CHAPTER FOUR
INFORMATION AND COMMUNICATIONS TECHNOLOGIES IN THE ARAB COUNTRIES: THE PILLARS AND TOOLS OF KNOWLEDGE

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Introduction

Over recent decades, unprecedented global advancement has occurred in the production, exchange, and processing of information, as well as its analysis and use. The impact of this advance may exceed that brought about by the Industrial Revolution, since the infrastructures of information and communications technologies (ICTs), their equipment and their software, have come to play the role of society's nervous system. ICTs are valuable tools for the circulation and adaptation of knowledge, as well as being among the forms of human knowledge that are the most dynamic, have the most far-reaching effects, and are the most embedded in the fabric of modern life. They present many opportunities and challenges and mandate the formulation of specific strategies. In addition, they demand the dedication of human and material resources at the national level and the improvement of mechanisms for cooperation at the Arab, regional, and international levels to ensure ideal diffusion and utilisation.

Information technology (ICT) represents one of the main pillars for the establishment of a knowledge society. It represents the key means to deploy and circulate knowledge, in addition to its role in developing, supporting, facilitating, and speeding up scientific and cultural research of the widest possible scope.

The Arab countries have made noteworthy progress in most of the pivotal aspects of ICT and in particular in infrastructures, where investment is ongoing. In 2008, they recorded levels of development in technological performance exceeding those observed in all other regions of the world.[1] Four Arab countries have been listed among the top fifty most ready to utilise ICT, all of them Gulf Cooperation Council (GCC) countries (the UAE, Qatar, Bahrain, and Kuwait, occupying twenty-eighth, thirty-seventh, thirty-ninth, and fiftieth ranks respectively) (World Economic Forum, 2008b).

However, scrutiny of the Arab knowledge landscape reveals that the digital gap remains and is acute. Investigation of Arabic digital content, which is a guide to the utilisation and production of knowledge in Arabic, demonstrates that the Arab countries and their societies fall short according to most criteria (UNESCWA, 2008). As long as steps are not taken on various levels in the domain of technology policy and legislation, and as long as many issues related to Arabic language usage on the net are not settled, the state of Arabic knowledge content will never pass an extremely low threshold but will continue to draw upon other, random sources for content and seek succour from past tradition, both good and bad.

Performance also varies from one Arab state to another. The disparity that we witness today in the Arab countries' utilisation of new technologies and in the use and production of Arabic digital content also affects sections of society within each one. This promises further fragmentation and extremism until such time these countries lay the basis for equal access to technology and its potential.

No Arab countries will be able to emerge from the current embryonic stage in dealing with technology and contributing to its development unless they open themselves up to those parties that, to the extent possible to them, are active and relevant. Similarly, they must orient themselves to the indigenisation, adaptation, and reformulation of the production of technological knowledge, thus enabling more enlightened and creative utilisation of the available tools of

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technology. There is of course a major role for the government and private sectors and for the organisations of civil society in reaching this goal. Yet the roles of all these will remain limited without a deeper understanding of the crisis of knowledge content–digital or otherwise–within Arab societies.

While necessary material costs may affect opportunities and limit them to particular groups, successive ICT revolutions and ongoing cost reductions will power the diffusion of knowledge among wide sections of society, provided that such advances in technology are accompanied by accelerated production of content and its utilisation in new applications. This, however, will require improved utilisation of time and better deployment of resources if the knowledge gap and the wealth gap that divide the world's peoples and the social groups within a single society are not to become more pronounced.

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ICT IN THE ARAB COUNTRIES

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The World Bank's ICT index, which is based on progress in acquisition of telephone lines, computers, and the internet,[2] is the most evolved knowledge economy index indicator for eleven Arab countries. This index shows that six of these countries are substantially ready to adopt the knowledge economy. Only one Arab state—Jordan—scores lower on the ICT index than on any of the other knowledge economy indices. For comparison, for four countries it is the economic incentives and institutional regime index or the innovation system index that holds this position, while for eight it is the education and human resources index that does so.

Some Arab countries that enjoy high GNPs occupy a high position on the ICT index. However, this position remains lower than that of other countries in the world that enjoy comparable GNPs

Eleven Arab countries witnessed a rise in their score on the ICT index in comparison with 1995. In the case of Sudan, this score rose from 1.2 in 1995 to 3.8 in 2008, one the highest growth rates in the Arab region. With respect to the six countries that witnessed a decline in their scores, and with the exception of Djibouti where the score fell by 1.7, the decline did not exceed 0.3.[3]

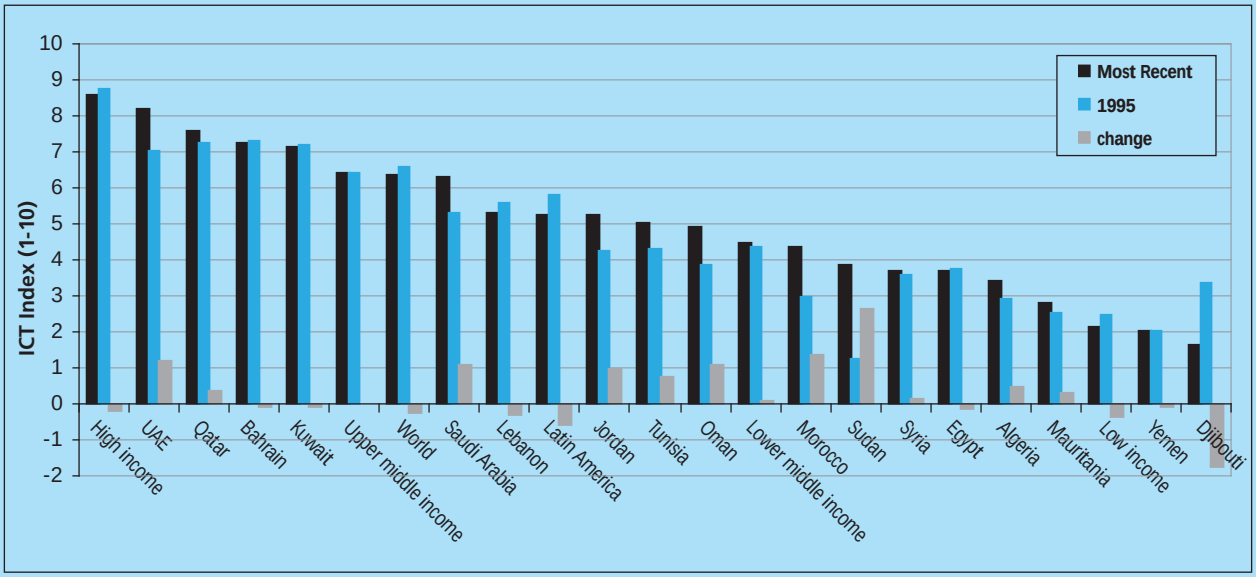
As Figure 4-1, and Table (a-1) in the Statistical Annex (ICT), indicate, some Arab countries that enjoy high GNPs thanks to their natural wealth occupy a high position on the ICT index. However, this position remains lower than that of other countries in the world that enjoy comparable GNPs. On the basis of international indicators in the area of ICT infrastructure, there are some grounds for optimism and hope in terms of the acquisition of a range of ICTs in the future. The following paragraphs present a picture of the advancement achieved in the distribution of computers and access to the internet–an advancement considered to have a tangible effect on the production and diffusion of knowledge. On the other hand, the spread of fixed and mobile telephones is deemed to be less of an indication of, and to have lesser impact on, the production and diffusion of knowledge (see Part B of the Statistical Annex/ICT). Much of this is attributable to the fact that the telephone networks available to most citizens of the Arab countries are of traditional forms and do not enable access to digital content or the utilisation of modern communications technologies. Certain further obstacles may hinder the utilisation of such technologies even when they are present.[4] Part C of the Statistical Annex/ICT presents a comparative categorisation of the Arab countries according to a number of indicators that reflect ICT plans and initiatives under implementation.

THE SPREAD OF COMPUTERS AND THE INTERNET

The emergence and spread of the personal computer in the second half of the 1980s laid the foundations for major transformations in the relationship between technology and its users with regard to

FIGURE 4-1

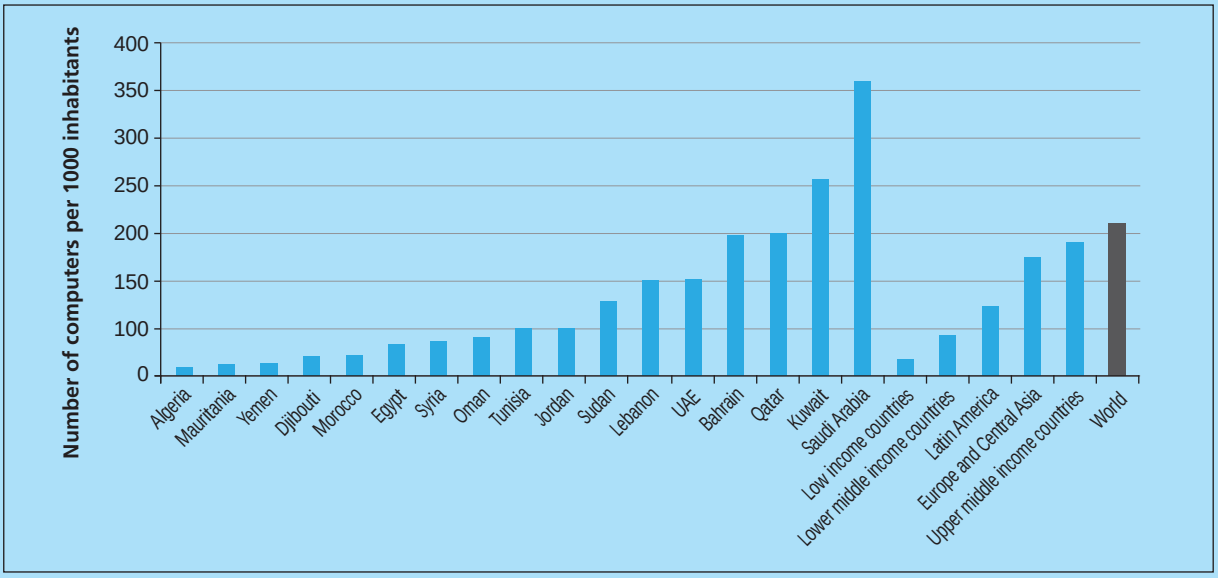
ICT index values for Arab countries and selected groups of non-Arab countries (1995, most recent statistics with + and – change values)



Source: World Bank database, Knowledge Assesssment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp on 13 February 2009.

FIGURE 4-2

Number of computers per 1,000 inhabitants, Arab region, and selected groups of non-Arab countries



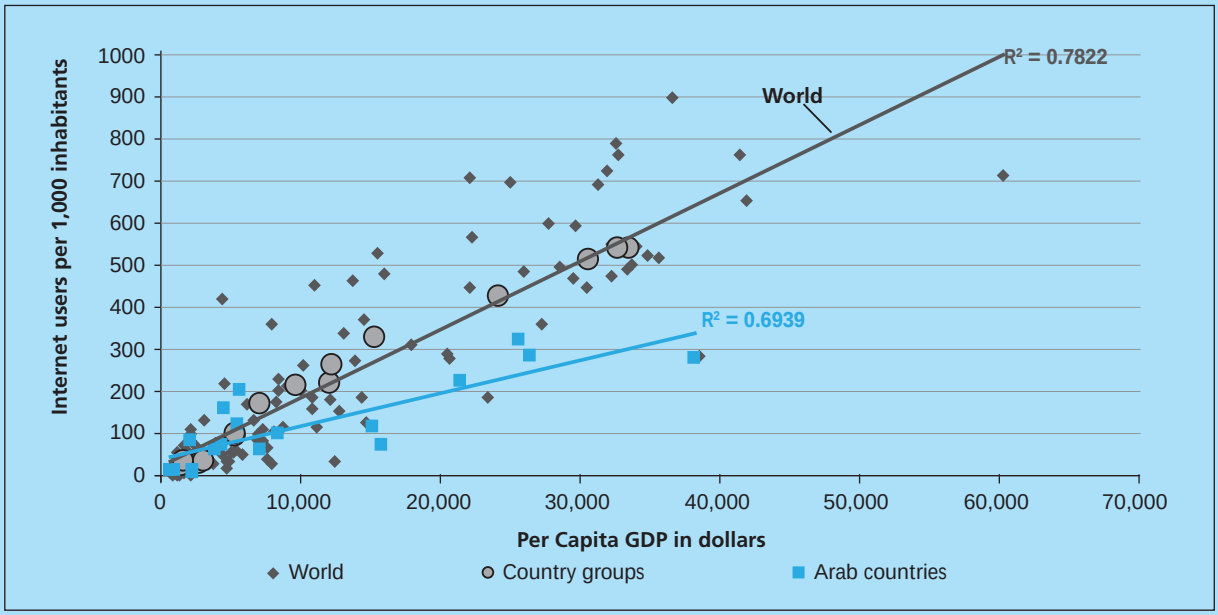
Source: World Bank database, Knowledge Assesssment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp

access to information and knowledge resources stored in various media. Figure 4-2 makes clear that in most of the Arab countries the number of computers per person is less than the global average. With the exception of Saudi Arabia and Kuwait, the average number of computers per 1000 inhabitants in all Arab countries falls below the world average, approaching it in Bahrain and Qatar, but falling perceptibly below it in Lebanon, Sudan, Jordan, Tunisia, and Oman. In the other Arab countries

In most of the Arab countries the number of computers per person is less than the global average

FIGURE 4-3

Internet users - Arab world, world, and selected non-Arab country groups by per capita GDP



Source: World Bank database, Knowledge Assesssment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp

In the Arab world as a whole, internet usage has noticeably proliferated in the last five years

(Syria, Egypt, Morocco, Djibouti, Yemen, Mauritania, and Algeria) it is substantially lower than the world average.

In the Arab world as a whole, internet usage has noticeably proliferated in the last five years. However, rates of internet use in most of these countries are still less than the prevailing global rates of twenty-one per cent of the population. With the exception of four Arab countries–Bahrain, Kuwait, Qatar, and the UAE–rates of internet usage in the Arab region are lower than the world average. The population of a number of Arab countries–among them Egypt and Algeria, which together represent one third of the total population of the Arab region–uses the internet at rates lower than those prevailing in lower middle income countries.

The proliferation of personal computers in Arab countries, as in others, is dependent on the costs of obtaining them–which continue to go down–and on the dissemination of the skills necessary to use them among groups of users– which continue to grow. Some Arab countries have participated in programmes that aim to make low-cost computers available. Available information indicates how important it is to expand such programmes and encourage cooperation between concerned international parties–manufacturers and international organisations–and concerned public and private sector parties in the Arab World, with the goal of arriving at designs better fitted to local requirements. Computer assembly workshops have spread in some Arab countries and personal computers are available on the local market at lower cost than imported models. Given that a local assembly industry permits a broader diffusion of computer technology, it is worthwhile for relevant government bodies to offer it support, to set regional quality standards for computer production to safeguard the interests of consumers, and gradually to raise the level of production so that the industry can respond in an on-going fashion to technological development.

Figure 4-3 shows clearly how the number of internet users grows hand in hand with per capita GDP in the world's

countries and the Arab countries. The circles show the world average and average rates of internet use for some regional groupings based on income and according to their position on the scale of the Human Development Index (HDI). This figure suggests that the increase in average per capita income in the Arab region may not have stimulated internet use to the extent that comparable increases in average per capita income have done globally. This must be due to the extent to which digital content in Arabic meets the requirements of the Arab countries' citizens and institutions. It is also worth pointing out here the low level of internet use by businesses in the Arab countries and the small number of schools able to access the net. Despite some of these countries being in the top third of countries in the world with respect to a number of ICT indicators–such as mobile phone penetration, numbers of computers, and costs of internet access–the Arab country with the highest levels of internet use places only thirty-eighth with respect to internet use by businesses (see Statistical Annex/ICT).

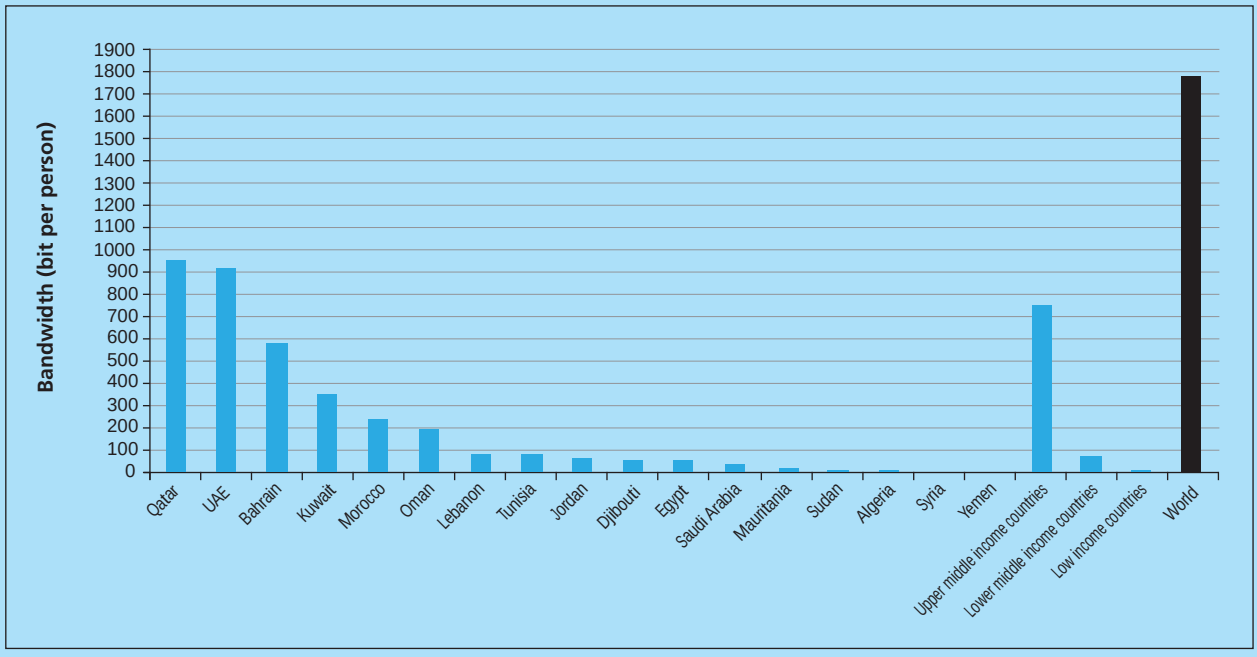
Figure 4-4 shows the existence of a double divide in internet bandwidth[5] between the Arab countries on the one hand and between them and higher middle income countries on the other. In general, communications networks capable of accessing internet services in Arab countries are still of low specification. For example, internet users in a number of advanced countries like the US, Canada, the UK, Singapore, and Japan can access internet services at speeds that reach or exceed one billion kilobits (kb) per second. By comparison, in most Arab countries the connection speeds of the networks in use range from 128kb to 1024kb per second.

The cost of internet access influences the nature of internet use, especially in light of the rise in cost of basic commodities and the fall in real income. Figure 4-5 depicts the cost of internet access in the Arab countries for which data is available as well as the world average and that of some groups

Some Arab countries are in the top third of countries in the world with respect to a number of ICT indicators, but the Arab country with the highest levels of internet use ranks only thirty-eighth with respect to internet use by businesses

FIGURE 4-4

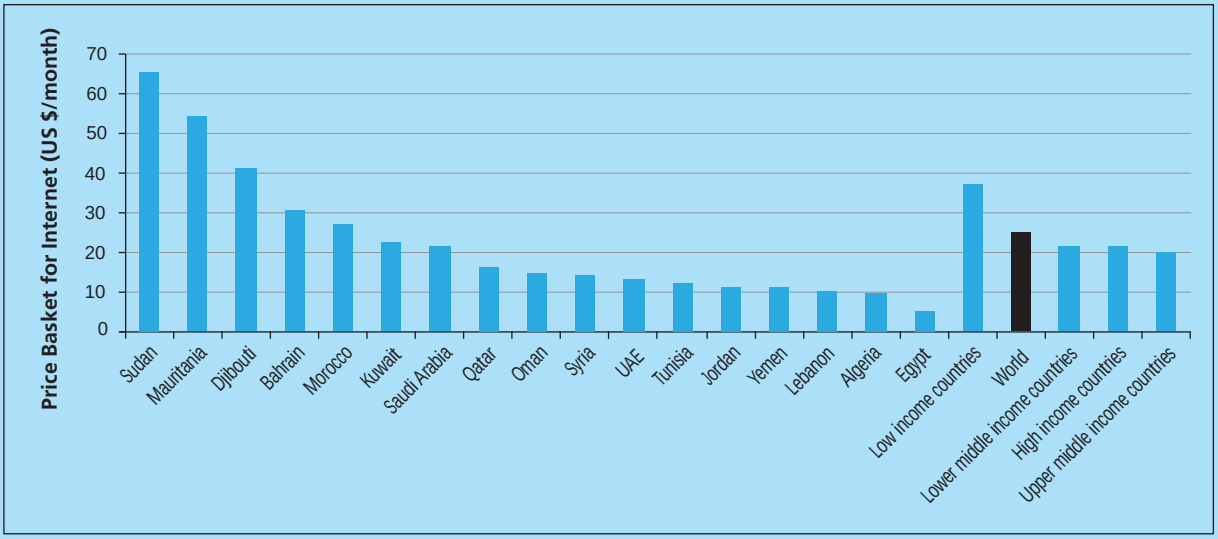
Bandwidth of global internet access for the Arab world and selected non-Arab country groups



Source: World Bank database, Knowledge Assessment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp

FIGURE 4-5

Price basket for internet (in US dollars per month) in some Arab countries, worldwide, and in selected non-Arab groups of countries by income



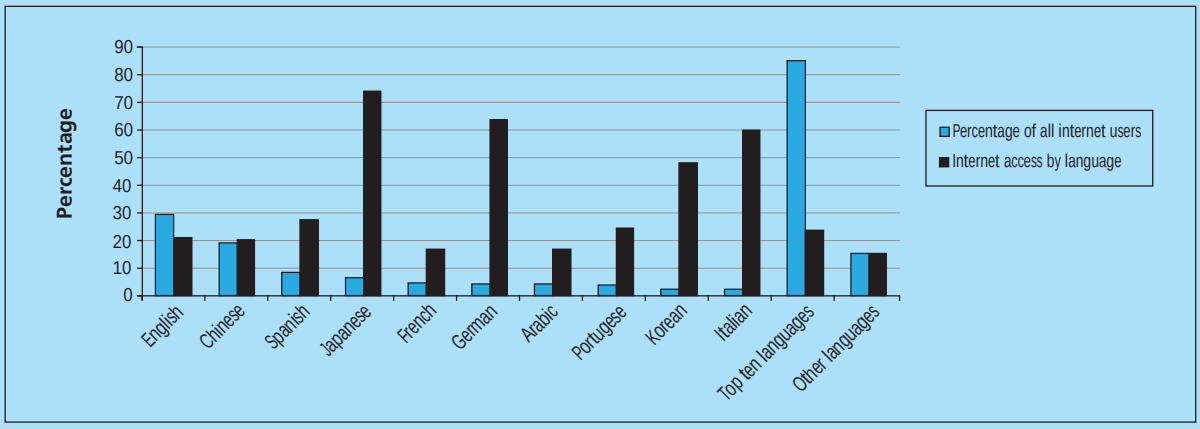
Source: World Bank database, Knowledge Assessment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp

Internet access costs in Egypt are lower than in any other Arab country, and lower even than those prevailing in the advanced nations

of countries for comparison. It shows that the cost of internet access in most Arab countries is lower than the average value for all the world's countries. Only three Arab countries–Sudan, Mauritania, and Djibouti–have a noticeably higher cost than the world average, and these are countries that have only made modest progress, even with respect to the other Arab countries, in obtaining ICTs. Internet access costs in Egypt are lower than in any other Arab country, and lower even than those prevailing in the advanced nations. Another matter worthy of attention is the drop in internet access costs in Yemen in comparison with its peers in the low income group of nations. The cost of access in ten Arab countries is much less than the average cost among the higher middle income nations. In six

FIGURE 4-6

Language access to internet and ratio of speakers to total internet users



Source: Internet World Stats website in January 2009.

Arab countries–Egypt, Algeria, Lebanon, Yemen, Jordan, and Tunisia–this cost is less than half the world average.

The fall in the price of internet access, particularly in high population countries such as Egypt, indicates policies that encourage internet use. However, it is necessary to go further than these policies in confronting the difficulties which broad swathes of Arab society undoubtedly face in utilising technology applications. This means giving attention to developing Arabic content and acquiring technology able to process it. It is also necessary to adopt creative approaches that make interaction with computers and the net easier for the illiterate and those lacking computer skills using touch-sensitive screens and user-friendly software.[6]

On a reading of the data presented in the preceding paragraphs (Figure 4-1's presentation of the ICT index from the World Bank database and the data indicating an expansion in internet use in some Arab countries), we find some improvement in the indigenisation of knowledge tools and technologies. However, the data neither put these matters in context, nor reveal their actual contribution to the productive employment of these technologies.

THE ARABIC LANGUAGE AND THE INTERNET

The number of those using the internet in Arabic approached 60 million at the beginning of 2008. That is, the access of Arabic speakers to the internet is close to 17 per cent of the population of the Arab countries.[7] This proportion falls below the world average which is close to 22 per cent. Arabic also has one of the lowest penetration rates among the top-ten group of world languages on the net. While it is close to the internet penetration rate of Chinese speakers, the number of Chinese web pages tips the balance in favour of the latter language. As for Arabic language penetration in comparison with Hebrew, the latter comes out on top with almost 66 per cent penetration, placing it in the ranks of the languages of advanced nations such as Japan (73.8 per cent) and Germany (63.5 per cent).

The number of Arabic speakers using the net is close to 4.1 per cent of all internet users globally. In terms of global internet use, this puts Arabic in seventh place among the world's top ten languages, and is close to the Arab countries' proportion of the world's population (see Figure 4-6).

Arabic has one of the lowest penetration rates among the top-ten group of world languages on the net

Table 4-1 gives a picture of the place of Arabic among the world's top ten languages in terms of numbers of speakers, its rate of growth on the internet between 2000

TABLE 4-1

Top ten languages used on the net (number of internet users by language)

Top ten languages	World population for this language 2007 (millions)	Growth of this language on the net 2000-2008 (%)	Internet penetration by language (%)	Internet users by language (millions)	Internet users as a percentage of world users (%)
English	2039	203.5	21.1	430.8	29.4
Chinese	1365	755.1	20.2	276.2	18.9
Spanish	452	405.3	27.6	124.7	8.5
Japanese	127	99.7	73.8	94	6.4
French	410	458.7	16.6	68.1	4.7
German	96	121.0	63.5	61.2	4.2
Arabic	357	2063.7	16.8	59.9	4.1
Portuguese	240	668.0	24.3	58.2	4.0
Korean	73	82.9	47.9	34.8	2.4
Italian	58	162.9	59.7	34.7	2.4
Top ten languages	5218	278.3	23.8	1242.7	84.9
Other languages	1458	580.4	15.2	221.0	15.1
Total	6676	305.5	21.9	1463.6	100.0

Notes:
1) These statistics were updated in June 2008.
2) Internet penetration is the ratio between the total of internet users speaking a language and the estimated total population speaking that language.
3) Data derived from publications of the International Telecommunications Union, the Computer Industry Almanac, Nielsen Net Ratings, and other reliable sources.
4) World population information comes from the U.S. Census Bureau.
For definitions and help in obtaining details on a number of languages see the website of Site Surfing Guide

Example for data interpretation: there are around 125 million Spanish-speaking users of the internet and this number represents close to 9 per cent of world internet use. Of all those who speak Spanish (some 452 million people), 27.6 per cent use the internet. During the period 2001-2007, the number of Spanish speakers using the internet increased by 405 per cent.

Source: Website of Internet World Stats in January 2009

The growth rate in Arabic-speaking internet users (2064 per cent in the period 2000-2008) is the highest among the top ten languages on the net

Arabic digital content is restricted to limited areas, most of which are disconnected from the reality and needs of Arab societies

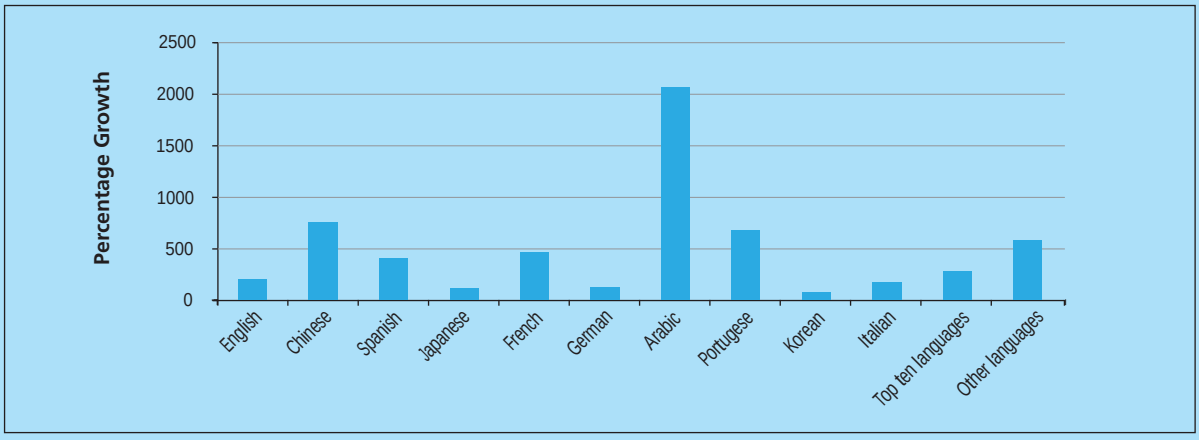
and 2008, and the number of internet users who speak the language and their proportion of total internet users. The fact that the growth rate in Arabic-speaking internet users (2064 per cent in the period 2000-2008) is the highest among the top ten languages on the net is one of the positive trends displayed in the table. In comparison with the other languages, the growth rate for Arabic speakers is many times more than that for Chinese (755 per cent) over the same period (see Figure 4-7). This acceleration in internet use promises greater possibilities for success in promoting applications of technology in various fields. This should contribute to a revival in Arabic knowledge performance in general.

Despite Arabic's accelerating growth on the internet over the last few years, its presence on the net remains below expected level in terms of the number of its speakers. The efforts expended in creating Arabic digital content are also restricted to limited areas, most of which are disconnected from the reality and needs of Arab societies and fail to enrich knowledge related to social or economic development. Certainly, the domination of some subjects and meagre treatment of others directly related to pressing developmental issues and current cultural affairs is out of keeping with the challenges of a highly competitive world; in such a world, marginalisation is the fate of cultures that fail to reproduce themselves adequately through the creation of knowledge and devise new forms for its utilisation. If Arabic digital content is to be upgraded, national and regional policies aimed at enabling creative intercommunication and interaction with the world and contributing to it in a critical spirit that affirms the Arab region's capacity to assimilate, indigenise, and cultivate and, indeed, create knowledge are called for.

While the proportion of Arabic-speaking users of the internet is not much less than the average of its global use, available data do not permit distinctions between kinds of internet use. Detailed studies must be undertaken to reveal the ways in which Arabic speakers use the internet in comparison with others. In preparation for the launching of initiatives aimed at developing Arabic digital content, studies of the content of sites visited would also be useful to reach an understanding of the kinds of digital content that have the biggest circulation among Arabic-speaking user sectors. Some recent statistics[8] reveal a total number of Arabic-only web pages of approximately forty million out of forty billion pages, or one thousandth of the total. This proportion clearly shows the low volume

FIGURE 4-7

Growth of languages on the internet 2000-2008



Source: Internet World Stats website in January 2009.

of Arabic content and its low rate of creation relative to other countries and languages.

On the other hand, the statistics indicate that the picture has begun to change, albeit extremely slowly. Although Arabic content on the net remains stable, the number of Arabic sites and pages has grown markedly larger. The number of web pages containing content in Arabic–including those written in both Arabic and English–has risen from 114 million pages in 2005 to 189 million pages in 2006, an increase of 65.8 per cent. The corresponding increase in the number of English language pages is 63 per cent. The number of Arabic language pages is expected to reach 5.1 billion in 2012, on the basis of a rise to 80 per cent growth in the years to 2010 and 60 per cent growth subsequently.

It is no exaggeration to say that the future of Arabic depends on the extent of its use on global information networks. This will require great effort on the technical level to obtain all the necessary capabilities to deal with the language itself. Ambitious targets on the national level are also called for so that institutions in the Arab countries–government ministries, universities, schools, civil society organisations–use Arabic in their operations. In this way, Arabic will become a language for the circulation and production of the various branches of knowledge, as it was during the flowering of Arab-Islamic civilisation. (‘Abd al-‘Aziz bin ‘Uthman al-Tuwayjiri, 2008, in Arabic).

Internet use and the spread of Arabic on the net present interrelated opportunities and challenges that call for unconventional approaches to broaden its user base and raise its status (see Chapter 1). Favourable policies and initiatives must be adopted; regional and international partnerships must be entered into. Digital content related to the Arab countries should also be produced and distributed in foreign languages.[9] As the following paragraphs in the section on Arabic digital content make clear, creating advanced search engines, automatic translation systems, smart processing of scripts, semantic searching, and the deployment of interactive websites to facilitate learning are among the tools needed to ensure the spread of a language on the net.

ANTICIPATED ADVANCES IN ICT

The number of web pages containing content in Arabic has risen from 114 million pages in 2005 to 189 million pages in 2006, an increase of 65.8 per cent

Over the last few years key technologies have converged so as to secure on a single platform kinds of services–such as internet access, video and audio telephony, and radio and television broadcasting–that were previously only available separately. In the last two decades great progress has been made in providing plentiful and up to date information on the internet and via the search engines operating on it. It is now possible, by networking computers in educational institutions and research institutes across the globe, to run software that requires the supercomputing capabilities used in models and simulations of physical and natural processes.

Microprocessor evolution is expected to continue in the short term on the basis of many current technologies that are all subject to incremental improvements aimed at limited performance upgrade. This development will help to increase the power of personal computers and lessen their cost.[10] This implies the continued dominance of the personal computer in accessing knowledge resources. Use of multi-core processors will allow high performance computing without a marked increase in energy consumption. Current processor design tends towards simplification of the internal structure through use of multiple cores and parallel programming. Utilisation of the gains made by microprocessor development requires new solutions for memory access, cross-core communication, and greater reliability.

It is no exaggeration to say that the future of Arabic depends on the extent of its use on global information networks

The term “next generation networks” describes all the anticipated key technologies in the backbone and access networks expected to come into general use during the next five years. These will

permit the transmission of various kinds of data packet, as is the case currently for the internet. Since these networks are built on top of internet protocols, this will facilitate communication between different kinds of network and allow users to get access to different kinds of content via any means–computer, mobile telephone, and similar devices–and at any time, irrespective of the quantity of data over the range of the different varieties of digital content.

During the coming decade the technology of the semantic web, which aims to make the web machine readable and enable computers to "understand and absorb" data prior to processing it, is expected to become more elaborated

Next generation networks will permit the securing of new services such as communication via multimedia, including instant messaging, video-calls, and video transfer on the net. Next generation networks also possess features superior to those of their predecessors in terms of information security and the use of more flexible and extensive data storage and computing structures on the network. Other features of the next generation networks are ease in securing services that conform to user requirements and behaviours and ease in searching and accessing knowledge content.

The acquisition of the semantic web technology should be a priority for Arab research and development programmes that aim toward a more intelligent and coordinated utilisation of forthcoming ICTs with regard to Arabic digital content

In many concerned institutions, research and development activity is tending towards the production of more effective versions of search engines, which currently often return unwanted results to the user. This will enhance internet performance in general for all its users and will enable, in particular, the expected search engines to gain a better "understanding" of the content of web pages and sites. Searching the web will focus on content, structure, and user ends. To a great extent this will be achieved by relying on marking up pages with semantic tags related to the content. During the coming decade the technology of the semantic web,[11] which aims to make the web machine readable and enable computers to "understand and absorb" data prior to processing it, is expected to become more elaborated. This should make the acquisition of such technology a priority for Arab research and development programmes that aim toward a more intelligent and coordinated utilisation of forthcoming ICTs with regard to Arabic digital content (Nawwar al-'Awwa, background paper for the Report, in Arabic).[12]

On the software level, the trend for collaborative software development outside the monopoly imposed by major companies is expected to continue. Freeware, or open source software, is anticipated to present a serious challenge to proprietary commercial products in terms of cost, speed of evolution, and reliability.

Expected advancement in networks, infrastructures, and software over the next few years will lead to the availability of a wider group of ICT applications, such as e-commerce, on the internet and to improved conditions for cooperation in various arenas including engineering design, distributed industrial manufacturing processes, and networked research and development activity. The most prominent example of the benefits that will accrue to users of next generation networks will be apparent in easier and more effective access to distance learning and continuing education services, with the possibility of tailoring educational programmes to suit the learner's requirements and previous qualifications. These services will come to rely to a greater extent on virtual reality applications and artificial intelligence software. Ideal utilisation of the coming technologies, particularly next generation network technologies, requires development of the communications infrastructure towards a unified format for the transmission of data in its various forms together.[13] Once this is done, it will be possible to offer such services at lower cost and in broader scope, which will generate the revenues and opportunities to develop these services and offer more of them, and in the long run achieve numerous economic and social gains. However, this is subject to the provision of favourable policies that permit competition in introducing the new technologies and that channel this competition in the interests of the consumer. Regional and international cooperation aimed at the

exchange of future technology services or at partnership in providing them will help to add value due to the migration to next generation networks and services. These, in turn, will realise comprehensive economic and social benefits that will extend in a cycle affecting all functions and sectors of society. In order to reach this goal, it is necessary to support research activity aimed at developing applications dedicated to spreading Arabic language use on the network. Coordination between Arab countries and benefiting from the lessons of countries and institutions that have made earlier progress in utilising and developing modern technologies is called for.

Advancement in the development and deployment of technologies that ensure improved confidentiality of data transmission is expected to continue. However, such an advance will not be enough to limit the practices of certain countries and institutions in exploiting their technological superiority to eavesdrop and breach data confidentiality and privacy.

The future of ICT presents valuable opportunities to deploy innovative means to acquire, produce, and distribute knowledge which will enrich Arab knowledge accumulation. It is expected that the cost of internet access in peripheral regions will continue to fall. The convergence of ICT and the media will also accelerate with the deployment of broadband network infrastructure. This will expand the opportunities and options available to citizens to obtain media, education, and health services and to communicate with their governments and with local and external markets. In addition, the business sector will be energised, and marginalised rural and urban groups will be developed. Nevertheless, this increase in opportunity is dependent on to the application of clear policies that make the massive investment required by communications technology compatible with guarantees of the social right of all citizen groups to benefit, as well as support for the participation of women and guarantees of freedom of expression.

TECHNOLOGY APPLICATIONS AND ARABIC DIGITAL CONTENT

REGULATORY FRAMEWORKS

Since the end of the last decade, most Arab countries have begun to institutionalise ICT through policy formulation, infrastructure, institution building, and the enactment of laws and regulations related to the utilisation of these technologies. Egypt, Tunisia, Jordan, and the UAE are considered the pioneers in these endeavours. Egypt created a ministry for communication and information technology in 1999. It laid the foundations for a national plan aimed at setting the bases for the information society in Egypt through coordination between the pertinent government agencies and in partnership with private sector institutions. Tunisia made marked efforts in the second half of the last decade aimed at developing and expanding the communications infrastructure and human capacity, and at creating databases to improve, in particular, the performance of government institutions. An initiative embracing ICT was launched in Jordan in 2000 to boost ICT exports and attract direct foreign investment. The UAE stands out among its Arab peers in the implementation of numerous activities that have come to fruition in an impressively short time. It therefore occupies advanced positions in world rankings, and the top spot among Arab countries according to many ICT indicators.

The Arab countries have finalised policies, strategies, and action plans concerning ICT and its utilisation in accordance with the decisions of the Summits on the Information Society of 2003 and 2005 and the working plan deriving from them. Initiatives have been taken that seek to make the information

Since the end of the last decade, most Arab countries have begun to institutionalise ICT through policy formulation, infrastructure, institution building, and the enactment of laws and regulations related to the utilisation of these technologies

The UAE has come to occupy advanced positions in world rankings and the top spot among Arab countries according to many ICT indicators

society a reality and lay the ground for the development of national capacity to utilise ICT in numerous fields. Organisations have been founded charged with formulating national strategies and programmes for the utilisation of ICT applications, particularly in the areas of government services, business, and education.

Apart from a few isolated bright spots, however, strategic planning for the ICT sector by Arab countries and creation of the legal framework needed to regulate its utilisation has taken place relatively slowly, as this chapter makes plain. A second look at these strategies and laws is obviously called for. This is not only due to the speed of development of these technologies, but because these strategies and laws have ignored, or not used the necessary care when dealing with, a number of key issues without which it is not possible to make ideal use of technology applications. Strategic decisions taken in many Arab countries have given the greatest share of attention to infrastructure issues and legislation and have not given equivalent attention to issues related to applications, digital content, and development of the use of the Arabic language on the net.

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THE ICT SECTOR IN THE ARAB COUNTRIES

The technology sector in the Arab countries has witnessed considerable growth, the telecommunications branch providing the lion's share. The liberalisation of the telecoms sector has resulted in the emergence of large companies, some of which have become active in the regional Arab and international arenas. However, the contribution of these companies in most Arab countries to knowledge production remains weak, even in terms of the content related to their operations. There is some evidence indicating a trend for some companies in this sector to offer grants directed at economic and social development. Once the foundations, institutions, and supporting legislation are in place, this sector will help to produce digital content, especially that related to their own marketing, as is done by similar companies elsewhere. It is noticeable that most Arab countries have created institutions to incubate, direct, and disseminate ICT. What they offer, however, is in its early stages. The existence of sponsoring institutions is reckoned a necessity if the successful utilisation and expansion of usage levels of technology is to be guaranteed, provided this is accompanied by legislation and practices that grant extensive freedom of use of these technologies.

Securing low cost computers is considered one of the essential conditions for the broadest possible dissemination of technology and access to information and knowledge sources

HARDWARE PRODUCTION OR ASSEMBLY

Activities connected with ICT are limited to the production or assembly of hardware for personal computers and other ICT related devices on the one hand, and software production on the other. Some Arab countries–Egypt and Saudi Arabia in particular–have witnessed tangible private sector investment in setting up assembly lines, generally for low-specification computers. Securing low cost computers is considered one of the essential conditions for the broadest possible dissemination of technology and access to information and knowledge sources. To achieve this there is no alternative to the reliance on new forms of cooperative initiative. The "Computer for $100" initiative recently launched by the UNDP in cooperation with the Massachusetts Institute of Technology secures a starting point to enable limited income sections of society to purchase computers. Nevertheless, securing $100 to buy a computer still remains an impossible goal for tens of millions of students and other Arab citizens who could–and ought to–benefit from such projects. Hence, to make such initiatives succeed, particularly in the high-population, low-income Arab countries, partnerships between government, the private sector, and civil society organisations are essential. The Saudi project "A Computer in Every Home" provides, in principle, an example

of national partnerships aimed at similar ends.[14] However, it will also be necessary to reduce the cost of securing the computers produced within this project to a much greater extent so that they become available to those with middle and low incomes.

THE SOFTWARE INDUSTRY

Since the end of the last century, the software industry has grown within the environment and economics of the internet. Control of the software market by multinational companies has made it difficult for local market requirements to provide a base for the introduction of a software industry. In many cases, this has been made possible by exploitation of qualified human resources in developing countries like India. In developing countries in general, the role of government is limited to facilitating the operation of multinational companies through the creation of legal frameworks favourable to the protection of their software from piracy and securing a climate that allows its widest possible distribution.

The software industry is still embryonic in the Arab countries in comparison with other countries or with what it ought to be. One news report[15] even describes the state of the software industry in the Arab countries as pitiable, pointing to the continued absence of the Arabs from the world software map despite the availability of material and human capabilities and the tangible returns that this industry–which has revived the economies of many countries–could achieve. There are promising opportunities to make returns on the local and regional markets by meeting, in the first place, Arabic software requirements. The world markets are also brimming with opportunities. Computers are not the sole focus of the software industry. Indeed, they account for a declining share of its attention due to the increasing proliferation of computer components in a broad spectrum of products and applications across telecommunications, defence, security, transportation, and media, in addition to growing product lines of office and domestic devices intended for general use in sectors like tourism, banking, and the engineering industries.

Lack of awareness of its importance and of the returns it could generate is a key impediment to an Arab software industry. Hence investments directed at the national software industry are limited, while ready-made, and even arabized, software is imported from abroad. However a number of Arab countries including Egypt and Jordan have over the last few years begun to take steps to activate software manufacture and guarantee accessories supply. Included, for example, within Egypt's ICT strategy are items designed to support export-oriented software manufacture. Egypt has also created a body devoted to developing the ICT industry. The number of dedicated software houses in Egypt is estimated in the hundreds. Sources indicate that these companies have, since the beginning of the decade, exported software worth hundreds of millions of dollars annually. The volume of their sales was expected to reach $500 million in 2005. Statistics going back to 2005 report that up to 25,000 software engineers work in the sector. Egyptian universities are also estimated to produce approximately 20,000 graduates specialised in the software field every year. However statistics from the beginning of the current decade indicate that returns per programmer from software industries elsewhere in the world are several times greater than those achieved by Egyptian programmers. Per programmer returns in Egypt reach $10,000 per year, which is less than that generated by a programmer in India ($15,000), and many times less than that generated by programmers in Ireland ($38,000) or Israel ($140,000).[16]

In Jordan, local universities and international companies have entered into partnership to cooperate in software production. In 2006, one of the pioneering programmes in this field[17] developed plans that aim to attract direct foreign investment

Control of the software market by multinational companies has made it difficult for local market requirements to provide a base for the introduction of a software industry

The software industry is still embryonic in the Arab countries in comparison with other countries or with what it ought to be

valued at $170 million in the field of software development, create thousands of job opportunities in that sector, and generate local returns valued at $500 million.

One solution put forward to stimulate the Arab software industry is the design of regional projects to generate demand for industry products that aim to spread essential applications in fields such as government services, education, business, and healthcare. An incubator system primarily concerned with creating and supporting small businesses active in the various areas of the software industry is a possibility. It is worth pointing out here that expenditure on such projects does not have to equal expenditure on readymade software imports, if the projects are flexibly run and expertly managed.

In general, the Arab countries are clearly underdeveloped in their use of technology applications to provide education, health, and government services and in their utilisation in media and business

ICT APPLICATIONS AND BUILDING THE KNOWLEDGE SOCIETY

ICT applications fulfil a tremendously important role in the production and reconstruction of knowledge in Arab countries. Although some advance has been made in the utilisation of this technology, the Arab scene is not at all encouraging. The Arab countries in general, with the exception of GCC members, are clearly underdeveloped in their use of technology applications to provide education, health, and government services and in their utilisation in media and business. Indeed, advanced applications, in the field of healthcare in particular, are almost totally absent in all Arab countries.

Low-population Arab countries with high capacity resources could–with appropriate policies and practices–enjoy rates of technology application utilisation equivalent to or exceeding those currently enjoyed by some advanced nations

Accelerating advances in applications of ICT in the Arab countries are expected to cause gradual transformations within a growing number of sectors, the business sector chief among them. In the majority of cases this is likely to come about in response to external trends and pressures rather than as a result of internal initiatives. Business administration and marketing via e-commerce systems on the internet are proliferating and becoming more secure in many of the world's countries. The trend towards electronic transaction systems will extend to other sectors including education and distance working.

Utilisation of ICT applications will certainly require the creation and consolidation of new rules to regulate them, control their quality, and guarantee the general deployment of their benefits. Despite this technology offering solutions that will strengthen demand for its applications, technological solutions are not enough on their own. They do not guarantee the rights and duties of users who come with disparate tastes and aims and do not necessarily guarantee the enrichment of knowledge. Closely linking technological solutions to updated regulations is imperative in order to produce knowledge content in Arabic, particularly in the area of knowledge dissemination via education and training and by the generation of new job opportunities in fields connected with knowledge production and utilisation. The spread of new standards that ensure the upgrading of the knowledge archive in terms of its quality and range is also vital.

Low-population Arab countries with high capacity resources could–were they to put in place appropriate policies and practices–enjoy rates of technology application utilisation equivalent to or exceeding those currently enjoyed by some advanced nations. This would help improve ICT utilisation in the other Arab countries.

E-GOVERNMENT SERVICES

Over the last decade, the computerisation of the functions of government has been limited to spreadsheets and use of the computer as a high-spec typewriter for document retrieval and manipulating and storing statistical data. E-government services made their appearance in the world with the beginning of the spread of the internet.[18] These services generally aim at two goals: facilitating the needs of citizens and improving the efficiency of government processes via dedicated websites on the internet. Sites are classified

TABLE 4-2

Readiness of Arab countries to adopt e-government applications

Country	Index 2005	Index 2008	Ranking 2005	Ranking 2008	Change in ranking 2005, 2008
UAE	0.572	0.630	42	32	10
Bahrain	0.528	0.572	53	42	11
Jordan	0.464	0.548	68	50	18
Qatar	0.490	0.531	62	53	9
Kuwait	0.443	0.520	75	57	18
Saudi Arabia	0.411	0.494	80	70	10
Lebanon	0.456	0.484	71	74	-3
Egypt	0.379	0.477	99	79	20
Oman	0.341	0.469	112	84	28
Syria	0.287	0.361	132	119	13
Libya	..	0.355	..	120	..
Algeria	0.324	0.352	123	121	2
Tunisia	0.331	0.346	121	124	-3
Morocco	0.277	0.294	138	140	-2
Iraq	0.333	0.269	118	151	-33
Djibouti	0.238	0.228	149	157	-8
Sudan	0.237	0.219	150	161	-11
Yemen	0.213	0.214	154	164	-10
Mauritania	0.172	0.203	164	168	-4
Comoros	0.197	0.190	155	170	-15
World	0.427	0.451	..	..	..

Source: United Nations, 2008

TABLE 4-3

Readiness to adopt e-goverment applications in some comparable countries

Country	Index 2005	Index 2008	Ranking 2005	Ranking 2008	Change in ranking 2005, 2008
Cyprus	0.587	0.602	37	35	2
Turkey	0.496	0.483	60	76	-16
Azerbaijan	0.377	0.461	101	89	12

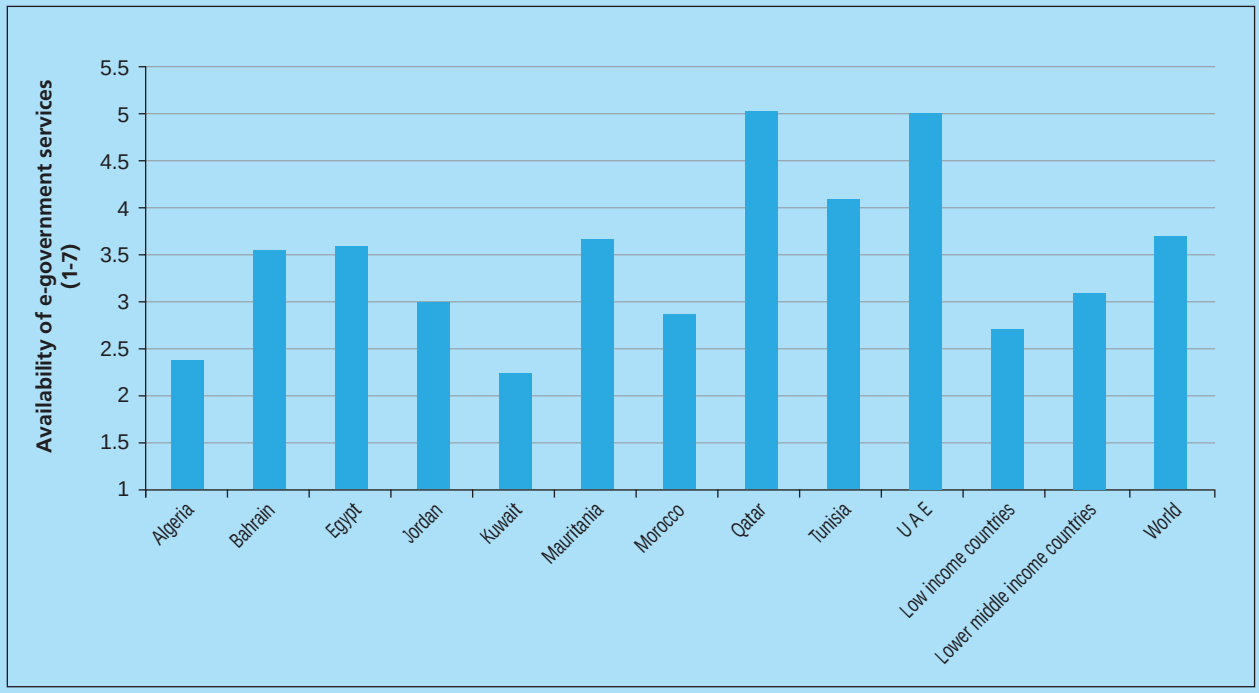
Source: United Nations, 2008

Review of sites that have been updated to offer e-government services in the Arab countries over the last few years reveals that most of them remain at the informational stage

into groups according to the nature of the services provided, such as informational, one-way interactive or two-way interactive. The last of these extends to include sites that handle financial transactions and sites that allow networking with other sites. A review of sites that have been updated to offer e-government services in the Arab countries over the last few years reveals that most of them remain at the informational stage.

Table 4-2 presents the values of the indicator that measures the state of readiness of the Arab countries to adopt

FIGURE 4-8



Source: World Bank database, Knowledge Assessment Methodology (KAM). http://info.worldbank.org/etolls/kam2/KAM_page5.asp. on 12 December 2008

The advanced nations have accumulated a wealth of knowledge connected to e-government initiatives because major consulting firms in these countries are planning and implementing e-government initiatives that revolve around the priorities and requirements of the citizen

e-government applications in the years 2005 and 2008.[19] The table makes clear that five GCC countries (the UAE, Bahrain, Qatar, Kuwait, and Saudi Arabia) lead in their readiness to adopt e-government applications. Jordan and Lebanon also occupy advanced positions in this regard.

Figure 4-8 gives indicator values for a group of Arab countries pertaining to availability of e-government services as used by the World Bank within the Knowledge Assessment Methodology (KAM) framework.[20] It also gives the average performance for some selected groups of countries. On the basis of the figure, the Arab countries can be divided into three classes. In the first are those that enjoy a high level of e-government services (the UAE and Qatar). These are followed by a second group (Mauritania, Egypt, and Bahrain) that have been able to secure a medium level of these services. The third group (Kuwait and Algeria) provide lower levels of e-government services than these two groups.

Figure 4-8 reveals that the average value for the second group of Arab countries approaches the global average value on the indicator of availability of e-government services. It also makes clear that for the Arab countries for which data is available the level of e-government services exceeds that of the countries with average scores on the HDI and also exceeds the level of other groups of countries of the world.[21]

The advanced nations have accumulated a wealth of knowledge connected to e-government initiatives because major consulting firms in these countries are planning and implementing e-government initiatives and are supported by other institutions devoted to research and software development. These initiatives revolve around the priorities and requirements of the citizen. It is essential to build a similar knowledge framework to put government services in the Arab countries on the same level as those of other countries of the world. This will require the acquisition of knowledge on a number of levels as well

as the implementation of programmes to monitor the development of e-government services and the modernisation of the frameworks for government operations themselves according to the needs of administrative reform.

Despite the importance of the ICT infrastructure, cognitive and behavioural factors such as user skills, political will, and the commitment of leaders in the relevant administrations have more influence on e-government initiatives than technological factors. E-government is a means to reengineer the operation of government, and its initiatives are usually designed with the purpose of integrating and managing information in the best fashion. For this reason, they are resisted by parties that oppose administrative reform. Factors that ought to strengthen the proper application of e-government programmes include ('Abd al-Ilah al-Diwahji, 2006, in Arabic):

- Responsiveness to citizens' requirements and readiness to utilise available services in the best possible way.
- Adoption of stable strategies to solidify the link between e-government programmes and initiatives to develop the working of government and administrative reform.

With regard to initiatives aiming to apply methods of e-government, the government should play a facilitating rather than controlling role and sponsor partnership between stakeholders–citizens, the private sector, and civil society–to spread e-government applications and improve the offerings available. Improvement initiatives usually come from users first. This requires the creation of channels to elicit public opinion via surveys, regular consultations, and many other means whose deployment is facilitated by the new technology.

ICT AND EDUCATION

ICT provides many opportunities to raise the quality of educational materials and programmes, as well as their means of delivery and development, in addition to benefits in administering the educational process. Technological inputs now available include, in the first place, hardware and software for word processing, spreadsheets, and the preparation of slideshows and video clips as explanatory aids. On a more advanced level, they include use of the internet for direct communication between students and their teachers, and between schools and official bodies concerned with overseeing educational activities.[22] On a yet more advanced level, it is possible to use smart programmes to produce study materials and to make use of virtual reality technology to raise the skills of students at a pace suitable to their capacity to absorb and in conformity with other educational programmes they are following. Forthcoming telecommunications devices will permit access to "asynchronous" educational content via mobile telephones or personal digital organisers. Here students will be able to reach educational materials at any time and in any place. Students will also be able to follow in real time lectures given in universities thousands of miles away. Native language discussion with the lecturer will become possible thanks to expected advances in the field of automated simultaneous translation.

Even though there are no absolute indicators of the success of ICT in the education sector, the results of a number of studies[23] indicate that its use in curricula has been of benefit in developing student problem-solving skills. Teachers' use of the tools of information has also had positive effects on the outputs of the educational process. The Organisation for Economic Cooperation and Development (OECD) countries have developed comprehensive policies for use of these technologies in the education sector in the context of the transformation towards knowledge societies and the knowledge economy. These policies deal with the introduction of technology into the education sector along main axes that include the eradication of information illiteracy[24] via continuing education for all members of the workforce on various levels, provision

E-government is a means to reengineer the operation of government, and its initiatives are usually designed with the purpose of integrating and managing information in the best fashion. For this reason, they are resisted by parties that oppose administrative reform

of ICT infrastructure, securing internet access by using broadband networks to make use of the net in classrooms and libraries, providing multimedia systems, and lowering the ratio of pupils to computers in schools. Programmes designed to implement these policies try to provide opportunities for internet access to educational institutes in marginalised urban and rural regions and communities and take effective advantage of sources available on educational websites in regions that enjoy better resources. As for less advanced countries, implementation policies are focused on improving pupil-to-computer ratios and securing content by linking libraries at acceptable speed over the internet.

Developing digital content related to educational and training programmes is considered a high priority for the coming stage for countries that have made some progress in laying infrastructure. These countries should encourage partnerships with publishers, television channels, museums, and national libraries to develop digital educational content. Among modern methods used in developing content are "learning objects" based on modules and educational content units that contain a specific portion of content in the form of texts, pictures, audio recordings, or video clips; the time required to present a unit does not go beyond a few minutes. Modules can be linked together to form an integrated part of the desired curriculum.[25] In all of this, reliance on the open source method leads to tangible development in interactive educational materials (see Box 4-1).

Despite the advances achieved through expenditure in many of the world's countries, current levels in the area of information tools in the education sector are not sufficient to achieve the ends promised by available technology. Technology is still used simply to digitise school textbooks, while computerised curricula comprising dynamic and interactive methods do not find the support they deserve.

As is the case in other areas, technology is not sufficient to develop the educational process. It must be combined with other behavioural, structural, and organisational factors to achieve ideal results. Relying only on digital indices to measure performance is also not of value in isolation from a concern for qualitative effects, despite the difficulty of coming to grips with these.

Some Arab states have taken initiatives to use ICT in the various stages of education. These efforts, in spite of their importance, remain less than what is required and possible

Some Arab states have taken initiatives to use ICT in the various stages of education. However these efforts, in spite of their importance, remain less than what is required and possible. Computer-per-pupil ratios in pre-university education are still low, and schools generally lack the ability to access the internet. By comparing school access to the internet in the Arab countries with that of all the countries of the world for which data are available, we find that some Arab countries (UAE, Qatar, and Tunisia) placed (at 5, 4.8, and 4.9 respectively) higher than the global score of 3.74,[27] while some other countries, such as Egypt and Jordan placed close to the latter (at 3.1 and 3.9 respectively), and yet others, such as Mauritania (at 1.9) , placed in the lower ranks and far below the global average in this field. However, the international community has not made great strides either to date in securing internet access for their schools. The corresponding score

BOX 4-1

Open Source Software and Educational Content

Most open source software is available for use by anyone who can access the internet and has an acquaintance with the software field. Open source software comprises a range of products which are devised, developed, and publicly deployed free of charge, on condition that anyone who is able to make improvements to the source code makes them freely available. Among the software systems belonging to the open source array are content authoring and deployment tools that have significant, direct applications in the various stages of education. These include the Open Office package which contains most of the applications found in Microsoft Office,[26] in addition to content authoring and deployment tools and blogging software which can be very easily utilised in educational activities that require interaction between students and teacher, and systems to design study curricula that are of use in building educational content. Open source systems also include Arabic spellcheckers and whiteboards that are of use in giving ideas visual form within texts. There are also programmes to arabize software and translate operating manuals and others to design academic tests that help the teacher to come up with questions and exams and permit the design of mental exercises with educational applications.

BOX 4-2

Evaluating the Performance of Projects to Network Educational Institutions

The world's universities were active throughout the 1980s and 1990s in the creation of networks linking their campuses and faculties and in linking their research laboratories with counterparts worldwide. A number of Arab countries over the last decade have created computer networks to link their universities. The dominant pattern in the work of these networks is directed at displaying summary information around educational activities and scientific research. Content on many websites of these networks and the universities they comprise has also not been kept up to date.

On the other hand, some Arab countries[29] are partners in implementing regional projects and initiatives aimed at creating a network infrastructure that links their scientific and research institutions globally. Among these is the Consortium of Arab Mediterranean Research and Education Networks (CAMREN), which aims to set up the infrastructure for e-services and applications to assist researchers in the region (Nawwar al-'Awwa, background paper for this Report, in Arabic). It is planned that this project will allow the utilisation of computing resources available in the partner institutions via networked computing applications. Such projects secure the high computing power necessary to utilise specialist software such as simulation and virtual reality applications. They help to create new learning environments based on multimedia applications, online lectures, and other means to enrich Arabic content on the net and escape the traditional approaches prevailing in many Arab educational institutions.

One of the potential benefits of the availability of internet services is to make it possible for schools to communicate with each other and with the government bodies concerned with supporting them and monitoring their performance. A very important initiative on this level is the endeavour by the Supreme Education Council in Qatar to monitor the performance of schools that offer basic educational services on the internet and to publish regular reports that review their progress in a range of respects.[30]

for upper-income countries is 5.26.[28] In terms of the immediate future, the current plans of the Arab states for the provision of computers to schools and through these of internet access cannot be described as overly ambitious.

The link between ICT use and higher education in the Arab countries is weak. This makes it imperative to provide computers at low cost, and to orient educational curricula design in a direction that stimulates computer and internet use within the educational process, as is the case in many countries. The number of virtual universities in the Arab World remains low.[31] The first virtual university was founded in Syria in the last decade. A virtual university has also been set up in Tunisia.[32] Cairo University in cooperation with UNESCO has founded virtual faculties. Ain Shams University is also cooperating with the Mediterranean Virtual University to offer a collection of study materials via the internet. The e-academy in Jordan can be considered a model for virtual universities created in the Arab countries. The Arab Open University adopts some forms of e-learning since it uses multimedia computer resources.

ICT also offers valuable opportunities for communication between educational institutions of various levels and with the bodies concerned with evaluating their performance (see Box 4-2). Such communication has the greatest influence in knowledge dissemination and in performance evaluation on the national, regional, and international levels.

The lessons derived from a review of global trends in exploiting ICT in education can be summarised as follows:

1. Introduction of wholesale changes to educational curricula to make it possible to offer them on the internet.
2. Eradication of computer illiteracy for workers in all aspects of education and educational administration.
3. Provision of schools with appropriate computer hardware and internet access, and reliance on open source software at all educational levels.
4. Development and deployment of the concepts, tools, and software of self-learning.
5. Strengthening the partnership between school, home, and community by utilising available technology.

The link between ICT use and higher education in the Arab countries is weak

The number of virtual universities in the Arab World remains low

E-COMMERCE

In contradiction to the call to restrict the role of the state in all matters impinging on economic activity, government bodies in the Arab countries must play a direct role in facilitating and organising e-commerce activities and find legal solutions that allow challenges to be confronted

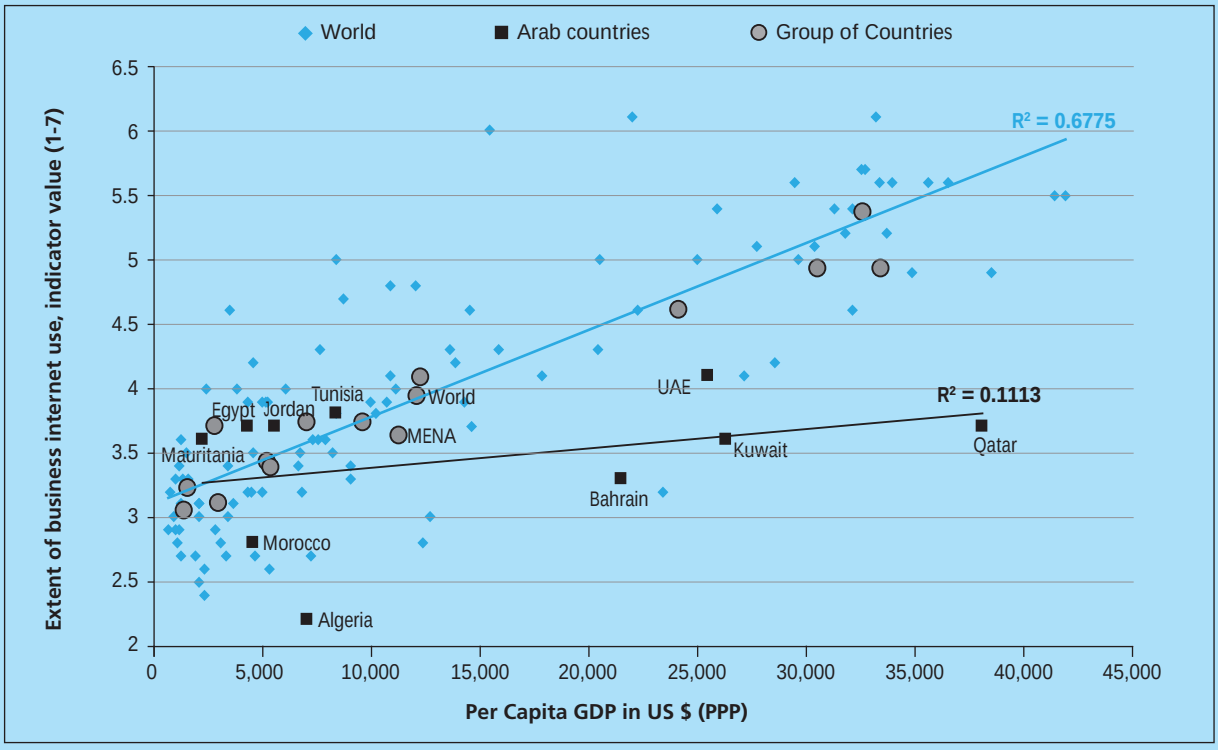
While "e-commerce" is a relatively recent term, use of computers, communications networks, and what is called electronic data interchange goes back to the 1960s. At that time however, it was restricted to large institutions, companies, and banks using mainframe computers. Regardless of the problems that still confront e-commerce, it is expected to continue to proliferate and generate expanded opportunities for trade exchange and competition. These will be followed by attempts to develop methods of production, expand choices available to the consumer, and open up access by small and medium businesses to wider markets.

Figure 4-9 sheds light on the growth of internet use by businesses–in most of the world's countries (the blue dots) and some Arab countries (the larger squares)–when plotted against growth in per capita income. The graph also shows the position for some groups of countries (the circles). The correlation coefficient, which measures the strength of the relationship between pairs of variables in such cases, reveals that for most of the world's countries there is a marked positive correlation between the indicator score and per capita income. However, the graph also shows that the distribution of scores on the indicator of the extent of business internet use for the Arab countries does not strongly correlate with per capita income.[33]

In contradiction to the call to restrict the role of the state in all matters impinging on economic activity, government bodies in the Arab countries must play a direct role in facilitating and organising e-commerce activities and find legal solutions that allow challenges to be confronted and the opportunities they present to be exploited. In this context, the formulation

FIGURE 4-9

Change in business internet use plotted against per capita income in some Arab countries and worldwide



Source: World Bank database, Knowledge Assessment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp

of common principles that guarantee the compliance of e-commerce systems with national development policies is incumbent upon all Arab states. At the same time they should adhere to international standard solutions laid down for the application of taxation systems and the protection of the rights and privacy of citizens.

TECHNOLOGY APPLICATIONS FOR HEALTHCARE

The reliance on ICT applications by health sector agencies is growing. A host of positive effects have arisen from this including the improved performance and lower cost of equipment, the possibility of transferring it from one environment to another, and the speed of information exchange and data storage. These applications can be classified into groups including:

- Administrative and statistical applications that institutions such as hospitals, clinics, and insurance companies make use of to keep medical records. Such applications have proliferated in a number of Arab countries.
- Raising awareness of health matters via multimedia and the internet. The health sector is considered among the first sectors to exploit ICT to produce and distribute a multitude of documents via web pages with the aim of raising awareness of user groups.
- Medical consultation at a distance using video-conferencing in diagnosis and treatment.
- Use of robotics in surgery. A number of experiments have been undertaken to connect hospitals in developing countries with those in other, advanced, nations, either to perform surgical operations or to guide surgical work.

There are many examples and observations that reveal growth in the use of ICT systems related to medical care in the Arab countries in the first three fields mentioned above. However the level of use differs from one country to another and varies within a single country between one treatment institution and another and between the capital and other cities. Electronic systems may be in broad use in the advanced hospitals in the GCC countries, Jordan, Lebanon, and Egypt, but are much less widely used, or totally absent, in small hospitals and clinics, particularly in the countryside, where many medical clinics still resort to traditional paper files despite the rapid transition towards electronic files in all other fields.

The various fields of e-health include tangible knowledge content that must be produced and deployed in Arabic, particularly in the domain of awareness. Some e-health applications provide fertile ground for the activity of small local businesses, on the one hand, and relevant professional associations on the other. Partnership between these parties is expected to lead to the implementation of many laudable initiatives and programmes, particularly in relation to endemic diseases and the health of pregnant women and children. To take the best possible advantage of such programmes, the available infrastructure must be upgraded and broadband services extended to various rural and peripheral regions, which in most cases suffer from the underdevelopment of their healthcare systems. The ongoing decline in the prices of computer and wireless network devices will make these goals achievable even in the medium and low income Arab countries. Systems conducive to the preservation of patients' rights and the improvement of professional practice related to e-health services should also be put in place. In this context the regional office of the World Health Organisation has set out the basics needed for the launch of e-health programmes.[34]

The various fields of e-health include tangible knowledge content that must be produced and deployed in Arabic, particularly in the domain of awareness

Systems conducive to the preservation of patients' rights and the improvement of professional practice related to e-health services should be put in place

TECHNOLOGY AND SOCIAL DEVELOPMENT

Many local development projects worldwide testify to the positive role ICT fulfils in setting frameworks, founding

businesses, and creating new employment opportunities. The role of ICT in this domain acquires particular importance within marginalised local environments and communities and those facing crises (see Box 4-3). A prominent lesson to be derived from an analysis of success and failure in this respect is the importance of partnership between parties active within the local community, among the most conspicuous of which are associations of farmers and agricultural laborers, women's groups, officials in local government departments and concerned parties in central government, civil society organisations, and private sector institutions. Here emphasis has to be placed on the importance of a deep understanding of the specificities of the local community and the points of strength and weakness that characterise each participating or affected party. For the most part, projects where the local community helps to provide a share of the resources necessary for operation–such as a piece of land or use of a building dedicated to the project groups or its administration–are crowned with success.

The experiences of both developing and advanced countries emphasise the importance of providing flexible sources of funding to secure loans to set up small business projects that rely on ICT within the local community

The experiences of both developing and advanced countries emphasise the importance of providing flexible sources of funding to secure loans to set up small business projects that rely on ICT within the local community. Such flexibility does not lead to laxity on the part of borrowers. Such experiences also indicate the importance of the contribution of women in the community as trainers and trainees in the ICT domain and of the participation of universities and scientific research centres in these projects to provide technical assistance and help improve and upgrade the technical skills of trainers.

One promising application of ICT is its use to develop the human resource base on the national and local levels. Such projects remain rare in the Arab countries. Some, however, have launched initiatives that merit study and follow-up. Among these is the project of the Jordanian National Centre for Human Resources Development (Al-Manar)[35] which collects

BOX 4-3

ICT and Local Development: Examples from Arab countries

The Smart Communities Project: the Smart Communities Project was launched by the UN Economic and Social Commission for Western Asia (ESCWA) at the beginning of the decade and aims to deploy integrated technological inputs to help upgrade skills. Skills particularly targeted are those leading to opportunities for decent and rewarding jobs for women and young people and subsequent poverty reduction within local social, economic, and environmental conditions. The project has been implemented at sites in Syria, Yemen, and Iraq. All the Smart Community Projects comprise two key facilities: a unit to manufacture and market agricultural and food products using modern standards of safety and quality and a multifunction technology centre for the local community that provides the community with access via computers and the internet to a number of services. These include professional training, skill acquisition, and community awareness. The achievements of the project include:

- Creation of units that offer training services and help to introduce new technology for the manufacture of agricultural and food products, water treatment, utilisation of solar energy, and utilisation of interactive software in vocational training.
- Spreading basic ICT skills.
- Consolidating the bases for cooperation and networking that include municipal councils, community colleges, civil society institutions, and non-governmental organisations so as to make it possible to adapt new technological inputs to harmonize with the priorities of the targeted locations.

Syria's Countryside Net website (reefnet.gov.sy): This project aims to provide information to citizens in rural areas of benefit in their daily lives via an internet portal that includes a website for each of the villages participating in the project. In the course of one year websites were set up for eighteen villages participating in this portal, which has received more than 30,000 visitors.

The Risalah website: an interactive website developed as an initiative by students at the Faculty of Engineering at Cairo University and then transformed into the nucleus of a virtual charitable association that offers social care to the poor and sick. The activity of this association has expanded to encompass more than fifteen Egyptian governorates and a number of branches in Cairo. The website provides facilities for the collection and distribution of donations.

The experiences of other countries indicate the importance of the contribution of women trainers and trainees in the ICT domain and of the participation of universities and scientific research centres in these projects

data from various sources and then adapts, standardises, systematises, stores, and distributes it to interested parties. It also sponsors the utilisation of its information archive to undertake studies and research and its use in formulating human resource strategies. The project also provides opportunities for employers to advertise vacancies for free. The Ministry of Manpower in Oman is working to build a labor force database that collects data and information with the aim of guiding human resource policies by drawing up plans, designing appropriate measures to implement these policies, and evaluating their effect on economic and social development.

ICT also presents wide-ranging opportunities of deep impact through distance working. Despite the absence of reliable data, it is expected that the flourishing of business in the GCC countries will help distance working opportunities proliferate. This is particularly clear in the areas of authoring, media, research, translation, web design, and technical consultancy. There is currently a golden opportunity to nurture companies that promote this kind of work. The proliferation of distance working is anticipated to realise valuable opportunities for women in the Arab countries, where the social environment continues to restrict their participation in national labor markets–despite women having achieved advance levels of vocational and academic qualifications–and so limits opportunities for them to guarantee a decent living.

ARABIC DIGITAL CONTENT PRODUCTION

Digital content production offers many opportunities to move towards the knowledge economy and lessen the knowledge divide among countries and among the various sectors of society within each. It is based on three pillars: content production, processing, and deployment. Production accounts for the greater economic returns on the global level. Production and utilisation of digital content are obviously linked to the language of the society. The inputs and outputs of digital technologies are information, and to make it circulate rapidly and easily within the society it must use the society's language. Despite the economic capacity of the Arab countries and the size of their population, they are unable to impose their requirements on hardware and software manufacturers. This mandates self-reliance and the creation of formats to enable technology to deal with the particularities of the Arabic language in line with the needs of its societies.

One ESCWA study (Samir al-'Ayta, 2008, in Arabic) states that the size of the market for Arabic content on the internet and through books, the press, and the various media is around $9 billion annually at the beginning of the present decade. This study estimates the annual growth rate for this industry to be between 5 and 10 per cent. These estimates were based on three content areas: media and entertainment, business and trade, and public services. There is no doubt that the true current figures far outstrip these estimates, but there are no available data or recent surveys to rely on to estimate the current size of the Arabic content market

The proliferation of distance working is anticipated to realise valuable opportunities for women in the Arab countries

Arab countries are unable to impose their requirements on hardware and software manufacturers. This mandates self-reliance and the creation of formats to enable technology to deal with the particularities of the Arabic language in line with the needs of its societies

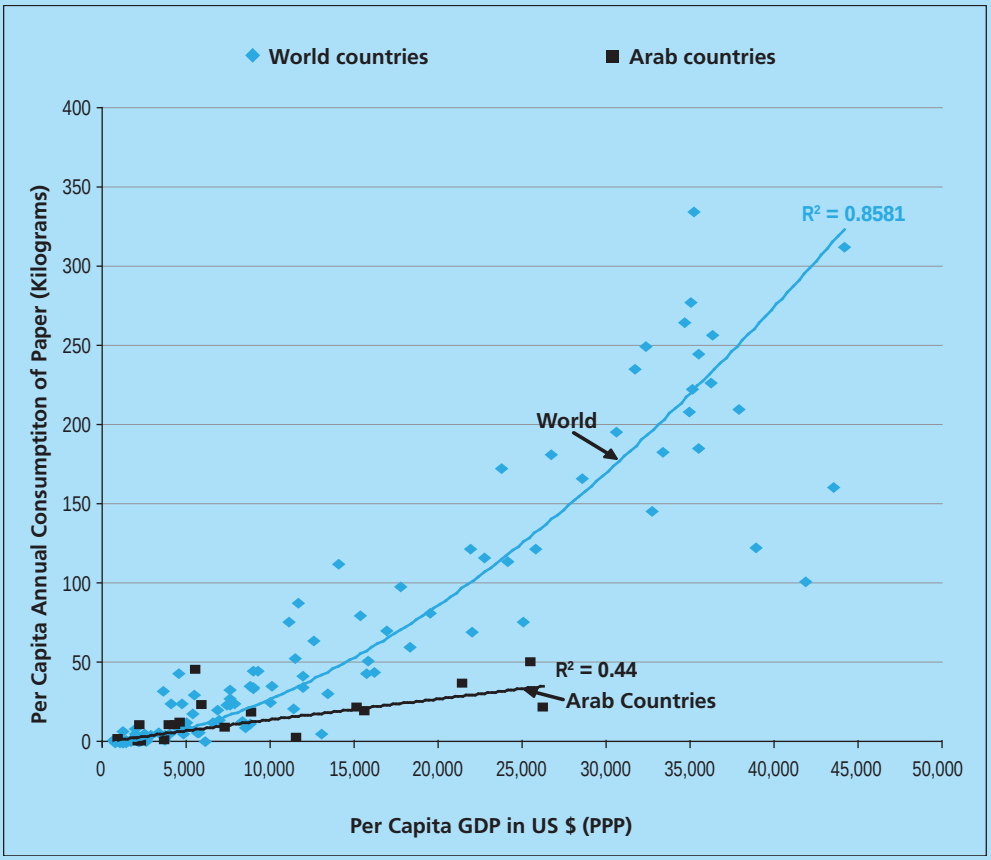
BOX 4-4

ICT Incubators and Arabic Digital Content

Business incubators are not new to the Arab region. Some Arab governments have set up incubators to assist in the launching of small business enterprises, and some have taken an interest in ICT projects. Examples of these initiatives are the Jordanian Technology Incubator, which is run by Jordan's Higher Council for Science and Technology and which specialises in computer games projects and publishing audio guides for tourists; the Network of Moroccan Incubators, which collaborates with universities and faculties of engineering, in particular the Technology Park of Casablanca University, set up in mid-2004 at a cost of more than $100 million; the Elgazala Pole of Communication Technologies in Tunisia; the Palestine ICT Incubator set up within the Islamic University in the West Bank; and the ICT Incubator in Syria, whose eight projects in 2007 were distributed between a number of content areas. Two of them deal with Arabic content through projects for television and cinema direction in the culture and entertainment sector, while another project deals with the provision of services for university students not provided by government agencies. However, these incubators do not, it appears, plan to carry through integrated projects specifically directed towards enriching Arabic content in particular or in responding to the problems of the presence and utilisation of Arabic on the net. Indeed a number of their websites do not contain information in Arabic.

FIGURE 4-10

Paper consumption worldwide and in some Arab countries by per capita GDP



Source: http://www.swivel.com/data_sets/columns/1000512 on 18 March 2009. Per capita GDP data derived from the World Bank database.

Content creation in the Arab countries is modest in comparison with the promising internal market

With regard to traditional publishing, consumption rates for writing and printing paper in the Arab countries are an order of magnitude lower than those in the advanced industrial nations, and doubly lower when the least developed Arab countries are taken into account

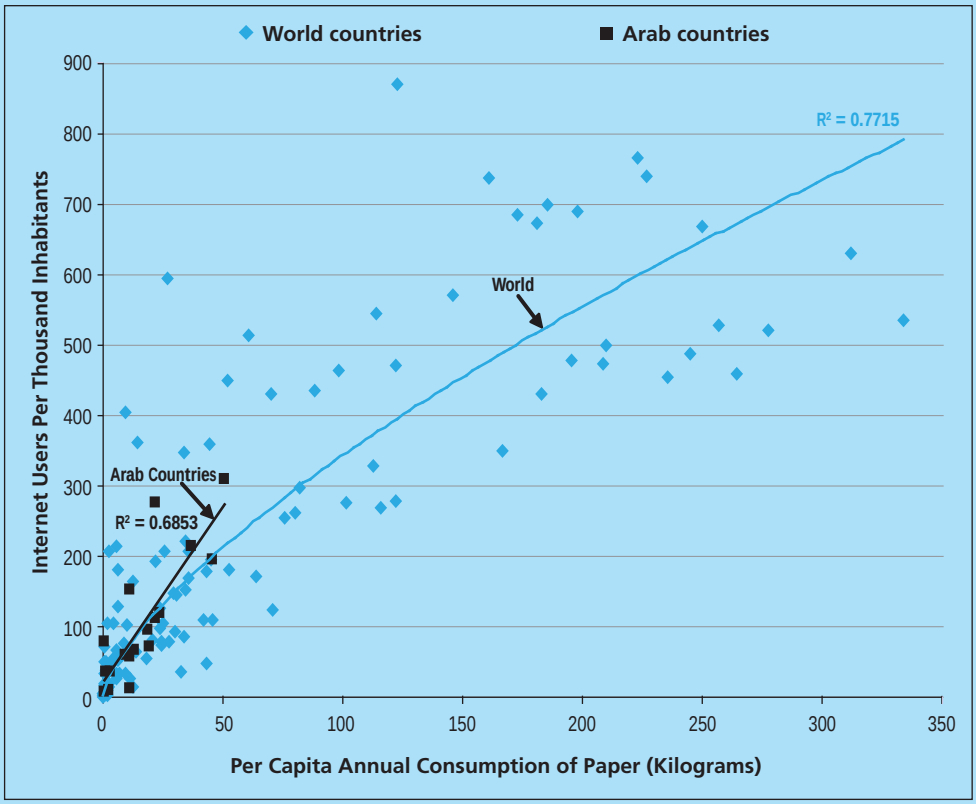
at the present time.

In relation to technical and entertainment content in particular, the Arab countries–like many others–have, for decades, fallen victim to foreign content creation. While the public and private sectors in many countries of the world are playing a role in resisting this dominance, a number of factors hinder such efforts in Arab countries. Among the most prominent of these are the lack of political will and the weakness of the enabling environment (ESCWA, 2003, in Arabic). Business incubators aimed at ICT development and utilisation, when well administered and furnished with the necessary incentives to produce and distribute content, are capable of overcoming many of these obstacles (see Box 4-4).

It can be said that content creation in the Arab countries is modest in comparison with the promising internal market, though Arabic-speaking expatriate communities around the world are an exception. As mentioned above, a brief look at the presence of Arabic on the internet compared with other international languages is enough to reveal the weakness of Arabic content creation, one of whose components is Arabic digital content. With regard to traditional publishing, consumption rates for writing and printing paper in the Arab countries are an order of magnitude lower than those in the advanced industrial nations, and two orders of magnitude lower when the least developed Arab countries are taken into account. These rates are also markedly

FIGURE 4-11

Paper consumption and internet use worldwide and in some Arab countries, 2004-2005



Source: http://www.swivel.com/on 18 March 2009.

Marked efforts have been recently made in Arab countries to support the generation and distribution of Arabic digital content in traditional modes and on the internet, but they are still insufficient in comparison with those made by other countries

lower than predicted by the levels of GDP in comparison with other countries of the world. See Figure 4-10, which plots paper consumption against per capita GDP for most of the world's countries (blue dots) and some Arab countries (squares).[36]

Figure 4-11 depicts the correlation between paper consumption and internet use worldwide, revealing the shortfall in content production, in both its traditional and digital formats, in the Arab countries (ESCWA, 2007, in Arabic). The current situation is not expected to improve in the absence of strategies to deal with a whole series of inhibiting factors such as lack of cadres specialised in the production of a range of content, scarcity of resources, limited cooperation to confront these, and the rarity of research and development programmes related to the technical obstacles and other issues that hinder content production. Marked efforts have been recently made in Arab countries to support the generation and distribution of Arabic digital content in traditional modes and on the internet. These efforts, however, are still insufficient in comparison with those made by other countries. Numerous indicators taken from other fields point to the fact that the Arabic presence on the net remains limited compared with that of other languages.

ARABIC LANGUAGE INTERNET CONTENT AND PROBLEMATICS

The distribution of Arabic digital content via the internet requires the adaptation of a number of available technologies to make them Arabic compliant

The production and distribution of Arabic content are beset by many and varied obstacles which become more severe when confronted by the new obstacle of internet penetration. This is because the distribution of Arabic digital content via the internet

A system for machine parsing Arabic sentences is considered a key requirement for Arabic to catch up with second generation applications of natural language processing

requires the adaptation of a number of available technologies to make them Arabic compliant. Technical solutions have to be found too to certain questions, which fall into two groups, the first connected with the Arabic language itself, the second with the preparation of Arabic content for in-depth processing. An example of the first group of issues is optical character recognition technology for Arabic letters and for reading from the screen. The second group contains spellchecking and grammar checking systems. Developing the software necessary to perform these tasks is extremely difficult. Automated grammar checking for example must handle the difficulty posed by the excessive length and flexible word order of Arabic sentences when compared to the strict word order of English, for example. Some difficulties are attributable to the lack of a standard punctuation system and to the need–for grammar checking–for a coherent system to parse sentences as a basis for error checking. Preparing Arabic texts for deeper processing (preparatory to indexing or searching for example) requires the development of software that permits morphological analysis, automatic vocalisation,[37] and automated parsing. A system for machine parsing Arabic sentences is considered a key requirement for Arabic to catch up with second generation applications of natural language processing. These include systems for machine comprehension and narrative structural analysis of the languages. Some Arab and foreign businesses are making notable efforts in these fields, but the pace of work and the results achieved remain insufficient (see Box 4-5).

Discussion of the Arabic language is not limited to the generation and unification of technical terms among groups of those working in ICT but includes everything connected to Arabic-language word

BOX 4-5

Arabic Language Processing Systems: machine translation, grammar checking, and searching

The production and deployment of Arabic digital content on the net requires the availability of translation systems to and from the main languages. More effective Arabic search engines are also required. Technologies to mine, process, and retrieve content also require automated indexing and summarising systems.[38] In addition, it is essential to develop advanced systems for automatic speech processing including automated speech analysis, generation, and recognition in Arabic.[39]

Machine translation systems: a number of software systems for machine translation to and from Arabic exist. One prominent example is the Google system. This adopts statistical methods which make it impossible for the quality of its translations of texts to go beyond very modest limits, rendering it unfit for serious translation. There is also software that adopts an overly simple linguistically and lexically based analytical model. Since their launch around three decades ago, attempts to improve the performance of such machine translation systems have failed. Another system developed by an Arabic company is based on a transformational model and relies on a limited base of linguistic rules and lexical data, which limit the possibilities of improving its performance.

Grammar checking: neither of the two grammar checking systems in use uses an automated parser, relying instead on a store of contextual examples. They are thus incapable of recognising grammatical errors that occur when the words and syntactical elements in question are far apart and of adding the syntactically significant final vowels to words, especially in the long sentences prevalent in Arabic texts. Of the three systems for morphological analysis, two are distinguished by complete linguistic coverage of the whole of the Arabic lexicon and one of these enjoys a coherent linguistic foundation which makes it capable of deriving semantic elements from morphological and lexical aspects. Among the faults of the third system is the errors it generates when dealing with words with multiple and compound affixes.

Arabic search engines: there are an extremely limited number of search engines for Arabic texts on the internet. Many of the sites which allow the discovery of Arabic texts are no more than directories comprising lists of Arabic website addresses (the portal www.arabsgate.com is a prime example). The Google Arabic search engine is reckoned to be the most used Arabic search engine on the net. In addition to being far from meeting most of the search requirements for cultural and educational applications, it also enjoys only modest success in meeting most of the requirements of the ordinary user. This search engine does not take into account the complex derivational and morphological formation of Arabic words in comparison with the simple formation of English words for which the system was designed. It searches for a word as it appears in the text without paying attention to its lexical lemma, which may appear in as many as a thousand forms as a result of the affixing of prefixes and suffixes to the Arabic word. This search engine is also incapable of broadening the scope of a search on the basis of the users search terms. Thus, when the user enters a word like "boy" (*fata*), "desert" (*sahra'*), or "tree" (*shajara*), the search engine will not return texts containing the plurals "boys" (*fityan*), "deserts" (*sahara*), or "trees" (*ashjar*). And when searching for a verb, if the user enters a third-person form "[he] condemns" (*yudin*), Google will not return other related morphological forms like "[you/she] condemn/s" (*tudin*), "[we] condemn" (*nudin*), and "condemners" (*mudinun*).

Adapted from the draft background paper for the Report by 'Abd al-Ilah al-Diwahji, in Arabic

processing and the methods and tools for operationalization, in-putting, and out-putting. With regard to the inputs and outputs, the Arab countries have been unable, since the 1960s, to rely on a unified encoding of the Arabic letters and symbols, even though such encoding is no more than a method for computers to deal with Arabic. The excessive attention devoted to fonts, which display a wide degree of variability from one site to another, to the detriment of attention to the linguistic content of the text, and the refusal to accept a balanced interplay between language and technology have led to wide-scale underdevelopment in machine-processing methods for Arabic. Similarly, the delay in setting a uniform standard for Arabic letters and vowels is considered one of the causes of underdevelopment in research, studies, and applications related to the language, including applications pertaining to linguistics and the authentication and retrieval of information. As a result, searching for information in Arabic using semantic keywords and phonetic approximation remains backward when compared with the achievements of such applications in other living languages.

Upgrading the production and distribution of Arabic digital content requires intensive efforts rather than the usual talk about the dangers of foreign cultural incursion and the importance of preserving the Arab identity. Media and entertainment content forms an appropriate entryway for the proliferation of technology and knowledge (see Box 4-6); however, it will be necessary from the outset to adopt strategies for the production and deployment of content in both its traditional and digital forms (ESCWA, 2007, in Arabic). Arab countries have suffered from the absence of such strategies and Arab attempts at content production have, as a result, conflicted with each other and have mostly stumbled due to the lack of specialist cadres, resources, and cooperation, and the weakness of research and development programmes aimed at surmounting the technical obstacles faced by various kinds of content production, digital in particular.

Proposed strategies must start with a clear vision of the future, define measurable goals, and include mechanisms to develop the human resources needed to found and support an Arab software industry and stimulate research and development activities in all fields related to content, its applications in Arabic, and its use on the internet. They must lay the foundations for the creation of technology incubators in the universities and research centres to transform technological innovation into marketable products and services (see the major elements of the general working vision in Chapter 6). Content relating to education and Arabic culture must be given priority in the proposed working strategy. Laws must be enacted that safeguard intellectual property without

Upgrading the production and distribution of Arabic digital content requires intensive efforts rather than the usual talk about the dangers of foreign cultural incursion and the importance of preserving the Arab identity

BOX 4-6

Digital Content in Entertainment and the Media

In all parts of the world the market in media and entertainment materials is facing sweeping changes characterised by unprecedented growth in digital platforms, be it on the level of products or of services; this growth is also reliant on the convergence of disparate industries. Competing in the new market emerging from this convergence are cable TV companies, telecom companies, consumer electronics companies, and ICT companies. The model used by businesses to provide integrated products within this market is known as the "triple play" model since access to audio and visual applications and digital data is achieved through one subscription. This convergence leads quite specifically to direct competition between telecom companies and television broadcasters. This requires the availability of infrastructures that enable the utilisation of broadband technologies. Hence it is expected that the proliferation of convergent services will be restricted to the Arab countries that have acquired compliant infrastructures, as is the case with the Gulf countries. Among these is Qatar where Qtel has launched "triple play" services to enable its customers to access the internet and obtain TV and telephone services via the net. The UAE's Etisalat is also trying to combine cable TV services with the telecommunications operations they offer to the consumer. It also offers TV services via the internet. More than two-thirds of Arab satellite TV companies have websites. Yet it seems that only a few of these companies have strategies to generate revenues through these sites. These companies also vary in the degree to which they have integrated the material ordinarily broadcast by the satellite channel with the possibilities for accessing media content and related services via the internet.

Technological convergence coupled with the transformation of entertainment and media platforms into digital space permits broader-scoped knowledge distribution than previously. However, the utilisation of these two trends requires the drawing up of dynamic and comprehensive strategies to train cadres, establish laws and infrastructures suitable for generating and deploying Arabic digital content, and overcome the various obstacles to its ideal deployment and utilisation.

BOX 4-7

Preserving Tradition through Digitalization

Egypt's Centre for Documentation of Cultural and Natural Heritage (CULTNAT) was created to archive digitally Egypt's cultural and natural heritage. The centre is implementing the Egyptian Cultural Heritage Project, which includes drawing up an archaeological map of Egypt and documenting Egypt's architectural, musical, and manuscript heritage. The project uses multimedia software, geographical information systems, 3D modelling, and virtual reality. The centre cooperates with a number of international organisations and companies such as UNESCO and UNDP. It is also helping to deploy multi-lingual information system using the internet to document the cultural and civilisational heritage of the Mediterranean basin countries within the scope of a programme sponsored by the EU and implemented by Arab and Mediterranean countries.

impinging on the opportunities needed to set up small businesses that can play an effective role in content production and deployment. One of the first tasks such businesses could fulfil is to digitise the Arabic cultural heritage (see Box 4-7). This could be done in cooperation with the national libraries and funded by relevant government bodies such as ministries of culture or by unconditional donations from large private sector institutions.

Strategies for digital content should assign appropriate importance to the utilisation and development of open source software given its importance in the distribution of content at exiguous cost

Strategies for digital content should assign appropriate importance to the utilisation and development of open source software given its importance in the distribution of content at exiguous cost. One feature of much of this software is that a large portion of it was originally designed to make it easily adaptable to the requirements of different languages and modes of utilisation. Its utilisation in the Arab countries, however, remains limited to a small number of institutions, some companies offering VOIP telephony services, and Arabic blogging sites. Isolated initiatives are being taken by websites to coordinate efforts and offer support to open source software developers with a focus on arabization (http://arabeyes.com, for example). Other Arab initiatives, which deserve to be supported to the greatest extent, are also undertaking the arabization of such software and adding plug-ins to other software to support the Arab user.

Among the obstacles which prevent the broader deployment of open source software is the reluctance of a number of Arab governments to use it, in contrast with the global trend which has seen many government institutions throughout the world adopt this software in order to remove sensitive government systems from the sway of readymade software packages.[40] The Arab governments, however, have submitted in many cases to the offerings of the world's large software companies and, because of the availability of technical support packaged up with readymade products, preferred to rely on them rather than to embrace open source software, even though the latter offers greater hope of establishing a national software industry. This is because open source requires users to employ in on-going fashion the technical cadres needed to maintain and modify the software they use. In principle this ought not to form a major obstacle. Many Arab countries have the critical mass of technical cadres to ensure the utilisation of open source software. As a group, they have the necessary human and material resources to participate in the development of these systems and make ideal use of them. Some Arab countries may be more likely candidates than others to rid themselves of the phobia of open source software. It seems that Syria, Lebanon, and Egypt include a good proportion of Linux OS users. Promising associations of open source developers have also been set up in all these countries.[41]

Ideal deployment and utilisation of open source software requires interested parties in the Arab countries–including government institutions, universities, private sector institutions, national computer associations, and networks of open source developers–to draw up strategies. Such strategies should allow the information of working groups to set down the rules and ethics of intra- and extra-mural conduct while seeking enlightenment from the policies laid down in this respect on the global level.[42] They must also offer incentives to workers, particularly in relation to human capacity development.

TECHNOLOGICAL ADVANCE AND FUTURE INITIATIVES

Making progress in the field of knowledge distribution, generation, and utilisation in the Arab countries requires that national development strategies include initiatives that seek to realise an integrated vision of knowledge. They must be guided on this path by studies that analyse the strong and weak points in the prevailing economic, social, and cultural dynamic, that define the requirements needed to revive and accelerate this dynamic, and that draw up working plans to develop technology capacity. These initiatives should press for improvement to legal and regulatory environments and support for backbone networks and the means to access them to make best use of ICT. To achieve sustainable goals in these areas, investment in ICT infrastructure should be encouraged, to ensure its conformity with next generation technologies and its compatibility with new applications and services.

Many factors hinder the devising of such policies, strategies, and plans. Among the most prominent are the absence of a unified vision, within the limits of the possible, on the national and Arab levels to oversee future directions and set the ground rules for common action and constructive interaction within the regional and global environments. The absence of such a vision leads to a host of difficulties in drawing up policies for developing ICT. These difficulties are compounded by the accelerating dynamic towards technological advance on one side and the entanglement of technological development with many aspects of social development on the other. Many Arab countries are confronting difficulties that hinder the prioritization of technological development on a list of development goals crammed with pressing priorities, foremost of which is the securing of such basic necessities of life as food, water, shelter, and social services. Drawing up the open policies required, in particular, by the spread and use of ICT faces major difficulties, one of the most important of which may be the high level of government control over this technology and its development on the pretext of national security.

There is no essential difference between sector-based development policies (which include the social services sectors including education, health, and others) before and after the deployment of ICT and its expanded application. A prime characteristic of the current era is the unprecedented involvement of policies for technology capacity development within sector-based policies–something not taken into account before by the relevant parties in most Arab countries. As long as this weak spot is not treated by integrating technology capacity development policies with sector-based policies, isolated programmes, fragmented efforts, and their ever-growing negative consequences may be expected to continue.

Initiatives aimed at the indigenisation and development of ICT applications also strengthen, and do not conflict with, economic and social development efforts, except when left exposed to exploitation by hardware promotion as an end in itself, and to the achievement of various temporary gains. These initiatives must be formulated so as to respond to the needs of development rather than to the desire of the promoters of technology equipment and the government officials who support them for rapid material returns. It must also be aimed at building capacity on various levels, with decision making centres and NGOs concerned with development matters taking priority.[43] Also necessary are capacity building in integrated form to cover both supply and demand, as well as deepened technological know-how with reasonable possibilities for exploring the horizons of technological progress in the future.

The accelerating march of progress in many aspects of ICT requires, on the one hand, the creation and support of specialist research and development institutes able to compete with their counterparts in the

Progress in knowledge distribution, generation, and utilisation in the Arab countries requires that national development strategies include initiatives that seek to realise an integrated vision of knowledge, guided by studies that analyse the strong and weak points in the prevailing economic, social, and cultural dynamic

Initiatives aimed at the indigenisation and development of ICT applications strengthen, and do not conflict with, economic and social development efforts

advanced and emerging nations and, on the other, an effort to probe the expected economic, social, and cultural effects of these new technologies. More research should be directed towards exploring the effects of technological development on the Arabic language and how new technology will handle recognition, speech, and semantics in a way that ensures the preservation of the language and dedicates a pivotal role to it in regional development and the building of human civilisation. The proliferation of ICT applications in fields closely connected with scientific research, education, culture, and social services is expected to lead to a boost for Arabic digital content on the internet in terms of its volume and content.

More research should be directed towards exploring the effects of technological development on Arabic and how new technology will handle recognition, speech, and semantics to ensure the preservation of the language

Arab countries cannot undertake on their own the many tasks aimed at utilising the continuous and accelerating innovation within ICT and thus consolidating the role of knowledge in development on an individual basis, however large the resources available to any one of them. Cooperation between relevant national institutions must be strengthened, cooperation between the Arab countries and their intercommunication with international organisations must be activated, and the human resources needed to design and implement common initiatives in various fields must be secured. Successful acquisition and deployment of new technology is today connected to a great extent with the ability to cooperate within multidisciplinary teams in the concerned state and with partners at the regional and the global levels. Most production of new forms of knowledge does not now take place within the walls of a single institution, but is the fruit of cumulative efforts made by groups belonging to various schools of thought which can be in constant touch with each other and with the various external sources of knowledge. Herein lies the latent importance of ICT. The role it fulfils in facilitating cooperation between institutions, wherever they are, and individuals, wherever they work, is a basic factor in the achievement of the goals of sustainable development in various domains. It is therefore essential that national policies and regional strategies designed to build capacity in these technologies include elements favourable to the success of the new models of cooperation provided by ICT, such as "virtual research laboratories." It is possible that such research centres will cooperate to carry out research related to specific aspects of a given problem in priority fields at the national and regional level. Among the most pressing such problems are those related to broader and smarter uses of the Arabic language on the net, development of interactive digital content in the various branches of knowledge, and broadening the scope of Arabic content in the fields of education,[44] scientific research, healthcare, environmental protection, government services, and heritage preservation.

Cooperation between Arab national institutions must be strengthened, and their intercommunication with international organisations must be activated

It is widely acknowledged that the creation of an environment favourable to internal and regional cooperation will generate opportunities to grow and develop an active private sector that invests in the means of production of technology, the fields of knowledge related to it, and its applications. It will also open the gates to Arab investments in joint research and development projects related to technology, its applications, and the services connected to it. This is especially the case in relation to the knowledge content required and generated by such applications. In this, the creation of legal frameworks and laws that contain the open and transparent measures necessary to ensure the success of applications and enable all sectors of society to benefit from access to technology and its applications must be given special attention, lest the digital and knowledge gap among countries widen, while an improvement in the familiar overall indices serves simply to improve the image of these countries relative to others. Here it is necessary to emphasise support for initiatives designed to gain acceptance for the open source methodology while at the same time guaranteeing data privacy and security and protecting intellectual property

within bounds that do not hinder business growth and provision of employment. In spite of weaknesses–which must be taken suitably seriously–it is possible to outline a number of strong points that will bolster the Arab countries' attempts to make ideal use of technology and its applications. Among the prominent strong points are:

- The enthusiasm of Arab political leaderships to give impetus to technological development.
- The availability of the necessary expertise and reference cadres–thanks to the regional and international conferences[45] dedicated to promoting and spreading technology–to ensure the formation of an Arab strategic vision to indigenise and make good use of ICT in the Arab countries.
- The investment opportunities made available by oil wealth, and more specifically those that enable the region's economies to make the transformation to knowledge-based economies.
- The youthfulness of the human capital, which will without doubt be able to keep pace with global developments and meet the ambitions of the peoples of the region when employed in projects to indigenise and develop technology and knowledge production.

CONCLUSION

The dilemmas of Arab development are, as we have said, epistemological in essence. The response to these challenges, although requiring the acquisition of basically technological capabilities, will never bear fruit if restricted to these alone. In the first place, this requires specific political choices. The efforts directed at the deepening and broadening of the scope of knowledge content in the Arab countries demand the optimal use of available technologies within a strategic perspective congruent with comprehensive sustainable development goals aimed at reducing inequality in all its forms. At the same time, they require affiliation with Arab internal, regional, and international initiatives[46] that endeavour to develop modern technologies and adapt and apply them to participate actively in the drawing up of the aims and directions of such technologies. However, none of this will lead to ideal outcomes unless, from a third angle, they are linked to persistent action to formulate national initiatives that build, complement, and support the components of the knowledge economy and society. Countries such as Finland, Norway, Ireland, Malaysia, and South Korea have recently succeeded in utilising the advance in the various branches of ICT and the innovations based on this advance. They have achieved this through national and sector-based policies and initiatives aimed at bringing about major qualitative and integrated transformations in their own capabilities, rather than resorting to gradual and piecemeal improvement in their capabilities in disparate directions. At the same time, these countries have introduced wholesale reforms encompassing the institutional cadres who implement ICT activities and the innovations arising from them. They have also taken a second look at many of the legislative, regulatory, and legal frameworks that control these activities, the resources devoted to supporting them, and the approaches followed in taking pivotal decisions in this respect. The experiences of these countries also indicate the necessity of adopting mechanisms that permit ongoing coordination of institutional capacity within national borders in parallel with serious attempts to ratify active and effective international and regional alliances to produce the scientific and technological knowledge connected with these technologies. These alliances will, in the end, lead to the utilisation of the latest knowledge within new products and services that can be used to confront the competition raging on the world market.

The chasm that divides the developing Arab countries from the advanced nations does not justify the adoption by the former of the position of "spectator" and

The dilemmas of Arab development are epistemological in essence. The response to these challenges, although requiring the acquisition of basically technological capabilities, will never bear fruit if restricted to these alone

The chasm that divides the developing Arab countries from the advanced nations does not justify the adoption by the former of the position of "spectator" and passive recipient of whatever knowledge is thrown at them

The possession of information and communication technologies by limited or socially isolated groups will not suffice to realise the benefits of globalisation and deter its dangers; rather, it will ensure the deepening of fragmentation, poverty, ignorance, and extremism

It falls on the shoulders of the governments of the Arab countries and concerned NGOs to play founding and creative roles that deal with the formulation of policies, strategies, and initiatives for the production, distribution, and utilisation of knowledge

passive recipient of whatever knowledge is tossed to them. Rather, a restructuring and review of numerous concepts and practices is required so as to make knowledge production and distribution take place within these countries and through cooperation among them. The role of the political and intellectual leaderships here is vital, alongside that of NGOs. When planning these initiatives and the projects they may comprise, it is essential to take into account the ever shorter time frame for scientific discoveries to make it possible to include them in innovative products and processes. The railway took 120 years to spread worldwide, while mobile telephone penetration reached 80 per cent of the population of certain countries within four years. Anticipated technological evolution, be it on the level of processors, computers, networks, or network technologies, will offer rare opportunities to acquire and distribute knowledge, as signalled by past experiences in the evolution of other modern technologies. Current trends are expected to lead to private sector institutions having greater influence over individuals. The former possess greater technological knowledge aptitude in addition to superior capacities for technological adaptation and learning. The ability of companies to measure and analyse the behaviour of consumers of their wares or users of their services using the technological resources and expertise in their possession will multiply, making the results more accurate.[47] This will give various institutions unprecedentedly comprehensive powers to monitor the behaviour of consumers of their wares, users of their particular services, and internet users in general. This also applies to potential surveillance of citizens by government bodies, which mandates the establishment of national and regional institutions concerned with studying the trends in technological evolution, and in particular the changes in terms of patterns of use of the internet, the structures and resources available on it, and the pace of content development. There should also be ongoing analysis of the risks and challenges posed by internet use, exploration of the violations it may be exposed to, and the development of approaches, methodologies, and tools to ensure that information on the range of levels is used in conformity with agreed standards for the protection of human rights and individual freedom.

In the light of globalisation, ownership of ICT has become a pivotal requirement for driving the various aspects of development. Its use will also lead to a reduction in the resources needed to build scientific and technological capacity and to utilise numerous other technologies in the various sectors of production by condensing, and reducing the cost of, many of the measures that traditional production and service activities require. This trend is expected to continue, and even to accelerate and expand. However, the possession of these technologies by limited or socially isolated groups will not suffice to realise the benefits of globalisation and deter its dangers; rather, it will ensure the deepening of fragmentation, poverty, ignorance, and extremism. For this reason, projects for national development must strengthen the role of knowledge and the sectors and social and economic activities connected to it so that all sectors of society share in its benefits. The private sector–and the tripartite partnerships between it, the government sector, and civil society organisations–is expected to have a major role in carrying these tasks. In the context of such partnerships, it falls on the shoulders of the governments of the Arab countries and concerned NGOs active in them to play founding and creative roles that deal with the formulation of policies, strategies, and initiatives for the production, distribution, and utilisation of knowledge in areas where the private sector cannot get involved or with which it should not perhaps be entrusted.

In conclusion, will current and future technologies lead to a decline in the status of Arab cultural identity? Or will they provide opportunities that enable its

preservation and the consolidation of its position on the map of human civilisation? A positive answer is conditional upon the digital presence of the Arab countries and their citizens on the current and future internet. When the Arab universities, for example, offer their educational services in electronic form, when the communications infrastructure is designed to conform with multimedia applications, and when all sectors of society are given access via all platforms, the Arab identity will in all probability preserve its essence, or even make marked gains that will ensure it opportunities for communication, innovation, and progress over the long term. Applications of ICT are expected to bring about profound and wide-ranging social and economic effects. However the nature and extent of these effects will be determined by the efforts made by the active parties to build and support the various kinds and models of Arabic content. If governments and other interested parties fail to generate and distribute knowledge content closely linked to social and economic conditions, cultural structures, and the expectations of citizens, then it is likely that most of these effects will have negative ramifications. The opportunities offered by new technologies are accompanied by risks that mandate enlightened approaches which keep pace with accelerated technological evolution and put it to use in the effort towards comprehensive, balanced, and sustainable social and economic development. Only when this is achieved will the Arab countries be able to look forward to a glowing future in which new technology will play a supportive role in responding to the region's chronic crises with its twin swords of knowledge and development.

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End Notes

1 According to the majority of available indicators, including the World Bank report on Knowledge Assessment Methodology (KAM), published in 2008.

2 The World Bank's KAM comprises twelve indicators with respect to the ICT index. Three of these indicators are used to calculate the above mentioned index: fixed and mobile telephones, computers, and the internet. Index values range from zero to ten and express the position of the country relative to that of all other countries for which the index has been calculated. The top 10 per cent of countries are those ranked between nine and ten; the next top 10 per cent are those ranked between eight and nine, and so on. A decline in the value of the index with regard to a given country does not necessarily mean a decline in the values for the indicators entered to create the index. It may simply be a product of the fact that the values of these indicators have risen but to a lesser degree than those of other countries that are jockeying for their place on the scale.

3 Website of the World Bank, database of the Knowledge Assessment Methodology (KAM), http://info.worldbank.org/etools/kam2/KAM_page5.asp on 13 February 2009.

4 Reports on the spread of third generation mobile telephone technology in Egypt for example predict that a proportion that may reach 70 per cent of the population will not be able to afford such devices. Other factors may lead to slow progress in the introduction of 3G to the Arab markets. For example the lack of technological preparedness may open the door to illogical practices and delay the securing of applications and services suitable for Arab societies. The restrictions imposed by some states, on the pretext of security in many cases, will also hinder the use of technologies that form key incentives for migration to 3G such as geographical positioning technology based on satellite connected systems.

5 Bandwidth is used as a measure of the rate of data transfer on the internet. It is measured in bits per second. The report uses the measure of bit per person to indicate citizens' ability to access the net via the national infrastructure and the links it has with the international network by means that include satellites, optical fibre networks, and traditional copper wire. While transfer of data across these networks occurs at different speeds, overall bandwidth is a product of the bandwidth characteristic of each medium.

6 In this context, and as is made clear in the paragraphs dealing with anticipated advances in ICT, coming generations of communications technology will provide greater possibilities and opportunities for internet access for a broader spectrum of user groups via mobile telephone.

7 According to the World Population Prospects/2006 revision published in 2007 the population of the Arab states is 328.6 million. However, statistics from the website used to derive information on language use on the net indicate a total number approaching 357 million. This variance does not affect the calculated proportions and hence the deductions and analysis.

8 Statistics from Madar, the Digital Economy Research Centre in Dubai, Study presented to ESCWA, 2007, in Arabic.

9 English, Chinese, Spanish, and French.

10 These processors will also fulfil a pivotal role in adding "smartness" to numerous consumer devices without a marked increase in cost. The processors come in two types: those usually used in computers and specialist ones to control industrial devices and various consumer products.

11 Among the most prominent uses of semantic web technology are in e-learning and research and development.

12 Reference in the background paper for the Report by Nawwar Al-'Awwa, in Arabic : Cardoso, Jorge, "Semantic Web Vision: Where are we?" in IEEE Intelligent Systems, Sept. 2007, pp. 22-7.

13 For example, it will be essential to combine the various data transfer networks within a single network based in internet protocols. This will mean, shifting voice telephony services from the telephone network to services based on internet protocol.

14 A monthly $25 fee added to the telephone bill for a period of two years (a total of $600) is a condition for taking part in this project.

15 Website of Al-Jazirah for Press, Printing, and Distribution, http://www.al-jazirah.com.sa/digimag/03092006/add21.htm on 28 January 2009.

16 This paragraph relies on data given in a lecture by Rakan Zarruq of the Department of Computer Engineering at the University of Damascus and Mahmud 'Anbar of the Software Industry Forum at the 2005 dialogue forum on the software industry organised by the Syrian Computer Association.

17 The REACH programme.

18 This is counter to the prevailing belief that the concepts and origins of e-government in the advanced nations arose with the proliferation of the internet in the mid-1990s.

19 Some sources call this index "e-readiness." The concept of "e-readiness" provides an objective means to measure various factors that enable the adoption of e-government and set a point of reference for governments to observe their progress in this field. The assessment mechanism includes hard factors such as measures of the telecoms infrastructure and other soft factors such as the economic, social, and behavioural level of the country.

20 Data are not available on the KAM site for a number of Arab states such as Syria, Yemen, Comoros, Djibouti, Libya, and Saudi Arabia.

21 As a result of the nature of composite indices that are relied upon to evaluate the availability of e-government services or the readiness to provide them to citizens and the need for surveys on the ground to define the value of their component parts, it is necessary to read the trends revealed by these indicator values with a considerable amount of caution and circumspection. It is worth pointing out the variation in values given on "e-Government Readiness Index" developed by UNPAN for Mauritania, for example, in comparison with the scores achieved on the index of "availability of e-government services" adopted by the Knowledge Assessment Methodology (KAM) for the same states. While the two indices differ from each other, they are without doubt connected in various aspects, and it would therefore be expected that at least in terms of ranking the states they would conform to each other within reasonable limits. Yet what can be observed is Mauritania coming in 162nd place out of 182 states according to the UNPAN index, with Jordan in eighteenth place and Egypt twentieth for comparison, while the KAM index ranks Mauritania above Jordan and Egypt.

22 Without the knowledge giver and receiver being restricted to the same site.

23 World Bank, Information for Development Programme (InfoDev), 2005; British Educational Communications and Technology Agency (BECTA), 2004; and Tinio, 2003.

24 To this end European states have relied on programmes such as the "European Computer Driving Licence" (ECDL) as a means to make teaching and administrative frameworks in schools acquire the appropriate skills. OECD plans also include subjecting ICT to develop teaching and learning methods.

25 Joint study on ICT in education, ESCWA and UNESCO regional office in Beirut.

26 Comprising word processing, spreadsheet, presentation, and drawing software, a calculator, and project management software.

27 Based on a country performance assessment scale ranging from one to seven.

28 World Bank, KAM database, http://info.worldbank.org/etools/kam2/KAM_page5.asp on 12 December 2008.

29 At the time of its inception this project included Syria, Jordan, Morocco, Algeria, Egypt, and Palestine.

30 See the website of the Supreme Education Council in Qatar, http://www.english.education.gov.qa/content/general/detail/7117 on 26 January 2009.

31 Some sources consider open universities to be virtual universities. This is not necessarily the case, however, though open universities tend to use some of the methods of virtual universities. On this basis, it is possible to deem the Arab Open University a virtual university. It was launched in 2002 with headquarters in Kuwait and branches in Jordan, Bahrain, Lebanon, Egypt, and Saudi Arabia.

32 See the website of the Virtual University of Tunisia, www.uvt.rnu.tn.

33 If Morocco and Algeria are disregarded, the graph permits the relationship between business internet use and per capita income in the Arab states to be represented by a straight line almost parallel to the horizontal axis. This indicates that there is no significant correlation between business internet use and per capita income.

34 Website of the World Health Organisation, Regional Office for the Eastern Mediterranean, http://www.emro.who.int/Arabic on July 2008.

35 Website of al-'Arab al-Yawm newspaper, http://www.alarabalyawm.net/pages.php?news_id=101464 on 28 January 2009.

36 This graph shows consumption rates for paper in all its forms. Recent data on consumption of paper exclusively for writing and printing are not available, and this is of greater significance in terms of the various forms of content. However, the quantity of paper used for writing and printing is estimated at half of total consumption. The figure relies on 2004 data.

37 Unambiguous machine understanding of Arabic texts requires their vocalisation. Naturally, before being vocalised, the sentences of an Arabic text must be parsed.

38 One Arab company has launched automated indexing and summarising systems, based on purely statistical foundations, that summarise the words present, define the subject of the text, and summarise the collection of sentences that contain significant content. These systems, however, were developed on the basis of out-dated technologies, in terms of their use of either statistical linguistic models or analysis of the Arabic narrative structure.

39 The Sakhr company has developed an Arabic speech engine. A large US company has also developed an Arabic speech recognition system using a statistical basis. This system has been used to develop an automated dictation (speech to text) system, but the error level remains high and it is in need of automated systems for morphological, syntactical, and lexical processing in order to correct a larger proportion of errors.

40 The Chinese government has been a frontrunner in the use of open source software on all government computers. It has developed the Chinese version of the Linux open source operating system through the Chinese Linux Extension (CLE) project. Local government and city councils in many EU cities are also making use of open source software.

41 The University of Aleppo has convened two conferences on open source software. These discussed aspects related to the arabization of open source software and means to promote it within Arab societies.

42 E.g., the Taiwanese plan for the introduction of open source.

43 Building national capacity in a wide series of information and communication technologies represents a key aim of development policies in all the countries of the world. The attempt to achieve this goal in the Arab states must be accomplished with an eye to priorities that take into consideration manifest and latent challenges.

Technology research and development in fields closer to the key concepts and the frontiers of knowledge must be undertaken in support of high quality qualifications and in preparation for coming stages that aim to develop hardware and software systems and introduce them to regional and international markets. It is necessary at the same time, however, to focus in the early stages of strategic action to build national capability for the ideal utilisation of available technologies.

44 ICT provides valuable opportunities to improve the efficiency of the educational process in addition to the support it offers to e-learning programmes. Networks and virtual incubators could also be created to work in this field. Among the features enjoyed by such solutions to the research and development crisis and the education crisis in the Arab states are the possibilities they offer for many researchers of Arab origin who occupy distinguished positions in universities and laboratories in the advanced nations of the world to participate in such networks. As previously indicated, the net is overflowing with learning resources, in the form of units and modules, that can be arabized and exploited to develop interactive curricula.

45 Among the most prominent of these is the World Summit on the Information Society, which was held in two stages, the first in Geneva in 2003, the second in Tunis in 2005.

46 There are many institutions within the private, public, and NGO sectors whose areas of operation are distributed across a series of fields including higher education, scientific research, and technological development and which are charged with drawing up programmes and launching regional initiatives in the ICT domain that aim to stimulate the development and growth of this sector and the utilisation of its results to benefit partner nations. There are many examples of such programmes in the EU. These programmes and initiatives mostly handle the linkage of partner states by regional communications networks or by modernising the backbone networks. International coalitions are also formulating regional policies aimed at finding ideal solutions to the technical or economic problems afflicting the partner states or completing national strategies, consolidating the position of the region on the global level, cooperating in the use of open source software, developing applications of these technologies in the media, entertainment, and healthcare fields, providing job opportunities, or reducing poverty.

47 Technological development in the area of data mining technology will permit more detailed and deeper understanding of service user behaviour and the prediction of web surfers' demands.