ICT Diffusion in Egypt: Market Dynamism and Public Policies

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Abstract

The objective of this article is to analyze the role of market dynamism and of public policies in diffusing Information and Communication Technologies (ICTs) within the Egyptian society. The methodology consisted of a close observation of the actors and interviews with some of them along with a tracking of the sector's news. It is noticed how ICTs foster Public Private Partnerships (PPP). However, these programs didn't support enough the needs of Small and Medium Size Enterprises (SMEs) and local innovation. Besides, disadvantaged areas are still lagging behind. We considered the role of different users; individuals, business sector and the government. We find, on one hand, that there are situational factors that influence the adoption decision. On the other hand, ICTs democratized innovation so that the user can innovate his own solutions.

Keywords: Technology diffusion, ICTs, Public Policies, usages, innovation.

Introduction

ICTs are general purpose technologies; they have a wide scope for improvement and elaboration, they can be applied across a large variety of uses, and they have strong complementarities with existing and potential new technologies (Lipsey, Bekar and Carlaw, 1998).

ICTs externalities and spillover through its use and application can have a more important economic impact than its contribution in the GDP as a production sector. In a study on the U.S.A. economy, Stiroh (2002) showed that gains from ICT investment in various sectors of the economy were positive and complementary to gains from the ICT producing sector itself. Research showed that in developed countries gains were mainly driven by ICT use and application while in developing countries growth gains related to ICT were driven by ICT producing sector (Atkinson and McKay, 2007). Bayoumi and Haacker (2002) research illustrated that their sample of developing countries (between 1996- 2000) got smaller demand boost from IT spending in comparison with developed countries even if they were

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relatively specialized in IT production. Although developing countries attracted investment in the sector and their share in world production of ICTs is increasing, demand for ICT is mainly from developed countries. Few exceptions exist, for example China.

That is why this article is interested in analyzing ICT diffusion in Egypt, a developing country where policy makers adopted an information society initiative. The article analyses the role of public policies and of market dynamism, by market dynamism it is meant the role that each actor can play by interacting with another actor or with the technology. The role of three actors is considered; from different perspectives; first, individual users, second, the business sector as a producing sector and as a user and third the role of the government as a policy maker and as a user. Conclusions rely on the close observation of the actors and a follow up of the sector's news. Besides, some government's officers responsible for e-government application were interviewed.

The sequence of regulatory reforms and privatization influences telecommunication diffusion and investment (Stiglitz, 1999; Wallsten, 2002). ICT policy making in developing countries may suffer from weaknesses (Maclean et al., 2002). Involving the business sector can help overcome those gaps. However, the most important role of the business sector is to supply to the market, local innovative solutions that can respond to local specific needs thus diffusing ICT.

Besides, the usage of ICT and the effect this usage is generating is a determinant factor of ICT diffusion. From the diffusion literature perspective, users can play an important role in diffusing a new technology. This is especially the case for the innovative users (where innovativeness designates first adopters), whom communicated experience influences the followers' decision (Rogers, 1995). But in real world there are situational factors that influence the adoption decision which differ from one adopter to another and from one technology to another (Midgley and Dowling, 1978). So the article will be discussing those situational factors that might impact the adoption decision.

From the R&D literature perspective, the computer based relatively easy design tools available now for users at affordable prices democratized innovation (where innovation means new products or processes) (von Hippel, 2005). It is argued here that users' innovations contribute to the process of technology diffusion as they are the best placed to define their needs.

The article will be structured as follow; the first part will describe the structure of the ICT sector then it will go through the role of public policies and of the business sector with an overview on ICT indicators in Egypt. The second part will analyze the role of the different users.

1- Public Private Partnerships and the Role of the Business Sector

This part will start by describing the process of deregulation of ICT sector in Egypt and its structure. It will then discuss public policies in place in collaboration with the private sector in

order to enhance ICT diffusion indicators. Finally, it will analyze the role of the ICT business sector in addressing local needs.

Sector Deregulation

In a research covering 200 countries from 1985 to 1990, Wallsten (2002) proves that in the telecommunication sector, the sequence of regulatory reforms and privatization is important. Establishing a regulatory authority before privatizing the telecom firm is correlated with increased telephone penetration, telecom investment, and mobile cellular subscriptions. Without having a regulatory framework prior to privatization, investors will require a risk premium to compensate them for future change in rules, thus the value of the firm will be reduced (Stiglitz, 1999).

Until 1996, the Arabic Republic of Egypt National Telecommunications Organization was the only provider of all public telecommunications' services in Egypt, and after was renamed Telecom Egypt (TE). In 1998, TE became a joint stock company 100% owned by the government of Egypt. The National Telecommunications Regulatory Authority (NTRA) was established to undertake the regulatory functions and TE became an independent operator. NTRA was further empowered by the telecommunication law of 2003, according to which, NTRA is an independent body, yet, the Minister of communication and information technology chairs NTRA. The Ministry of Communications and Information Technology (MCIT) was established in 1999.

In Varoudakis and Rossotto (2003), they confirm that telecommunication liberalization is conductive to a higher efficiency contributing to ICT growth. Bialiamoune-Lutz (2003) using data from developing countries found that liberalization indices may or may not affect ICT diffusion. Today, ICT sector in Egypt is partially liberalized. Concerning the fixed line segment, TE continues to monopolize the market. TE started trading its shares on the Cairo and Alexandria Stock exchange in December 2005. MCIT offered 20% stake in TE. The initial public offering (IPO) is the biggest flotation that the Cairo and Alexandria exchange have witnessed and also the biggest sale of state-owned assets. Subscription for shares offered to private investors in the IPO was 70% oversubscribed according to the local press, witnessing a successful experience of deregulation of the sector.

As for the mobile market, it is an oligopoly of three operators. In 1998, Mobinil Company and Vodafone Egypt Company obtained two 'Global System for Mobile Communications' (GSM) operators' licensing. In 2006, a third GSM license has been granted to Etisalat Company, which started offering its services in the Egyptian market in the first half of 2007.

The number of Internet service providers (ISP) was 214 in the end of September 2007. According to the telecommunication law, ISPs should have licenses from NTRA, on a free competition basis.

The IT market is served by major international investors. There is also a substantial number of local integrators with strong market presence, such as Raya integration.

The sequence of deregulation of the Egyptian ICT sector was favorable for ICT diffusion. The set up of a regulatory authority preceded the deregulation process. However, further competition, would lead to more attractive packages for customers and more pressure to innovate to respond to local needs. It gives the customer a room to influence the market and consequently ICT penetrates faster in the economy and on a wider scale. The arrival of a new operator in the mobile segment, as indicators below will show, dramatically increased the number of subscribers.

PPP & ICT Diffusion Indicators

After having presented the sector structure, the public initiatives in place in collaboration with different stakeholders will be discussed. Recent research has indicated several weaknesses in ICT policymaking in most developing countries (Maclean et al., 2002).

- Lake of awareness of the potential of ICTs in the decision-making process of the government.
- Lack of integration of ICT policymaking with other areas of the government, in particular with the Ministry of finance and the ministries responsible for development.
- Lack of engagement of the expertise of the private sector and of the civil society.
- Inadequate knowledge management systems.
- Lack of expertise in both the technical and the policy dimensions of ICT decision-making.

Involving the private sector can help overcome those weaknesses. Although in Egypt there was no big experience in PPP, the ICT sector deepened this experience. Egypt has adopted an Information Society initiative since 1998, aiming to become a high-tech hub for the Middle East and Africa region. Many developments took place in terms of infrastructure and legislative and administrative environments in order to achieve this goal. The initiative has two strategic objectives; to spread ICT tools nationwide and to set the foundation of an export oriented ICT industry. Many sub-initiatives followed, they consist of two main rounds; first deregulation of the ICT sector and 'Access for All' programs. Second, the establishment of the research and development (R&D) centers of excellence.

Table (1): ICT diffusion indicators in MENA region in 2007.

Percent of inhabitants	Egypt	Israel	Morocco	Tunisia	Turkey	Average
Fixed Line	15.2	44.4	7.7	12.3	24.3	20.8
Cellular Phone	40.7	128.5	64.2	76	83	78.5
Internet Users	14.2	28.9	21.1	16.7	16.2	19.4
Broadband Subscribers	0.6	22.1	1.5	0.9	6.1	6.2

Source: International Telecommunication Union (ITU) and Egypt ICT Indicators Portal.

The table above shows that despite 'Access for All' programs, Egypt's ICT diffusion indicators are below the MENA region average.

Looking at the telephone segment, the telephone itself is a factor of ICT diffusion. Chinn and Fairlie (2006), found evidence that telephone density is associated with technology penetration rates and has a statistically significant relationship with computer penetration.

Telephone penetration rate in Egypt is constantly increasing. In 2007, telephone's penetration rate has reached 54.9%[2] compared with 10.2% in 2000. This increasing diffusion of telephone is driven by the mobile segment. Mobile's subscribers are increasing with high percentages, while fixed line's subscribers follow slow growth path. Although the network of both was modernized following NTRA instructions.

In the end of 2007, fixed and Mobile telephone's penetration rates represented respectively, 15.2% and 40.7%[3], with an annual growth of 1.3% and 64.2% respectively compared with 2006. Besides, cellular phones are dominating telephone subscribers' repartition. In December 2007, mobile's subscribers represented almost 72% of the total telephone's subscribers.

The mobile operators introduced many packages to attract low spending customers to their network. The operators' prepaid users' number increases continuously, and with the entrance of the third operator in the market in 2007, competition has led to more attractive schemes for customers, annual growth of subscribers was 64.2% in 2007 compared with 29.6% in 2006. Moreover, the fixed line service is not equally spread over the Egyptian territory. In urban areas, fixed telephone density was 26% in the end of August 2007[4]; while in rural areas it was only 6.6%. Unlike many other developing countries, Egypt doesn't suffer from the challenge of improving mobile network coverage, with the majority of the population living along the

[2] Data are from the ITU, and the MCIT yearbook, 2007.
[3] Egypt ICT Indicators Portal.
[4] MCIT website.

Nile River. Indeed, the percentage of the population covered by the mobile cellular telephone is 95% in March 2009[5]. With the strong penetration in the mobile segment, the growth of the penetration rates of fixed lines is expected to be limited.

As for the IT sector, the annual growth of the number of IT companies was almost 13%[6] in December 2007. Egypt's computer penetration rate is very low and home computers' ownership is very limited. In January 2009, only 13.1% of Egyptian families own computers[7]. Yet, this reflects an unsaturated market, with waiting business opportunities. Spending in IT market is dominated by hardware spending (including communications' hardware). Software spending represents only 13% of IT spending in Egypt in 2005[8]. That is mainly due to the presence of software piracy, because of low income and the high cost of operating systems. Currently, the major categories of IT's services are education and training, Internet services, consulting and technical maintenance.

In 2002, the government joined forces with the private sector, and begin 'computer in every home' initiative, with a payment plan in cooperation with TE, a plan by which computers can be paid for in monthly installments, to be charged on the telephone bill. There are other more specific programs to empower various sectors of activity. The initiative was then restructured[9]; being a TE customer is no longer necessary, as financing banks offer the required loans through facilitated retail banking procedures. This program is practical but still its achievement is limited. For those who do not have a computer, IT clubs provide Internet access and training. In December 2007, they constitute 1,712 clubs[10] nationwide and are being continuously established. However, this number is insufficient to cover the 96.9% families who don't own PCs. Although cooperation with international technology providers has resulted in discounts of up to 50% on hardware, the price of computers might remain the main constraint for low income consumers. However, a public policy to enhance the quality of after sales service may foster sales growth. Support and maintenance services represented about 35%[11] of 2005's IT services spending.

Concerning Internet, its capacity in Egypt has accelerated since its introduction to reach almost 14.866 Gbps in December 2007, compared with 9.9 Gbps in December 2006. Access to the Internet has been available for the cost of local telephone call since 2002. Successive reductions of the cost of broadband took place, it dropped by 30%[12] in 2007 compared with 2004. Those reductions aim to stop the line sharing practice, which seek to split the cost between many users. A related development concerns the trials of Worldwide Interoperability of Microwave Access (WIMAX) which provides broadband wireless access. WIMAX could

[5] Egypt ICT Indicators Portal.
[6] MCIT year book 2007.
[7] Egypt ICT Indicators Portal.
[8] Egypt Telecommunication Report, Q1, 2006.
[9] Renamed 'Egypt PC 2010 Nation Online'
[10] MCIT year book 2007.
[11] *ibid*.
[12] *ibid*.

provide a solution for making broadband services available in rural areas where infrastructure is less developed.

Internet service remains too expensive for most Egyptians. The number of Internet users, in December 2007[13], represented only 14.2% of the Egyptian population compared with 12.7% in December 2006. Households' computers are still limited so the main access points are cybercafes which makes further growth in the Internet market difficult. Another challenge is the English content of the majority of the World Wide Web material and the user interface in operating systems. The Arabic content initiative established a community development portal 'kenanaonline' targeting citizens in rural areas with around 50,000 pages[14] online. It covers topics including how to start a small business, how to develop skills, a guide to civil society, agricultural development issues and health issues. Further progress on this dimension may influence Internet usage deeply.

Despite these efforts to diffuse ICTs, people in the capital and big cities remain the main beneficiaries. In 2005, a Universal Service Fund was established under the control of NTRA to correct for market failures, which disadvantaged people living in rural areas and poor communities. This is realized via incentives for PPP to serve those segments of the population. The task is not an easy one and results are sometimes below expectations.

The paper will move now to the role of the ICT business sector, wondering if the programs in place are helping the sector to fully play its role.

ICT Business Sector & Local Innovation

The ICT producing sector is playing an important role in diffusing ICT within Egypt as a partner in various PPP programs. This holds for both local and foreign investors. This section focuses on its role in supporting local innovation.

Innovation of local suppliers helps diffuse ICT. This is because it leads to innovative solutions that respond to local needs and which are adequate with the local context. This requires among others, a competitive market, and demanding end-users. In Porter (1990) opinion, the consumer in the home country should be the world's most sophisticated, enough to pressure companies to innovate and create sophisticated competitive advantages. It is argued here that it is not only the sophistication of the demand that pushes to innovation but its variety and uniqueness. In fact, every country has its specific demand and specific innovation experience. Besides, Egypt benefits from a big market with a diversity of needs and expectations.

Human capital is a main determinant of innovation not of imitation (Durate and Simoes, 2004; Benhabib and Spiegel, 2002), especially acquired through high education (Durate and Simoes, 2004). It facilitates domestic technological innovation and technological catch-up.

[13] Egypt ICT Indicators Portal.
[14] MCIT year book 2007.

The Kearney[15] outsourcing Index ranks the high end of Egypt's IT professionals among the best in the world. The Kearney report states that due to long-established international education institutions in Egypt and to the tourism industry, Egypt has unique multilingual capabilities and it may be said that the entry offers a better mix of capabilities than any other single location.

Herein, a challenge for the ICT market in Egypt, as well as for all low income countries to preserve the ICT skilled personnel who can usually earn much higher wages in other countries, so many of them leave. In July 2008, the proportion[16] of faculties/institutes at the university education level with communication specialty was 9.6% of public education, 4.7% of Azhar University[17] and 11% of private education. As for IT specialty, it constitutes 14.4% of public education, 6.3% of Azhar University and 42.7% of private education. These percentages are high enough to cover the market needs in terms of quantity. ICT's expenditures represent 6% of GDP[18]. However, in most cases, graduates, once entering the employment market, they face the inadequacy between what they have learned academically and the tools that the professional life requires.

Numerous training programs exist. The 'Basic Skills Development Training Program', the 'Professional Training Program', besides, the Information Technology Institute and Nile University were established to target the highest-ranking graduates. At the school level there were initiatives to provide schools with ICT tools; still the high density in Egyptian schools makes it difficult for the students to access the material in place.

Despite its ICT skilled professionals, its policy objective to have an export-oriented industry, Egypt remains an importer of ICT. Some of the foreign investors export their products to their country of origin. For example, IBM technology development Center is a major IT exporter in Egypt; over 99% of its services are delivered to IBM's labs and customers in the U.S.A. and Europe.

Without national innovation and interaction with the imported technology, Egypt might be increasingly used as a base for exports to other countries in the region. Exportation leads to improved efficiency in the country to which the products are exported rather than strengthening local manufacturing and services (Joseph, 2002).

SMEs represent about 92.7%[19] of private-sector businesses in Egypt. The Information Technology Industry Development Agency' (ITIDA) was established to support the Egyptian ICT industry and exports. In a joint MCIT/ ITIDA survey of 151 ICT companies in 2007, respondents pointed to difficulties in attracting new customers and lack of access to financial markets as the main obstacles to their business development. These were followed by high costs of office rent and slow Internet connections. A large majority of the respondents were

[15] U.S. management consultant firm A.T. Kearney.
[16] Egypt ICT Indicators Portal.
[17] A public university.
[18] Egypt ICT Indicators Portal
[19] MCIT year book 2007.

domestically owned SMEs. In contrast, an A.T. Kearney study (2005) focusing on service offshore business in Egypt shows that from a financial perspective, including office renting costs, Egypt is an attractive location for foreign companies. When taking into account the spending on specialized personnel, infrastructure costs and tax regulations, A.T. Kearney ranked Egypt among the top five most financially attractive offshore locations, before countries such as Indonesia, India, Thailand and China. Indeed, it is important to have a business environment attractive for foreign investors but it is crucial to support domestic SMEs and to give them incentives. Consequently, promoting national production and innovation to respond to local needs.

The annual ICT business plan competition, aims to reward and support innovative business ideas. This is done through three ways, the winners beside the financial prize are allocated equipped space for 18 months in the Smart Village and they have access to advice on business process. An example of an SME which won the business plan competition prize is Salis which is a company that develops software for the food and agricultural industry. Their first successful product was for export control, which enables the tracking of all the criteria from farm to importer. This is a local innovation addressing local needs thus further diffusing ICT. Now all of Egypt's big exporters have installed the Salis. There are other successful experiences that we can enumerate. However, some forms of innovation that take place in developing countries' enterprises unlike in developed countries, are difficult to account for by patent statistics. This is the case in 'creative imitation' when a new innovation is being introduced to the market, and is being adapted to developing countries' context.

There is an initiative to create centers of excellence according to which, each center is created in the form of a consortium consisting of leading industrial organizations, Egyptian expatriates and both public and private sector entities, in collaboration with Egyptian universities and research institutions. Three centers are being established in the following areas: data mining and computer modeling; wireless technologies; mobile and e-service and electronic design. In 2006, Nile University was established dedicated to excellence in technology and related fields. In 2003, the 'Smart Village Pyramids' project was founded. It is a high-tech business park that has attracted big local and international companies. In 2001, the Software Engineering Competence Center which is the first center of its kind in the Middle East and Africa was established aiming to promote and support the development of the local software industry.

There are efforts to boost local creativity that still need to be widened in coverage, focused on SMEs and complemented by others. As the example of Salis showed, when incentives are there national innovations manifest themselves.

Now moving to the second part of the article which will introduce the role of the different users in diffusing ICT. Starting by the individuals, followed by the business sector and finally the role of the government, each actor has a traditional role in diffusing technology. The interesting question is whether ICT with its particularities have added a new perspective to it.

2- The Role of Users

In ICT sector, production is shifting from technology oriented products, to commercial, often user driven new applications of ICT. The role of individuals is increasing and influencing the supply-side and its decisions. From the diffusion Literature perspective, the early adopters of the new technology (innovative users) are change agents and opinion leaders who facilitate further diffusion of the technology (Rogers, 1995). Midgley and Dowling (1978) criticized the time of adoption approach and introduced 'innate innovativeness' approach, according to which in the real world, there are situational factors that affect the adoption decision. Those situational factors might be income, education or the perceived benefit of the new technology, etc. Agarwal and Prasad (1998), define domain specific innovativeness in the field of IT as the willingness of an individual to try out any new information technology.

Below are discussed some of those situational factors in Egypt, that influence the adoption decision. In the government section, an additional dimension is analyzed; it is the role of 'user innovativeness' from the R&D literature perspective in diffusing ICTs.

Individuals

Although data is unavailable about adopters' behavior, observing the market can help make some deductions about the individual users' attitude whether it is active or passive in response to the supply's decisions. High proportion of developing countries' citizens has little experience even of telephone. Adopting new ICTs is much faster and easier in societies in which citizens are used to the older ICTs. This might limit the end user role in terms of price and product definition in developing countries, as the concerned technology is not common for him.

Yet in the Egyptian mobile market, in 2004, there were boycotts from disappointed consumer rights groups because of price hikes in mobile's charges. There is a continuous revision of the terms of use in order to address low income customers and a variety of packages. For example, there is a credit transfer service from one customer to another which can be useful within low income families. Also, there are special tariffs for rural areas. Between 1999 and end 2008, on the one hand, mobile tariffs were reduced by 91.8%. On the other hand, Internet tariffs were reduced by 90.9%.[20]

The other segments of the ICT sector, are also considering the specific local needs in their product design, not only national investors, but also foreign ones. For example, Intel will establish a center in Egypt that would study the needs of customers of the Middle East and Africa, defining and developing platforms designed specifically for the users of the region. So there is an interesting interaction between the demand and the supply. However, if the results of the survey mentioned above which was conducted by MCIT and ITIDA, found that SMEs find it difficult to attract new customers, then this interaction needs to be magnified and supported by operational feedback mechanisms.

[20] Egypt ICT Indicators Portal.

Getting back to the situational factors that might influence the adoption decision, two factors are considered; per capita income and education. In Chinn and Fairlie (2006), they found evidence that income is associated with technology penetration rates. They found that income per capita is associated with differences in Internet penetration between countries. Besides, the tests revealed statistically significant relationship between income per capita and computer penetration. Bialiamoune- Lutz (2003), using data from developing countries examined the links between ICT diffusion and per capita income. The results showed that income influences ICT diffusion and Internet hosts seem to be positively associated with income.

Egypt has the benefit of a big domestic market with a population of 75.5 million in 2007. But, it is a low-income country, with an annual gross domestic product per capita at current prices of almost US$ 1772 in 2007[21]. There is a risk that the international financial crisis negatively affect the economy, hence the ICT sector growth, and the spending on ICT. As was shown in the first part, despite reductions in prices of hardware, of Internet access and broadband subscription, ICT diffusion rates are still mediocre. Low income explains those limited results but also education is influential in some segments.

A paper for Durate and Simoes (2004) has focused on a sample of developing Mediterranean countries, among which Egypt, and the role of human capital as a facilitator of technological diffusion i.e., the transfer of technology from developed countries to developing countries as it determines the absorptive capacity of the recipient. The results support higher education as a main determinant of ICT diffusion, a result accordant with the idea that the diffusion of ICT needs more than basic literacy levels. Bialiamoune- Lutz (2003) using data from developing countries examined the links between ICT diffusion and education. Unlike expectations, ICT diffusion is not associated with education. Computers may require substantial levels of education for use, but telephone and Internet may not (Dasgupta et al., 2001). Indeed, Chinn and Fairlie (2006) found evidence that years of schooling and illiteracy have statistically significant relationship with computer penetration.

In Egypt, families invest heavily in educating their children according to their resources and sometimes beyond them. However, the high percentage of illiteracy among the Egyptian population and of English-language ignorance constitutes a major obstacle for ICT diffusion. Conversely, the cost effectiveness of the new technologies can help overcome the illiteracy problem as the teaching of language and numeric literacy can be combined with the basic steps of computer literacy. The illiteracy eradication initiative of the government is producing a CD for elementary self learning of Arabic and mathematics. Learning time decreased to 5 months compared with 10 months in traditional methods. The CDs are available for free; the challenge is to have the material reaching the targeted population, only 3500 people benefited from them until end 2007, representing only 0.02% of the illiterate population which represented on its turn 21.6% of Egyptian population[22] .

[21] International Monetary Fund.
[22] UNESCO Statistics.

The Business Sector

As for the Business Sector role as a user, ICT investment costs are generally much higher in developing countries where almost all ICT equipments are imported. If we compare between developing countries and the Organization of Economic Cooperation and Development (OECD) countries, we find that investment finance is available for OECD firms because of investors' confidence in their business expertise, the risk business environments, and their big experience in managing change and restructuring business operations to take advantage of new technological and management techniques. Companies in developing countries have much less experience of restructuring and much less access to high quality business advice and venture capital.

An investigation covering 105 Egyptian private firms working in the manufacturing sector with 20-500 employees was part of Bellon et al. (2004). The majority of questioned managers believes that ICTs play a major role in growth and development. They reduce production and communication costs, enhance products' quality, facilitate accounting and personnel management, increase sales and enable better decision making by allowing access to more information.

However, these convictions are not necessarily translated into a high investment in those technologies. ICT spending is considered in many cases as expenditure and not as an investment. Most firms are buying new material to respond to a current need and a current competition and not according to a real strategy. In some cases, the entrepreneur considers that his firm has achieved the required level of ICT investment and that further investment would induce constant return to scale. While in fact, his firm is still lagging behind in term of ICTs' optimum level of investment.

The study also found that the scale of the firm and its sector of activity are main determinants of the level of ICTs' investment. In addition, the average age of the employees is influential, the more the personnel is old the more ICT training is costly and the more the organizational change is avoided as employees fear to be replaced by younger ones who are more familiar with the new technologies. Costs of equipments, of training and amortization, low level of education, and of English-language knowledge within the personnel represent major obstacles for ICT investment in the business sector.

According to research, firms are more interested in communication technologies (fixed lines, fax, and mobile) and not in information technologies. Few firms have small informatics' department, rarely found a firm which has a website, it depends on the firm's exportation activities. Moreover, the website seems to play a limited role of marketing and information exposition, reducing costs of brochure sending.

Distant work is almost inexistent due to lack of confidence and of culture. There is no evidence that the adoption of new technologies resulted in changes in the decision-making process, which is in general very flexible and ad hoc. The table below gives a detailed picture:

Table (2): Proportion of different uses of ICTs by the business sector in July 2008.

Proportion of Business	Size		
	Enterprise	Medium	Small
Using Computers	96.8	79.8	40.2
Using Internet	82.6	52.7	20.3
Having a Website or Web Presence	65.2	33.1	10
With an Intranet	65.8	36.1	11.1
Receiving Orders over the Internet	17.8	24.6	16.6
Placing Orders over the Internet	18.8	22.7	16.6
With a LAN	69.7	45.2	15.4
With an Extranet	4.5	3.6	1.2
Accessing Internet through ADSL	79	87	88

Source: Egypt ICT Indicators Portal.

The table shows that e-commerce is not developed for the three categories as 'placing and receiving orders on the Internet' represent mediocre percentages of usage. It should not be forgotten that SMEs represent 92.7% of the sector, so even if some indicators are high for big enterprises they are not representative of the sector. It is noticed that Small enterprises are lagging behind compared with Medium ones.

Table (3): Proportion of business using Internet by type of activity in July 2008.

Activity	Size		
	Enterprise	Medium	Small
Customer Service	39.8	40.6	32
Dealing with Government	21.1	13.7	9.5
Developing Products Online	30.5	30.3	22.2
Information about Goods or Services	77.3	68.6	60.1
Information from Government	57	42.9	31.7
Internet Banking	37.5	29.1	18.6
Others	2.3	0.0	2.9
R&D	47.7	32	21.6
Sending or receiving emails	86	79.4	77.5

Source: Egypt ICT Indicators Portal.

Table (3) shows that 'information about goods or services' and 'sending and receiving emails' are the main Internet uses for the three categories. It is noticed that Internet usage in 'developing online products' and 'R&D' activities is limited. This means that the Egyptian business sector is not enough integrated within the world open source innovation process. This is a potential channel for local innovation development and promotion. Internet banking is still not diffused in the society. 'Dealing with the government' is also not developed through Internet. This can be attributed to an ignorance of the service availability online, an attachment to the old methodologies or lack of qualified personnel. In contrast, the item 'information from government' has bigger percentage, which confirms that information seeking is still the main usage of Internet.

The business sector in Egypt lacks the incentive to invest in ICT. There is no enough awareness of the financial benefits of ICTs' applications or of their potential uses in various sectors of activity. And since SMEs constitute the majority of this sector, they should be targeted by the public policies and by the business sector. A good example of targeting SMEs is Oracle Company's strategy. The company is forecasting that SMEs would emerge as the main drivers of Egyptian applications' spending, and is promoting a tailored approach to the

SMEs community. ICT usage in e-commerce can help SMEs to market their products and services. Participation in open source innovations can play a role in developing local innovation and in deepening local experience. Those usages need to be developed.

With further competition in the sector, it is envisaged that the local user would have bigger room to influence the market. It would have been very interesting to have data about users' innovations of the two users' categories presented above; in term of new products, processes or usage, which shall play a role in diffusing ICT. But this data, is not available. However, the government role as a user analyzed below showed how users' innovations from the R&D literature perspective can help spread the technology.

The Government

E-government means the strategic, coordinated use of ICT in public administration and in political decision-making. It is expected to lead to greater efficiency of the institutions concerned, improvements in public services and political participation and transparency (Von Haldenwang, 2004). However, there is the risk of the 'digital divide' between those who have and those who have not, which might increases the already existing disparities in ICT diffusion within the population. It would be possible to achieve in a developing country the same level of efficiency and flexibility achieved in developed countries' e- government applications, if governments are willing to decentralize responsibilities and processes, and if they start to use electronic tools (Basu, 2004).

Many projects are in place to implement e-government initiative. To give some illustrative examples, the Egyptian post authority (EPA) has offices all over the Egyptian territory. That is why EPA is considered and used as a gate for many IT applications. EPA main centers in Cairo and Alexandria have been modernized. It has conducted many PPP; it has joined the international financial system network, and undergoing a twinning approach project with France la Poste. Another initiative is to procure and install Enterprise Resource Planning Systems in Egyptian ministries. The package includes payroll, accounting, budget, personnel, inventory and procurement systems, to be followed by document management and electronic archiving. The system shall reduce bureaucracy and costs of government administration. Although the law for electronic signature was issued, high cost of banks' cards issuance, of banks' fees, and the challenge of stimulating people's awareness and acceptance of the new method makes the application in electronic payment difficult. In 2003, unified central bank law was issued, requiring that the Egyptian Banks modernize their electronic systems. In response to this development, HP will deploy a data and disaster IT solution for the Central Bank of Egypt, which is a pioneering deal in the Middle East. Meanwhile, Egyptian IT services' group Raya Holding is establishing a Banking Service Unit. The e- government applications opened new business opportunities in the market.

E-government application's main obstacles are the highly centralized administration and responsibilities in Egypt, the difficulty in reaching rural areas' citizens, the cost of applications, and people acceptance for the new system. When we think about e-government, indeed we suppose that it helps spread ICT nationwide. The government is one of the users of

the technology, and its usage leads to further usage for the other actors as ICT applications become their interface with the administration, it can be claimed that it has a multiplier effect. Interviews with e-government officers in Egypt revealed that the government's role does not stop at this point; the government was an innovative user.

The term 'innovate' definition is different in the R&D literature from its definition in the diffusion/adoption literature. In R& D it means to develop a new product or process. In the diffusion/adoption literature it refers to the 'timing of the adoption of a new product or process' both definitions concern individuals and organizations (Morrison et al., 2004).

Although the article context is within ICT diffusion, it will now move to the R&D literature definition. Many users invent, they develop and modify products for their own use.

Forary (2004) argues that users are at the center of knowledge production. In his opinion one of the major challenges managers face is to capture the knowledge being generated by users 'online' during the process of doing and producing, and to integrate it in knowledge created 'offline' in laboratories.

Innovativeness is concentrated among lead users and there innovations are often commercialized. von Hippel (1986) identified two characteristics of 'lead users': first, they are at the leading edge of an important market trend(s). Consequently, their current needs will be the future needs of other users in the considered market. Second, they anticipate relatively high benefits from obtaining a solution to their needs, and so many of them innovate.

The Ministry of Finance of Egypt has undertaken a plan to automate financial units nationwide, and to connect major financial units to their affiliates. This project, which began in 2005 and shall end in 2010, would increase efficiency by providing advanced technical tools for calculating the cash flows and the financial position of the government.

This plan resulted into designing a simplified computer by a local national designer to be used for transactions' settlement. The local national designer and developer didn't find decisive R&D foreign subsidiary, in Egypt with whom they can cooperate in order to get the samples done in the affiliate. Thus, the samples were produced abroad and then developed by local national companies. This raises the question about the role of foreign subsidies within host economies and in the innovation process of the Multinational Enterprise.

This example shows us that the government was an innovative user, who like theory predicts perceived a benefit in innovating in term of cost, and efficiency. The new design has no storage capacity; only a compact flash and an operating system. Thus, it reduces heavily the cost of acquiring 'computers' for financial units. It takes the form of a laptop in areas where electricity is not stable and the form of a desktop elsewhere, thus avoiding electricity shortage in some areas in Egypt. Hence, it will help to spread the e- government service in more financial units than it would have been the case with a standard computer. Besides, it is easier to use and training for employees would be faster. The government can be an innovative user who has the tools to get its innovation produced and maybe commercialized. In our example,

the foreign investor who produced the samples was willing to commercialize the locally innovated design.

The government also introduced new usages in the market. There are projects to digitally document Egypt's Heritage. For example, the Center for Documentation for Culture and Natural heritage developed Eternal Egypt website in cooperation with IBM to create an interactive multimedia experience of Egyptian cultural artifacts, places and history. Eternal Egypt received the World Summit Award November 2005[23]. There are also projects to digitize the Egyptian Philatelic Museum and to produce watermarked high-resolution digitized images for the National Library and Archive. Another initiative in place that would help keep the Egyptian dialect easily understood within the Arabic world as it was before the era of digital competition, is to create a database for theatrical work, to establish a digital library for Egyptian radio and television production and to scan Egyptian books.

Those initiatives not only help Egypt keep its historical position in some domains, but also it have created new jobs and have introduced to the Egyptian market new notions of specialization like e- documentation.

Conclusion

ICT diffusion in Egypt is below the MENA region average. Disadvantaged areas which embrace the majority of the population are not benefiting enough from the projects in place to diffuse the technology. Besides, SMEs which constitute the majority of the business sector need to be empowered. Without addressing those two segments, Egypt's ambition to have an 'Access for all' ICT sector can't be achieved.

Within household, low income and illiteracy or English language ignorance challenge ICT diffusion. Concerning the business sector's adoption; finance, the level of education of the personnel, lack of awareness and of incentive constitute the main obstacles. Usages need to be developed concerning e-commerce and open source innovation which can help develop SMEs business. E-government will generate further adoption within the society, however it is not an easy task to get the people accept the new methods, to decentralize, to reach rural areas and to finance the mission.

ICTs have particularities that make the diffusion process within the society go beyond the traditional role of the different actors. In the ICT sector the producer is investing in training his future customer which is a phenomenon hardly found in another sector. In a country that didn't have much experience in PPP, the business sector has played a significant role in diffusing the technology. However, the ICT business sector potential role is not fulfilled. This requires supporting SMEs as a priority, and supporting low skill innovations that respond to the poor population necessities. This can be realized through encouraging and supporting open user centered innovation approaches. In addition, there is a need to develop mechanisms

[23] It is a global competition for selecting and promoting the world's best e-content and applications, held in the framework of and in cooperation with the World Summit on the Information Society.

that allow feedback from users to policy makers and to producers, which will result in further innovation and more adequate solutions to local needs, thus further ICTs' diffusion. Moreover, with further liberalization of the sector the user will be more capable of influencing the supply side.

The government is no longer only a policy maker; there is a new role that was generated by being a user of ICT in e-government applications. The government can be an innovative user who can help spread the technology on a wider scale through innovating cost effective solutions. Besides, the e-government application can introduce new specialties in the market. However, the policy maker main responsibility still is to have the ICTs reach disadvantaged areas, and to support local innovation.

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