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Technology, Economic Development, and Education Reform: Global Changes and Egyptian Response

A Report and Recommendations Submitted to

The Ministry of Education, Arab Republic of Egypt

and

Partners for a Competitive Egypt

Pal-Tech, Inc.

Sponsored by USAID

By

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Goals of this Report

I have been asked by Partners for a Competitive Egypt [PfCE] (Planning and Learning Technologies, Inc. [Pal-Tech, Inc.]), with the sponsorship of USAID, to draw on my international research and consultation experience with ministries in other countries[1] to consult with the Ministry of Education, Arab Republic of Egypt on the role that technology might play in education reform and economic, human resource, and social development in Egypt.

I traveled to Egypt for three weeks in September and October, 2004. During this time, I read numerous research reports and documents from the Egyptian government and international organizations, visited public and private schools, talking with principals and teachers, and met with Ministry of Education officials and staff from reform-based and technology-based projects in Egypt, including the Pal-Tech "Ed Tech in Schools" demonstration project. While this project is the immediate context for my work, I have been asked to review the education system generally and comment broadly on the role technology might play in supporting reform in Egypt. One can only begin to understand an education system with three weeks of observation and analysis. Nonetheless, I respectfully offer my insights on the strengths, challenges, and opportunities that I see exist in the Egyptian education system and the role that technology might play to support change. But in the end, what matters less are my analyses and recommendations and what matters more are the analyses and decisions of Egyptians. I hope this paper contributes to that important work.

As in any country and with many social systems, the education system in Egypt is highly-tuned to be internally coherent and self-sustaining. Students enter school, teachers lecture, students memorize facts and procedures and take exams; many graduate and some go on to the university—the system works, in this regard. But just because the system works does not mean that it is successful. Such self-reinforcing systems often become quite static and resistant to change, particularly if there are few ways that a system interacts with other systems and there are limited mechanisms for responding to external feedback. Internally, each piece of the system fits with and reinforces every other piece. An attempt to change any one piece of a system elicits a hundred reasons from every other part of the system why the change can not or should not succeed. If you try to train teachers in new, student-centered methods, it will be said that it does not fit the curriculum. If you try to change the curriculum to be oriented more to higher level thinking, it will be said that it does not fit the exams or that the teachers are not trained to

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teach problem solving. If you introduce computers, it will be said that there is no room for them in the curriculum or that teachers do not have technological skills or access to technology.

The key to change—and even the necessity for it—is the extent to which the system is in turn tuned with other components of the larger system, such as a country's economic and social sectors. If there is a disconnection or dissonance between the education system and other components of the society, the challenge then becomes finding the right "pressure points" within the education system and the "opportunities" to apply strategic "levers" to make the system dynamic, to realign its internal components, piece by piece, with each other and thus become more compatible with and responsive to the needs and demands of the larger system.

This reality prompts the question: Is the highly-tuned system of education in Egypt in turn coherent with the external realities, economic goals, and aspirations of the Egyptian people? Are children getting a quality education? And if not, can technology be used as a lever to bring about change within this system?

Let me first say that the mere introduction of technology into schools will not change anything in Egypt. There are many examples around the world where technology has merely reinforced the existing structure or where it has been marginalized or not used at all, thus becoming a major investment with little or no return in educational improvement. Technologies can reinforce the old curriculum; they can be pasted onto current ways of teaching; or they can be left in the closet or become game toys. Vast sums of money can be spent on hardware and software without sufficient thought toward training, maintenance and technical support. Where technology has helped to change education it has been in places disposed to reform in the first place.

If technology-based change is to be successful in Egypt it will be because the use of technology hooks into and is coordinated with a strategic set of other changes inside and outside the educational system that can be used, bit by bit, to bring about change of the entire system and bring it into alignment with the broader needs of society. In this case, the strategic selection of these changes will depend on the Egyptian context—how the changes work together within and across ministries; how they fit the country's economic, social, and educational goals; how they leverage current resources and programs that are in place; and how they are applied to key pressure points within the system.

Structure of the Report

The national level, in this case the Arab Republic of Egypt, is in turn a component of an even larger social system—the global social and economic community. Changes at this level will have implications for changes in the economic and social systems of Egypt, including the education system. Thus I start this report by reviewing global changes that represent the larger context for economic, social, and educational reform in Egypt. I follow this with several brief case studies of other countries where technology has been used to bring about economic, social, and educational change. I also present a variety of examples of classrooms around the world where technology has helped to change how teachers teach and what students learn. I present these case studies not to propose specific solutions that Egypt should adopt, for I believe that each country must craft its own solutions to meet its own goals and fit its own context. But I present these as

examples of the approach by which several countries have so crafted their own solutions. It is this approach of coordinated, coherent, vision-driven, action-oriented change that I recommend as a model for Egypt to follow as it seeks its own path to using technology to promote educational reform and improvement.

In subsequent sections, I review the specific Egyptian context—the current status and recent developments in Egyptian economic and education policy—to identify strengths, challenges, and opportunities. In this analysis, I discuss the current technology resources and programs that are available, and the way these might be used to help bring about educational change that will advance economic and social development in Egypt. Finally, I make some recommendations for "next steps" that the Ministry might take as it explores the potential for technology-supported change.

Global Changes

Over the past several decades the world has witnessed a fundamental economic transformation. Economists generally acknowledge that a profound shift has occurred in the role that knowledge and technology play in driving productivity and economic growth (Stiglitz, 1999), a phenomenon referred to as the "knowledge economy" (Organization for Economic Co-operation and Development [OECD], 1996). In addition to the extraction of natural resources and the manufacture of goods, the creation and use of knowledge has become a primary source of new economic wealth. The production, distribution, and use of new knowledge and information—scientific discoveries, patents, works of literature, music, art, and multimedia—are major contributors to the generation of national wealth, a surge in cultural vitality, increases in productivity, and the creation of new, high-paying jobs. From this perspective, knowledge is both the engine and the product of economic growth (OECD, 1999). The associated improvements in manpower qualifications and institutional capabilities that are needed for and result from this economy are, in turn, major sources of new knowledge and innovation.

A parallel, linked development—sometimes called the "information society" (European Commission [EC], 2000)—is the broader social transformation resulting from the convergence of computers and communication technologies and their assimilation throughout society. As information and communications technologies (ICT) become an integral part of work places, schools, and homes, they are changing the way people live, work, play, communicate, and learn (U.S. President's Information Technology Advisory Committee [PITAC], 1999). The information society refers to the potential that these technologies have to make education and health care more widely available, foster cultural creativity and productivity, increase democratic participation and the responsiveness of governmental agencies, and enhance the social integration of individuals with different abilities and of different cultural groups.

ICT plays an important role in the knowledge economy and information society. In this changing paradigm, technology is not merely a delivery device that transmits information from one place or person to another, as with radio or television. It is a management tool that allows for the organization of information and its use in making decisions. It is an analysis tool that supports the application of information to solve problems. It is a knowledge creation tool that supports the production of works of literature, art, and culture. It is a communication tool that facilitates interaction, exchange, and collaboration.

These economic, social, and technological developments require new skills and habits. They do not merely require new skills of operating hardware and using software. They require the ability to use these new tools to search for, organize, analyze, and synthesize information to create new ideas, to share knowledge, and to solve complex, real world problems to improve the human condition (Educational Testing Service [ETS], 2002; International Society for Technology in Education [ISTE], 1998; OECD, 2000; 21st Century Partnership, 2003; 21st Century Partnership, 2003; Quellmalz & Kozma, 2003).

When applied in this way, ICT can also make a tremendous contribution to human development; it is not only the most advanced countries that benefit from these trends (World Bank, 2003; Kozma, McGhee, Quellmalz, & Zalles, 2004). Technological innovation affects human development in two ways (United Nations Development Programme [UNDP], 2001). It can directly contribute to human capabilities by increasing people's ability to participate more actively in the social, educational, economic and political life of a community. It can also support economic growth through the productivity gains that it generates. In turn, human development—particularly the development of a highly skilled workforce—can contribute to technology development and its application to solve problems in the developing world. Together these two developments can create a "virtuous circle" that can reduce poverty, improve the human condition, and support economic development.

The Arab Human Development Report (UNDP, 2003) envisions the use of knowledge to support a cultural, social, and scientific renaissance in North Africa and the Middle East. Building on the historic role that the Arab culture has played in creating new knowledge and synthesizing it from other cultures, the report encourages the development of policies and practices in the Arab world that promote freedom of expression, broaden the quality of education and make it available to all, embed science in Arab society and develop research capacity, and shift to knowledge-based production. They encourage the development of an Arab knowledge model that reflects Arab language and culture while encouraging cognitive learning, critical thinking, problem solving, and creativity. Similarly, the World Bank Institute (Aubert & Reiffers, 2004) promotes the development of knowledge-based economies in the Middle East and North Africa that will increase foreign investment, spur economic development, and create new jobs. According to this report, development of a knowledge-based economy rest on four pillars: economic liberalization, improvement in the quality of education, promotion of innovation, and the development of ICT infrastructure.

But what implications do these changes have for Egypt? What role can technology play in Egypt to support economic, social, and educational improvement? What are the requisites for technology-supported change? How might the introduction of ICT be used in conjunction with changes in educational policies related to pedagogy, teacher training, curriculum, and student assessment so as to better coordinate the educational system with new visions for economic and social improvement? How might technology be deployed in a cost effective manner that fits the social, economic and cultural realities of Egypt? Let us begin by examining how other countries have responded to these global changes.

Responses in Other Countries

Countries and their school systems around the world have responded in somewhat different ways to these global changes (Kozma, 2003b). Often the global forces that drive

education change are modified and, in some cases, even transformed to meet local ends and values (Arnove & Torres, 1999). For example in the economic sector, Stiglitz (2002) describes two different responses that the West and East have taken to the globalization of trade. While the U.S. and the U.K. urge the deregulation of markets as means to drive economic development, the governments of many Asian countries take a more active role in creating, shaping, and guiding markets (Stiglitz, 2002). In this section, I summarize how selected countries have used ICT in their education systems to create a distinctive response to these global trends at both the national and school level.

National Policies

I have selected three different countries with which I am familiar to illustrate the range of technology-based policy changes that can be explored by the Ministry: Singapore (Mui, Kan, & Chun, 2004), Finland (Kankaanranta & Linnakyla, 2004), and Chile (Hinostroza, Hepp, Cox, & Guzman, 2004). These countries are very different from each other and very different from Egypt and each chose rather different response to the same global opportunities and challenges that now face Egypt. My intent here is neither to draw direct comparisons with Egypt nor to imply that these are model responses that Egypt should adopt. Rather, my intent is to provide several different responses that might stimulate discussion within Egypt about what should be its unique response, the response that best fits its context, opportunities, and needs. Plomp, Anderson, Law, and Quale (2004) provide more than thirty ICT case studies of such countries that Egypt could consider.

I present these examples also with the knowledge that a number of Egypt's neighbors, notably Jordan, have recently begun implementing national policies and plans for ICT in education. These plans bear watching closely as Egypt reinvigorates its reform efforts.

Singapore. According to the World Bank, the GDP for the Singaporean economy is $US 91.3 billion with a current annual growth rate of 1.1%. Singapore is an island nation with a population of 4.3 million, a .8% annual population growth rate, and a per capita GDP of $US 24,000. According to the most recent figures, there are about 622 PCs per 1000 citizens and 2.1 million people with access to the Internet, about 49% of the population.

Singapore has approximately 24,000 teachers and 480,000 students in primary and secondary schools. The adult literacy rate is 96.6% for males and 88.6% for females. Singapore scored at the top of the 2000 Trends in Mathematics and Science Study [TIMSS], an international assessment of student achievement.

In Singapore, decision making in policy matters is centralized at the Ministry of Education. Generally, the Ministry provides guidelines for curriculums, textbook use, and assessment. Within this broad national framework of policies and guidelines, schools develop and implement their own programs to meet local needs.

In 1997, Singapore initiated a plan called "Master Plan for IT in Education" to incorporate ICT into the school system. This $US 1.2 billion project provided a national blueprint for the use of ICT in all schools and aimed to create an ICT-enriched school environment for every child. The goals of the Master Plan were to

- Enhance linkages between the school and the world around it.
- Enhance creative thinking, lifelong learning, and social responsibility.
- Generate innovative processes in education.
- Promote administrative and management excellence in the education system.

In 2001 and in response to changing economic conditions including the emergence of China as a major economic power, a high-level Economic Review Committee of the Ministry of Trade and Industry identified education and e-learning as a key export, the goal being to make Singapore the educational hub of the Asian Pacific Region. In coordination with this economic plan and under the title, "Thinking Schools, Learning Nation", Ministry of Education launched its Master Plan 2 in 2002. The new master plan adopted a more systemic and holistic approach in which all the key pieces—curriculum, assessment, instruction, professional development, and school culture—are integrated and addressed. For example, the curriculum was reduced by 10% to allow for the integration of technology in the subject areas and university admission requires the submission of an electronic portfolio of student work, in addition to exam scores.

Finland. The GDP for the Finnish economy is $US 161.5 billion with a growth rate of 1.9%. Finland has a population of 5.2 million, a growth rate of .2%, and a per capita GDP of $US 26,000. Finland has approximately 441 PCs per 1000 citizens and 2.7 million people with access to the Internet, about 52% of the population.

Finland has approximately 48,000 teachers and 700,000 primary and secondary students. The government spends approximately 5.9% of their GDP on education, about 12.2% of all government expenditures. Finland scored in the top third on the TIMSS international assessment of student achievement.

The school system in Finland is decentralized. Every school writes its own curriculum, developed in accordance with discussions among teachers and parents, and based on very general guidelines from the National Board of Education. As a result, school curricula may be quite diverse across the country. Primary and secondary school students receive free tuition, teaching and learning materials, school meals, and, where necessary, accommodations and school transportation.

During the 1990s, the Government of Finland established the Finnish Information Society Program with the aim to boost competitiveness and productivity, to promote social and regional equality, and to improve citizens' well-being and quality of life through the use of ICT. This was a coordinated effort across ministries to provide all citizens with access to the information they need for work and everyday life and to take advantage of and support business, research, education, and other government services.

As part of this program, the Ministry of Education developed the Information Strategy for Research and Education. Among the goals of this policy was:

- Moving from a "once-and-for-all" training to lifelong learning.
- Providing basic information society skills for all.
- Ensuring that teachers achieve a high level of professional skills.
- Securing the development of information products and services.
- Building education and research networks into an open, global network.
- Increasing Finnish content on the Web.

- Developing learning-centered approaches that focus on collaboration, individual styles of learning, learning difficulties, alternative ways of learning, and multidisciplinary approaches to learning.

The program helped schools purchase computers, link them to international information networks, promote the introduction of ICT as a tool for teaching and learning, and carry out in-service training for teachers. The program's aim was for all schools to be connected to the networks and for all teachers to be using ICT-based tools in their teaching. The purpose of the in-service training program was to provide teachers with the knowledge and skills needed to reform the pedagogical practices in their schools, especially with regard to collaborative teaching and learning, networking and team work. The program also produced instructional materials that are available on the Internet.

Chile. The GDP for the Chilean economy is $US 72.4 billion with a growth rate of 3.3%. Chile has a population of 15.8 million, with an annual growth rate of 1.2% and a per capita GDP of $US 9,820. It is estimated that 20% of its population is below the poverty line. Chile has approximately 119 PCs per 1000 citizens and 3.6 million people with access to the Internet, about 23% of the population.

Chile has approximately 129,000 teachers and 3.4 million students at the primary and secondary levels. The adult literacy rate is 95.8% for men and 95.6% for women. The government spends about 4.4% of its GDP on education, 18.7% of all government expenditures. Chile scored in the bottom third of international TIMSS assessment of student achievement.

In Chile, a national curriculum framework is maintained but each school has the freedom to define the specific syllabus. Over the past decade, Chile has been implementing a major initiative to substantially upgrade the quality of the schools and the equity of educational outcomes. The components of the effort are comprehensive investment, better teacher salaries, and extended school day, new teaching and learning methodologies, programs for poor schools, and a new curriculum that emphasizes higher-order thinking skills. The *Enlaces* program was started as a pilot and is now a national program that has been going on for 10 years. The goals of the project are to put ICT tools at the disposal of students, teachers, administrators, and parents, equip schools with computers connected to the Internet, and the uses of the technology is determined by local schools and teachers. To date, the project has put networked computers and software in 100% of the secondary schools and 75% of the primary schools (covering 93% of the student population), integrated ICT throughout the subject areas, provided three years of training and technical assistance for 67% of the country's teachers, and built a portal that contains educational content, news, and collaboration opportunities for teachers, students, and families. The telephone company, *Telefonica CTC Chile*, donates phone lines and unlimited Internet connections to the great majority of schools, as well as free email accounts to all teachers and students. The program is now spreading into the hard-to-reach rural communities. An evaluation of the project found that parents improved their attitude about their school's performance; teachers believed the program had improved the teaching-learning process in their class; and students increased their motivation. On assessments students in the program scored higher on tests of reading and comprehension, as well as higher on measures of creativity and self-esteem.

Classroom Practices

What do these changes look like at the other end of the education system? In a study of 174 innovative classrooms in 28 countries (Kozma & McGhee, 2003; Kozma, 2003a), we found in a large majority of classrooms students were using computer-based tools, resources, and networking to search for information, design products, and publish results. Teachers created structure, provided advice, and monitored progress. Some examples of these practices are (see www.sitesm2.org for the full set of 174 case studies):

- Teachers and students in a lower secondary school in Singapore used an integrated set of learning and teaching tools called "Learning Village" to implement a standards-based approach to students' project work. The goal of this shared project between IBM and the Ministry of Education is to move schools from a traditional teacher-led, content-driven curriculum to one that is more learner-centered and process-focused. Students choose from interdisciplinary, problem-oriented, real world topics, such as "The ageing population in Singapore" or "Water in Singapore: Its past, present and Future", and work in teams with ICT tools and resources to conduct research, write reports, and post them on the network.
- Students in a lower secondary school in Finland engaged in computer-supported collaborative learning projects in chemistry and biology courses. Teachers choose common research theme (e.g. circulation of plastic) and students, working in pairs or small groups, choose one area under this theme for their own research project (e.g. circulation of plastic cards or circulation of plastic bottles). They define research questions themselves and search information, make hypothesis and present their results. In their research, students use the Internet, spreadsheets, and word processing tools.
- Groups of students in a Chilean primary school used the Internet to collaborate with senior citizens in Belgium on projects on topics such as tourism and current affairs. Chilean students were studying French and the Belgium seniors were studying Spanish. Students also produced displays, murals, and monthly presentations to the whole school.
- Russian high school students in a modern history course developed a website about their school, which was a hospital during World War II. To prepare this website, students investigated historical documents and maintained a local museum that went along with the website.
- Students in several primary schools in the same rural region in Spain conducted parallel research about their villages. Each group collected data on village monuments, town squares, and local history and used word processors, email, and digital audio and photography to publish their research in their native Catalan (a minority language in Spain) on a common website.
- A South African private primary school focused on bridging the gap between their students and those from the native Xhosa culture. Students learned about Xhosa culture from social, electronic, and printed sources and by the establishing e-mail, chat, and real life contact with students in Xhosa schools. On the last day of the project, students showed exhibits, demonstrations, and PowerPoint presentations to their parents.

- In an upper secondary school in the Slovak Republic, students taking computer science learned how to create hypertexts and worked in teams with their computer science teacher and with teachers in mathematics, physics, the Slovak language, and history to develop online educational materials for students in other courses to use.

Essential to the sustainability of these ICT-based projects was the perceived value of the innovation, teacher support, administrative support, teacher professional development, and student support. Having an innovation advocate in the school, access to funding, support within and outside the school, and supportive policies and plans also contributed to sustainability (Owston, 2003). Not all of these innovations were coordinated with local or national technology policies but a majority of them were connected to both. Those cases that were connected to national policies and local plans were more likely to report changes in teacher practices and student activities and those that were connected to national plans were more likely to report dissemination of the innovation to other classrooms. We found that without national and local ICT plans and programs, teachers were left to rely on their own personal resources and efforts to make changes in their classrooms (Jones, 2003). While teacher energy and creativity is an important contributor to educational change, it is difficult for them to sustain the changes that they make and their impact on the educational system is minimized without supportive national and local policies and programs.

Summary and Questions for Egypt

Each of the case study countries—Singapore, Finland, and Chile—responded to the global changes in a coordinated way. These countries developed a national technology plan, designed programs and allocated resources for equipment, software, and teacher training that fit the realities of each country. As a result, classroom practices in these countries and other in others are beginning to change.

These ICT policies and plans connected the use of technology in schools to global changes and trends. Yet these countries shaped their response to these global trends in ways that matched their own economic and social goals and values. These case studies and classroom examples raise important questions for Egypt: What plan should Egypt have for ICT in the schools? What should classrooms look like in Egypt where ICT is used to support change? How should these plans and practices connect to and accelerate other changes in the education system, such as those related to decentralization, community participation, curriculum, assessment, pedagogy, and teacher training? How can these plans align human and financial resources to ensure changes in teaching and learning become sustainable? How should these educational changes connect with other policies and efforts in government and private sectors?

Egyptian Context

Egypt is now going through a period of exciting change. President Mubarak, Prime Minister Nazif, the new Cabinet, and the National Democratic Party are all committed to both economic and education reform. These commitments provide a strong base for further development. Nonetheless, there are serious challenges within and outside of the

educational system and there are some significant barriers and constraints to change. I briefly review these strengths and challenges not to inform the Ministry of conditions that they know much better than I, but to provide a context for my analysis of the opportunities, pressure points, and levers that might allow the Ministry of Education, along with other Ministries, NGOs, and the private sector, to use technology as a way to further improve educational, social, and economic development in Egypt.

Strengths

From my analysis, the foundations for further change in Egypt rest on significant developments to date in economic, education, and technological policy.

Economic Development and the Knowledge Society Initiative. According to the World Bank, the current GDP for the Egyptian economy is $US 82.4 billion with an annual growth rate of 3.2%. The population is now approximately 73.4 million with a growth rate of 1.8% and a per capita GDP of $US 3,810. It is estimated that 23% of the population is below the poverty line. The International Monetary Fund contends that Egypt's GDP growth remains considerably below the minimum required to absorb labor force growth and reduce poverty.

While the current growth rate is relatively slow, the new government has already taken actions to increase growth, including tariff and tax reforms, as cited by Foreign Trade Minister Rashid at a recent opening session of the World Economic Forum in London (Egyptian Gazette, September 30, 2004). Minister of Investment Eddin also announced that the government will be passing new laws to encourage foreign investment. And in the last month, Prime Minister Nazif presented a new strategy to boost economic development at a conference on IT & Telecommunication in the Arab world (American Chamber of Commerce in Egypt, September 6, 2004). The plan is intended to support the use of IT to offer better services to the public; initiate efforts to turn IT sector into a major engine to boost economic development, spur growth and improve income levels; use IT to facilitate procedures and services to the business sector; and use IT to assure more accuracy and transparency in availing data. During his presentation, the Prime Minister stressed the need to empower the new generation with modern technology skills and capabilities.

This strategy builds on earlier work on Egypt's Information Society Initiative that the Prime Minister started as the Minister of Communication and Information Technology. The Initiative, launched by President Mubarak in September of 1999, offers a vision of providing equal access for all to information technology, nurturing human capital, improving government service, providing companies with new ways to do business, improving health services, promoting Egyptian culture, and developing an ICT export industry. Minister of Communications and Information Technology Kamel is extending the work on the Information Society Initiative to support the purchase of home computers, provide low fee access to the Internet, expand broadband services, and develop IT clubs.

Education Reform. Egypt has approximately 16.9 million students at the primary and secondary levels. The adult literacy rate is 67.2% for men and 43.6% for women. The government of Egypt is making a significant financial commitment to education. It spends about 6.1% of its GDP on education, which compares to 5.9% in Finland and

4.4% in Chile. Egypt has only recently begun to participate in international comparative student assessments (i.e. TIMSS 2003) and it is not yet clear how Egyptian students fare compared to those in other countries.

Paralleling the reform of the economy, Egypt has engaged in a series of education reforms going back to the early 1990's (World Bank 2002). Most recently, Recently, President Mubarak said that he wants his new government's educational reforms to prepare Egyptians for a modern future, in which Egyptians are open to cultures of other peoples, and the education becomes integrated into that of the outside world (*Daily Star*, September 1, 2004). At its 2002 congress, the National Democratic Party [NDP] identified three pillars of their education reform policy. The policy document emphasizes a need to broaden the base of community participation and decentralization of the education system to provide Governorates and communities with more control over schools and the curriculum within the framework of the general policy of the State. It calls for the improvement and monitoring the quality of education. And it proposes the development of the human and physical infrastructure in the education system, including improvement of the quality of administrators and teachers, the reform of technical education, a reduction in student drop out, a revision of the national exam, a reduction in illiteracy, and the improvement of higher education.

This education reform policy is connected with specific reform efforts that were pilot tested in the Governorate of Alexandria. The Alexandria Education Reform Pilot Project was started in 2001 and was designed with three components: decentralization, community involvement, and teacher improvement. In the project, 30 schools were given authority to develop local school improvement plans that would guide their participation in the project and monitor their success. A Board of Trustees was established to increase community involvement and input in the project. And teachers were trained in new teaching methods that encourage student-centered learning and high-level problem solving. This successful project has now evolved into the USAID-supported Education Reform Program that extends these reforms to six more Governorates.

Another USAID-supported reform-based project is the New Schools Program which has recently been incorporated into the new USAID Education Reform Program. New Schools targeted girls age six to 14 that have never enrolled or have dropped out of school. CARE, World Education and the Education Development Center, working in close collaboration with local Egyptian NGOs and community development associations, are implementing the program in Minya, Beni Suef, and Fayoum, to eradicate illiteracy where there are the greatest gender imbalances. The program includes school construction and renovations of approximately 818 classrooms and strong quality improvements in teaching and learning methodologies. Community participation and parental involvement are an important part of the project. The project involves training for supervisors and headmasters, innovative furnishings, peer learning, and the introduction to applied technologies. The project draws upon pilot models that have proven effective in increasing girls' enrollment and uses these lessons learned to "scale up" models of quality primary education with an emphasis on girls. Models of teaching and learning that are based on learner-centered methodologies rather than teacher-centered methodologies.

A number of other donor-funded initiatives are underway to support the Ministry's new vision. A key challenge will be in expanding lessons from these relatively small donor activities across the wider education system.

Technology Policy and Resources. Among the strengths in this area, the government has connected education reform and the use of ICT and to a vision of an Egyptian knowledge society. A 2003 NDP policy document entitled "Toward a Knowledge-Based Society: Integrating Technology into Education", offers a vision that would integrate technology into the education system to both improve education and benefit the economy through the export of knowledge-based services and software production. The document proposes policies to increase in the computer skills of pre-university students, increase the efficiency of learning across subject areas, improve the curriculum to match the capabilities of ICT, and upgrade vocational education. At the university level, the document proposes the use of ICT to improve the quality of education and advance research.

There are a number of resources and projects that support an impetus for ICT-based educational improvement in Egypt. The Technology Development Center [TDC] in Mubarak City is a state-of-the-art technology facility. To date, through various projects and programs, the TDC has provided nearly 300 CD ROMS on various topics in the curriculum, 113,000 computers in schools, 22,000 schools connected to the Internet, and 200,000 teachers with training on the use of ICT.

Several NGOs are working with the Ministry of Education and the Ministry of Communication and Information Technology to develop Egypt's ICT capacity in education. The PfCE Ed Tech in Schools K-12 demonstration project (http://www.pfc-egypt.com/) has designed an ICT-intensive 1:5 computer per student classroom model and a 1:2 laboratory model to integrate technology into the curriculum. They provide high-speed, filtered Internet access to these computers, along with productivity and educational software. They have a 26-day teacher training curriculum that not only trains teachers in the use of ICT hardware and software but in the development of ICT-based, student-centered lesson plans and activities to integrate technology into their teaching. They provide school management software and training to school administrators. And they provide an Educational Resources Network in English and Arabic (www.pal-educ.com/) in which teachers can exchange ideas and post and share their ICT-based lesson plans, mapped to the Ministry of Education curriculum objectives. This project is being implemented in 10 private and 4 public schools in the Cairo, Giza, Ismailia, Dakahlya, Qena, Assiut, and Alexandria Governorates. The project is also developing a legacy institution that will continue to support these resources when the project is completed at the end of 2005.

In 2000/2001, MCIT started the Smart School Network initiative at the preparatory level with support from UNDP which will be completed over a three-year period. The project objectives are focused primarily on ICT literacy and to raise student awareness about modern technologies through:

- Introducing a 3-5 hour-per-week IT syllabus into the educational system, specifically in preparatory education
- Supplying sufficient computers and accessories to schools so as to allow a one-to-one student-computer ratio in a computer laboratory.

- Introducing computer-aided education to the school system.
- Training teachers in technology and computer-aided education.

These are just a few of a number of technology-based projects and resources that are available in Egypt that include Microsoft Partners for Learning, Intel Teach to the Future, I*EARN, GLOBE, Global Teenager, and Oracle ThinkQuest. Other prospective technology-based projects that may be implemented in Egypt include the CARE-Vodafone project for rural schools and communities in Upper Egypt (working through the New Schools Project and the Ed Tech in Schools project) and the World Links project for secondary schools.

Challenges

Economy. While the policies and programs above provide a strong base for reform in Egypt, there are many challenges and barriers to ICT-based change. In the economic sector, the high poverty rate impedes Egypt's economic progress, as it does in Chile. The World Bank cites a figure of 23% of the population living under the poverty level, compared to 20% for Chile. Unemployment is also a problem. Almost 900,000 people, including drop outs and new entrants, join the labor force in Egypt each year and the economy absorbs just under 60% of this supply. (Radwan, 2002). These figures, along with the high level of illiteracy in Egypt, particularly among women, represent an alarming trend and will constrain the type and amount of economic growth that Egypt can expect in the near future, particularly if the strategy is to build a knowledge economy.

Technology. On the technology front, the UNDP Arab Human Development report (2003) points out that merely increasing the technology in the Middle East has not led to new knowledge. Difficulties exist within the current ICT infrastructure. For example, there are only 16.2 PCs per 1000 people in Egypt, according to the World Bank and only 1.9 million people connected to the Internet, about 2.3% of the population. This compares to 52% of the population for Finland, 49% of the population for Singapore, and 23% of the population for Chile. It will be a significant challenge for Egypt to implement the Knowledge Society Initiative with such a low penetration of ICT and network access in society. This low penetration rate relates as much to language usage and illiteracy as it does to economics. The vast majority of the Internet is in English and the development of Arabic-language content and better English education will continue to hinder efforts to connect the vast majority of Egyptians to the information superhighway.

Related to this, the International Telecommunications Union (ITU, 2001) conducted a case study of Egypt's emerging ICT infrastructure and its ability to contribute to economic development. They found that Egypt is in the upper levels of computer and Internet use among North African and Middle Eastern countries (led at the time of the report by the United Arab Emirates, the Kingdom of Saudi Arabia, and Lebanon). They also recognized the ICT economic sector in Egypt as one of the largest in the Arab region and that it is starting to emerge as a regional software hub with 80% of its software being exported to other Arab countries. However, they also concluded at the time of the report the connectivity in Egypt was between "thin" and "expanded" and the absorption of ICT into the education, health care, commercial, and public sectors was between "rare" and "moderate."

Thus, while there are significant opportunities for Egypt to create a knowledge economy and society, the physical and human infrastructure may not yet be at a critical mass to form a base for this development.

Furthermore, the relatively low penetration rate of technology interacts with the country's geography. That is, the ITU points out that the geographic dispersion of the infrastructure is between "moderate" and "highly" dispersed, most of it concentrated in the Cairo area. Poverty is still a significant problem in Egypt with 23% of the population living below the poverty line. In recent years, this poverty has become more concentrated in Upper Egypt and Lower Rural Egypt and those households headed by a poorly-educated adult (El-Laithy & Lokshin, 2003), those least serviced by the current ICT infrastructure, according to the ITU. A separate analysis of the Egyptian situation concurs (Wheeler, 2003). Wheeler is concerned that the current developments might exacerbate the situation for the poor in Egypt. She observes that forward-thinking ICT policies distinguish Egypt among Arab and North African countries. However she concludes, "If its strategy is to develop its vision of an information society beyond a small elite . . . it will need to introduce much greater reform—to the education sector as a whole and to fiscal policy—than it has considered to date, as well as freeing public information flows" (pp. 640-41).

Education. Moving to the education sector, the education system is currently very centralized with a standard curriculum and schedule determined by the Ministry of Education. Students are examined on a regular basis by high-stakes tests—particularly the *thanawiya amma*—that determine their educational and economic future. The education system is divided between public and private schools and the public schools are further divided between regular, "experimental", national, and technical schools. Some private schools have smaller class sizes, 20-30 students per class, I am told, although I have not seen studies that document class size distinctions among types of schools. These schools have more curricular flexibility than public schools, particularly those that draw on international curricula and exams. They are also significantly more expensive than public schools. Public experimental schools also charge fees but less than private schools. I understand that class sizes for experimental schools range between 40-50 students per class and this corresponds to my observations in the few classes I visited. Finally, the regular public schools are free but they have between 70-80 students per class.

It is generally reported that most teachers are poorly qualified, particularly those in the regular public schools, and poorly paid, with salaries in regular public schools starting at LE 100-200 a month. There is no standard teacher certification procedure or requirement in Egypt. Private school teachers are often better qualified but even here there is no requirement for an education degree. Teachers are also typically better paid in private schools, as I understand it, with starting salaries at around LE 500 a month and the most experience teachers make much more.

The poor teacher salaries and the emphasis on examination performance have created a huge private tutoring business in Egypt that, by some estimates, is half the size of government expenditures on public education. Indeed, one comparative review of research on private tutoring (Bray, 1999) found that 54% of the grade 5 and 74% of the grade 8 students in Egypt received private tutoring, far more than most other countries in the study. It is generally reported that this arrangement can provide a significant

disincentive for Egyptian teachers to provide high quality instruction in their courses. In the most extreme cases, it was reported to me that teachers would reserve "correct answers" on exams only for their paying tutees.

In several documents, including the 2002 NDP education policy document, reported that a major challenge in the Egyptian educational system is the emphasis on memorization of facts and basic procedures that cuts across the curricula, textbooks, examinations, and teaching methods. This corresponded to my experience during visits in both private and public schools, where I saw lower secondary chemistry teachers ask "what are the parts of an atom?" and biology teachers would ask, "what are the components of plant cell?" and language teachers would ask, "what are the types of adjectives?" In each case, students would either call out the well-rehearsed answers in unison or raise their hands to be called on individually. There is nothing wrong with factual knowledge about atoms, plant cells, or adjectives. However, this approach to learning results in what cognitive scientists (Bransford, Brown, & Cocking, 2000) call "inert knowledge"—knowledge that is learned in school but is not recalled or used to solve problems in the real world. Indeed, it was generally reported to me that this approach to the curriculum, teaching, and learning in Egypt results in a small number of students who do very well on tests and can successfully get into universities and a very large number of students—including university graduates—whose skills are severely mismatched to the high-level problem solving skills needed by the modern labor market.

This focus on memorization extends to the software and use of ICT. Generally, in the classes I observed, ICT was used as a delivery device rather than as a tool for knowledge creation and use. For example, in one classroom in a private school, the science teacher gave a lecture on plant cells to 25 students, five students each clustered in front of a computer. The teacher's PowerPoint presentation was projected onto the screen in the front of the room and onto the screen of each of the computers. Throughout the lecture, the teacher asked questions like "what are the parts of the plant cell?" Other classes followed a similar pattern except in public schools where there would be 8-10 students clustered around each computer. This application of technology should be compared to the applications in the innovative classes described earlier in this report.

The use of technology to deliver information to be memorized will always be an added expense over textbooks. Indeed, some of the software I saw merely transported the textbook onto a CD, as noted by the 2003 NDP policy paper on "Towards a Knowledge Based Society: Integrating Technology into Education". Few of the software packages that I saw had more than simple, typically game-like interactions and none used the full power of the technology. These applications will rarely provide a compelling reason for ICT to be used over current approaches.

In a case study of educational technology in Egypt, Warschauer (2003) contends that there are major contradictions between the rhetoric of reform and the reality of school practice when it comes to ICT in Egypt. On the other hand, this is totally understandable and perhaps even inevitable when there is also a dissonance in Egypt between the rhetoric of reform and the other interlocking and self-reinforcing components of the educational system, such as the curriculum, the examinations, the textbook, and pedagogical practice. This disconnection between policy and practice is well documented elsewhere (Cohen & Hill, 2001; Cuban, 2001) and is perhaps the greatest challenge that Egypt faces in improving the education system and, in turn, its economic and social development.

Egyptian Response

Such is the tightly-linked, self-reinforcing system of education in Egypt. While new policies focus on the knowledge economy, information society, and the integration of technology in education, the assessments, curriculum, contents, and teaching methods all focus on memorization. In the face of this stasis, the questions then become, what are the opportunities for change that exist in the Egyptian context? What are strategic pressure points that can be identified that might be used to make the system dynamic and begin change the components, bit by bit, to bring about significant reform over time? And what role might technology play as a lever to apply to these pressure points? I will begin by analyzing pressure points, opportunities, and levers and conclude by making some recommendations that might take advantage of these.

Pressure Points, Opportunities, and Levers

From my analysis, the great challenge facing the Egyptian education is the emphasis on memorization in the examinations, curriculum, content, and teaching methods. A pressure point needs to be found to begin to change this system.

An important set of opportunities relate to the education reform effort that is beginning to take hold and expand here in Egypt. There are three components to this effort: teacher professional development, decentralization, and community participation. These were all essential components to the Alexandria Reform Project and a central part of its success. They are also a central part of the subsequent USAID-sponsored Education Reform Program. ICT can support these important reform efforts.

Other opportunities exist in development resources to address rural illiteracy and poverty, the development of Arabic content for education and the economy, and reform of the memorization-based examinations, curriculum, and teaching methods that dominate the Egyptian education system. In each these cases, I look at how ICT might be a lever to support change.

Examination-curriculum-content-teaching methods. The real knot to untie in the Egyptian education system is the closely knit connections between curriculum, examinations, content, and teaching methods, all of which are focused on memorization. I believe that without addressing this interlinked set of elements, reform will not happen in Egyptian schools.

But where does one start to make changes here? Which piece if changed will bring the other components into line? I believe the most powerful pressure point is the examination. Teachers will not use new methods, however well they may be trained in student-centered teaching, if the examinations continue to emphasize rote memorization. They will not spend time on a new curriculum that emphasizes problem solving and critical thinking if the examinations still test the recall of factual knowledge and simple procedures. Nor will they use the powerful capabilities of ICT. But if the examinations are redesigned to emphasize creative thinking and complex problem solving in real world contexts, the curriculum, the teaching methods, the textbooks, and the software will all eventually fall into alignment.

As I understand it, the MOE has already begun a process to review the national examinations. I believe that this effort can be very effective in bringing about reform of

the entire system if it shifts the emphasis of the exams away from memorization toward the assessment of higher-level thinking and problem solving. A number of countries around the world are redefining assessment frameworks to reflect the demands of a knowledge economy and information society. This approach includes assessment not just of subject matter knowledge but the ability to access, analyze, evaluate, communicate, and use information and data to solve problems and create new knowledge (Educational Testing Service [ETS], 2002; International Society for Technology in Education [ISTE], 1998; OECD, 2000; Quellmalz & Kozma, 2003). Clearly, such a change would have to be phased in. One possibility being to start with the monthly exams of secondary one students in the first year of the change and building up to the *thanawiya amma*. University admission requirements would need to be adjusted in a corresponding way.

Can technology be a lever for changes in the examination? Not directly, at least in the short term. ICT-based resources are being developed for assessments in other countries but these require a very high level of access that is not yet available in Egypt. But as ICT becomes more accessible, it can be incorporated into these redesigned assessments in powerful ways. With ICT-based assessments, students can be given complex, real world problem situations and a variety of ICT tools, simulations, and resources that they can creatively use to pursue answers and solve problems. Ultimately, the inclusion of ICT in the assessment, particularly in this way, will assure that it is also imbedded in the curriculum and teaching methodology to help students learn skills needed for the knowledge economy and information society. In the short term, ICT tools can be used in the classroom for problem solving, knowledge creation, and communication, along with teaching methods that emphasize student-centered learning approaches. These approaches will be adopted much more successfully when teachers and students know there is a payoff in the examinations.

Teacher professional development. Changes in the examinations, curriculum, and teaching methods will require significant teacher professional development. There is a desperate need in Egypt to professionalize teaching. From my analysis significant changes need to be made in teacher credentialing and pay structure. But more immediate—and more modest—changes can be made to improve the effectiveness of current teachers, in coordination with the phased changes described above.

An important component to the Alexandria Reform Program was teacher professional development and this continues in the Education Reform Project. The Alexander Reform Program provides training in student-centered teaching methods that emphasize the active engagement of students in high-level problem solving. This would be an important and necessary contribution to a reconfigured examination and curriculum. Teachers would also need training in the use of ICT—not just hardware, software, and networking skills but skills in how to incorporate ICT into the curriculum in support of student-centered learning. Several ICT-based programs in Egypt are taking this approach to teacher training, including the Ed Tech project. ICT can be a means as well as a goal of this training. That is, networked ICT can provide any-place, any-time training for teachers, as well as access to experts, resources, and on-going communication and collaboration with other teachers across Egypt. For example, Ed Tech's Educators' Resource Network (www.pal-educ.com) supports new classroom methods learned in training by providing an online mechanism by which teachers share student-centered lesson plans, course content and student portfolios. This collaboration center serves to

reinforce the training and provides ongoing support in applying the new teaching methods. Thousands of lesson plans and educational resources are available to any teacher in Egypt with an internet connection. Building these extended communities can contribute significantly to the development of teaching as a profession in Egypt.

Decentralization. A second component of the Education Reform Program is decentralization. Decentralization is a force that can create dynamism in an otherwise static system by allowing more decisions to be made at the Governorate and local decision and at the same time making the decision process more transparent and accountable. In the Alexandria Reform Project, each school constructed a School Improvement Plan that gave local administrators more control over their goals and plans and programs designed to achieve them. They also had some budgetary authority related to these programs. However, the effectiveness of this approach rests on the ability of administrators to manage budgets and analyze student achievement data to determine if their local plans and programs are on course.

ICT can be a lever that contributes to and supports decentralization and the dynamism it creates. ICT management tools, such as those in the Pal-Tech Ed Tech in the Schools project, can provide school administrators with information that they need to make informed decisions and make adjustments in plans and programs. It can also create transparency that makes administrators and the education system more accountable to the MOE, the Governorate, and to the community.

Community participation. A third component of the Education Reform Project and another force that can create dynamism in the system is community involvement. As local schools become more responsible for decisions related to the localization of the curriculum and development of materials (within the MOE's curriculum guidelines), the involvement of community leaders, business leaders, and parents can make the system more responsive and create more local ownership and dedication to the success of the education effort.

Within this context, ICT can make the schools *local information hubs* by which the community has access to educational information, as well as other Web-based information that can improve the quality of their lives. A resource portal can be created for the exchange of ideas, information, and materials. Within this portal, a Web presence can be created for each district and school can provide parents with greater access to the education system and make it more transparent. School notices, assignments, lesson plans, and student work can be posted. The Ed Tech Educators' Resource Network can serve as a starting point for this portal and its design could be refined to support the process of decentralization and community participation.

Broadening the ICT base to the rural and poor. Poverty and illiteracy are problems that limit economic and social development in Egypt. In rural and high poverty areas, school-based *local information hubs* can be community technology centers that broaden access to ICT and serve as resources that can address the needs of local communities (Wagner & Kozma, in press). These community technology centers can provide community members with access to computers, technical assistance, training, and digital resources that they would not otherwise have. These centers can connect communities with other government services to provide access to human support and digital resources for adult literacy, small business development, agricultural productivity, and health care.

Development of high quality Arabic content. The most recent, although somewhat dated, study of languages on the Web (Langer, 2001) shows that the Arabic language represents less than 1% of the content on the World Wide Web. This makes it difficult to use ICT as a means to support education in Egypt. At the same time, as one of the world's five major languages, it is estimated that more than 180 million people speak Arabic (Bright, 1992). This fact, and the central role that Egypt plays in the culture of the Middle East and North Africa, provides Egypt with a unique opportunity to take a leadership role in the development of digital content, including educational content that emphasizes critical thinking and the solution of complex, real world problems. These ICT resources, once developed, could then be brought to bear on improving the quality of education in Egypt, as well as developing Egypt's knowledge economy. From my conversations and analysis, it appears that the Ministry's Technology Development Center and the private sector are working to take advantage of this opportunity. E-Labs, a union of more than twenty software development companies, is dedicated to improving the quality of educational software in the Arabic language.

Opportunities could also be created to recruit teachers into this software economy, such that they could be compensated for ICT-based lessons that they develop for students or lesson plans for teachers, should they prove to be popular in the market. I believe many of the most creative and talented teachers would be interested in this effort, as I observed in several schools during my visits. Mechanisms could be developed to support an electronic economy for the development and distribution of these digital products and for the compensation of teachers.

Changing entrenched social systems is probably one of the hardest tasks for any policy maker. But as the 2003 NDP knowledge-based society and education technology policy paper points out, Egypt has the capacity and ability to change the challenges and threats facing the education sector into opportunities. This can be done through the integration of ICT into assessment, curriculum, pedagogy, and teacher training to the benefit of education, as well as the social and economic sectors.

Recommendations.

Of course, merely saying that there is the capacity for change does not make it happen. Much would have to be done to convert these ideas into a vision and a set of policies, plans, and resources that would create an Egyptian response to global trends and changes. The following are my recommendations for next steps to make this happen, based on my analysis and the ICT policy analyses of others (World Bank, 2002; Jones, 2003; Kozma, 2003c; Pont, 2004; UNESCO, 2004; Wagner & Kozma, in press):

Develop an Educational ICT Master Plan. Policy leadership will be the key to any successful effort to use ICT in support of educational reform, particularly if these efforts are to contribute to economic and social development. Projects and programs offered outside of a policy context—however well-intended and designed and whether designed by the government or NGOs—will have a minimum effect and will not be sustained in the long run. Many countries (Singapore, Finland, and Chile, to name a few) have developed ICT national plans to provide a policy context that guides new technology-

based programs, projects, and the use of resources. These national plans articulate a vision for how ICT can contribute to education reform and improvement. The vision may tie the introduction of ICT into economic development (as is the case of Singapore), social development (as in Finland), or some other national priority that would fit the Egyptian context and resources available. The NDP document "Toward a Knowledge Based Society: Integrating Technology into Education" can serve as an important foundation for the master plan. The master plan should also:

- authorize specific projects and programs to advance this vision,
- specify goals and actions,
- create a time line and intermediate goals for phased implementation,
- provide the resources needed to implement the plans,
- create a structure for monitoring and evaluation.

Coordinate Policy Within and Across Ministries and Sectors. To maximize the impact of ICT investments, ICT-related policies in education must be coordinated with other reforms and changes in education. As mentioned, the mere introduction of technology, no matter how sophisticated, will not result in educational improvement or reform. Indeed, without other, parallel education reform policies, the introduction of ICT is likely to have only a marginal effect, if any at all, and at worst reinforce the current situation. The plan should be developed along with other changes within the Ministry, such as those mentioned above related to changes in assessment, curriculum, pedagogy, and teacher training. However, the impact of ICT will be greater—particularly if the goal is to advance the information society and contribute to the knowledge economy—if its introduction is linked to a curriculum that emphasizes ICT use for knowledge creation, along with a pedagogy that emphasizes student engagement, teacher training that emphasizes student-centered learning, and, most of all, student assessments that focus on use of knowledge to solve complex, real world problems.

Furthermore, the impact of ICT use in education can only be fully realized if educational policies and programs are articulated with higher-level national goals that are driving policy changes in other ministries, such as telecommunications, economic development, human resource development, health, agriculture, rural and urban development, and so forth. For example, changes in school examinations that emphasize higher-level problem solving skills and have implications for human resource and economic development would have implications for student admissions policies and curriculum revisions in the Ministry of Higher Education and making these changes across ministries would increase impact and reduce problems.

Accordingly, I recommend that the national ICT master plan be developed by a high level working group that includes the various segments of the Ministry of Education and Ministry of Higher Education, along with representatives of other appropriate Ministries, such as the Ministries of Communications and Information Technology, Foreign Trade and Industry, Manpower, Social Affairs, Youth, Culture, and Rural Development. I recommend that the working group also include key representatives from the business community, especially the IT and telecommunications sectors, as well as NGOs. Because the Egyptian education system is so ingrained in the society, a massive public

information campaign will need to help the public understand, accept, and support the significant changes that result from this effort.

Connect Investments to Benefits. The significant investments required of the approach that I advocate require a significant return in terms of impact on schools, communities, and the economy. While policy statements may offer sweeping visions for how technology can advance economic, human resource, and social development, they should also describe how these visions articulate with measurable goals. Policies should not only provide for programs and resources intended to realize visions but specify phased, measurable outcomes. Reasonable goals should be developed, scheduled over time, with phased inclusion of both the most accessible private schools and the most disadvantaged and rural public schools and communities. Measures of both process and outcomes should be used to monitor the progress and provide information to policy makers that can be used to revise and refine policies and programs.

I believe there is now a unique and perhaps limited window of opportunity for dramatic reform in Egypt. There are tremendous global challenges facing the nation and change will not be easy. But I believe the country has the leadership and policy commitment to create an Egyptian response to these global trends and changes. I also believe that ICT can play an important role in creating education reform and supporting economic and social development.

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