

Information Technology and Growth: Will the Software Industry Lead Egypt into a New Economy?

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Information technology builds tools to manipulate, organize, transmit, and store information in digital form. It amplifies brainpower in a way analogous to that in which the nineteenth century Industrial revolution's technology of steam engines, metallurgy and giant power tools multiplied muscle power...Information technology builds the most all-purpose tools ever, tools for thought.

(Cohen, DeLong, & Zysman, 2000)

1. Introduction

In light of the massive developments in Information Technology (IT) in the past few years, there has been a recent debate in the literature on the economic impact of IT. Of particular interest has been the role of the 'New Economy' sectors (hardware, software, and communications) in bringing about economic growth and productivity revival in the United States. While on a much smaller scale, Egypt has also witnessed a strong boost to the development of IT in the past few years. One New Economy sector in particular-- the software industry, is now viewed as one new area of comparative advantage with very strong potential for the country's development, especially as the Internet itself has become a channel for software service delivery. In light of the literature on IT and growth, this paper is a preliminary review of the software industry in Egypt, bringing the new economy debate to the Egyptian experience. In particular, the study aims at answering the question: will the software industry lead Egypt into a New Economy? It is an initial study in preparation of a larger research to project different scenarios for the potential impact of IT on Egypt's growth.

The paper is divided into four sections. After the introduction, the next part is a review of the 'new economy' concept: definition, characteristics, and summary of the debate over IT and economic growth. In the third section, I present an overview of the software industry in Egypt: structure, performance, potential and problems. The concluding section links the above issues and wraps up this presentation.

2. IT and the New Economy: What is the New Economy?

The term 'New Economy' has been recently used in the literature. So far, the term has been mostly used to refer to the current state of economic landscape, particularly in the United States, in light of the advent and development of information technology. The concept 'New Economy' has broader and narrower definitions, which include interrelated and sometimes coinciding connotations.

A narrow definition of the 'New Economy' adopted by Nordhaus refers to the *production sectors* involved in information acquisition, processing, transformation, and distribution. Accordingly, the three major components of the 'New Economy sectors' are 'the hardware (computers) that processes the information, the communications systems that acquire and distribute the information, and the software which with human help manage the entire process' (Nordhaus 2001a).

The importance of software emerges from its being the digital brainpower of the IT revolution which itself promotes economic growth. The term 'software' refers to computer instructions or data, or rather 'anything that can be stored electronically'. Software can be split to two types: system software and application software. System software refers to 'any software required to support the production or execution of application programs but which is not specific to any particular application' (Webopedia 2001).

Systems software includes the operating system and all the utilities that enable the computer to function.' (Free Online Dictionary of Computing Foldoc 2001) Examples include operating system, compilers, editors and sorting programs. Applications software includes programs that do real work for users. For example, word processors, spreadsheets, and database management systems fall under the definition of software (Webopedia 2001) Examples of application software would include an accounts package or a CAD program (Foldoc 2001).

A narrower definition of the new economy looks only at the *Internet side of the economy*, involving what is referred to as the 'brand new economy'. This is the sector that produces or heavily uses the Internet (Nordhaus 2000a). Related to this is the term 'nude economy', referring to an economy that has become more transparent and exposed thanks to the Internet. The latter facilitates price comparisons for buyers and sellers, does away with middlemen, and reduces transaction costs and barriers to entry (The Economist 2000).

A broader version of the new economy refers to the state of *economic performance* in the information age. Reference here is made to the American economy. Accordingly, the new economy is characterized by two principal developments: an increase in the economy's maximum sustainable rate of growth, and, the expansion and rising importance of information and communications technology. The latter is assumed to be the major contributor to the acceleration in labor productivity, which, in turn, is the principal source of the increase in trend growth in real GDP. One more related development in the New Economy is a possible increase in the economy's sustainable utilization rates, specifically a decline in the non-accelerating-inflation rate of unemployment (NAIRU)(Meyer 2000).

Finally, an even broader definition, is that we are witnessing a world where old rules of economics (e.g. supply, demand, business cycles) no longer apply, -- 'a fundamental change in the paradigm' (Meyer 2000). This last definition stretches the concept of 'New Economy' to '*New Economics*', where standard economic analysis is put to the test. This in itself is a subject of a debate, which may be beyond the scope of the present paper.

So what is the New Economy then? Is it the 'information economy', the 'innovation economy', 'the Internet economy', the 'twenty-first century economy', the 'new growth economy'? The answer is all of the above. It is perhaps better called the 'New E-economy', where electronic-based information and communication technology has been the driving force behind today's economic transformation (Cohen et. al. 2000). It is 'a knowledge and idea-based economy where the keys to job creation and higher standards of living are innovative ideas and technology embedded in services and manufactured products. It is an economy where risk, uncertainty, and constant change are the rule, rather than the exception' (Atkinson & Court 1998). Within that, software is the brainpower that drives the new economy. Hence its importance as a crucial new economy sector with strong potential for countries like Egypt.

Characteristics of the New Economy:

The New Economy has a number of unique characteristics, especially as it involves the production and use of technology that includes software. Software is argued to substitute, if not add to, human intelligence. Just like earlier industrial revolutions replaced and amplified the impact of other human attributes - software development in the new economy is amplifying human intelligence (Nordhaus 2000a). This point has implications for human resource development, and potential increasing returns to investment in human capital.

Second, IT, particularly software, is characterized by a unique cost structure that is peculiar to information: expensive to produce, but inexpensive to reproduce. With the growth and expansion of the Internet, digitized information can be reproduced and transmitted across the globe almost instantly. This has significant implications for further IT investment and growth. Nordhaus describes this as 'the most powerful economies of scale known to date' (Nordhaus 2000b). Again this has implications for potentially high returns to investment in software development.

Third, related to the above is the growing significance of the Internet within an expanding trend of globalization. In an increasingly border-less world, the use of the Internet as an information distribution channel involves positive network externalities. As the Internet search and communication time declines, benefits from electronic communication and trade multiply. Specifically, the Internet acts as an excellent channel for transmitting digital goods and services, software included.

Fourth, it is not surprising then that investment in IT has soared in the United States over the last three decades. 'Overall, the IT sector has grown to about one-quarter of nominal total fixed investment and about one-third of real investment, constituting about 5% of total GDP. Investment in computers and software have been the dominant force in IT investment (Nordhaus 2000a).

Related to the above point is the impressive growth in the IT sector itself in the American economy. It has grown twice as fast as total GDP in nominal terms (from 1995-1998 average growth rate of nominal value added 5.2% for total GDP; 11.5% for all new economy: total hardware 10.6%, total software 14.0%, and total communications 8.9%). It is interesting to note that the software industry has scored the highest growth rates for all new economy sectors. In fact, between 1978 and 1998, gross product

originating from the software sector (measured in terms of 1996 prices) has increased more than twelve fold, from \$13 billion to \$157 billion. This is again the highest rate of increase among the other new economy sectors. Software industry hence emerges as the driving force among new economy sectors (Nordhaus 2000a).

Finally, the New Economy is characterized by an improvement in economic performance: unprecedented strong growth in real GDP and real GDP per capita, higher profitability, higher investment rates, low inflation together with low unemployment, and 'a somewhat more equitable distribution of the gains in income (Fraumeni 2001).

The recent upsurge in labor productivity in the American 'new economy' has inspired a wealth of literature debating the extent to which IT investments have triggered such a boost. The debate centers around the question: to what extent has the IT sector been a driving force in the economic transformation, particularly the productivity revival in the American Economy? In other words, to what extent has Information Technology actually brought about a 'New Economy'? In the following section, I present a summary of this debate. It becomes relevant to the present subject as software development is one pillar of IT production whose impact on growth is highlighted within this debate.

IT Production and the New Economy

Within this context, economists are divided between proponents and opponents of the impact of IT. At the heart of this debate is the distinction between IT use and IT production; the software industry is an integral component of the latter. On the one hand, the impact of IT on productivity was first challenged by the famous Solow computer productivity paradox (1987), which was recently followed up by the now famous Gordon hypothesis (1999-2000). In 1987, Professor Solow remarked "We can see the computer age everywhere except in the productivity statistics". In 1999 & 2000, and after the productivity upsurge starting 1995, Professor Robert Gordon still confirmed: "Computers can be found everywhere except in the productivity statistics" (Nordhaus 2000b). While Gordon accepted the recent productivity gains of the last few years, he argued that they had been confined to the *IT producing sector*, representing only 4% of the economy. For the rest of the economy, once allowance is made for the temporary effects of the business cycle, there was no increase in productivity in the second half of the nineties. Gordon later revised his figures, and slightly modified this conclusion. He found an increase in cyclically adjusted labor productivity growth, of 0.4% points a year in the late 1990s. This, however, does not change his general conclusion. Productivity gains were found to occur only in the *durable manufacturing* sector, including the manufacturing of computers and semi-conductors, representing 12% of the economy (Gordon 2000b).

On the other hand, IT optimism is portrayed by new economy proponents who argue for a significant role played by IT in boosting productivity (Jorgenson, Stiroh, Oliner and Sichel, Baily and others). In addition to arguments based on the 'delay hypothesis' (Paul David), measurement issues, and micro studies, the computer paradox and the Gordon Hypothesis are still refuted based on macro level data and productivity analysis by IT optimists. IT proponents agree that overall economy *average labor productivity* has witnessed unprecedented growth rates in the second half of the nineties. There also seems to be an agreement that *total factor productivity* has increased in the *IT producing* sectors (software included), and that IT investments have led to *capital deepening* in both *IT producing and IT using* sectors. The debate seems to be on whether there has been an increase in *total factor productivity* in the *IT using* industries. Recent studies are providing evidence towards that end.

The general consensus (even approved by IT pessimists) on the impact of IT on capital deepening and TFP increase in the IT producing sectors is reassuring. Encouraging investment in IT production acquires a special flavor for developing countries that may acquire potential in this area. As the producer of digital brainpower, and being relatively most labor intensive among IT producing sectors, the software industry in particular becomes a high priority for countries that acquire potential comparative advantage, Egypt being an example. It is from this perspective that I move on to review the software industry in Egypt, and its potential as an IT producing sector.

3. IT Production and the New Economy: Why Should Egypt Promote The Software Industry?

As an IT producing sector, the software industry can act as the driving force behind a potential new economy for Egypt. As mentioned before, the software industry comprises a unique cost structure as information is expensive to produce, and inexpensive to reproduce. This allows for unprecedented economies of scale and increasing returns to investment. The industry is labor intensive, and faces an expanding global export market. Given Egypt's well-educated labor force, and its strategic geographic location in the region, there is more than one reason why Egypt should expand investments in this particular sector.

On the global scene, there is an expanding world market for the industry. Since 1997, worldwide information services marketplace has expanded considerably. Previously at \$301.8 billion in 1997, strategic consulting is expected to reach \$622.4 billion by the end of 2002. International penetration of software exports is expected to increase by 200 percent over the coming few years. Offshore tailored applications and packaged applications to the United States and Europe will be the driving forces behind this growth, since both regions have already established a significant demand for the software industry. More than half of the total worldwide consulting opportunity lies in the United States market place (Harvard Consulting Group 1999). Since the domestic marketplace is

'soft', most firms seeking dramatic growth should focus on the International markets. This is where there is already tremendous growth and demand.

On the regional front, there is a wide scope for Egyptian software exports to the Middle East and Africa. The regional market for Arabic applications, comprising 300 million Arabic speakers, represents a very attractive export opportunity for Egypt's software industry. So far, Egypt has become the major software exporter to most Arab countries. In 1999, Egypt met 70 percent of the demand for such software from the Gulf region, mainly the United Arab Emirates and Saudi Arabia. Multimedia-related products such as cultural, educational, entertainment and religious Compact Discs are the leading products exported to the Middle East region. The majority of Egyptian software companies have established branches in the United Arab Emirates, Saudi Arabia, Bahrain and Oman.

At present in the Middle East, most IT spending goes to Enterprise Resource Planning (ERP) (about 60-70%). GCC countries alone spend between \$ 100-200 million a year on ERP. In addition, Customer Relationship Management (CRM) solutions have become an important component for successful businesses. CRM applications are expected to witness a sharp rise in the next few years, especially among banking, telecomm, and utilities sectors (American Chamber 2000). There is large room for Egypt to capitalize on such opportunities.

On the domestic front, Egypt possesses a strong and well-established institutional structure in education. Despite the high adult illiteracy rate (45.4% in 1999 according to UNDP 2001), the country ironically possesses a critical mass of well-educated labor force. Egypt's labor force is young (below the age of 25), and represents fifty percent of the population. The UNDP estimates Egypt's Education Index as 0.6. The Index is calculated as a weighted average: two third weight on adult literacy rate, and one third combined gross primary, secondary, and tertiary enrollment ratio (UNDP 2001). With 160,000 students graduating from university annually, the quality of human capital together with a low cost of labor, result in an ability to offer cost-effective packages at competitive prices. This blesses Egypt with a strong potential comparative advantage in software development.

Another point of strength that Egypt could exploit to its benefit is the language issue. The majority of software developers have both the English and Arabic languages. Arabic is a language spoken by over 300 million people in the Region. As such, Egypt could use the language factor to its advantage for software development to the Arab market. With the recent convergence in technology, and with Egypt having been the center of Arab entertainment industry (Cairo often termed Hollywood of the East), there is certainly a potential for developing Egyptian software in this area.

The Introduction of the "Unicode Technology" (which brings the software usable in multiple languages), however, is expected to lower the demand for Arabized software. Despite that, Egypt still has a potential advantage in providing cultural content for the Middle East and North Africa (Harvard Consulting Group 1999), and for nationals of the region that reside all over the world. While exposed to different languages, knowledge of the Arab culture is still an asset for developing software targeted at Arabs.

Related to that is Egypt's strategic geographic location. It is the gateway to the Arab and African markets. Its time zone can add an additional work shift to North America. Its proximity to Europe is an added asset.

In addition to the above, the real potential of the Egyptian software industry is illustrated in the revenue per employee impact (Tables 1 & 2). With very little activity in the export category, the average annual revenue per employee in Egypt at present is relatively low: \$10,000 compared to Israel's figure of \$140,000. However, in firms already based in Egypt with some effective offshore or export activities, these numbers rise to \$40-50 thousand dollars per year, for each employee (Harvard Consulting Group 1999). At \$40,000 annual revenue per employee, the multiplied benefit is obvious: \$400 million for the whole country given a total of 10,000 employees. The impact of expanding the industry is obvious: much higher revenue per employee generates significant wealth and income for the firm and Egypt as a whole.

In line with this, the recent attention accorded by the government to IT development in the last three years places the software industry as a priority on Egypt's export agenda (see Table 3 and Fig. 1). In addition to developing a high-speed communications network, the government removed all customs and sales tax on software and services, which had been 5 percent and 10 percent respectively. The government offered a 5 years tax break for all communications and information technology activities (Nazif 1999). A 10- year tax break was offered to software companies that establish their operations in new industrial zones. Exemptions start from the year following the start of production. More importantly, these companies are exempted from a number of bureaucratic requirements (e.g. having to issue an import ID, being recorded in exporters register, having to pay service fees) (Atta 2001).

The Egyptian Software Industry: Present Structure and Performance:

There are more than 400 Egyptian companies specialized in computer hardware, software, and manufacturing computer parts and they have been growing at 82% annually, which is the second highest rate in the world (Khalil 1999). In 1999, the Egyptian IT market was estimated at \$300 million, and has not changed much since (Amin 2001). The software industry accounted for 12.3%

of that total market (American Chamber 2000). Between 1994 and 1999, Egypt's software production increased from \$35.5 million in 1994 to 55 million in 2000 (about 57% increase). The industry was expected to grow at 35% annually (Harvard Consulting Group 1999), reaching \$1.8 billion in 2005. This does seem, however, a little exaggerated in light of the performance in the past two years (see Table 4), and compared to projected exports by the government as L.E. 2.5 Billion, which represents about US\$ 700 million according to 1999 exchange rate, and about US\$ 600 million given the current exchange rate (Table 3).

The software industry in Egypt includes three subcategories: application solutions (e.g. e-commerce solutions), application tools (which perform functions that aid in building a systematic program, e.g. Oracle Tools, Java), and operating systems. Application solutions, including packaged and tailored applications customized for end users, have accounted for the highest share in Egypt's software industry, representing more than half of the software industry, and increasing by approximately 50 percent from 1997. Application tools captured the second highest share of Egypt's software market in 1999 accounting for 22.2% of the market, an increase of 67% from 1997. System infrastructure had the smallest share of the software industry in Egypt, accounting for 13.4%. It is forecasted that application solutions will continue to dominate the Egyptian software market, accounting for an estimated 56% of the market in 2003. Application tools will continue to rank second and system infrastructure will continue to lag behind, accounting for an estimated 18% of the market (American Chamber 2000). The majority of the software companies working in Egypt are focused on tailored and packaged applications, with a lesser number of companies manufacturing multimedia products and only a few companies specialized in Arabization of software and software tools. Egyptian multimedia products are the leading packages throughout the Middle East region.

In 1998, there were 120 firms ranging from 1-5 person startups each with 50-150 employees, averaging about 5000 programmers (Harvard Consulting Group 1999). About 15-20 of these companies were engaged in exporting software, mostly to Saudi Arabia and the Gulf, and accounting for 20% of regionally developed software (American Chamber of Commerce 2000). Today, there are 160 software development houses in Egypt employing around 10,000 programmers. There are about 30 companies that export software, 8-10 of which are claimed to be the 'serious' exporters, and are specialized in exporting professional services software (Amin 2001).

Out of the software output in 1994, 55% was resale of imported packaged software, and only 45% was actually locally developed software. Exports of locally developed software were estimated at \$4.9 million, representing 25% of the \$19.525 million (the 45%). The government has generated 25% of total software revenues demand; only 6% of revenues have been generated from sales to small office/home office.

In 1999, Egyptian software exports reached US \$15 million (representing 27% of total software production) (American Chamber 2000). Currently, software exports stand at around \$25 million (about L.E. 100 million). Software exports are projected to increase to LE 2.5 billion in 2009 (equal to about \$600 million given today's exchange rate) (see Table 3 and Fig.1).

The performance of the Egyptian software industry is modest if compared with other developing and/or small countries that have realized the role of software development in promoting economic growth. Most notable in this regard are India, Israel and Ireland. Indian software exports have increased from \$50 million in 1987 (Amin 2001) to \$330 million in 1993, to \$4 billion in 1999 and \$6.3 billion in 2001. The generated revenues have increased from \$558 million in 1987 to \$8.6 billion in 2001. Indian software exports have hit their target year after year (Amin 2001). In Ireland, software revenues have increased from \$2.7 billion in 1991 reaching \$7.7 billion in 1999 (Arora et. al. 2001). Israel's software exports reached \$700 million in 1999, (American Chamber 2000) increasing to \$2.5 billion in 2001 (Arabicnews 2001). Indian and Israeli software exports have been directed primarily at the United States and Europe. In 1999, the US and Europe accounted for 58% and 21% of exports, respectively, from the Indian software industry, while they accounted for 38% and 37%, respectively from the Israeli software industry (American Chamber of Commerce 2000). Irish software exports have been directed mostly towards Europe (Arora et. al. 2001).

The Real Potential for Egypt's Software Industry: A Niche in World Markets

The size of the global software market is about \$600 billion. Based on the extent of value added, business vision, and innovation, the global software market is divided into three segments: low, medium, and high (see Fig. 2). Within the low spectrum, there is very little business vision, low value added and no innovation. This segment of the market is well covered by India. Companies pay their workers less than US \$4 an hour, and charge between \$8-25 per labor-hour. Heavy reliance is placed on volume and price. On the high end of the spectrum lie the top IT firms, where there is high value added, high business vision, and a high level of innovation. These companies charge between \$200 and \$4000 per labor-hour. Finally, there is the middle market where companies charge between \$30-200 per labor-hour (Amin 2001). This segment of the market is where Egypt's potential lies. Egypt cannot compete with India on price basis. Typically Egyptian software companies pay their workers between \$4-7 an hour, and charge an average of \$25-30 per worker. It is this middle market where Egypt has potential comparative advantage based on the relatively low price of labor compared with the higher level of value added, business vision, and innovation. There is also room for alliances between companies in the middle market with others in other segments of the market.

Hindrances and Limitations

Exploiting the above potential is limited by a number of weaknesses in the economy. On top of the list come business-related hindrances. Most notable in this regard are the weak managerial skills and the lack of business development services, particularly marketing and sales training in the software industry. As only a few companies in Egypt are exporting products and services to the United States and European markets, very little intelligence is being gathered for which application areas and products are in most demand (Harvard Consulting Group 1999).

Related is the low level of entrepreneurial skills for IT graduates, with outdated management structures/cultures prevalent in the industry. This affects Egypt's reputation as not being considered as a good hi-tech brand. People recognize India, Ireland as possible destinations, but don't think of Egypt. Many organizations are said to work irresponsibly in the software industry, not leaving a very good impression.

In addition, access to financing is one major hurdle against developing the domestic software industry. Banks do not finance hi-tech industry and instead focus on industries that have physical collaterals. At the same time, economic conditions in Egypt are still not very conducive to international financing. Lacking are the financial schemes that support start-up software companies. Investors ask for ready-made existing contracts, which is practically impossible. The concept of venture capital is still not developed in Egypt.

Moreover, and despite human capital being an asset, there are still problems that are related to this particular factor. First, as they are, firms are said to be unable to 'attract and retain qualified software engineering talent' (Amin 2001). The industry suffers from hi-tech brain drain of new graduates to United States, Canada and Australia. Students perceive software industry as small, with few jobs, and are attracted to IT administrative jobs in multinationals or non-IT jobs altogether.

Related is the lack of hands on training offered by educational institutions. Many Universities still have outdated and rigid curricula, with very little machine time allocated to students. Strong business education programs are lacking in Egypt. Few universities have Business and Management programs. Software company managing directors agree universally that current computer science graduates lack key attributes. Among these is understanding of team environments, sophisticated problem solving skills, Project management skills, and familiarity with some of the latest software products (e.g. data base systems, programming languages, web technologies) (Harvard Consulting Group 1999).

In line with this, current training programs are not meeting the demand in almost all categories of IT labor force. The supply of IT workforce suffers structural imbalance. On the one hand, there is a severe shortage of senior programmers (see Table 6). On the other hand, there is an oversupply of junior programmers. These, however, are not always well qualified to meet industry needs, mainly because the training they received has not been properly focused. There is a need to increase quantity and quality of graduates able to work in software companies. Quality is perhaps more of a priority. Amin, CEO of IT Worx, argues that the quantity of labor force is not the real issue: the real problem is the lack of managerial skills among the already available labor force (Amin 2001).

The next issue is the lack of awareness of the importance of software and IT-related products. The lack of awareness of IT is a hurdle that generally faces IT development in Egypt, including the adoption of e-commerce (Hashem 2001). Limited awareness of the software product and delivery mode poses administrative problems with government representatives, especially tax and auditing bodies (Atta 2001). Related to that are other legislative issues including having to pay an annual fee equal to 1% of gross sales rather than of value added, having to pay 1% import fees on inputs, and having to pay 1 per thousand insurance on imported parts.

Another major hurdle is the high cost of infrastructure, particularly electricity for free zone companies. Despite improvements in communication infrastructure and decline in communication costs, there is still room for improvement. The telephone capacity is still weak, and high speed internet is not yet available for all. Measures such as the ban on internet telephony and satellite uplinks have negative impacts on further developing the industry.

In addition to the above, there are organizational limitations. There is a lack of an impartial/apolitical body that represents interests of software industry. Currently there are fragmented software/high tech associations (about 4) each with its own political agenda. There is very little coordination with government. The industry is said to be losing out on government support and promotion. There is also very little coordination with education institutions on the one hand, and among IT companies on the other. The latter mostly consider each other as competition, do very little work together, while the real competition is in India, Pakistan, Ireland (Amin 2001).

Moreover, the high piracy rate is a major hurdle facing the software company. In 1999, the piracy rate in Egypt ranged between 75-80 percent, meaning that about 3 out of 4 pieces of software in the country have been copied illegally. The piracy rate is said to

have dropped to 56% in 2000 (Shahine 2001).

Related to that is the question of intellectual property rights. Software creates unique problems because it is so easy to duplicate and the copy is usually as good as the original. While Egypt does have commitments under the Trade-related Aspects of Intellectual Property Rights (TRIPs) agreement starting in 2000, this question needs to be more aggressively addressed. Lack of copyright protection can effectively kill any chances of a software market developing in Egypt. It is worth noting that India's copyright law is one of the toughest in the world (Harvard Consulting Group 1999).

To sum up, the above has been a preliminary review of the software industry in Egypt: performance trends, potential, strengths and weaknesses. In light of this, it seems feasible to conclude that Egypt has a potential comparative advantage for software development: the low cost but well educated labor pool in Egypt represents a key asset. Egypt's real potential lies in carving a niche in the middle market, midway on the spectrum of cost and the value added/business vision/innovation trio. Such potential, however, has not been properly utilized. At present, the industry faces a number of hindrances: managerial, organizational, and legislative, among others. If the government is to accord a top priority to software production and exports, such limitations need to be addressed immediately.

While the government is taking some steps towards promoting the industry, e.g. expanding infrastructure and offering some tax breaks, there is still room for more aggressive measures to be taken towards this end. The government should, for example, intensify training programs to resolve the structural imbalance in the software labor market. The development of business education curricula in universities should be encouraged. The government should utilize the mass media towards E-ducation programs that increase people's e-literacy and awareness. The development of flexible financial schemes for startups is a must. The government should also include software industry as a main item in trade pacts. Legislation on intellectual property rights should be laid out, with strict piracy penalties imposed. On the administrative side, the government should provide incentives by cutting all unnecessary costs such as taxes (now called 'fees') and high infrastructure costs.

In short, the development of the software industry needs to be placed as a top priority at present. As Egypt places a high priority on exports in general, software development can be the wild card for Egypt in the age of the ICT revolution. Egypt cannot afford to miss out on such an opportunity.

4. Conclusion: Will the Software Industry lead Egypt into a New Economy?

The present paper has been an attempt to bring home the issue of IT and economic growth in the new economy. The debate over the new economy does not dispute the growth of productivity in the IT *producing* sectors. As an IT producing industry, software development has a strong potential for capital deepening as well as TFP growth, both promoting labor productivity and acting as the driving force for the new economy.

Against this background, the present research has been a preliminary review of Egypt's software industry. In the case of Egypt, software production emerges as a new key export sector. The dynamic nature of this industry, encompassing digitally produced and transferred services, together with Egypt' high quality human capital, bless Egypt with a strong potential to be exploited, globally and regionally. On the regional level, proper utilization of this potential can prove Egypt an IT leader in the Arab world, especially in light of the uniqueness of the language and geographical proximity. On the global level, there is a wide 'middle market' with lots of potential for penetration by the Egyptian software industry. With the Internet as an instantaneous mode of delivery, and with the convergence in technology allowing for multimedia communication, there is reason for Egypt to focus on software development as the driving force leading its new economy. Software development is Egypt's chance to catch up with the global new economy thanks to IT.

Hence, in answer to the question posed at the outset of the paper: Can the software industry lead Egypt into a new economy, the answer is yes, potentially. Carving a niche in the middle segment of the global software market is Egypt's opportunity to catch up with the global ICT developments within its new economy. Particularly against the current world recession, Egypt should place developing the software industry as a top priority, and mobilize its resources towards that end.

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Table 1: Revenue Per Worker Impact

Country	India	Ireland	Israel	Egypt
Revenue per employee (thousand US \$)	14	38	140	10
Total revenue per country (million US\$)	2200	6200	2800	50
Number of employees	160000	18000	20000	5000

Source: Harvard Consulting Group 1999.

**Table 2: Example of increase in revenue per employee and industry development
(in millions of US\$)**

	1999	2000	2001	2002
Estimated number of staff	5000	6000	7500	9000
At 10 \$ k per employee	50	60	75	90
At 20 \$ k per employee	100	120	150	180
At 30 \$ k per employee	150	180	225	270
At 40 \$ k per employee	200	240	300	360

Source: Harvard Consulting Group 1999

Table 3: Targeted exports volume: in millions of L.E.

Year	millions of L.E.
1999	5
2000	50
2001	100
2002	200
2003	400
2004	600
2005	900
2006	1200
2007	1600
2008	2000
2009	2500

Source: Nazif 1999.

Table 4: Size of Egypt's Software Industry

Year	Output (million US \$)
1994	35
1997	48
1998	50
1999	54
2000	55
2001	60-70
2005	1800

Source: Harvard Consulting Group 1999, Amin 2001 and American Chamber of Commerce 2000.

Table 5: Egypt's Software Industry Indicators

	1999	2005
Domestic Production (US \$ millions)	54	1800
Software Exports	15	900*
IT professionals	5000	25000
Software Developers	2000	10000

* Contradicts government predictions of LE 900 million, equal to about US\$ 300 million at 1999 exchange rate (see Table 3 above)

Source: American Chamber of Commerce 2000.

Table 6: Egyptian graduates from University and Industry Programs (Number of Graduates per Year Against Anticipated Demand)

Employment Need	Number required	Number produced	Annual Shortfall	Demand Met Now (%)
Project Managers	116	50	66	43
Product Managers	29	15	14	51
Middle Managers	145	100	45	69
Senior Programming staff	377	200	177	53
Entry level programming staff	870	1500	..	172
Business analysts and Consultants	58	20	35	34
Marketing management	58	25	23	43
Sales and sales management	232	100	132	43
Totals	1885	2010

Source: Harvard Consulting Group, 1999

Targeted Levels of Egyptian Software Exports

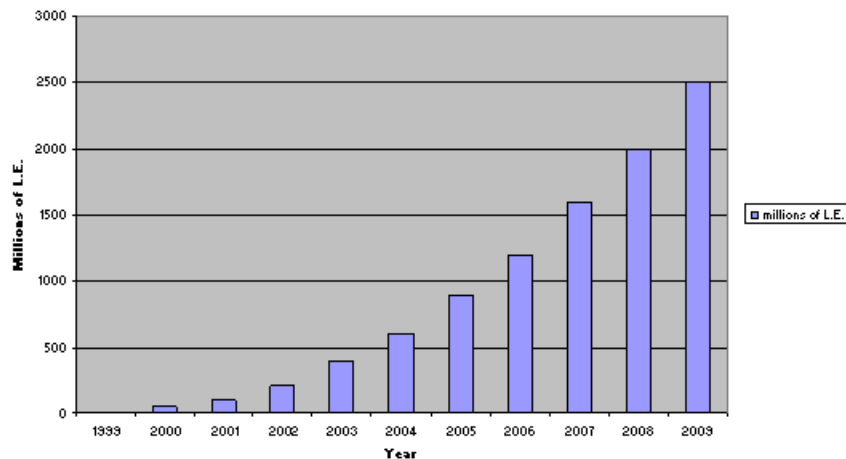


Fig. (2)

Global Software market

The Real Potential for Egypt

