Factors Influencing the Adoption of RFID among Logistic Service Providers in Libya

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Abstract: *The Radio Frequency Identification (RFID) has been recognized as the most powerful technology in the 21st century. RFID is a way of improving the management and operation efficiency when used in industries of logistics, manufacturing, and public information services. The aim of this study is to propose a model of the factors influencing the adoption of RFID in Logistic Service Providers (LSPs) in Libya. The research model is developed based on the Technology-Organization-Environment (TOE) framework. It is hypothesized that cost and complexity (from the technological context), organizational readiness and top management support (from the organizational context), and competitive pressure and government support (from the environmental context) influence the RFID adoption. Data will be gathered using a quantitative survey directed to the senior executives of LSP companies in Libya. Ordinary least square regression will be used for data analysis.*

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Keywords: RFID, Logistics service providers (LSPs), Libya

1. INTRODUCTION

Keeping in mind the end goal to fulfill the expanding necessities of clients, numerous assembling organizations enhance their administration productivity by constant reception of data or computational advances (Mason-Jones & Towill, 1999; Sauvage, 2003). The importance of innovation as a competitive driver for organization is one of the key research areas in the Information Systems (IS) field (Battezzati, Miragliotta, & Perego, 2006). Technological innovation is widely acknowledged as an influential catalyst of business transformation and economic growth (Keating, Coltman, Fooso-Wamba, & Baker, 2010). As a result, many organizations are increasingly turning to emerging information technology (IT), such as Radio Frequency Identification (RFID) as a means of coping with such rapid changes sweeping their environment.

RFID has he ability to enhance efficiency, data collection and information sharing (Moberg, Whipple, Cutler, & Speh, 2002). The application and administration of RFID as a new innovative technology has significantly improved the productivity of Libyan organizations. To fulfill different necessities of customers, organizations, such as manufacturing companies, enhance their service proficiency by using RFID. The RFID has the capacity to enhance the speed, accuracy, and visibility of data sharing border system in supply chain, which can lessen inventory expenses and enhance client services (Moberg, 2004).

A number of large of manufacturing, retailing, health care, and other organizations have some ongoing project(s) related to RFID technology. For instance, CHEP (a pallet and container pooling services company) implements RFID at its facilities across Europe to track returnable goods for the automotive industry in 2008 (Wessel, 2008). According to ABI Research (RFID World, 2012), it is anticipated that US$70.5 billion will be derived from sales between 2012 and 2017 on RFID readers, transponders, software, and services. Likewise, Gu (2011) predicts a more than double RFID market growth in China from 2009 to 2014 (from US$ 1.1 billion to US$ 2.4 billion).

Nonetheless, less research conducted on RFID implementation (particularly by the LSPs in Libya) is

evident from prior literature. This study, therefore, aims to examine the factors affecting the adoption of RFID among LSPs in Libya. It is hoped that the study's findings will contribute to the existing body of knowledge that serve as reference materials to those who wish to further studies in this area. The findings will also benefit the LSPs in explaning the extent of RFID adoption in the organizations in Libya.

This article is organized as follows. A review of literature on RFID is introduced in section two. This is followed by the research framework and hypotheses. Section four and five explain the proposed research design of the study and data analysis, respectively. The paper concludes with the study's limitation in section six.

2. LITERATURE REVIEW

RFID depicts a tag equipped with an integrated wireless circuit chip and antenna which is capable for responding to radio signal waves emanating from the RFID encoder which retrieve process and transmit information (Finkenzeller, 2003; Piramuthu, 2007). An essential RFID system normally comprises of various segments: receiving, reader, tag, antennas, wires, peruses, middleware, and host application programming. The RFID reader

can identify different items which are labeled at the same time. In comparison, bar-coded items oblige an observable pathway, which implies that each thing must be examined each one in turn. RFID development seems to be the most effective and profitable technology innovation ever.

According to Roberts (2006), RFID is grabbing conspicuousness as a development for modified recognizing verification. Nikam and Satpute (2004) described RFID as a system that allows organizations to track their physical resources and keep up information about the items at all times. This intelligence RFID runs over to the forceful and aggressive organizations' sense and respond through the joining of IT establishment. RFID has an incredible ability to remarkably distinguish items, and possibilities towards numerous industries, such as in the management of supply chain, telemetry, and tolerant development discovery (Yu, 2007). Nonetheless, the adoption of RFID in the manufacturing business, supply chain logistics, and banking in the Middle East nations is still low (Alqahtani & Fosso, 2012). Hence, our study aims to examine the factors affecting the adoption of RFID, focusing specifically on the LSPs in Libya. This study is the first study of RFID adoption that will be carried out in Libya.
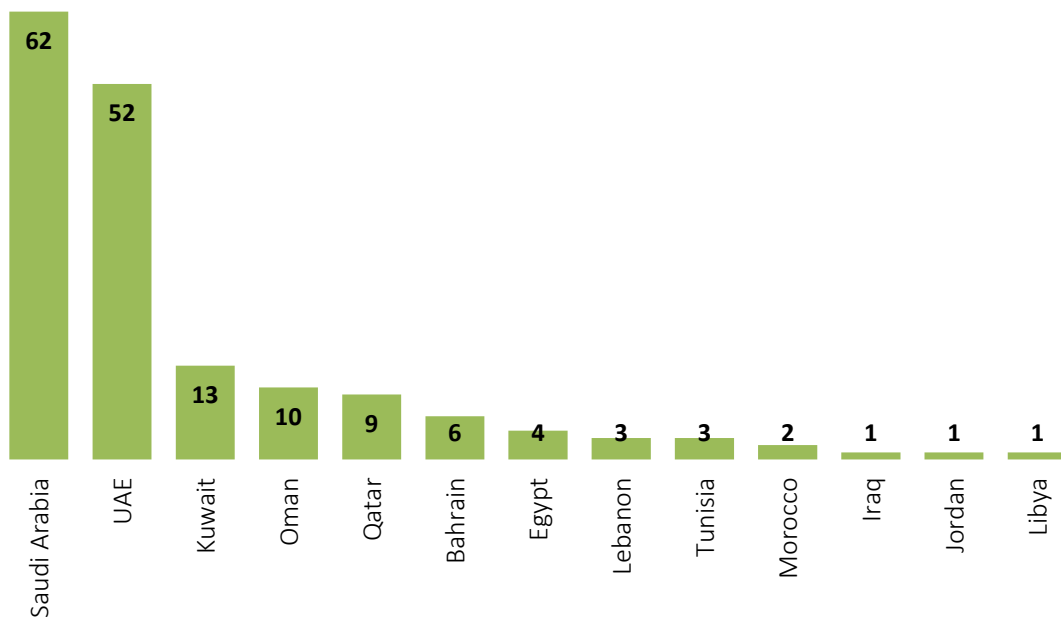

Fig 1: RFID adoption in the Middle East countries
Source: Mahmoud, Sayed, & Abdou (2012)

In the Middle East, there is a little number of organizations adopting RFID (see Fig. 1 for details). Some of the organizations are not even aware of what RFID can or cannot do. In most of the organizations, the RFID projects in Libya are moderately less and still at a pilot test stage, as compared with the most advanced nation, such as the USA where the RFID business chain incorporates full grown and extensive measure plans from titan companies (Mahmoud et al., 2012). In addition, the organizations failed to appreciate the impact of the RFID adoption (Marcus, 2005).

3. RESEARCH FRAMEWORK AND HYPOTHESES

The research model of this study is developed based on the Technology-Organization-Environment (TOE) framework (See Fig. 2) and existing literature on RFID. TOE framework suggests that the adoption, implementation, and assimilation of technological innovations are influenced by factors from three contexts: technological (T), organisational (O), and environmental (E) (Tornatzky & Klein, 1982).

The dependent variable of this study is the RFID adoption. The factors influencing the adoption of RFID are cost and complexity (from the technological context), organizational readiness and top management support (from the organizational context), and competitive pressure and government support (from the environmental context). Each of these factors is explained in detail below.
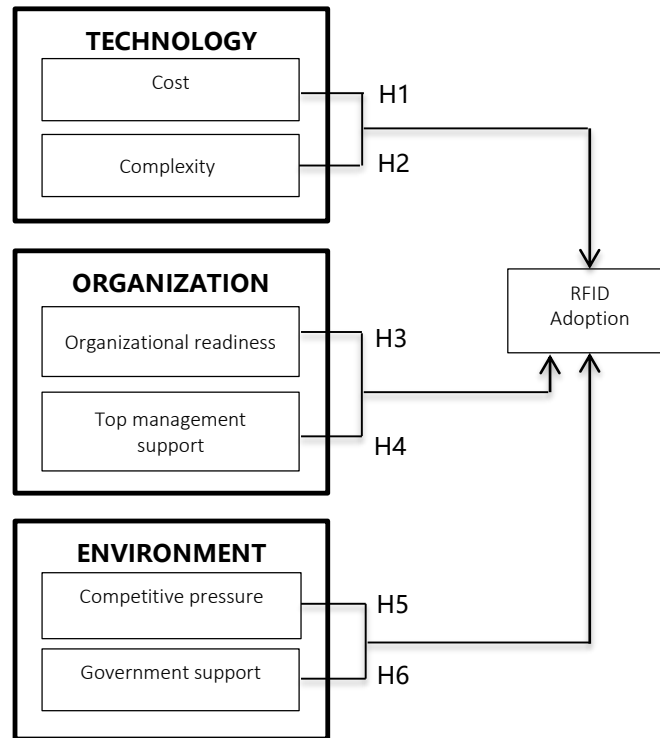

Fig 2. Research model

3.1. Technological context

Technological context refers to technologies that are relevant to the organizations. Two factors covered under the technological context are cost and complexity.

Cost has been identified as one of the important factors that affect the adoption of technological innovation in an organization (see, for example, Brown & Russell, 2007; Hossain & Quaddus, 2011;

Pigni & Clerici, 2012). Particularly, cost can potentially affect how the technology would be adopted in developing countries. Organizations from developing countries might not be able to launch a full scale adoption of the technology if the cost associated with the technology is high. According to Tornatzky and Klein (1982), technologies that are low in cost are more likely to be implemented. Sharma and Citurs (2005) pointed out that technologies with higher cost will

disadvantage the implementation. Therefore, it is hypothesized that:

H1 : There is a negative association between cost and RFID adoption.

Complexity refers to the extent to which innovation is seen as generally hard to comprehend and utilize. New technical skills are obliged to accurately utilize the innovation that has a tendency to repress its selection (Cooper & Zmud, 1990). RFID provides various benefits to organizations, such as minimizing inventory holding and simplifying the process of managing inventory. Despite these benefits, the implementation of the system remains difficult (Wang, Wang, & Yang, 2010).

Earlier studies proposed that difficulties in understanding and applying the technology may bring to slower acknowledgment of its esteem, apprehension of disappointment, and resistance (Cho & Kim, 2002). Park and Rim (2011) found that technology complexity has a negative impact on the RFID adoption. Technology of higher complexity brings a question of the possibility of its objective attainment as the implementation tends to be difficult for the company's employees (Schmitt & Michahelles, 2009). Thus, it is hypothesized that:

H2 : There is a negative relationship between complexity and RFID adoption.

3.2. Organizational context

Organizational context refers to descriptive processes of the firm, such as its degree, scope, and the slack assets accessible inside (Zhu & Kraemer, 2005). Two factorss covered under the organizational context are organizational readiness and top management support.

Organizational readiness is the extent to which the customers and suppliers of the company are eager and prepared to lead their business exercises electronically (Barua, Konana, Whinston, & Yin, 2004). Asif and Mandviwalla (2005) pointed out that organizational readiness is a vital variable for RFID selection. Thus, it is hypothesized that:

H3 : There is a positive relationship between organizational readiness and RFID adoption.

Top management support has been perceived as an important determinant of RFID adoption. Early studies discovered that top management support

affects the selection of plan choice (Fichman, 2000). Top management support is crucial in making a steady atmosphere and giving sufficient assets to the adoption of new technology (Lin & Lee, 2005; Wang & Yang, 2010). As the intricacy and refinement of innovation expand, top management understanding of the technology brings long-term benefits to the organization (Premkumar, Ramamurthy, & Crum, 1997). Thus, it is hypothesized that:

H4 : There is a positive association between top management support and RFID adoption.

3.3. Environmental context

Environmental context is the arena in which a company conducts its business. This context incorporates business, contenders, government, customers, and suppliers in the supply chain in which the business works. Two factors covered within the environmental context are competitive pressure and government support.

Competitive pressure is a significant variable to RFID adoption (Chang, Hung, & Yen, 2008; Iacovou, Benbasat, & Dexter, 1995. As the level of business sector rivalry develops, organizations progressively look to understand an upper hand through development. RFID enhances the organization's productivity (Looi, 2005). Hence, it is proposed that:

H5 : There is a positive relationship between competitive presure and RFID adoption.

Government support is one of the factors that have emerged as a determinant of RFID adoption especially in the previous literature. For instance, Hossain and Quaddus (2009) considered an insufficient government concern and support as one of the factors that hinders the adoption of RFID technology in Bangladesh. Li, Wang, Zhang, and Chu (2010) identified government support as one of the significant drivers for RFID adoption in China. Government support can play an important role through providing information, facilitating examination and progress, providing inducements, tax breaks, and building and improving the infrastructure to stimulate technological innovation for LSPs (Fawcett, Ogden, Magnan, & Cooper, 2006). Further, government's rule can inspire the adoption of innovation (Scupola, 2003). Shih, Chiu, and Chang (2008) considered government policy and regulation as one of the important

determinants of RFID adoption. Therefore, it is hypothesized that:

H6 : There is a positive relationship between government support and RFID adoption.

4. RESEARCH DESIGN

Our study is quantitative in nature. The data will be gathered via a cross-sectional survey.

4.1. Population and sample

The population in this study is 1,000 LSPs in Libya. One hundred LSPs operating in Tripoli city, located in the northwestern part of the country, will be chosen as the sample of the study.

The questionnaires will be directed to the senior executives of the companies, which include managers, system analysts, and chief information officers. They are chosen because they are the key officers vested with the responsibility of the RFID adoption and remain the only parties that can tell over the success or failure of the technology's implementation.

4.2. Measurement of variables

Each item within the construct is taken from the existing literature. RFID adoption is measured by using a binary option of whether the organization is adopting or not adopting the RFID (hence, the companies will be classified as either adopter or non-adopter).

Following Igbaria (1993), the technological factors are measured by three items scale that evaluate the costs and complexity of the technology. The items of the organizational factors (i.e.,

organizational readiness`and top management support), and the environmental factors (i.e., competitive pressure and government support) are adapted from Premkumar and Roberts (1999). A five-point Likert scale of 1 (strongly disagree) to 5 (strongly agree) is used for all independent variables.

5. DATA ANALYSIS

The data of this study will be analyzed using ordinary least square regression. The ordinary least square regression establishes direct relationship among the variables in the study.

6. CONCLUSION

This study is conducted to examine the factors affecting the adoption of RFID LSPs in Libya. The factors include cost and complexity of the technology (from the technological context), organizational readiness and top management support (from the organizational context), and competitive pressure and government support (from the environmental context). The findings of the study will provide a beneficial insight to the LSP managers into the extent of RFID adoption among the LSPs in Libya and assist them in making decisions around adopting RFID.

This study will, however, has two limitations. First, the present study will focus on the LSP companies only. Hence, the findings will be generalized to LSPs only and will not illustrate any significant differences in RFID adoption among other companies in the country. Second, the results emanating from this study only reflect Libyan context, hence, different cultural and environmental contexts could generate different results.

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