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TECHNOLOGY INITIATIVES IN THE ARAB COUNTRIES

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ABSTRACT

This paper discusses the various technology initiatives currently being planned and implemented in the Arab countries, focusing specifically on technology incubators. The initiatives deal mainly with science and research, while some deal particularly with ICTs. Individual efforts and experiences of the Arab countries are described, covering areas such as technopoles, incubators, and science and technology policies.

INTRODUCTION

New institutional forms such as research parks and technology incubators have been proliferating for almost four decades in the developed, and more recently in many developing, countries around the world. Their effectiveness as tools for capacity building in science and technology (S and T) is mainly due to the fact that they provide means for closer cooperation between concerned stakeholders, research centers, higher education institutions, industrial and service enterprises, sharing an interest in new technology development.

By themselves, institutional forms such as research and technology parks and technology incubators will not constitute a panacea for ills that afflicts S and T in the Arab countries. They do, however, provide effective means for achieving many worthwhile objectives in a number of directions. This is demonstrated by experiences in developed and developing economies, where new employment opportunities based on new technologies have been created to meet the challenges of growing populations and new global, regional and local changes.

As in many other areas of technological capacity building, the role of the private sector is emphasized having concerned government departments ensure that regulatory frameworks are observed, and that powerful incentives are provided for fruitful economic activity towards the acquisition, adaptation and implementation of new technologies.

Initiatives aimed at setting up new institutional forms need to be closely adapted to needs and conditions pertaining in the Arab countries. Surveys, studies and expert-group meetings can examine specific needs and establish parameters for future changes and prepare the grounds for new legislative and regulatory changes, which are essential requirements for new institutional forms. Workshops will also be essential for training management and administrative staff engaged in running the intended institutions. Emphasis on fund raising will constitute another crucial area of activities.

Initiatives targeting the establishment of technology parks and technology incubation schemes are already making progress in a number of Arab countries¹. A current initiative by the Economic and Social Commission for Western Asia (ESCWA) aims at accelerating progress and harmonizing efforts aimed at their establishment and optimal functioning (see Frame 1). Steps will also be taken, through the present Initiative, to facilitate access to essential expertise and training with emphasis on raising awareness of the possibilities offered by the new institutional forms, acquiring expertise in building national teams to undertake a variety of tasks in this respect, and creating infrastructure capabilities that render the new institutional forms attractive to high-tech entrepreneurs and international technology-based partnerships.

Frame 1. ESCWA Initiative for Technology Parks and Technology Incubators

On the strength of a recent Study and an expert-group meeting on the subject, ESCWA has been approached to provide technical assistance in the design of technology parks and technology/business incubators from concerned institutions in Syria, Kuwait, Lebanon, PAT and Jordan. Institutions in a number of other Arab countries, e.g. Egypt, Oman, Bahrain and the UAE, are in the process of setting up their own technology park facilities, contemplating their establishment or seeking advice on such measures.

The role that ESCWA aims to play in the creation and support of member country initiatives pertaining to the establishment of new institutional forms will focus on the following tasks:

- Preparation of documents on the role played by technology parks and other capacity building schemes, including their constitution, organizational structures and resource requirements with case studies from developed and developing countries, including nascent examples from some Arab countries.
- Elaborating frameworks for establishing technology parks and other capacity building schemes with at least three models in mind, to cater for variations in the nature and diversity of prevailing economic conditions and degree of sophistication of national S and T and innovation systems.
- Undertake training activities that target funding, management administrative practices in technology parks and technology incubation schemes in collaboration with other concerned agencies.
- Monitoring activities aimed at the creation of technology parks and their subsequent operations in the Arab countries with the aim of facilitating exchange of know-how and expertise.
- Playing the part of hub for a network of technology parks and other capacity building schemes in the Arab countries.

An Internet homepage has already been set up to cater for an ESCWA network of Technology parks and Technology Incubators. This homepage posts substantive reports and other information on relevant activities in the field. <http://www.escwa.org.lb/ntpi>

EGYPT

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, and transforming Egypt into a technology producing/exporting country on the basis of local capabilities. The establishment of technopoles is an important element of this plan.ⁱⁱ

The Mubarak City for Scientific Research and Technological Applications, established in 1993 by Presidential decree, aims for the advancement of technologies in the country, establishment of technology development units, personnel training in modern technologies, and co-operation with national and international organizations in technology transfer. The City is to incorporate centers and institutes covering areas such as genetic engineering, biotechnology, laser, renewable energy, and engineering industries development.

The Sinai Technology Valley (STV) is a technopole being built by the Egyptian government, and focuses on fields related to ICTs, microelectronics, biotechnology, new materials, fine tools, and renewable energy. Another technopole is being planned in Qena Governorate, in Upper Egypt. In 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.

Technology incubators in Egypt [1]

The objective of the *Egyptian incubator program*, launched in 1995 and spearheaded by the Social Fund for Development (SFD), is to develop a sustainable network of incubation-related facilities that would spur the competitiveness and productivity of SMEs. Eight locations have been selected for incubators in non-exploited areas. The only one currently in operation is the *Tala Incubator*, which has been functioning since 1998. Its present tenants operate in areas such as sheet metal works, household appliance parts, computer training, and electronic components assembly.

The *Mubarak Science Park (MSP)* 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 teamed up with MSP to promote entrepreneurship in high technology. The Egyptian Incubator Association (EIA), the promoter of incubator program in Egypt, has also joined the team to manage and administer the collaborative initiatives.

LEBANON

Science and Technology Policy Initiatives

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 was never formally approved [2]. A principal aim of this policy was the rational development of Lebanon's scientific potential and the utilization of research results for improving social and economic conditions. The intention is to produce a five-year implementation plan, in collaboration with the concerned directorates and institutions, once the policy document is officially adopted.

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 Program". Partnership with educational institutions is a cornerstone of the Educational Support Program, 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."ⁱⁱⁱ

Another educational initiative was launched in 2000 by Saint Joseph University (SJU) and Cisco Systems, whereby the University was designated a "Regional Academy" under the Cisco Networking Academies Program (CNAP). This worldwide program 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.

Case study of a technopole: Berytech [3]

The private sector in Lebanon has also embarked independently on a number of technopole and incubation projects. Efforts by SJU to establish a technopole called BERYTECH aim at helping Lebanon regain its leadership in business formation, encouraging entrepreneurship especially among young graduates, enhancing competitiveness among small and medium-sized technology firms, and providing Lebanese universities with a tool that promotes creative thinking and applied research [3]. Support is being sought from Lebanese authorities and from NGOs and international organizations, including ESCWA.

The Lebanese Technology Incubator Project^{iv}

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 one hand, and small high-technology industries or businesses on the other. ESCWA has been approached for help in setting up the LTI.

SAUDI ARABIA

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 programs in the Kingdom. In 2001, the government adopted this strategy, which was prepared by King Abdulaziz City for Science and Technology (KACST) in collaboration with the Ministry of Planning, concerned public and private institutions and expert input from ESCWA. It includes long-term goals and objectives for the period 2001-2020 as well as four executive five-year plans defining priorities and describing detailed programs and projects. 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.

Incubators in Saudi Arabia

KACST intends to create, in collaboration with ESCWA, an S and T incubator in order to build a bridge to industry and transform ideas resulting from R and D into products. King Fahad University for Petroleum and Minerals (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.^v

JORDAN

National Information System (NIS)

The NIS initiative^{vi} was launched in 1996, by the National Information Center (NIC) of Jordan, with the aim of promoting socioeconomic development through enhanced managerial and organizational effectiveness. Its main objectives were to establish a distributed system to link information collecting centers, so that activities may be coordinated, and the flow of information to users in the public and private sectors can be ensured. NIS has grown to include a considerable number of institutions in various sectors. Training courses, workshops and seminars have been held in an effort to promote understanding and enhance co-operation among national institutions, while ensuring proper implementation of unified procedures and standards as prepared by NIC. 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.

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, signed between the two partners, stipulates 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 [4]. This multi-million dollar project is expected to attract capital venture investments, and to generate thousands of job, as well as research, opportunities.

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, and aims 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 [4]. Several facilities and incentives will be available at the site such as high-speed telecommunications, technology incubators, medical services, leisure and living quarters, access to a major transportation network, and duty-free exports to United States markets.

The E-Government initiative in Jordan

The e-government initiative is one of an array of transformations aimed at moving Jordan toward the knowledge-based economy. E-government is expected to streamline public services and government agency performance, enhance efficiency of businesses, and allow citizens to save time while dealing with government institutions. A task force has been formed to develop an e-government strategy for Jordan, focusing on four major areas: Government-to-Business (G2B), Government-to-Citizen (G2C), Government-to-Government (G2G), and the creation of the legal, institutional, infrastructure and management frameworks needed for attainment of the strategic goal of e-government

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 [4]. Objectives of this initiative include developing an internationally competitive ICT industry focused on software, attracting foreign and local investment, generating job opportunities, increasing ICT exports, and facilitating modernization of the public and private sectors.

Empowering rural communities with ICT [4]

The NIC has taken necessary steps to extend accessibility to the NIS to rural areas of Jordan where communication service standards are low and therefore access to knowledge is more difficult. 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. This project will be accomplished through the establishment of IT community centers in every town and village, so that tools for accessing, locating and acquiring knowledge will be available everywhere in the country. However, funding remains a major obstacle facing this initiative.

PALESTINE

Science and Technology Planning Unit (STPU)

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. Among others, STPU's main objectives are to contribute to the formulation of national S and T policies, promote cooperation and facilitate the integration of Palestinian scientists and technologists abroad in various S and T programs.

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 and methods, 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.

UNESCO Biotechnology Educational and Training Center (BETCEN)

The UNESCO Biotechnology Educational and Training Center (UNESCO BETCEN), established in 1995 by the UNESCO Biotechnology Action Council (BAC) at Bethlehem University, 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 related to biotechnology are planned: organizing intensive lectures, workshops, and courses; training young Palestinian and Arab scientists in modern research techniques; and conducting large-scale research projects.

University Information Technology Centers of Excellence

Government, universities, international agencies, donor institutions and private sector firms have launched initiatives aimed at the development of the Palestinian ICT sector. In particular, two distinct initiatives are being launched for establishing IT centers of excellence at Palestinian universities. Palestinian expatriates, businesses, non-governmental and international organizations, among others, are contributing to the establishment of these centers. Tasks that these centers perform include: advanced education and training of high-quality IT graduates, provision of short-course programs in specialized focused areas, development of university faculty, consulting services, technology transfer, R and D for local firms, liaison with similar regional and international centers. However, the sustainability of these centers will depend on their ability to generate income through their services to both local and international firms and stakeholders.

SYRIAN ARAB REPUBLIC

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 the government emphasized that S and T 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 to enhance the country's economic and social conditions. Harnessing S and T education and R and D for socioeconomic development is becoming a national priority.

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 to use PCs, basic software tools, as well as

specialized software packages and the Internet. This initiative, known as the National Program for IT Dissemination, is designed to reduce computer illiteracy among the general population. Computer laboratories in the secondary schools of most Syrian cities are available to the public in the evening for a minor fee, during which introductory computer courses are given. This program reaches all strata of society of all ages. The number of these centers is increasing, and Syria's four universities are also carrying out a similar program for university personnel to help diffuse IT knowledge.

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), and the University of Damascus Computer Engineering Intermediate Institute (CEII). 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 decree^{vii} 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. Student applications flooded these faculties, clearly indicating the need for higher education in various ICT fields and its importance for the country's economic development.

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, and 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.

UNITED ARAB EMIRATES

Technology parks^{viii}

The United Arab Emirates is nowadays committed to the development of a skilled national workforce animated by entrepreneurial spirit. The Center 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. CERT offers courses in a variety of fields, including engineering, business and health care. Online courses are also available to the community. CERT operates two science and technology parks, in Abu Dhabi and 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.

Abu Dhabi's Business Incubator^{ix}

At the Tridex 2000 defense 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 up a mechanism for the development of SMEs in the Emirates. 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. In due course, a full-fledged business incubator will be operating at the CERT Technology Park in Abu Dhabi.

Abu Dhabi Innovation Center^x

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

Dubai Internet City

In 1999, the Government of Dubai launched the Dubai Internet City (DIC)^{xi} initiative to create the infrastructure, environment and attitude that modern businesses need in order to operate globally and efficiently in a knowledge-based economy. 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. Incentives being offered to companies include the right to 100 percent foreign ownership, 50-year land leases and tax exemptions on both corporate and personal income. DIC has plans for S and T parks, where R and D centers 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.

YEMEN

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 aim at four sectors or areas: higher education sector, Research and Development sector, Transfer of Technology, and Science and technology services.

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. Its highlights focus on integrating ICTs into the job market, and encouraging developmental projects towards creating technology incubators and parks [5].

This will be followed by a national plan for 2001-2005 that will seek to implement projects, such as a National Information Center, a National Information Network and a National Institute for Information Technology. It would also include steps for introducing IT at school and university levels, encouraging private-sector investment in projects, adopting methodologies for e-administration, and promoting the use of the Internet and e-commerce tools by SMEs.

TUNISIA

The national incubator project [6]

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 aims to promote and

coordinate all incubator-related initiatives. Three pilot sites were originally 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.

In 1999, the Ministry of Higher Education and the Ministry of Industry signed a convention on the creation and promotion of incubators in the country to stress collaboration between universities and industries as an effective means of supporting innovation through entrepreneurial initiatives. In 2000, Sfax Innovation incubator was established. Although 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).

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 centers, universities and incubators are concentrated at a single site.

The Technological City of Telecommunications (TCT) is a technology village operating under the supervision of the Ministry of Communications at a location near Tunis. Its mission is to accommodate innovating companies in the communication technologies sector, develop links among industry, research and higher education, and establish an international cooperation network. TCT accommodates several institutions and structures such as the Communications Technology Park, Higher Institute of Communications (SUP' COM), Higher Institute of Technological Studies in Communications (ISET' COM), Telecommunications Research and Studies Center (CERT), Tunisian Internet Agency (ATI), a training center, and an incubator.

National incentives for the productive application of R and D results [6]

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: the creation of specialized units for productive application of research results; financial incentives for public and private companies that conduct research and implement technological development projects; benefits for research personnel who undertake the industrial and commercial exploitation of products of their invention; and grant incentives for 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.

MOROCCO

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 finalized in 1999, thanks to political support and collaboration between selected business leaders and representatives of civil society.

The main focus areas of the ICT Action Plan are: Education, training, research and culture, with emphasis on the young generation; Public administration and local communities; Enterprises, especially start-up firms and SMEs specializing in ICTs; E-Commerce,

particularly B2B and G2B aspects; Dissemination of ICTs to reduce the digital-divide in Morocco [7].

E-commerce pilot project

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.

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 [8] include policy formulation, improving connectivity, and the creation of knowledge brokers_.

CONCLUSION

Various forms of S and T capacity-building initiatives have proved their effectiveness in developed and developing countries alike. Similar initiatives are needed in the Arab countries in order for them to meet the socioeconomic challenges that the twenty-first century brings. Although certain initiatives have been launched in the Arab region, consistent and integrated strategies for the propagation of such initiatives are hard to find. In fact, most of the Arab countries still lack even a general S and T policy, let alone sectoral policies designed to fit into the general policy.

Concurrently with the formulation of full-fledged S and T policy initiatives in the Arab countries, national and regional initiatives can and should be launched at all levels. In particular, the establishment of new institutional forms, such as technopoles, technology incubators and high-technology industry clusters, is a promising approach to the tasks of expediting technology transfer from R and D to industry and reforming education to serve economic and social development. These outcomes, in turn, are likely to foster the formation of national innovation systems that will upgrade standards, making products and services more competitive at the global level.

The various initiatives can be classified into the following categories:

- (a) Policy and strategy initiatives for defining national directions in science, technology and innovation, leading to better co-ordination between existing systems, institutions and markets, the reduction of obstacles to the diffusion of technologies and increased spending on R and D;
- (b) Initiatives aimed at revising and reforming legislative and regulatory frameworks to bring them into line with the ongoing process of global change, especially in the areas of industry, trade and technology;
- (c) Initiatives aimed at facilitating technology transfer, especially through legislation and regulations designed to favor innovation-based entrepreneurship and the forging of strong links between R and D institutions and the business community;
- (d) Initiatives designed to provide direct and indirect financial backing for technology-based institutional forms and start-up firms;
- (e) Human resource development initiatives aimed at upgrading the competence of S and T personnel through education and training, inasmuch as skill formation aspects are crucial role to the success of other capacity-building initiatives;

- (f) Programs designed to provide assistance and guidance for the establishment of new institutional forms such as technopoles, incubation schemes and high-technology clusters.

These various types of initiatives complement one another. If undertaken in a consistent way, they will create synergy that will afford better prospects for success. However, any given country's initiatives should be adapted to its scientific and technological maturity level, taking its national priorities into account and ensuring that return on investment is clearly favorable. Non-governmental organizations such as professional societies and chambers of commerce and industry, and academic institutions as well, should always be involved in the process of selecting and launching technological capacity-building initiatives.

Governments have a crucial role to play in creating an environment in which S and T capacity-building initiatives can flourish. They hold the main responsibility for adopting appropriate legislation and regulations that will effectively advance R and D, promote entrepreneurship and sustain technology transfer. Civil society institutions also have an important role to play in the promotion of these initiatives, specifically by lobbying for a favorable legislative and regulatory environment, and helping firms overhaul their structures, procedures and human resource management practices while at the same time striving for innovation and collaborating with academic institutions.

Lastly, international organizations, and United Nations organizations and agencies in particular, should co-operate with national and regional entities involved with technology transfer, knowledge dissemination and enterprise development in order to develop frameworks for S and T capacity-building initiatives with a view to sustainable development. The "ESCWA initiative for technology parks, incubators and high-technology clusters" is one such framework, aimed at identifying and implementing schemes that are adapted to the countries of this region.

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ⁱ Information on initiatives in the following countries is presented: Egypt, Lebanon, Saudi Arabia, Jordan, Palestine, Syrian Arab Republic, United Arab Emirates, Yemen, Tunisia, and Morocco. Although not included in this document, information is also available on initiatives in Kuwait and Oman.

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

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

^{iv} 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.

^v 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.

^{vi} <http://www.nic.gov.jo/nis2.html>

^{vii} Presidential decree No. 15 for the year 2000.

^{viii} 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 Team, and M. Farah, Team Leader, ICT Division (February 2001).

^{ix} Ibid.

^x Ibid.

^{xi} <http://www.dubaiinternetcity.com/>