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Information Technology Dissemination in The Arab World: Survey Study of Constraints and Limitations

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ABSTRACT

It is very clear that the whole world is living new era of its age that is called Digital Economy in which everything, almost, is based on innovative ideas, cutting edge technology, and knowledge of power. Modern tools (smartphones, iWatch, iPod, and GPS) that are based on the Internet is becoming dominant in our day-to-day life covering most of our life aspects. In comparison with other nations on the planet the Arab world (22 countries) is lacking behind in the field of information technology amongst other domains based on several measurements and various analysis. This research aims to highlight constraints and limitations that are causing the Arab world behind other nations in the domain of information technology usage, implementation, deployment and dissemination. So many billions of dollars have been spent in IT without achieving the planned objectives neither in human resources nor at the level organizations development. This situation should alert decision makers and community leaders to assign more attention to the fast-moving world in-order-to "jump in the wagon" of IT towards satisfying prosperity and progress in the Arab world. [1] says it is ironic that a small set of countries represent only 20% of the people's population controls more than 90% of the scientific research production.

Key words

Arab World, Information Technology Dissemination, Scientific Research, Arabic Language

1. INTRODUCTION

The issue of IT diffusion in the Arab world could not be addressed alone apart from scientific research because there is no sufficient formal statistical information about IT in public reports that could be referred to as official source of information. In addition, the IT domain is an empirical area that needs to be addressed like other branches of science, engineering, and medicine. IT is unique in various aspects in term of implementation and spreading within any country. All stakeholders are contributing to its success or failure and every participant has its own weight that affects the progress of the IT dissemination. Government bodies are enforcing regulations and standards (ISO, CMMI, PMI), universities are qualifying human resources working in this field, staff unions are monitoring all stakeholders to maintain the balance between its participant and

others bodies (like government and companies) and finally the companies that are running computing projects in the country to satisfy private or public objectives. In some situations, the communication infrastructure is run by an independent body which adds one more player on the scene of IT implementation. As we can see, information technology implantation is unique field that is affected by several stakeholders and is sensitive to any major change of these stakeholders. Because of the above facts, we need to identify some facts about scientific research since it represents the umbrella of the IT among other scientific disciplines.

2. FINANCIAL SUPPORT ON SCIENTIFIC RESEARCH(R&D)

There is no doubt that scientific research in the Arab countries has witnessed reasonable improvements since 1970s till now which gives clear indication that there is a good chance to get promising improvements in this direction. The question that should be raised is that: is it enough spending on R&D in comparison with other countries similar in population and/or Global Domestic Production (GDP)? Table 1 published by UNESCO shows percentage of spending on scientific research compared to the GDP in two specific years [2].

Table 1:Percentage of spending on R&D against GDP

Year	Country	% of the GDP
1999	Egypt	0.40%
	Jordan	0.33%
	Morocco	0.20%
	SAR, Lebanon, Tunis, KSA	0.10%
	Israel	2.60% ($ 2.5 b)
2004	All 22-Arab countries (average)	0.30% ($ 1.7 b)
	Israel	4.7% ($ 9 b)

As per [3] the International World Bank report, the number of published researches of GCC 6 countries in 2014 reached 18,030 paper in comparison to 28,917 researches published by Sweden in the same year as shown in Table 2. It is worthwhile mentioning that GCC countries population is five times Sweden, as shown in Table 2, the number of researches against population shows major gap between the two sides. Furthermore, number of researches in South Korea is almost three times of GCC countries in 2014-2015 which indicates a major difference between the two communities. One good example of research centres achievements is FireEye Inc. in Singapore research centre. This centre is delivering trained innovators in the field of information technology and cooperation with all interested and innovators in this field [4].

Table 2: Number of published researches in 2014-2015

Year	Country	No. of published researches	Population in million
2014	GCC (6 countries)	18,030	51
	South Korea	59,870	50
	Turkey	30,624	75
	Sweden	28,917	10
2015	GCC (6 countries)	18,688	51
	South Korea	56,903	50

3. LIMITATIONS AND CONSTRAINTS

The research is distinguishing between limitation and constraint terms in certain way. Limitation is a restriction that needs huge amount of efforts -at the level of a country- to get it resolved or mitigated. While the constraint is a lesser restriction in term of significance comparing to the limitation and it is this kind of fact that needs personal and community effort to overcome it. To make it more clear, Israel-Arab conflict can be classified as a limitation while lack of financial resources is an example of constraint. Some critical areas that generates several types of restrictions in the Arab world and need to be addresses is general education, human development, and supporting scientific research institutions side-by-side with democracy and human rights. In the following paragraphs, the research will display its core idea at the current situation of IT industry in the Arab world lacking behind. These restrictions vary in degree of significance and they apply in different degrees in each Arab country but they are common to most, if not all, countries.

4. LACK OF RELATIONSHIP BETWEEN INDUSTRY AND RESEARCHES (LIMITATION).

In general, the Arab countries lacks well-defined objectives and means of scientific and technological policy, lack of information industry, there is no information networks and devices for coordination between the institutions and research centres, and there is no specialized fund assigned for research and development (R&D). Due to the latter fact of spending on scientific research, including IT as the leading trend in the world of digital economy, it is painful fact that what is spent on scientific research in the Arab world is very weak and could not be compared to what big countries are spending in term of percentage and not amount. One further problem is that spending on IT research is funded by governments in the Arab word in a major fashion (like %80) while private sector, beside other non-profit bodies like the United Nation, is taking the rest of spending [2]. The picture is opposite in the developed countries where we can easily see that private sector is leading major funding on IT projects (%80 part) such as in Japan [5].

These facts are leading into having low level of scientific research tangible outcomes and lack of contribution to the country economic development. Countries like India, where IT is contributing by 5% in the GDP [6], and Israel are concentrating a lot on IT industry and they consider IT as a major element of their local income. The other negative result is the migration of IT workers from the Arab world to the developed countries seeking better chance of life because of the above-mentioned reasons.

Some government initiatives in Qatar and Jordan (cooperation between Jordan Education Initiative and World Links initiative of World Bank) have applied recommendations using technology information and communication in computer lessons for all grades of primary to secondary education [7]

such ambitious initiative is strengthening the relationship between student and his career and when it is the right time for making important decision, the student will be equipped with ICT knowledge to strive in future.

5. WEAKNESS OF THE IT INFRASTRUCTURE AND COMMUNICATION (CONSTRAINT)

IT Infrastructure deficiencies in the Arab world are: not keeping up with modern trends, communication cost, and not having enough research efforts to link research and development community (such as innovation centres, industrial incubators) as mentioned by the Arab Knowledge Report Index for 2015 published by the UNDP [8]. One of the impacts of this restriction can be seen in the weak of investment in the IT sector at the level of each country individually since it varies between countries. Estimates in this area may reach 15 b which is relatively small number of the Arab world comparing it to other less rich countries. One of IT related issues to infrastructure is the lack of intellectual property laws and regulation which keeps some investors

hesitated to invest since they are not sure about the way they can protect their products specially in the software domain which is prone to be hacked, somehow, easily [9]. If human resource (HR) is considered as an element of infrastructure, there is a huge gap between requirements of HR and the qualifications, technical skills, experience required for the companies and governments. This latter issue can be resolved by global work of academic bodies, government, and staff unions. The world is moving faster and faster towards adopting the 4G communication technology while some elementary communication service has not reached tens of millions in the Arab world extending the Digital Divide more and more between those people and the rest of "connected people". One of the obstacles in the field of expanding IT implementations is to overcome traditional wired telephone networks and to depend more and more on wireless technologies including satellites technologies (VSAT), microwave towers, and WiMAX to reach remote areas and to overcome geographical barriers in huge countries such as KSA, Western Sahara and Algeria. One further aspect related to HR is the lack of balance of needs between HR and equipment. Although there is not enough reports and statistics about the comparison between those two needs, it is very clear from practical experience that organizations are willing to invest in hardware purchasing while saving money on training and qualifying HR. The government support of providing free-access of the Internet, or very cheap, is a strategic decision that radically improves the IT-oriented knowledge levels in the Arab countries and it is certainly an important option as free education and free treatment.

6. LACK OF SECURITY AT VARIOUS INSTALLATIONS AND FEAR OF ATTACK (LIMITATION)

Several statistics around the world is showing that security breaches are causing financial losses that may exceed billions of dollars on annual basis. Arab world is not an exception where governments and citizens are victims to these attacks just like other countries. Due to several other Arab-related factors (culture, illiteracy, lack of freedom), this constrains is causing people to be more hesitated in the direction of IT embracing. These attacks could be virus attack, malware, spyware, and causing victim installations to break for some time causing financial damages. One famous example of virus attacks has occurred in KSA in 2013 in which 30,000 PC was halted due to virus attack. No detailed report was issued in this accident to identify the entire situation.

7. THE INTERNET PENETRATION RATE AND THE NUMBER OF THE USERS(CONSTRAINT)

Table 3 shows the position of the Arab world among other languages since Arabic language is only used in the Arab world countries. Despite the highest growth rate in the Arab world, the percentage of Arab speaking Internet users is still low (4.7%). By comparing the Arab world against Japan or

Germany we will see a major difference in the Internet penetration rate, as an example. These figures give clear evidence that the Arab world is still suffering from the Digital Divide considering other relevant facts such as that the Arabic language content on the Internet is weak if we compare it to other languages [10]. Let us give explain the figures related to the Arabic on the Internet as shown in the Table 3. There are 168,426,690 Arabic language speaking people using the Internet, which represents 4.7% of all the Internet users in the world. Out of the estimated 388,332,877persons that speak Arabic, 43.4% use the Internet. The number of Arabic speaking Internet users has grown 6602.5% in the last 16 years (2000-2016).

Table 3: Number of Internet Users by Language, Top Ten Languages Used in the Web - June 30, 2016 [11]

TOP TEN LANGUAGES IN THE INTERNET	Internet Users by Language	Internet Penetration (% Population)	Users Growth in Internet (2000 - 2016)	Internet Users % of World Total (Participation)	World Population for this Language (2016 Estimate)
English	948,608,782	67.80%	573.90%	26.30%	1,400,052,373
Chinese	751,985,224	53.10%	2227.90%	20.80%	1,415,572,934
Spanish	277,125,947	61.60%	1424.30%	7.70%	450,235,963
Arabic	168,426,690	43.40%	6602.50%	4.70%	388,332,877
Portuguese	154,525,606	57.90%	1939.70%	4.30%	266,757,744
Japanese	115,111,595	91.00%	144.50%	3.20%	126,464,583
Malay	109,400,982	37.80%	1809.30%	3.00%	289,702,633
Russian	103,147,691	70.50%	3227.30%	2.90%	146,358,055
French	102,171,481	25.90%	751.50%	2.80%	393,892,299
German	83,825,134	88.30%	204.60%	2.30%	94,973,855
TOP 10 LANGUAGES	2,814,329,132	56.60%	848.40%	77.90%	4,972,343,316
Rest of the Languages	797,046,681	33.70%	1141.00%	22.10%	2,367,750,664
WORLD TOTAL	3,611,375,813	49.20%	900.40%	100.00%	7,340,093,980

8. LEVEL OF ILLITERACY AT THE ARAB WORLD COUNTRIES (LIMITATION)

Official sources of ALESCO [12] have expressed concerns on Sept,8,2016 (International Literacy Day) that number of illiterate people at the Arab world has reached 54 million persons in 2015. This huge figure represents 14% which does not represent real progress in this direction if we considered the fact that Arab world population reached 392 million by the end of 2016 as per World Bank information [13].

9. LACK OF STRATEGICAL COOPERATION BETWEEN PUBLIC AND PRIVATE SECTORS (CONSTRAINT)

One of limitation that could be avoided is the lack of strategical cooperation relationship between those two sectors. It is a reality that private sector in the developed countries is driving the IT revolution and drawing the future of this industry. Examples are too long to count, but easily can mention the big names in the IT industry, but not limited to, Microsoft, Apple, Samsung, Dell, …etc. Private sector is leading major funding on IT projects (%80 part) such as in Japan (Thanet, 2004). One further aspect that should be attended is the partnership with international companies in the IT industry to learn from their experience and experts. During the period 2003-2009 Ministry of Education in Jordan established strategical partnership with private sector

(Microsoft dealer) to provide training for its 90000 teachers over seven years between 2003 till 2009 [14]. In response, the government decided to implement international copyright laws for software which benefited Microsoft.

10. LIMITED LOGISTICAL SERVICES (CONSTRAINT)

Services provided by the host government, such as shipping and marketing, could be a limitation that may cause the IT industry to be more expensive and difficult to market. Examples are: import and export fees, production costs, taxes on IT-related products and services, low competitive ability, copyright laws. Companies in the developed world are investing in countries like India and China because those countries, as an example, are acquiring human resources and basic raw material which make software and hardware products manufactured their more competitive and easy to promote at other countries. To overcome this limitation, local governments should continuously review regulations in this regard to make them more agile and adaptive to serve IT companies. More modern services should be established, again, by local governments to help IT companies establish advanced projects in this regard. United Arab Emirates and Qatar are progressing very well in this direction as reported by [4]. These services should an integral part of a comprehensive network and based on long-term vision towards investment and technological solutions where e-government is considered as the corner stone of this direction. The logistical obstacles for shipment and that provide a business and investors IT industry a lot of time and money, and make them more competitive with strong global companies, and added that the high production cost for such industries may be one of the obstacles, especially with a lot of draws specialized in the field of IT industry known international companies to their labour permits countries, the availability of raw materials for these industries on its territory to ease the cost of productivity and competitiveness [4].

11. LACK OF SKILLED HUMAN RESOURCES

At the level of each country, ministries and other high-level authorities are required to have proper plans to qualify youth of both genders to be sufficiently skilled and equipped with knowledge to face modern challenges at current times of marketing and competitiveness. Malaysia is a good example of countries that have created more than 41,000 jobs were provided by Multimedia Development Corporation (MDC) during1996-2005 [15] by establishing Multimedia Super Corridor project which was established by MDC in 1996 [14]. Jordan is an example of good performance in this regard since ministry of education has provided ICDL training for 90000 teachers over seven-years plan to qualify them for new curriculums via the cooperation with Microsoft

dealer in Jordan and World Bank during 2003-2009 and it has positively affected the performance of HR at the country level [14].

12. LACK OF INTEGRATION OF IT AND EDUCATION PROCESS

School education should be IT-focused to make use of modern technologies to improve various level of education starting from KG-level up to higher education. This trend should be applied on all parties of education i.e. student, book, and mentor so that the entire process of education is computer-oriented. It was found at some surveys that computer literacy heavily affects (positively or negatively) the amalgamating of computer with the computer teaching at school. The computer subject must not be an "isolated" course at the school and being an independent area of the computer teacher. The process of digitizing should address all topics taught at school wherever is possible such as math, science, and English language to create new ways of thinking and learning between students and to change old fashion paradigm which assigns the teacher as the only source of information.

New paradigms of education such as distance learning, virtual universities, and web-based training and education are clear proof on the collaboration between education and IT industry [14]. In this regard, it is very important to encourage mentor at the first step to embrace the technology through training, coaching, and mentoring and through other incentives like promotion chances and rewards. At the student side, school and family should work together to help accepting new trends of IT. If the teachers' level (and other co-workers such as head teacher and supervisor) of IT illiteracy is low or weak the receivers of education i.e. students will be negatively affected.

13. LACK OF INTER-COOPERATION BETWEEN ARAB COUNTRIES IN THE IT

Experiments are not sufficiently shared between Arab countries and lessons learned were not utilized which means several losses of resources due to this absence. Arab countries have so many common factors between its citizens and local experiments can be of a great value if they are shared and exchanged properly. The exchange of experience and experiments across Arab countries saves money, efforts, and decrease illiteracy. It should clear to all involved parties at the level of policy makers that investment in IT would lead to more productivity and innovation.

14. LACK OF FINANCIAL AND ADMINISTRATION RESOURCES AT THE ARAB COUNTRIES IN THE FIELD OF SCIENTIFIC RESEARCH.

Installation of IT projects requires a lot of expenses on computers, cabling, networking, cooling, furniture providing, maintenance, training…etc. This is not common problem for Arab countries since some Gulf countries are not suffering this constraint. Some poor countries like Jordan have taken the help of World Bank (initiative of World Links) and Microsoft to overcome this issue. Other entities such as the United Nations agencies may provide projects in this regard and relief the local government financially. Using modern technologies can easily save expenses such distance learning and hiring developers at lower costs from countries like China and India. Simulation of several activities using computer labs can also save some expenses if properly utilized at various locations and implementation of IT industry [16]. Admin problems may appear in budget planning and allocation of resources, responsibilities and authorities between different parties. One more technical fact is the short age of the computer equipment which costs more expenses in the hardware equipment. This later limitation can be easily avoided by implementing modern techniques that adopts thin-client technologies in this regard. There several international non-profit agencies that are providing programmes to support developing countries to overcome their problems in the domain of IT and to minimize the digital gap between poor and rich countries. To name few examples, USAID (United States Agency for International Development), UNESCO (United Nations Educational, Scientific and Cultural Organization), UNRWA (United Nations Relief and Works Agency), World Bank (World Links programme in 1997), JICA (Japan International Cooperation Agency) from Japan, and CIDA (Canadian International Development Agency) from Canada.

15. LACK OF IT-ORIENTED VOCATIONAL EDUCATION

Local Arab market has lots of academic institutions that qualifies youth of both genders in computer related majors such as computer science specialists and information systems workers. At some countries like Egypt and Jordan they have a problem of un-employed graduates in these theoretical majors due to the imbalance between "supply and demand". If we look at the vocational side of IT-oriented education, we will find a very small number of colleges that qualifies youth in this business line. Some of the reasons are culture-related and lack of awareness of the important significance of these jobs. Because of this limitation, Arab countries are depending on other advanced countries, such as India and Philippine, in this regard to fill in this gap which increases level of dependency on others in the IT domain.

16. ABSENCE OF ELECTRONIC PUBLICATION

The absence of electronic publication and activation in the Arab world to activate the scientific research, in the Arab world, and the dissemination of science and culture, is something that should be established and take appropriate decisions in it, and any delay harms the Arab world IT diffusion. Achieving this goal cannot be attained by the efforts of individuals, but to be productive cooperation between all relevant institutions of the Arab governments. It could be achieved by several means such as group-based committees, councils, institutions. The goal is to form a strategy and productive effort that produces tangible service accessible by the Arab citizens. There are several international experiences in the developed countries (USA, UK) and third world countries in this regard. American experiment in this regard is very well established and internationally recognized since it is providing several scientific databases for free access. Some of these databases are: MEDLINE, ERIC, AGRICOLA, UNCOVER, IEEE, and Elsevier. UK has provided full access for its famous all sciences inclusive bibliography BRITANICA. The last example is from Brazil in which the government has provided full access to 100 scientific journal in one unified format.

17. CONCLUSION

This research has explored set of limitations, constraints, and obstacles that encounter IT dissemination in the Arab world. The purpose of this research is to highlight these challenges for the decision makers, planners, and strategic analyst to solve as much as possible these challenges partially or completely.

REFERENCES

[1] A. M. Cetto, "Democratic Approach to Electronic Publishing in a Non-Democratic System," in *ICCC/IFIP Third Conference on Electronic Publishing*, Ronneby, Sweden, 10-12 May (1999) pp. 318-326., 10-12, May, 1999.

[2] M. M. Yaqout, "Arab scientific research: constraints and challenges," 14 Sept 2011. [Online]. Available: https://translate.google.com.sa/translate?hl=en&sl=ar&u=http://www.mawhopon.net/%3Fp%3D4683&prev=search.

[3] M. M. Al-Rabban, "Strengthening the Gulf Cooperation in Scientific Research and Development and to link the results of Economic Development," 11 April 2016. [Online]. Available: http://www.arsco.org/detailed/8d41cec1-997c-4c64-a193-8ea2dbd7348e.

[4] A. Kurds, "Shipping and Marketing the most prominent obstacles to the information technology industry," Al-Raya

newspaper, dated 29-Dec-2014, Qatar, 2014.

[5] A. Thabet, "Aspects of the Arab-Israeli conflict and its fields," 10 March 2004. [Online]. Available: https://translate.google.com.sa/translate?hl=en&sl=ar&u=http://www.aljazeera.net/specialfiles/pages/853B454B-A3B3-4705-A41B-4ABBD5540589&prev=search.

[6] P. Oostreviius and J. Bozeman, " India's economy .. and future role in the new world order," 11 Nov 2012. [Online]. Available: http://studies.aljazeera.net/ar/files/2009/2011721124925484524.html.

[7] UNESCO, "ICT in education in five Arab countries: comparative analysis of the integration of information and communication technology and e-readiness," April 2013. [Online]. [Accessed 31 Dec 2016].

[8] B. Al-Qhadi, "Read in the Arab Knowledge Index Report," 7 June 2016. [Online]. Available: https://translate.google.com.sa/translate?hl=en&sl=ar&u=http://www.arsco.org/detailed/80d1a0ab-7842-4c1e-ab9b-7445ddbb2c1f&prev=search.

[9] "www.siironline.org," 25 Dec 2006. [Online]. Available: http://www.siironline.org/alabwab/derasat(01)/301.htm. [Accessed 31 Dec 2016].

[10] S. Y. Omri, "Impediments to the flow of electronic information in the Arab world,," *Cybrarians Journal,* p. Issue 11, Dec 2006.

[11] IWS, "INTERNET WORLD USERS BY LANGUAGE - Top 10 Languages," 30 June 2016. [Online]. Available: http://www.internetworldstats.com/stats7.htm. [Accessed 31 Dec 2016].

[12] alecso, "www.alecso.org," 19 Nov 2016. [Online]. Available: https://translate.google.com.sa/translate?hl=en&sl=ar&u=http://www.alecso.org/site/2015-04-14-11-43-16/355-%25D8%25A8%25D9%258A%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%2580%25D9%25.

[13] World Bank, "http://data.worldbank.org," 19 Nov 2016. [Online]. Available: http://data.worldbank.org/indicator/SP.POP.TOTL. [Accessed 31 Dec 2016].

[14] UNESCO, "Narrowing the gap between the information rich and the information poor: new technologies and the future of education," 10 Aug 2001. [Online]. Available: http://www.ibe.unesco.org/International/ICE/46english/46ws6e.htm. [Accessed 31 Dec 2016].

[15] G. Joha, " Jordan to kick-start new IT ventures with Malaysia," 29 April 2001. [Online]. Available: http://www.1stjordan.net/content/archives/biz0429a.html.

[16] G. Mark, Integrating Technology for Meaningful Learning, Boston, USA: Houghton Mifflin Company, 2001.