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CHAPTER SIX

Information and Communications Technology for Development: Building the Knowledge Society in Egypt

Sherif Kamel

Since ancient history, Egypt has witnessed massive information flows through different means. This included inscription on Rosetta stones and papyrus papers, and the establishment of the Library of Alexandria, the world's first and most famous library and the gateway for knowledge creation and accessibility (Kamel 1998a). During the middle ages, Arabic manuscripts became one of the most common means for information and knowledge dissemination. In the modern age, paper printing and publishing started in Egypt during the nineteenth century, witnessing publication of the first journal in Egypt in 1826. A few years later in 1830, Egypt witnessed the establishment of the first national archive system (Kamel 1998b).

However, in the twentieth century prior to 1985, a number of characteristics identified the status of information in Egypt. The country was rich in data but poor in information; known for accumulated bureaucracy through red tape; computers were viewed as ends and not means and there were islands of innovation with no bridges (Kamel 1998b, 1999). From a government perspective, the focus was more on technical issues and not decision outcomes; there was poor multisector coordination and no synergy between information and socioeconomic development strategies.

Given this reality, even as information and communications technology (ICT) was increasingly becoming a necessity for socioeconomic development (Press 1999), the government of Egypt recognized the need to take proactive measures and build the required information infrastructure. The strategy deployed followed a two-tier approach, inviting society with its different stakeholders to contribute in shaping the infostructure, which in turn would effectively contribute to the socioeconomic development (World Bank

2006). Between 1985 and 2007, the government announced nine major policy initiatives to promote the development of Egypt's information society. Table 6.1 demonstrates the development of the information society in Egypt during the twentieth and twenty-first centuries (Kamel 2007).

Since the early 1990s, Egypt has been undergoing a liberalization program of its public sector. The government has announced that it will invest in its human capital, encourage foreign direct investment (FDI) and emphasize innovative ICT as a platform for business and socioeconomic development (Kamel 2005a). The government in collaboration with the private sector through a variety of public-private sector partnerships has announced the restructuring of sectors such as education and health as well as working on closing the digital divides and promoting social inclusion.

This chapter examines the introduction and diffusion of ICT into Egyptian society, and the role it played in providing awareness and access to knowledge to different clusters in the community. The chapter addresses four main research questions. These are: To what extent has ICT become a vehicle for development and a platform to access knowledge? How did ICT for development (ICT4D) policy and strategy formulation and infrastructure deployment evolve? What were the challenges and the lessons learned from efforts aimed at using ICT for socioeconomic development? What are the implications of diffusing ICT for access to knowledge in Egyptian society?

Table 6.1: Development of the information society in Egypt

Program	Year
Open Door Policy	1974
Economic Reform Program	1985
Information Project Cabinet of Ministers (IPCOM)	1985
Information and Decision Support Center (IDSC)	1986
National Information and Administrative Reform Initiative	1989
Egypt's Information Highway	1994
Ministry of Communications and Information Technology (MCIT)	1999
National Information and Communications Technology Master Plan	2000
Egypt Information Society Initiative (EISI)	2003
Egypt ICT Strategy 2007-2010	2007

ICT4D in Egypt since 1985: from an information society to a knowledge society?

The idea of information and communications technology for development (ICT4D) came into vogue in the early 1980s when Egypt was faced with multiple chronic challenges common to developing nations, including foreign debt, economic reform, public sector reform, a balance of payment deficit, a high illiteracy rate, poor technological and telecommunications infrastructure, constrained financial resources, unemployment, environmental protection and cultural heritage preservation. During that period, Egypt was striving to implement a nationwide strategy toward its socioeconomic development objectives and ICT was identified as a catalyst for that process. Therefore, the government of Egypt adopted a set of information based projects leading to the establishment in 1985 of the Information and Decision Support Center (IDSC), a think tank affiliated with the Cabinet of Egypt. The IDSC's objective was to develop and implement, using a supply-push strategy, large informatics projects to achieve socioeconomic development using state-of-the-art ICT (El-Sherif and El-Sawy 1988).

During the 1990s, technological innovation and economic and social organization became more tightly linked than ever. Continuous innovation in ICT geared industry and society toward information acquisition and knowledge dissemination (Branscomb 1994). Consequently, innovation has transformed the activities and relationships of individuals and organizations into a new information society, or "knowledge society," in which ICT services pose both challenges and opportunities (Shapiro and Varian 1999). The knowledge society refers to a second-generation information society. Whereas an information society aims to make information available and invent the technology necessary for this, a knowledge society aims to generate knowledge, create a culture of sharing, and develop applications that operate via emerging ICT like the Internet (ESCWA 2005).

The knowledge society is now a force for fundamental global change (Garito 1996). Knowledge and ICT innovation are becoming important values for business, socioeconomic development and wealth creation – with implications at the macro and micro levels (ESCWA 2005). The changeover is complex, requiring new forms of partnership and cooperation between public and private sector organizations (Kamel and Wahba 2002). This is best achieved through collaborative strategies that diffuse best practices and develop ICT applications, with the primary objectives of promoting

growth and strengthening competitiveness. For many emerging economies such as Egypt, formulating strategies and policy frameworks to support the growing knowledge society could significantly accelerate development. In the context of Egypt, the goal of joining the knowledge society is to fulfill societal needs, create wealth, and sustainably enhance the community's quality of life (Kamel 2009).

For millennia, the basic needs of humankind have been food, clothing and shelter. Now it is time to add information to this list. Information and knowledge are nowadays the drivers in the global society, much more than land, capital or labor. The capacity to manage knowledge-based intellect is the critical skill of this era; a firm or a society with a strong base of knowledge can leverage that base to create further knowledge, increasing its advantage over its competitors (Kamel and Wahba 2002). ICT innovations are making a growing impact on business and socioeconomic development by introducing and diffusing the concepts of knowledge sharing, community development and equality. These impacts are felt at the individual, organizational and societal levels. ICT is not an end in itself, however, but a means of reaching broader policy objectives. The main objective of ICT should be to improve the everyday lives of community members, fight poverty and advance the Millennium Development Goals (MDGs). In this respect, ICT is delivering the key productivity gains that enable lives of material comfort for many around the world that would have been unthinkable only two centuries ago. Expanding access to knowledge through these new channels and tools creates emerging opportunities for learning and employment with strong implications for social and economic development.

These technology innovations could have remarkably positive implications for developing nations, if they are properly introduced and managed. However, if they are not well supported, or if ICT is marginalized in the development process, inequities may increase between the developed and developing worlds. It is a commonplace in development literature that the developing world lacks access to ICT – a condition often dubbed the “digital divide.” Nevertheless, it is important to note that such a divide also exists within nations, both developed and developing. This internal digital divide, also referred to as a gap between “haves” and “have-nots,” relates the possession of ICT resources by individuals, schools and libraries to variables such as income level, age, ethnicity, education, gender and rural/urban residence (Kamel 2005b).

The usual causes of this divide include, but are not limited to, expensive personal computers that are unaffordable for most developing country citizens, poor or limited telecommunications infrastructure especially in remote locations, and high illiteracy rates and poor educational systems (Kamel and Tooma 2005). However, the major obstacle is the ICT ecosystem, including the complexity of the necessary operational details that need cultural adaptation and localization. For societies to develop, grow and benefit from the ICT revolution, nationwide introduction, adoption, diffusion and adaptation of ICT should occur. Yet this is rarely seen in developing nations where most of the ICT implementations and infrastructure are focused in capitals and major cities.

The knowledge society promises to capitalize on emerging ICT to create economic and social benefits. It encompasses ways in which various high technology businesses, including ICT, universities and research institutions, can contribute to the economy of a nation while enabling economic sectors to operate more efficiently and effectively. In this context, Egypt has made efforts toward adapting to the changing global and technological conditions while catering to local markets. The ongoing restructuring of the ICT sector to serve development is liberalizing the telecommunications sector and opening the market to new competition. This restructuring has involved designing laws and regulations related to telecommunications, electronic commerce, intellectual copyrights and industry development; investing in human resources and promoting innovation and research and development.

To be sure, ICT is not the only enabler of the knowledge society. The European Commission (2003) defined the knowledge society as characterized by a number of interrelated trends, including major advances in diffusing and using ICT, increased emphasis on innovation in the corporate and national context, the development of knowledge-intensive business service economies and knowledge management, in addition to trends toward globalization and economic restructuring. The most highly valued and profitable assets in a knowledge society are intellectual: knowledge and expertise acquired by workers. Culture is one of the most important factors in formulating the knowledge society: universities, education and training institutions from both the public and private sectors will also need to cooperate to realize the knowledge society paradigm.

As the impact of the availability of information on socioeconomic development became apparent, governments around the globe started to invest in national

information infrastructure (Petrazzini and Harindranath 1996). Egypt too has heavily invested in its technology and infostructure to become the platform for the economy's development and growth (Kamel 2005a). During the period 1985-1995, a government-private sector partnership had a remarkable impact on the build-up of Egypt's infostructure (Kamel 1995, 1997). Hundreds of informatics projects and centers were established in different government, public and private sector organizations targeting socioeconomic development (Kamel 1998b). These projects included human, technological and financial infrastructure development. Such elements represented the major building blocks necessary to establish a fully fledged infostructure capable of keeping pace with the developments taking place globally (AmCham 2002).

In 1999, ICT was identified as a priority at the highest policy level and a new Cabinet office was established, namely the Ministry of Communications and Information Technology (MCIT). MCIT was charged with the task of creating an information society, which started with preparation of the national ICT plan. MCIT has articulated a strong vision and strategy on development and infrastructure deployment since its first national plan in 1999. Due to changes in global and local markets, both vision and strategy were amended in 2000 and 2004 (Kamel 2009). MCIT took concrete steps like establishing the National Telecommunications Regulatory Authority (NTRA) in 2003 and the IT Industry Development Agency (ITIDA) in 2004, and radically modernizing Egypt National Postal Organization (ENPO) in 2002. The partnership between these institutions and the ICT private sector accelerated ICT growth over the last two years, reaching 20% in 2006 and surpassing 25% in 2007 (AmCham 2007). The ICT sector is driving the gross domestic product (GDP) growth in many nations and Egypt is no exception.

As will be discussed in more detail in the next section, the government of Egypt has formulated various initiatives to promote ICT and pave the way for an electronically ready community that can benefit from public, universal access to knowledge. Other factors, however, will also be critical to closing the digital divide and promoting social inclusion within the digital economy: the legal and regulatory environment, awareness and capacity development, and mechanisms needed for collaboration between different sectors in the economy. This underscores the importance of developing national ICT strategies that recognize the role of ICT in enabling access to knowledge. In the final analysis, the challenge is to

leverage ICT as a platform for knowledge dissemination in the community, and the focus should always be on outcome assessment for this strategy.

Promoting ICT4D: an overview of current programs and initiatives

The evolution in the knowledge society heralds a new socioeconomic order. This era is witnessing the emergence of knowledge-based economies, with traditional economic, industrial and business activities moving toward more knowledge-driven processes and the progressive transformation of advanced economies into knowledge-based, technology-driven, services-dominated economies. These shifts are increasingly laying emphasis on economic activities with intellectual content and knowledge, enabled by the development and exploitation of new information and communications technology within all spheres of human endeavor.

Against that background, Egypt's government has announced efforts aimed at developing its information and knowledge base through investments in ICT and human capacity development, improving and broadening universal access to quality higher education and training with an emphasis on lifelong learning and creating digital content accessible to the society. Egyptian efforts for ICT development are government-led in collaboration with the private sector and civil society. In that respect, Egypt has developed a number of policies and strategies to facilitate socioeconomic development and accelerate the transformation of the nation's economy and society to become information-rich and knowledge-based.

In May 2007, the Ministry of Communications and Information Technology (MCIT) released its 2007-2010 national ICT strategy (MCIT 2007b). The plan paved the way for the Egyptian Information Society Initiative (EISI), which represented the vision of the ICT strategy translated into specific initiatives and programs to diffuse ICT connectivity (MCIT 2005a, 2005b). The EISI is structured around seven major tracks, each designed to help bridge the digital divide and progress Egypt's evolution into an information society (MCIT 2005b).

There follows an evaluation of some of the initiatives and programs implemented by the government to capitalize on emerging ICT and to disseminate knowledge throughout all segments, sectors and communities of society. Rather than attempt to cover all seven elements of the EISI, the discussion will emphasize efforts in the eReadiness, eLearning and eCulture areas considered of greatest relevance to the access to knowledge theme.

Table 6.2: Seven tracks of the Egyptian information society strategy

eReadiness "Equal Access for All" <ul style="list-style-type: none"> • Enabling all citizens with easy and affordable access to new technologies • Developing a crucial robust communication infrastructure • Providing continuous training for doctors • Developing the tools for building a national health network. 	eLearning "Nurturing Human Capital" <ul style="list-style-type: none"> • Promoting the use of ICT in education • Shaping a new generation of citizens who understand ICT and are comfortable with its use in their daily lives
eGovernment "Government Now Delivers" <ul style="list-style-type: none"> • Delivering high quality government services to the public in the format that suits them • Reaching a higher level of convenience in government services • Offering citizens the opportunity to share in the decision-making process 	eBusiness "A New Way of Doing Business" <ul style="list-style-type: none"> • Creating new technology-based firms • Improving workforce skills • Using electronic documents • Developing ePayment infrastructure • Using ICT as a catalyst to increase employment, create new jobs and improve competitiveness
eHealth "Increasing Health Services Availability" <ul style="list-style-type: none"> • Improving citizens' quality of life and healthcare workers' work environment. • Using ICT to reach remote populations. • Providing continuous training for doctors • Developing the tools for building a national health network. 	eCulture "Promoting Egyptian Culture" <ul style="list-style-type: none"> • Documenting Egyptian cultural identity by using ICT tools to preserve manuscripts and archives, and index materials. • Offering worldwide access to cultural and historical materials. • Generating and promoting interest in Egyptian cultural life and heritage.
ICT Export Initiative "Industry Development" <ul style="list-style-type: none"> • Fostering the creation of an export-oriented ICT industry. • Developing an ICT industry that will be a powerful engine for export growth and job creation. 	

Electronic readiness: ICT for All

Digital inclusion and equality are becoming integral factors in the electronic readiness of different societies (Kamel 2007). Therefore, the government of Egypt announced that it was launching efforts aimed at universal, easy, affordable and fast access to ICT for all citizens while raising awareness of the potential in ICT tools and techniques. The MCIT has implemented different programs promoting computer literacy and encouraging the use of ICT across the nation. One of these programs is "ICT for All," also known as the electronic readiness (eReadiness) building block of the EISI. Recognizing universal access to ICT as key to socioeconomic development, the program is devised with two main objectives. First, it aims to assist the government policy to integrate ICT in government and public services by: 1) increasing ICT penetration; 2) fostering inclusion in the knowledge

society and better public services and quality of life; and 3) expanding the use of post offices to provide public services. Second, and more obviously, this strategy aims to facilitate ICT access for all citizens by: 1) increasing PC penetration; 2) expanding the reach of Internet connectivity and broadband to all communities; 3) raising youth employability through ICT training; and 4) encouraging government employees to attain international accreditation in ICT skills. There follows a description of three selected projects aimed at promoting electronic readiness: the Free Internet Initiative, Egypt PC 2010, and IT clubs. All three employ an implementation model of public-private partnerships in which the government's role is to articulate policy and regulatory frameworks for the private sector and civil society to implement. At the close of this section, the impact of these projects will be examined through the lens of representative indicators and secondary analyses, to assess the nation's progress in achieving its eReadiness goals.

Free Internet Initiative (Internet and broadband connectivity)

The Internet was first introduced to Egypt in 1993 by the Egyptian Universities Network of the Supreme Council of Egyptian Universities, originally serving two thousand users (Kamel and Hussein 2002). In 1994, in an effort to diffuse Internet usage among the broader society, the Cabinet of Egypt's Information and Decision Support Center (IDSC) in collaboration with the Regional Information Technology and Software Engineering Center (RITSEC) began providing free Internet access on a trial basis to public and private organizations. This was done with financial support from the government, in an attempt to boost global exposure of the local market and pave the way for commercialization of Internet services.

The free access formula was credited with accelerating the growth of Internet users, particularly within small and medium-sized enterprises and industry professionals (Kamel 1998b). In 1996, the government replaced its free access policy with an open access policy: commercial Internet services were privatized, and a dozen Internet service providers (ISPs) began operation (Mintz 1998). By December 2001, more than 600,000 Egyptians were online, but only 77,000 were paid subscribers, served by 51 private ISPs. Such limited growth was perceived as hindering the development of the knowledge society. Therefore, in January 2002, MCIT launched a new initiative providing free nationwide Internet access to all citizens (Kamel and Abdel Ghaffar 2003). This has contributed to rapidly growing use, with the percentage of the population

online rising from 5.5% (3.9 million users) in 2004 to 15.6% (11.4 million users) in 2008, still rising at a rate of 16.7% annually (MCIT 2008a, 1).

Egypt's free Internet initiative has made connectivity affordable to most citizens by enabling access on all fixed phone lines without additional monthly fees. The cost of dial-up access is the same as a local telephone call, less than US\$5 per month (MCIT 2008a, 4). Dial-up modems, however, are generally capable of a maximum speed of only 56 kilo bites per second (kbps) and occupy the telephone line. To enhance the Internet experience, broadband (ADSL) connectivity, which supplies at least 256 (kbps) and does not disrupt telephone use, has been offered since 2004. The continued expansion of broadband service may be expected to positively affect access to knowledge on the web due to its reliability, stability and capacity compared to the dial-up option.

At present, however, the higher cost of broadband connectivity still remains a challenge to its acquisition by more households. The broadband tariff initiated in 2004 has been revisited twice and in March 2009 was reduced again to LE95 (US\$17) per month for a 256 kilobytes speed. This cost may be further reduced by sharing a connection across multiple households. More than half a million Egyptians now subscribe to the web through broadband service, yet this is small compared with more than 11 million total Internet subscribers (MCIT 2008a, 1). Nevertheless, fully 36% of Egyptian Internet users report accessing the Internet through a broadband connection at the end of 2008, up from only 24% a year before (MCIT 2008a, 4). This likely reflects both the use of superior connections in Internet cafés, as well as sharing of a single broadband subscription across households. According to a survey by Arab Advisors Group released in April 2008, 63.4% of households in Egypt with ADSL subscription reported sharing the ADSL with neighbors, and 81.9% of those share it with more than three neighboring households (Arab Advisors Group 2008).

A computer for every home: Egypt PC 2010

Egypt PC 2010 is an initiative to bring Egypt as a nation online. It is an amended version of the 2002 PC for every home initiative launched in collaboration with Telecom Egypt (TE) (MCIT 2007b). The first initiative offered locally assembled PCs with bank credit for up to three years, using ownership of a landline telephone as loan collateral. PCs could be bought on hire-purchase terms by anyone with a TE telephone line, with the periodic loan repayments included in the phone bill. In the original initiative, a limited variety of PC models and specifications were offered, which rendered the product unaffordable to

many. Additionally, only TE customers could participate, which limited the project's scope to urban communities. These two issues hindered the success of the program among the community. Five years after the launch of the 2002 initiative the Internet penetration rate had increased to only 7% (MCIT 2007a). Since, as noted before, dial-up service is available to any home with a telephone landline at no additional charge, the slow Internet penetration rate must be attributed to the continuing difficulties of acquiring home computers.

The PC 2010 initiative implements several lessons learned. The new program offers local and international brand PCs, from simple models for beginners to high-end desktops and laptops. Participants no longer need to be TE customers to be eligible for the extended payment terms because financing banks offer the required loans through facilitated retail banking procedures. Under the new scheme the PC can be purchased on installments for as little as US\$8.50 per month, which comes to just over US\$100 per year. Compared with Egypt's average GDP per capita of approximately US\$4337 per year (UNDP 2007, 231), this rate is quite affordable. Additionally, the new initiative focuses on improving PC distribution in all provinces, with an emphasis on serving underprivileged communities through partnerships with civil society organizations.

Integrated computing and training through IT clubs

Another example is the emerging network of IT clubs across Egypt's 28 provinces that provide citizens with access to information technology. Their primary objective is to open the global eSociety to Egyptian youth and rural and underprivileged communities by offering an affordable site for Internet access and training. The initial vision for the program was to open 300 such IT clubs (MCIT 2001, 2). The model proved highly replicable; today there are over 1747 IT clubs across the nation, a figure still growing by approximately 13.5% annually (MCIT 2008a). IT clubs give citizens the opportunity to become computer literate and electronically ready, regardless of their initial skill level or income, and can be used by small businesses, local organizations and individuals (Kamel 2007). These clubs are model knowledge disseminators since they provide both access to the technology as well as training in how to use it. Recently IT clubs have also been established in universities to bring up-to-date technologies into reach for all university students, not just those in educational programs with computer labs.

All stakeholders contribute to a typical IT club. MCIT provides all necessary equipment – including PCs, servers, printers, peripherals, Internet access and

networks – and supports the training and salaries of the club facilitators and administrators. Usually a local NGO or a university provides the space and takes responsibility for managing the IT club. To cater to the majority of the population, the IT clubs charge nominal fees of around US\$0.18 per hour. The availability of these clubs in rural communities represents an open-ended and accessible platform for underprivileged youth to enter the digitized strata of education and employment. Regardless of the infrastructure and resources made available in it, the success of each IT club ultimately depends highly on the club's public advocates and management, as well as the eagerness of the local community to make use of its services.

The goal of distributing IT clubs widely through the country has largely been achieved. At the end of 2008, clubs were represented across the regions as follows: Upper Egypt governorates (623), urban governorates (543), Lower Egypt governorates (487) and borderline governorates (98) (MCIT 2008c, 10). Of the total existing IT clubs, 89.7% are connected to the Internet (MCIT 2008c, 14). Although clubs vary in their levels of success, overall their presence contributes strongly to developing a more IT-literate society. Notably, the majority of users served by IT clubs are women, with many benefiting from the exposure to information technology to improve their job opportunities (MCIT 2008c). MCIT has also introduced IT clubs specifically designed to meet the needs of disabled users (MCIT 2005c).

Assessing the impact of Egypt's eReadiness initiatives

Through the efforts exerted as described above, significant progress has been made in achieving Egypt's eReadiness goals. As a reflection of this point, Egypt ranked 76th out of 134 economies surveyed for the 2009 Networked Readiness Index (WEF 2009, xvii).¹ Egypt also earned recognition as "an emerging outsourcing gateway in the Middle East" (WEF 2009, xiii), in part due to its competitive Internet usage charges (WEF 2009, 116). An alternative

1 The NRI is developed by the World Economic Forum (WEF) and INSEAD. The index is based on hard data produced by organizations such as the World Bank, the International Telecommunication Union and the United Nations, and survey data generated from the Executive Opinion Survey that is annually conducted by WEF. The three components of the index include the ICT environment created by the government, the readiness of the community's key stakeholders (including government, businesses and individuals) and the usage of ICT amongst those stakeholders. The index ranks Egypt 60th in terms of market environment and 70th in terms of IT infrastructure. While Egypt ranks 51st in government readiness, it is still lingering at 97th rank in individual readiness.

eReadiness index puts Egypt even higher, at 57th out of 70 nations, noting an upward momentum due to improvements in connectivity (Economist Intelligence Unit 2008, 3).²

Yet much additional work is still needed. The slow increase in fixed line density rates, in particular, has been identified as an element slowing down Egypt's electronic readiness. An external source reports that "Despite the moderate growth which Egypt's fixed-line market has continued to experience, the market has failed to keep pace with the country's expanding population" (Business Monitor International 2008). The report predicts a shrink in the sector in 2009, with more customers relying on mobile phones in place of fixed lines. A chance to move forward again is predicted, however, if competition enters the market: "The arrival of a new fixed-line operator sometime in the next two years could result in a new round of growth for the sector, particularly if the new entrant started providing fixed wireless services" (ibid.).

Taking the long view, significant progress on eReadiness has unquestionably been made. Over the last decade the ICT infrastructure witnessed massive developments in international links for telephony and the Internet backbone in addition to disseminating the Internet across Egypt's 28 provinces. The progress made toward Egypt's eReadiness goals – in terms of various aspects of ICT infrastructure build-out – is summarized in Table 6.3.

The ultimate goal, however, is not to achieve increased ICT adoption for its own sake. As the name "eReadiness" implies, these efforts merely lay the foundation to take advantage of ICT tools for development ends. With this in mind, the following section examines Egypt's efforts to date in leveraging ICT development for education.

Electronic learning: ICT for education

Education and lifelong learning are central drivers of socioeconomic development and growth, and have particularly relevant implications for

2 The Economist Intelligence Unit's eReadiness ranking is based on a set of quantitative and qualitative criteria that include connectivity and technology infrastructure, the business environment, the social and cultural environment, the legal and policy environment, the government's policy line and business adoption. The data are sourced from such institutions as the World Bank, the World Intellectual Property Organization, and the Economist's network of national experts and economists. In 2008, Egypt held an eReadiness score of 4.81 out of 10 as opposed to 4.26 in 2007.

Table 6.3: Change in ICT infrastructure indicators, 1999-2008

Indicators	October 1999	December 2002	December 2004	December 2006	December 2008
Internet Subscribers (millions)	0.3	1.2	3.6	6.0	11.4
ADSL subscribers	N/A	N/A	N/A	206,150	593,042
Internet Penetration per 100 Inhabitants	0.38	2.53	5.57	8.25	15.59
Mobile Phones (millions)	0.654	4.5	7.6	18	38.06
Mobile Phones Penetration per 100 Inhabitants	0.83	5.76	9.74	23.07	50.7
Fixed Lines (millions)	4.9	7.7	9.5	10.8	11.4
Fixed Lines Penetration per 100 Inhabitants	6.2	9.8	12.1	13.8	15.2
Public Pay Phones (thousands)	13.3	48.0	52.7	56.5	58.0
IT Clubs	30	427	1,055	1,442	1,751
ICT Companies	870	1,533	1,870	2,211	2,621
IT Companies	266	815	1,374	1,970	2,012
Communications Companies	59	75	152	244	265
Services Companies	88	121	148	211	242
Number of Employees in the ICT Sector (thousands)	48.1	86.0	116.0	147.8	174.5

Source: MCIT Indicators Bulletins.

access to knowledge. Boosting performance on these measures, however, has historically been a challenge for Egypt. The country's adult literacy rate stands at only 71.4% (UNDP 2007, 231), indicating that a substantial proportion of the country must overcome barriers beyond the merely technological in order to take advantage of the Internet. Egypt's education system has been fully subsidized by the government for decades, yet challenges with regards to infrastructure and quality persist. In the public school system, class sizes of 70-80 pupils are common, teachers are poorly qualified, and the emphasis

is on rote memorization rather than problem solving (Kozma 2004, 14-15). Since 2003, the country's ruling National Democratic Party has declared education reform to be a key priority (Essam El-Din 2003).

One major component of such reform is embedding ICT in education to promote information acquisition and knowledge dissemination. The objectives of deploying ICT for education include: optimizing ICT investments to avail the required infrastructure that promotes education and lifelong learning; satisfying the ICT industry training requirements; creating an open learning environment by connecting the education community through broadband; and increasing the efficiency and effectiveness of education institutions and embedding ICT in the curriculum.

Toward those ends, MCIT is supposed to work closely and strategically with the Ministry of Education (MOE) and the Ministry of Higher Education and Scientific Research (MHESR). Accordingly, a number of projects were devised, most notably the Smart Schools Network, the Egyptian Education Initiative (EEI) and ICT for Illiteracy Eradication. These programs share the common target of increasing ICT awareness and promoting education and lifelong learning. Their strategy is meant to capitalize on the potential of ICT to provide universal access to knowledge and education to all constituencies in Egypt, irrespective of socioeconomic group, gender, age or background.

Smart Schools Network

Begun in 2003, the Smart Schools Network (SSN) seeks to introduce innovative learning methods by using ICT-based applications, content creation, school administration software and interactive tools (Egypt ICT Trust Fund 2009a). SSN is established to diffuse computing literacy in Egypt whereby computers are readily available to students from an early age where they learn how to use them and, as a result, become comfortable with IT by the time they graduate from high school. To achieve this, SSN seeks to diffuse PCs in public schools at a rate of one computer per every ten students, as well as to provide appropriate software and support for teacher training. The network marks the first integrated move toward a comprehensive modernization plan for the local schooling system, with targeted goals to improve the effectiveness of schools in delivering knowledge and in administering their classes. The initial pilot phase – targeting 38 primary schools and benefitting 18,500 students – was formally inaugurated in 2005 (Smart Schools 2005).

A standard smart school has two computer labs, each lab with twenty computers for the students and one computer for the instructor. Computers

are also placed in libraries and in the teachers' rooms. Typically, all computers are connected to the Internet; some schools also have wireless connectivity. These connections allow all students and teachers within the Smart School Network to communicate with each other and to compete in various competitions. Usually, students spend four hours per week working on the computers during school hours. Labs may also extend services to the local community and students after school hours and during vacations, as a community learning center (CLC).

MCIT deemed the initial Pilot Phase a sufficient success to proceed with Phase Two, with fifty additional schools joining the network. By the end of 2009, the number of schools on the network should reach 185 schools and 800 teachers trained. The project's expansion is financially supported by the United States Agency for International Development (USAID 2002). To date, however, no formal evaluation of the program has been published. The extent to which the project is achieving its goals and offers a replicable model is thus difficult to ascertain. A progress report and evaluation of the SSN is likely to be issued, however, after the conclusion of the 2009 Phase.

Egyptian Education Initiative

The Egyptian Education Initiative (EEI) is a public-private partnership launched in 2006 between the government, the World Economic Forum (WEF), the IT community and different ICT multinationals and organizations operating in Egypt. Bilateral agreements have been signed with Microsoft, Intel, IBM, Oracle, Cisco, Intel, Computer Associates, HP and Siemens, as well as more than twenty-five local partners, such as the British Council and The American University in Cairo, in technology sectors from connectivity infrastructure to electronic content development.

The overall goal of EEI is to better prepare students to engage in the digital economy by improving the educational content and delivery mechanisms in local schools and universities (WEF 2008). The specific objectives of EEI are formulated to include: improving the development and delivery of education for all citizens; raising the quality of education and training; developing the skills needed for the knowledge society; providing education and training to a larger portion of the population; preparing students and teachers for the digital workforce by enhancing their effective and creative use of ICT; and leveraging the environment of

national government commitment and corporate citizenship to build an educational reform model that can be exported and replicated throughout the Arab region (ibid.). EEI is divided into four tracks: pre-university, higher education, lifelong learning, and ICT industry development to cover the entire spectrum of learners.

Numerous projects in EEI capitalize on ICT for access to knowledge for the community. A prominent example is the Intel "Teach to the Future" electronic content program, which promises to prepare teachers for the digital age. It was approved by the Supreme Council of Universities (SCU) to be included in the undergraduate curriculum for future teachers. The program started with a pilot in 2007 in twelve different universities, training 120 staff members how to teach a course using ICT. The program has since been expanded to include additional staff members to meet the demand in the market. In parallel, 220 staff members and 4109 teachers were trained on ICT fundamentals through Microsoft's "Digital Literacy" program. Another example is the eLearning Competence Center (eLCC) which prepares most of the eLearning curricula. The project demonstrates another partnership between MCIT and Cisco. The creation of appropriate electronic content is a large task with many players and eLCC has a team of developers continuously creating Arabic courses. This step is laying the foundations of the eLearning industry in Egypt.

As of 2008, the Egyptian Education Initiative has collectively trained 100,000 teachers in digital literacy, provided 2,000 schools with broadband connectivity and delivered over 39,000 PCs to schools (Business Monthly 2008). Investment in human resources coupled with the provision of ICT infrastructure in the classrooms is enabling the blending of theoretical foundations with hands-on experience and practices, representing an invaluable component of the learning process. Significantly greater efforts are still required, however, to fully cater to the needs of over 16 million students from elementary to postgraduate education. Given the right resources, however, these programs have the potential to scale up. The degree to which introduction of advanced ICT actually impacts teaching methods and learning outcomes also remains to be evaluated. In this respect, the SSN may be considered to be more sophisticated than the EEI, since it places an explicit emphasis on ensuring that ICT is deployed to enable new and more effective methods of teaching. The EEI pursues a more basic objective, which is simply to enhance student familiarity and comfort with ICT.

ICT for Illiteracy Eradication

Illiteracy is another challenging feature of Egypt's education landscape. Approximately 28% of Egyptians aged 15 and older are unable to read and write a basic statement about everyday life (UNDP 2007, 231). The continuing socioeconomic reality of poverty makes effective educational opportunities out of reach for many households. Within this context, the ICT for Illiteracy Eradication (ICT4IE) program was established in 2002, with funding through the Egypt ICT Trust Fund. Based on the General Authority for Literacy and Adult Education (GALAE) curriculum, the ICT4IE project produced electronic content for teaching Arabic letters and words and elementary mathematics. In addition, MCIT has established Training of Trainers (TOT) programs in 15 provinces to facilitate use of the software, in a mixture of taught and self-study approaches (Egypt ICT Trust Fund 2009b).

A successful initiative in this area was brought about by a partnership forged between ICT4IE and the Resala Association, a community-based NGO, to pilot the CD-based courses. According to a joint report by the partners, the pilot project attracted 230 illiterates to enroll in the course (Egypt ICT Trust Fund 2008). This response stood in marked contrast to the association's earlier offerings of literacy courses on the traditional method, which had attracted few students (*ibid.*). This experience indicated high demand for the ICT4IE project, with the use of PCs and CDs offering a substantial incentive for many illiterate adults to attend classes and learn to read. Moreover, 95% of students completing the course passed the associated exam (*ibid.*).

In 2005, GALAE and the Ministry of Education signed a memorandum of understanding to train 10,000 adults per year in basic literacy (*ibid.*). Progress toward this goal, although real, has been slower than hoped. As of late 2008, the program's website reported that approximately 5000 students had been enrolled in the electronic courses, with 2811 already graduated (*ibid.*). This slow progress reflects the small number of sites that participate in the program. Currently around 150 IT Clubs and NGOs offer access to the software (Egypt ICT Trust Fund 2009b). This may be compared to the total figure of 1747 IT clubs across the nation (MCIT 2008a). Significant further efforts are thus clearly required to meet the needs of millions of illiterate Egyptians. Expanding access to these educational tools presents a particular difficulty, as those Egyptians most in need of literacy training opportunities are precisely those who have the greatest difficulty accessing ICT, for reasons economic, geographic and social.

Assessing the impact of Egypt's eLearning initiatives

Although Egypt has made significant progress in achieving its eReadiness objectives, its eLearning programs are generally still at the pilot stage. According to a regional report, Egypt's ICT for education implementation was ranked at a maturity level of two out of four, indicating a number of sporadic projects and initiatives that had concrete impacts, but lacking the consistency and long-term vision for successful implementation and sustainability (ESCWA 2007).

Of the three eLearning programs detailed above, the Egyptian Education Initiative has had the greatest impact, training over 100,000 teachers in use of ICT. The Smart Schools Network, although still quite small, holds the potential to build on this success to use ICT in a way that truly transforms the educational experience. Finally, the ICT for Illiteracy Eradication project demonstrates that eLearning can be leveraged to achieve results in lifelong learning, even for those at the greatest educational disadvantage. To achieve a significant impact upon access to knowledge in Egypt, however, these programs must be greatly scaled up. This will require broader advances in access to computers and the Internet (eReadiness) than has already been achieved. Once this infrastructure is in place, however, the eLearning programs may benefit from the economics of easily reproducible open source software (OSS) to scale up with an efficiency of resources.

Electronic culture: digital Arabic content

Egypt's eCulture initiatives seek to address the gap between the country's vast cultural riches which exist "offline," and the very thin nature of Arabic language content available "online." The production of electronic content is crucial for several reasons. Digital Arabic content may serve as a major contributor to eradicating illiteracy using new ICT; it can help preserve cultural heritage and enhance international understanding; it can serve as a resource of knowledge dissemination to meet the country's development needs. In addition to the direct and concrete benefits envisioned from the production of digital content, enhancing Arabic digital content may also increase opportunities for exports with an emphasis on goods reflecting the nation's unique cultural and historical heritage.

In an interview, Minister of Communication and Information Technology Dr. Tarek Kamel pointed to the promise and challenges of creating digital Arabic content. "The content is there, in books, newspapers, films and

tapes. We need to digitize it and put it online. It takes investment, money, initiatives, training, human resources, server equipment and investment in communication networks" (Attalah 2008). The needed investment must be generated through models that achieve both profitability and access. An ESCWA report on business models for electronic content suggested that bridging the Arabic digital content gap can be approached from two perspectives: a policy perspective, which will generate a positive social outcome; and a market perspective, which will produce direct economic gains such as job opportunities and investments (ESCWA 2008). Marrying both perspectives becomes imperative when approaching Arabic digital content initiatives.

With this perspective in mind, this section explores two electronic culture initiatives: the Initiative for Arabic eContent for Books and Software, and the Eternal Egypt project of the Center for Documentation of Cultural and Natural Heritage. In both instances, the discussion seeks to suggest how the projects might be improved in future iterations to maintain their valuable contributions while reducing the tension with the values of access to knowledge.

Initiative for Arabic eContent for Books and Software

Announced in 2005, the Initiative for Arabic eContent for Books and Software seeks to digitize culturally significant materials from a variety of media – books, images, music and film – to create high quality electronic content (MCIT 2005d). The initiative's goals include enriching the Arabic content online and preserving Arabic culture for future generations as well as improving a national industry and its competitiveness, and creating job opportunities (ibid.). Throughout the protocol's four-year term, the Arabic digital content portal should have some 2000 addresses and 300 software programs (ibid.). The preliminary phase involved an agreement granting 24 publishers the rights to use and distribute the 165 books which had already been digitized in 2007, while the next phase involves 700 books. More initiatives and partnerships are in the pipeline. These include theatrical publications and 400 photographs, as well as images, maps, audio and video records (MCIT 2007).

The project's intellectual property arrangements, however, are problematic from an access to knowledge perspective. At the project's outset in 2005, MCIT agreed that all digitized books would become the

property of the Egyptian Federation of Publishers (MCIT 2005d). Similarly, any transformed content is owned by the Union for the Educational and Commercial Software Producers (ibid.). Both organizations committed to make the material accessible through a license during the duration of the project, with the end goal of charging for access to the content (ibid.). While the project represents a potential milestone to improving access to Arabic eContent domestically and internationally, the licensing component remains a limitation to a wide and free access. Materials long preserved by public institutions as part of Egypt's cultural heritage are now at risk of being lost to the public in the digital era.

Center for Documentation of Cultural and Natural Heritage

Another project, Eternal Egypt, is managed by the Center for Documentation of Cultural and Natural Heritage (CULTNAT). The project documents significant aspects of Egypt's heritage in the form of an online museum. According to a brochure published by a corporate sponsor: "With multimedia animations, 360-degree image sequences, panoramas of important locations, virtual environments, three-dimensional scans, real-time photos from Web cameras, and thousands of high-resolution images of ancient artifacts, Eternal Egypt weaves together more than five millenia of Egyptian culture and civilization and makes it available to people all over the world" (IBM Corporation 2005).

The project has yielded a rich and innovative resource for learning about Egyptian culture, which is accessible to students domestically and internationally in the Arabic, English and French languages (www.eternegypt.org). Beyond this significant achievement, the project also constituted an important experiment in the digitization of museum collections, relying on cutting edge three dimensional scanning of cultural artifacts (Rushmeier 2006). The digitization of these unique resources opens the door to many opportunities for further innovative reuses for this priceless electronic content, even as yet unimagined.

The value of this effort, however, may be compromised in unintended ways by the misguided use of intellectual property protections. The materials made available through Eternal Egypt cannot be reused by visitors without special permission. The website's terms of use indicate that no reuse of materials may be made without submitting a licensing inquiry; indeed, all images on the site have been digitally "watermarked" to prevent their suitable use.

This means, for example, that the materials may not be used by a blogger to promote Egyptian tourism, nor by a contemporary Egyptian artist seeking to reinterpret or repurpose a classical work for modern appreciation. The underlying technology of the website, too, has been patented, with the patent certificate proudly displayed as evidence of the project's originality. Even more impressive, however, would have been the licensing of such technology as OSS, inviting other Egyptian and foreign institutions to replicate and improve upon it in a collaborative style.

Assessing the impact of Egypt's eCulture initiatives

The objectives of a new digital content initiative are to: develop high-value Arabic digital content industry and the necessary Arabic applications; use these products for socioeconomic development; increase the quality and accessibility of online Arabic digital content; and create an environment conducive to the sustainable production of this important and growingly used digital content. These objectives can be realized by supporting universities, research centers and ICT companies to develop research and development capabilities for digital content; encouraging local communities to develop digital content; and expanding broadband capacity nationwide. Moreover, they can be realized through a regulatory and legislative setting that can help in the process of expanding electronic documentation of Egypt's cultural heritage, and developing business models based on open sharing of this content.

At present, the current initiative has focused on protecting cultural heritage, devising a revenue sharing model between content and service providers, and providing legal protection for digital intellectual property through a legislative framework. This is problematic from an A2K perspective, as cultural heritage is indeed a cornerstone of Egypt's identity, and any such digitization efforts should be devised with the objective of expanding shared access to content. The challenge in this process becomes one of striking the balance between treating digital content as a profit-making, exportable commodity and a tool to maximize knowledge in society.

On the one hand, there is a desire to promote the digital content industry, which encompasses the creation, design, management and distribution of digital products – including companies producing traditional content, media and entertainment, software and multimedia, and electronic hardware and telecommunications services. These sectors are converging due to

rapid growth in ICT, the Internet and broadband access, which is driving demand for the electronic distribution of content. On the other hand, from a more holistic perspective of human development, digital content may be understood as directly valuable to the Egyptian people, celebrating our cultural heritage, inspiring future generations, and meeting the myriad needs of the Egyptian knowledge society. These two goals may be seen in tension, as the treatment of digital content as a commodity for export might conflict with expansion of access to digital content by preserving it as a public good. The premise of the access to knowledge framework, however, is that this potential tension can be resolved in a mutually beneficial way.

Studies sponsored by the World Intellectual Property Organization have consistently sought to persuade Egypt that the interests of its content industries lie in enhanced copyright protection (Alikhan 2000, Ghoneim 2003). This uncritically IP-maximalist view is discredited, however, by developing countries' recent insistence that WIPO adopt a more even handed and empirically based approach to the costs and benefits of IP protection for development. The work of Nagla Rizk on the Egyptian music industry presented in this volume also calls this premise into question, suggesting that IP protection may be neither necessary nor desirable to promote artistic creativity and a vibrant industry. Business opportunities are created in many ways by eContent, beyond the traditional conceptions of copyright licensing. Open materials, free for use and repurposing, are typically more desirable to both promote access to knowledge and create new business opportunities. Toward this end, a greater role should be explored for Creative Commons licenses and OSS in the government's eCulture initiatives.

Efforts to promote eCulture should also be encouraged from the bottom up. In parallel to the MCIT projects, initiatives on a grassroots level are also endeavoring to expand the Arabic-language presence on the web. The Arab Techies Group is a case in point. Convened in 2008, the group first met to discuss ICT issues that pertain to community support and access to knowledge, concluding that Arabic support problems are consistent. For example, existing Arabic search technology, an important pillar for research and development, does not match with the rapidly growing content on the web. The group also agreed that improving Arabic digital content will require a broader spread of language processing tools, ideally in the form of widely affordable OSS. Hence, the group came up with the idea of developing a code sprint, whereby they will work together on creating an open source

solution around language tools. The group has launched a website at <http://arabtechnies.net> and to convened its first intensive code development workshop in May 2009.

Initiatives such as this highlight the fact that increasing eContent will require collaboration between government and civil society, including noncommercial partners. Emergent ICT hold great potential to capitalize on open content and open source tools to stretch scarce public resources to greater effect. This requires sensitivity to the access to knowledge perspective when establishing intellectual property and licensing provisions around government supported projects.

Conclusion

Over the last decade, Egypt has made significant progress toward realizing the vision of the knowledge society through information and communications technology. The developments of the initial phase addressed legal, technical and business fundamentals, enabling the ICT industry to develop significantly (IDSC 2005). These have been reflected positively in the overall growth of the sector, which exceeded 20% in the last two years and contributed to overall GDP growth by more than 7% (Fayed 2009). In the words of the ICT minister, the ICT sector has transformed itself "from a sector looking for support and subsidies to a sector contributing tangibly and intangibly to the economy with a total of 5.2 billion US dollars received by the treasury since early 2006" (Kamel 2008). The ICT sector has also served as a role model for other sectors of reform and liberalization, capitalizing on a free market economy and catering to different social groups and interests.

The National ICT Action Plan 1999-2009 was realized in many ways over the last decade, although not in its full capacity as envisioned in 1999. This action plan, set shortly after the establishment of MCIT, aimed to build a knowledge-based society that can boost socioeconomic development and entice economic growth. As originally conceived, the plan identified eight goals: 1) *Completing the ICT infrastructure build-up* to achieve universal interconnectivity among all 28 provinces including 520 local administrations and over 8000 cities and villages; 2) *Realizing infostructure interconnectivity* among value-added information networks in government, private sector and civil society organizations; 3) *Linking Egypt locally and globally* within the growing global digital market space; 4) *Investing in human capital* through lifelong learning programs and serving different segments of the community;

5) *Building an electronically ready community* capable of engaging in the global information society; 6) *Updating Egypt's information infrastructure* as a step in building the nation's information highway; 7) *Encouraging an ICT export industry* by promoting and supporting innovation, creativity and research and development in ICT-related areas; and 8) *Collaborating through public-private partnerships* engaging different stakeholders in high-tech projects with business and socioeconomic implications.

Although none of these objectives has been fully attained, the plan's achievements to date lie in gradually helping Egypt to bridge the nation's digital divide and in sharpening its competitive edge on the global ICT scene. Penetration rates are gradually increasing for infrastructure like Internet access, PCs and mobile and fixed phone lines. The liberalization of the telecom sector created competitive forces that are working for the best interest of the consumer. The action plan also helped create an ecosystem that is empowered by deregulation policies, which laid the foundations of the ICT sector's continuing development. The MCIT has gained valuable experience through a number of public-private partnership initiatives that can be expanded and improved upon to more fully achieve the vision of the knowledge society over the coming decade.

The development of the knowledge society cannot be left to market forces; it deserves and needs the attention of the highest political decisionmakers with a vision to expand access and contribution to knowledge. Nations like Egypt should prioritize information needs for business and socioeconomic development, just as they do already for sectors such as industry, agriculture, education and health. Governments are responsible for taking a strategic approach to the demands of an information-intensive global environment. This approach should include: creating a shared vision of the knowledge society, intensifying the process of information acculturation, generating the necessary human capacities, accelerating the development and deployment of ICT infrastructure, and building an electronically ready community.

A critical issue in the information age will be developing a win-win partnership between the government and the private sector. According to MCIT Minister Tarek Kamel: "Institutional build up is important. Transparency is important. Adherence to law is important. But I believe that the most crucial issue is genuine public private partnership including all the various stakeholders in the dialogue and in the development process" (Attalah 2008). The private sector is now seen as a major stakeholder in the

progress toward the knowledge society. Use of public-private partnerships will continue to be instrumental for the government's strategy. The nature of this partnership will be determined by the answer to this question: How will governance be exercised in the information-based world? While the framework is not yet defined, the private sector will probably provide information-based services while governments construct a supporting regulatory framework based on the greater public participation and consensus essential for a knowledge society.

The knowledge society requires not just an intricate web of legal measures but also a strong, comprehensive infrastructure, a human resource investment plan, good education and concrete incentives for local and foreign investments. Moreover, it requires full transparency in the transfer and use of data within an environment that encourages creativity and innovation. Information is power, and it is a factor in the manipulation of discourse about socioeconomic reform (Stiglitz 2002). Historically, in Egypt, the government has dominated the supply of information. The process of information sharing and dissemination was orchestrated by a number of public and private sector organizations led by the Central Agency for Public Mobilization and Statistics (CAPMAS), established in 1964 and considered the official source of data collection in the nation (El-Mikawy and Ghoneim 2005). This strategy has been gradually changing since the mid-1980s, when the government opted for a relatively more transparent strategy by collaborating with the private sector and by allowing research entities to conduct market studies, sharing findings and outcomes and generally contributing in the build-up of the knowledge society. This promising trend has opened venues for information sharing to the public, empowered the society and disclosed opportunities for business and socioeconomic development.

Access to knowledge will not reach all segments of the society across all provinces, however, until further efforts are expended. Despite significantly increasing ICT penetration rates, too many Egyptians are still excluded from the opportunity to participate in the knowledge society. Not only technological expansion is needed, but also educational opportunities and the economic resources for Egypt's people to avail themselves of the opportunities the new technologies provide. Moreover, a political revisiting and reform for media freedom will be conducive to improved access to information, which is currently still perturbed by a series of legal and extralegal restrictions.

A critical leveraging of the potential of OSS and open licensed content is also in order to expand access to eLearning and eCulture.

In this respect, access to knowledge emerges as an invaluable platform for development and growth in the global marketplace of the twenty-first century. With the increasing competition taking place around the world, investing in human capacities and disseminating knowledge through multiple channels is integral to business and socioeconomic development. Expanding access to ICT plays a pivotal role in this effort. Over the next decade, Egypt should further develop its ICT policies and programs within an overall ecosystem that encourages knowledge sharing and collaborative work, and which is guided by the notion that access to knowledge is the path to societal development and growth.

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