT

The Communications Technology Park covers an area of more than 60,000 square metres, and its mission is to:

- (a) Accommodate innovating companies in the communication technologies sector;
- (b) Develop links among industry, research and higher education;
- (c) Promote innovative ideas;
- (d) Serve as the showplace of the Technological City of Communications;
- (e) Establish an international co-operation network.

The park is also characterized by an outer belt of industrial activity zones and state-of-the-art communications and infrastructure that it offers to its tenants, including:

- (a) Reliable modern telecommunication services;
- (b) Protected sources of energy;
- (c) An underground array of networks of various kinds;
- (d) Functional facilities for incoming tenant firms;
- (e) A leisure centre.

The Higher Institute for Communications (SUP' COM) produces approximately fifty high-level engineers each year. It also offers continuing training for management personnel in the telecommunications field. Admission is by way of national entrance examination open to candidates who have completed two years of advanced studies in a preparatory school.

The Higher Institute of Technological Studies in Communications (ISET' COM), founded in 1998, produces high-level technicians in telecommunications, transmission, switching, network engineering, data processing, broadcasting, postal management (mail, administrative and financial management). Since its creation, more than 200 high-level technicians have graduated.

The incubator is a flexible structure that helps young entrepreneurs carry out their projects by providing optimal conditions for success. Its fields of technological expertise are limited to ICTs, application software in the communications sector and multimedia applications. It also provides appropriate office space, telecommunications and logistics services as well as a pool of competent consultants for administrative, legal, technical and financial affairs.

The training centre provides continuing training for technicians in communications to update their knowledge and know-how in new ICTs. It has its own well-equipped buildings, including IT laboratories and modern, effective telecommunications services (ISDN, Internet access and so on).

Source: Boussema, Initiatives for science and technology capacity-building in Tunisia.

About half the land reserved for TCT (i.e. 300,000 square metres) is currently under development. The first six companies selected for location in TCT, which employ approximately 220 engineers and high-level technicians, have been allotted land, having regard to their contribution to technology innovation and the potential jobs they are likely to generate for university graduates. Several multipurpose buildings are being erected, covering an area of approximately 12,400 square metres. These buildings will be completed by the end of 2001.

(b) *Legal and regulatory issues*

A law on the installation, operation, management and financing of technopoles in Tunisia will shortly be enacted. The law will regulate the creation of such parks and the rights and duties of their tenants, and will ensure that allocated land is put to judicious use.

Under the prospective law, a technopole may be established by any public or private institution with financial autonomy, including ministries, which may establish technopoles for the purpose of pursuing activities in their areas of competence.

The new law defines a technopole as an integrated space containing institutions of higher education, scientific and technological research institutions and industrial and commercial institutions active in technological development with a connection to the fields of S and T in which the technopole specializes.

3. *National incentives for the productive application of R and D results*³⁸

The law on scientific research and technological development contains a series of provisions aimed at making productive use of the results obtained by research organizations, the development of research within commercial firms and support for innovation. These measures include:

(a) The creation, within publicly-owned research establishments, of specialized units for the productive application of research results and the institution of scientific and technological partnerships with commercial firms;

(b) Financial incentives for public and private companies that conduct research and implement technological development projects;

(c) Benefits for research personnel who undertake the industrial and commercial exploitation of products of their invention;

(d) Incentives in the form of grants to inventors.

Furthermore, the Tunisian government has decided to create bridging structures between universities and industrial firms, on the grounds that the utilization and dissemination of research results are likely to have a positive effect on the national economy and reinforce the capabilities of industry, thereby stimulating innovation.

Lastly, article 42 of the incentive code for investment provides that investors in R and D activities shall be eligible for grants and tax advantages such as exemption from customs duty, value-added tax and consumer taxes.

L. TECHNOLOGY INITIATIVES IN MOROCCO

1. *Background information on ICTs in Morocco*

The introduction of the Internet in Morocco in the mid-1990s revolutionized people's thinking and brought hopes of economic renewal. The use of the Internet has increased rapidly in the course of four years, as will be seen from frame 49 below. Many tangible results are already perceptible: Web sites have had a positive impact on the important tourist industry (one portal for all tourist information is in the making), and there are more employment opportunities for young people, thanks to growing numbers of Internet service providers and cyber cafés. Moreover, curricula in schools of engineering have been revised to place greater emphasis on ICTs, and an academic and research network has been set up, connecting over half the universities and engineering schools in the country, with an ensuing increase in interaction between teaching staff and students both within the country and overseas.

Frame 49. The growth of Internet use in Morocco

In 1996, Morocco already had 20 Internet service providers, some 50 cyber cafés, about 10,000 Internet subscribers, 50 Web sites, 1.4 million fixed telephone lines and an estimated 100,000 mobile telephones. The average cost of an Internet subscription was \$50 per month.

Four years later, Morocco, with its population of 28 million people, of whom more than half are under the age of 20, now has more than 300 Internet service providers, 1500 cyber cafés and a reasonable communications infrastructure of 1.6 million fixed and 1.8 million mobile telephone lines. The national bandwidth is now 100 Mb/s compared with 2 Mb/s in 1995. There are more than 1500 Web sites, and, most significantly, the cost of a monthly Internet subscription has fallen to about \$6 per month.

Source: N. Rochdi, *Action plan for ICT development – Case study: Morocco*, a paper presented at the Expert Group Meeting on Capacity-building Initiatives for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

³⁸ Ibid.

Of late, the Government of Morocco has begun to give more importance to ICTs by promoting, liberalizing and regulating the use and development of these technologies (see frame 50 for a list of actions that have been taken and others that the Government plans to take). In particular, the Office of the Prime Minister, acting through the Secretariat of State for Post, Information and Telecommunications Technologies, has been responsible for ICT projects in the country since March 1998. In that same year, the National Agency for Telecommunications Regulation was created and the liberalization of telecommunications got under way, after a law to that effect had been enacted under which the private sector was allowed to enter into competition with the State and obtain a second GSM license. This process, which was completely transparent and credible, brought US\$ 1 billion to the treasury of Morocco.

Frame 50. Actions taken and planned by the government of Morocco in the ICTs sector

Actions taken by the Moroccan government to promote, develop and regulate ICTs include:

- (a) Production of a policy document on the telecommunications sector (March 1997);
- (b) Construction of a fully digitized network in the country using the latest technologies, with 100 Mb/s links to international networks;
- (c) Establishment of a legal and regulatory framework for e-commerce, IPR, electronic public administration, consumer protection, privacy and so on;
- (d) Expedited liberalization of telecommunications: 1 GSM license in 1999, 3 VSAT in 2000, 2 GMPCS in 2000 (full liberalization is expected by December 2002);
- (e) A programme of loans for the purchase of computers with Internet access in homes.

Actions planned by the government include:

- (a) Digitization of the cultural heritage and development of national portals for tourism by 2002;
- (b) Computers in all public and private secondary schools by 2005;
- (c) More technical graduates, with a target figure of 2000 per year by 2005;
- (d) Introduction of e-administration in one third of all government departments through intranets and extranets by 2005.

Source: Rochdi, Action plan for ICT development – Case study: Morocco.

2. Moroccan action plan for ICT development

The Moroccan government regards ICTs as a powerful tool for the country's socioeconomic development and a useful aid in its progress toward a knowledge-based economy. Accordingly, a national ICT Action Plan was formulated in December 1998 and finalized in May 1999, thanks to political support at the highest levels and the collaboration of selected business leaders and representatives of civil society. Its main goals are:

- (a) To improve the productivity of Moroccan industry;
- (b) To modernize the country's public administration, making it more efficient and responsive and winning greater trust by making it more transparent;
- (c) To reinforce government programmes aimed at eradicating poverty and raising the level of literacy;
- (d) To improve government health, education and training services;
- (e) To give isolated rural communities a sense of solidarity and identification with national development goals.

An implementation strategy for the several focus areas of the action plan (see frame 51), was devised. Emphasis was placed on preparing the necessary legal environment, building a consensus for change between the private and public sectors, developing civil society on a basis of partnerships and the common benefits expected to ensue from the introduction of ICTs, and organizing a well-planned, steady promotion campaign.

Frame 51. Main focus areas of the Moroccan ICT Action Plan

The main focus areas of the ICT Action Plan are:

Education, training, research and culture: targeting human capital is a high priority of the Moroccan Government, since it is a key issue in the new economy. Training the young generation, and preparing it to make effective use of ICTs will require radical changes to and upgrading of the education system.

Public administration and local communities: The use of ICTs to modernize and reform the public administration and related processes is one of the main strategic objectives of the plan. As public administration evolves toward e-government, it will become more competitive and closer to citizens and the business community.

Enterprises: The role of start-up firms and SMEs specializing in ICTs is crucial in the new economy. Indigenous developments and innovation are the only way to achieve competitiveness in the global market. Special attention will be paid to such start-up firms.

E-Commerce: There is great potential in Morocco for the development of e-commerce, particularly B to B and G to B aspects. An inter-ministerial commission has been drafting laws to shape the legal environment needed for such development. Identification of pilot projects to establish the market is also emphasized.

Dissemination of ICTs: The digital divide is a reality in Morocco, as in many other countries. The diffusion of ICTs country-wide is an major objective of the Action Plan, especially the use of the Internet by schools, universities and businesses. Under the plan, the Internet will become a public service as well as a universal service.

Source: Rochdi, Action plan for ICT development – Case study: Morocco.

3. E-commerce pilot project

It has become increasingly clear that the most dynamic trade routes of the twenty-first century will be dominated by transactions in intangibles rather than goods. Service industries will flourish and dominate the “roads” of the global “infostructure”, and they will be the main providers of the content being traded via electronic means.

For developing countries, including Morocco, the growing internationalization of services and rapid technological change in ICTs present both opportunities (such as new exports) and challenges (such as the designing of appropriate regulatory environments and investment in infrastructure). If developing countries are to take advantage of these opportunities, they must adapt their regulatory environments and develop supportive physical and human infrastructure.

The Moroccan e-commerce pilot project is conceived as the first few steps on the road toward a global knowledge-based economy. It is expected to be instrumental in helping potential users and providers to overcome the existing legal, cultural and mental barriers that are currently among the major impediments to the dissemination and development of ICTs in the country.

The strategic objectives of the Moroccan e-commerce pilot project are as follows:³⁹

³⁹ N. Rochdi, *ICT to Empower Women, a Case Study: E-commerce for Women in Morocco*, a paper presented at the Expert Group Meeting on S and T Capacity-building for the Twenty-first Century, ESCWA, Beirut, 1-3 November 2000.

1. **Awareness, advocacy and policy formulation:** Decision-makers at all levels and in all walks of life should become aware of the implications of the information and knowledge revolution, in order to lay the groundwork for the formulation of sound strategies and policies.
2. **Improved connectivity in rural areas:** Rural areas should be treated like urban areas by being provided with access to networks and knowledge through electronic means at affordable cost and under equitable conditions; the availability of computers, peripherals and software remains a prerequisite for the establishment of connectivity.
3. **Capacity and institution building:** Basic computer literacy, Web-browsing skills, desktop publishing and e-mail communications should be provided for all users, while networking, operation of servers and routers, web site creation, data selection and interpretation, digital management and technical maintenance skills should be provided for professional ICT personnel.
4. **Content and cultural diversity:** A substantial effort must be deployed to create information and knowledge in digital form, taking into account the country's linguistic and cultural diversity.
5. **The creation of "knowledge brokers":** Building solutions web sites or one-stop shops with hyperlinked access to structured and pre-selected sites, in order to minimize search time and lower user costs.
6. **Use of appropriate technology:** Local conditions should be taken into consideration, such as the non-availability of electrical power in some areas or harsh climatic conditions. Innovative solutions need be developed or adapted.
7. **Creation of multimedia access points:** A web of digital community telecentres should be built as public access gateways at the community level, especially in rural areas. Development applications, community training, capacity development and content creation could then be provided, with a shift from individual to community connectivity.
8. **Adaptive payment system:** Innovative transaction and payment procedures must be devised for an environment in which the banking infrastructure is weak and credit cards are not available.

In pursuit of these objectives, the following main actions are planned:

- (a) Development of a legal framework conducive to e-commerce, including digital signature, cryptography and privacy issues;
- (b) Developing sectoral portals on the Web;
- (c) Licensing private firms to provide e-commerce services to target populations;
- (d) Development of e-commerce initiatives with the support of the government for women's small production units (co-operatives) in rural areas in the handicraft and agriculture sectors;
- (e) Establishment of a national centre for women entrepreneurs, to enable those with promising projects to offer a variety of services through access to ICTs; they will also be entitled to legal or tax-related assistance for the creation of their start-up firms, and will be given the necessary training, notably in firm management, marketing and the use of computer techniques, multimedia and e-marketing;
- (f) Development of micro-credit programmes, infocentres, and innovative payment methods;
- (g) Training for trainers.

In order to implement the pilot project, the Government of Morocco recently issued an invitation to firms in the private sector to set up e-commerce platforms. Three companies have been selected to provide B to B and B to C services as well as a marketing strategy for the products. The Government is providing support for training, awareness-raising and equipment for the beneficiaries, through a special fund.

This initiative, which is to be evaluated in July 2001, is intended as a means of creating a dynamic force that will pull other sectors along and lead by example.