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BARRIERS TO ICT ADOPTION IN QUALITY OF ENGINEERING RESEARCH IN LIBYA: HOW TO BRIDGE THE DIGITAL DIVIDE?

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ABSTRACT

This paper aims to identify the barriers to the adoption of ICT in Quality of Engineering Research, and how to bridge the "Digital Divide" at Tripoli University through effective ICT implementation. The authors study the global digital divide with emphasis on the disparities in Information Technology between developed countries and Libya. It is obvious that effective ICT implementation should focus on understanding individual faculty needs. Then a thorough investigation is conducted in relation to the importance of implementing electronic education at Libyan universities, and of including faculty members in every step of the planning and implementation of up-to-date technologies, as well as the challenges and solutions of ICT implementation. This paper presents the factors that affect Internet use by staff members; how the Internet affects research and teaching; what the main purposes are for using Internet resources, and the level of Libyan research into IT development and implementation.

Keywords: Electronic education; technology transfer; ICT gap; digital divide.

1 INTRODUCTION

Miniwatts Marketing group (2011) published the results of Internet usage statistics for Africa, which show that 5.7 % of users in Africa and 5.4 % of users in Libya were subscribers. In the case of Libya, an Internet subscription is often used by several members of the household, by clients of cybercafés, and by visitors to libraries. The main restrictions to Internet use are relative poverty; poor quality of Internet services due to infrastructural shortcomings; low Internet bandwidth; unreliable electricity supply and outdated end-users (Al-Kahtani et al., 2005). These problems pose serious limitations and frustrations for African users, including those in Libya. Internet access officially came to Libya at the end of 1998, but it was not widely available until early 2000. Internet penetration at that stage remained low, at around 3.8%, but had increased by 2011 to about 5.4 % (see Table 1). The primary means for people to connect is through Internet cafés. The state-owned General Post and Telecommunications Company (GPTC) regulates and operates Libya's telecommunications infrastructure, and owns and operates the country's primary ISP, Libya Telecom and Technology (LTT), which offers Internet services via dialup, DSL, broadband, and satellite. At least seven other companies are licensed but are effectively subordinated to LTT, as LTT maintains a monopoly over the country's international Internet gateway. In October 2006, the Libyan government reached an agreement with a non-profit United States group, One Laptop per Child, to develop inexpensive, educational laptop computers, with the goal of supplying a machine to every Libyan schoolchild by June 2008. As the country contained only 130,000 computers in 2002, this promised to be a major boost to the availability of information communications technology (ICT) technologies and the Internet. Kenan (2009) points out that, thanks to the recent oil boom, Libya has one of the highest budgetary surpluses and one of the lowest government debt levels worldwide. Libya has now embarked on a process of economic reform and the list of challenges to be addressed is long, particularly the low penetration of the latest technologies to improve the overall level and quality of education. Table 1 shows the growth of Internet usage in Libya and countries near Libya.

Table (1): The growth of Internet usage in Libya and adjacent countries 2011. (www.Cia.gov**.)**

It is not possible to discuss the Internet in Libya and adjacent countries without considering the state of its applications, including the number of ISPs, and the cost of Internet access. The LTT monopoly in Libya raises the cost of Internet connection and, to some extent, exacerbates the deterioration of the service. Many Arab governments, for political reasons, create a monopoly in the ISP market by preventing new firms from entering the market, for example by control of licences (Hanouz & Yousef, 2008).
Another reason why Internet costs are high and connection speeds are low in Arab countries is because Internet service providers are not allowed to provide their own international gateways. Table 2 shows the number of Internet providers in each country.

Table (2): Internet service providers in countries near Libya (Elzawi, 2008)

2 LITERATURE REVIEW

Hamdy (2007) mentions that several indicators can be used on a global scale to determine the digital divide between countries. Hamad (2006) points out that generally, research projects within Libyan universities aim to satisfy academic requirements (students' certificates, job promotion, etc), but have not begun to address the real needs of society.

Porter and Yergin (2006) present the conclusions of the Libyan business executive survey/global competitiveness report (LBES/GCR). Libya has the rank of 97 (out of 111 countries) in university/industry research collaboration. The usefulness of research activities could be increased by employing innovative models for the creation and use of content, as well as the production of knowledge-based products, such as software.Al-Kahtani et al. (2005) note that increasing the use of the Internet will support the development of researchers in transdisciplinary areas, as well as entrepreneurs, in stimulating the growth of alternative approaches to digital copyright. Porter and Yergin (2006) formulate several research questions to be considered over the next five years:

What new models for the publication of academic and scientific journals and alternative IP licensing schemes (i.e., creative commons) are most appropriate for African development including Libya?

What is the impact of new Digital Rights Management technologies on access to digital content in Libyan universities?

Digital Divide of ICT in Libyan Education:

The Libyan national ICT policy for education aims to provide access to ICT tools and build a strong infrastructure. It also promotes research and development to ensure the provision of suitable learning. One of the main objectives of the national ICT policy for education is human resource development, and investment in human resources is the key factor to achieving the goals and objectives of the national ICT strategy. In 2005, UNDP and UNESCO worked hand in hand with Libyan government agencies to ensure the appropriate and timely implementation of the ICT strategy. This support also opens the door for the partner community and encourages investment in Libya. Libya has faced a number of constraints and challenges. Therefore, the implementation of the ICT policy is still at an early stage, as is access to ICT tools and the implementation of the national ICT policy, and development projects in different domains still lag behind. The human development report 2007/2008 by the UNDP shows the effect of the digital divide on researchers in members of academic universities, by comparing the number of researchers per million from 1990-2005, as shown in Table 3. In addition, there is an acute shortage of qualified and trained ICT teachers, who are needed to bring ICT into classrooms and educate a new generation of technically qualified students (Hamdy, 2007).

Table (3): Number of Researchers (per million people) 1990-2005. (Source: Human Development Report 2007/2008 (UNDP)).

The concept of the Digital Divide has historically referred to the lack of physical access to important information technology such as computers and the Internet (Gorski, 2003). The digital divide is evident in Libya and negatively affects the ability of the population to use information technology. Libya experiences limitations in ICT access due to geographic factors, infrastructure, and educational limitations, along with a history of restrictively traditional cultural values. This process affects the experience and development of members of Libyan universities, which eventually affects students. This general problem evolves into a twofold manifestation, which includes limited research by staff members of Engineering Faculties, and a lack of understanding of the perspectives of these universities in the context of the digital divide (Napaporn, 2007). However, research can support the development of innovative models for the creation and use of content, as well as the production of knowledge-based products such as software (Aladwani, 2003). It will also support the development of researchers in this transdisciplinary area, and especially the interests of academics as well as entrepreneurs, in stimulating the growth of alternative approaches to digital copyright. Research questions to be considered over the next five years include:

What is the impact of new Digital Rights Management technologies on access to digital content? Also, where does Libya stand in terms of development and implementation?

3 RESEARCH METHODOLOGY

Yin (2003) has pointed out that surveys are generally part of a positivist approach to research. Although surveys have weaknesses (such as low response rate and possible ambiguities in the questions), the use of a questionnaire is considered to be appropriate in this case, due to the advantages mentioned by Al-Footah (2006) and Saunders et al. (2003):

- It is a highly economical research tool - a large amount of data can be collected easily and efficiently from a large number of members;
- The survey data collected from standardized questionnaires allows for easy comparisons and statistical analysis.

The responses have been analysed using quantitative and qualitative methods, by considering the issues of reliability, validity, bias and triangulation.

Findings:

The findings indicate the existence of a digital divide, but also suggest that the availability of digital content has helped to overcome the substantial divide in terms of scholarly information. The questionnaire was conducted to provide comments on the final survey (Elzawi, 2008). The pilot study gave valuable experience in using the Internet for academic research, and in contacting and communicating with the respondents to explain the purpose of the survey. The main results of this work can be summarized as follows:

- The ability to make alterations and adaptations that were deemed necessary.

- The decision to exclude engineering faculty non-academic employees from the final survey, in order to concentrate on faculty members. The postal survey strategy has been adopted to satisfy the objectives of the study, and the need for a large sample to carry out the data analysis.

The overarching finding was that there were three primary elements that affected the use of the Internet by the respondents: job requirements, self-perception, and the availability of technology. However, within these three fairly obvious elements were subtleties that provide thought-provoking consideration. In order to show the development of the findings, the analysis is presented here in a building block approach, starting with each of the major questions considered in the research.

Usage of IT Strategy:

This question aimed to discover whether faculties should have their own IT strategy, independent of the University IT strategy. Table 4 shows that 31.25 % of respondents agreed with having separate IT strategies, while the majority was in favour of having similar IT strategies at both Faculty and University levels.

Table (4): The faculty IT strategy should be independent from the University IT strategy.

Type of network:

Table 5 shows the responses to the questions on the type of computer network in the faculty.

Table (5): Types of networks.

These responses indicate a need for managerial support, a new strategy and economic support from the authorities responsible. Networking is of no less importance than computers / PCs.

Usage of the Internet:

Table 6 shows the responses to the question on the frequency of use of the Internet and its applications. One quarter of the staff, apparently, do not yet use the Internet, while just over a third use it frequently.

Table (6): Usage of the Internet (Elzawi, 2008).

The difference here is directly related to the differences in opinion regarding the function of the intranet and Internet, and the extent to which it is seen as serving a necessary role in research.Internet users per 100 inhabitants in Libya were 14 in 2009, and approximately 10.80 in 2010, according to an ITUestimate.

Weekly using of Internet:

Table 7 shows the weekly use of the Internet, in hours, by the respondents. Nearly one fifth of the respondents used the Internet for academic purposes for less than two hours a week. Only a quarter used the Internet for more than an average of one hour per day, and only two respondents (6.25%) were more frequent in their Internet use, with a minimum of 10 hours weekly. The relevant analysis showed no obvious gender difference in the amount of time spent on the Internet. Based on common sense, it could

be presumed that people with science backgrounds would spend more time on the Internet, but the data do not support this assumption. Table 7 also suggests that having a lower income is not an obstacle for members in surfing on the Internet, since some of the students spend more than 10 hours on the Internet each week. The data also exhibit the time spent on the Internet according to different subject areas.

Table (7): Respondents' weekly use of the Internet

Barriers which are most likely to keep staff from using the Internet.
To avoid future problems in the use of the Internet for research purposes, it is necessary to discover any likely barriers and take action to remove them. The responses to this question suggested fifteen factors that could keep staff from using the Internet for academic research purposes; these are:
1- **Lack of Internet access.** Twenty (62.5%) members considered the absence of Internet access in their institutions as being the primary factor which has prevented the faculty from using it.
2- **Lack of access to specialized online databases.** Seventeen (53.13%) indicated that not having access to specialized online databases was what was keeping them from using the Internet for research. Also, before 1998, members of universities in Libya were required to have individual membership of research websites such as Science Direct/Emerald's/Cambridge Journals online.
3- **Low speed of connection.** Twenty (62.5%) members suggested that having a low speed Internet access was what has kept them from using the Internet.
 4- **Quality of the information source.** This included factors such as: strategies for searching for information; the variety and availability of information; convenience of obtaining information; quality of information; unfiltered information; speed of finding information; newness of the information, and opportunity for updates).
5- **System availability.** Eighteen (56.25%) cited the lack of computer availability in their institution as the main barrier to their use of the Internet.
6- **Lack of encouragement and incentives from the educational institutions.** Fourteen (43.75%) members believed that not having encouragement or incentives from their institution was a barrier to their accessing the Internet.
7- **Lack of skill in the English language.** Twelve (37.5%) members indicated that not being proficient in English was one of the main reasons that prevented them from using the Internet.
8- **Field of study.** Thirteen (40.63%) members mentioned that they could find information sources in their field of study without the aid of the Internet.
9- **Unfiltered information.** Eight (25%) members indicated that unfiltered information from the government sometimes prevented them from using the Internet.
10- **Clarity and ease of use.** Thirteen (40.63%) members considered the Internet as a complicated and unclear source of information.
11- **Technical difficulties.** Thirteen (40.63%) members mentioned that the barrier to their Internet use was related to technical problems.
12- **Lack of interest.** Twelve (37.5%) members mentioned that not having sufficient interest to learn about the Internet was what was preventing them from using it.
13- **Social factors.** Eleven (34.38%) members mentioned that certain social factors prevented them from using the Internet. (Because the Internet is considered by a large proportion of the community as a source for finding prohibited information, some schools or universities place restrictions on use of the Internet.)
14- **High cost of Internet connections.** Seven (21.88%) members indicated that the expense of Internet connection was one of the reasons that prevented them from using the Internet.
15- **Lack of training, computer support and Internet skills**. Sixteen (50%) members indicated that lack of computer and Internet skills and training kept them from using the Internet.

4 Implications for future research

There are significant differences in the perceptions of Libyan academics as to the potential use of the Internet for research purposes and the likely benefits from Internet access. This paper proposes several solutions to reduce the level of resistance displayed by some members of academic staff to the wide use of ICT tools and the implementation of the national ICT policy. The primary conclusion from this study is that there are significant differences in the perceptions of Libyan academics as to the potential of using the Internet for research purposes, and the likely benefits of Internet access. Staff, such as members of the engineering faculty, who are focused on new knowledge, are less likely to see the Internet as a danger and more likely to see it as a powerful tool for work enhancement. What was somewhat startling was that none of the responses mentioned the Internet as a way to bypass the constraints of their culture. While several of the questionnaire respondents mentioned the use of the

Internet as a way of collaborating with colleagues, none specifically mentioned the ability to extend their work. It is clear that proficiency in the English language is necessary for effective use of the Internet, since most of the sources on the Internet are in English. This study offers an in-depth understanding of problems in utilizing the Internet, and the perceptions of the engineering faculty regarding the Internet. Technological solutions are not likely to be a quick fix for all educational problems and issues, since it is generally known that technological solutions do not significantly improve teaching methods. Therefore, the focus should be on adopting the right technological solution that fits the educational context and the faculty involved. Existing factors should always be considered as the starting point for making decisions about how technology, and more specifically the Internet, could be employed to improve teaching and research efforts. Faculties should be given the chance to participate in decision making with regard to the appropriate use of technology in their specific academic field.

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Table (1): The growth of Internet usage in Libya and the adjacent countries 2011.(www.Cia.gov.)

The Countries	Population (2009)	Internet Users Dec/ 2000	Internet Users, Latest Data (2009)	Population Penetration	User Growth (2000-2011)
Libya	6,324,357	50,000	353,900	5.4 %	3,44%
Tunisia	10,629,18	100,00	3,600,000	33.9 %	3,50 %
Algeria	34,994,93	50,000	4,700,000	13.4 %	9,30 %
Egypt	82,079,6	450,00	20,136,00	24.5 %	4,37%

Table (2): Internet service providers in countries near Libya (Elzawi, 2008)

Number of Internet Service Providers in countries near Libya		
Country	Number of ISPs	Example of ISP
Libya	1	Libya Net (www.libyanet.net)
Tunisia	5	Global Net (www.gnet.tn)
Algeria	11	Cerist (www.cerist.dz)
Egypt	38	Link Egypt (www.link.com.eg)

Table (3): Number of Researchers (per million people) 1990-2005.
(Source: Human Development Report 2007/2008 (UNDP).)

No.	Country	Researchers
1	Libya	361
2	Tunisia	1013
3	Algeria	..
4	Egypt	493

Table (4): The faculty IT strategy should be independent from University IT strategy.

Case	Frequency	Percent
Yes	10	31.25%
No	22	69.75%

Table (5): Types of networks.

Case	Frequency	Percent
Only one computer/PC	2	6.25%
Currently in process of networking	4	12.50%
No need for networking	0	0.00
Networking is too expensive	12	37.50%
Networking is unreliable	6	18.75%
Need to improve understanding	8	25.00%
Other	0	0.00

Table (6): Usage of the Internet (Elzawi, 2008).

Case	Frequency	Percent
Not used and no plans to use	0	0.00
Not used but plan to use within next 6 months	8	25.00%
Not used but considering it for the long term	0	0.00
Rarely	4	12.50%
Occasionally	2	6.25%
Quite often	6	18.75%
Frequently	12	37.50%

Table (7): Respondents' weekly use of the Internet

Cas e (hours used/week)	Frequency	Percent
0--2	6	18.75 %
2--5	17	53.125%
6 --10	7	21.875%
>10	2	6.25%