Factors affecting enterprise resource planning (ERP) systems adoption among higher education institutions in Egypt

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**ABSTRACT**

The focus of enterprise resource planning (ERP) adoption among Higher Education Institutions (HEIs) has attracted the interest of many Information System (IS) researchers. As a result of its great business values, the adoption of ERP solution is increasingly growing within HEIs. However, very limited studies have focused their attention towards understanding the determinants of ERP adoption among HEIs, especially in Egypt. Furthermore, the adoption of ERP systems in Egypt is still in the beginning stage with no many adopters among HEIs. Therefore, this study aims to fill in the gap by investigating technological, organizational and environmental (TOE) framework among HEIs. Accordingly, the objective of this research paper is mainly trying to introduce a conceptualized research model that can be used to examine ERP adoption among HEIs. This article contributes to the development of theoretical framework of the ERP adoption to explain the competitive advantage within HEIs by using TOE framework. The current study will provide guidelines to ERP providers, the government, and HEIs in Egypt to accelerate ERP adoption.

**1. Introduction**

ERP systems mainly indicated as integrated software applications that govern different departmental functions such as finance and human resource. As a result of the significant benefits of ERP systems, some universities have distributed an investment of more than five billion dollars in the ERP systems (Abugabah and Sanzogni, 2010).

This includes the processes of student recruitment, student admission, student records, financial aid for students as well as some of the universities' administrative and academic services (McCredie and Updegrove, 1999). If each business function has its own information system that is incompatible with the others, it will create a set of islands working in isolation without any kind of integration. When one integrating system such as ERP system is used for all business functions, then the database could be shared by everybody with the same accuracy (Al Kilani et al., 2012; Albadri, 2012).

Therefore, the adoption of the ERP system in universities is targeted to create progressive improvement levels of efficiency and performance so that colleges, departments, and schools have an improved capability for teaching and research at a low or at a practical cost (Watson and Schneider, 1999). In the same way, Egyptian HEIs can gain a competitive advantage from adopting ERP system because of higher quality educational services for lower costs and the usage of their resources most effectively (Soliman and Karia, 2015a). Despite the fact that the majority of universities have implemented an ERP system or are in the process of applying one (Alsayed et al., 2011; Ghuman and Chaudhary, 2012), there is a dearth of research investigating ERP system in the context of the environment of a university, in comparison to other environments.

Due to this emerging shift to ERP systems, a research question can be posed as to what are the factors that are significant predictors of ERP systems adoption among HEIs in Egypt. Based on results of recent literature analysis, however, there are not many ERP adoption studies (Al Kilani et al., 2012). Therefore, this study is important for several reasons. First, it contributes to existing literature by exploring the factors that may differentiate organizations that adopt ERP systems and organizations that do not adopt ERP systems. Second, understanding these factors may help ERP systems vendors understand important factors that
may enhance demand for their products. HEIs in Egypt may also gain a better understanding of how such factors may enable or inhibit their ability to adopt new innovations.

The adoption of new IT innovation like ERP systems among HEIs requires great organizational, technological and business environmental commitments. Therefore, examining how these factors influence HEIs decision to adopt ERP is interesting, as it can help explain HEI’s readiness, the influence of external pressures to adopt and to gain perceived benefits from using ERP (Pan and Jang, 2008). In order to understand the influence of the abovementioned factors, this study adopts Technology Organization and Environment (TOE) framework (Tornatzky et al., 1990). TOE posits that new IT innovation is determined by three important dimensions—technology, organization, and the environment.

Although TOE has been used to examine ERP adoption; it is not examined within higher Education context. Using TOE within this context might give different results as this context does not have the same ability to afford failures and budget overruns like the other environments when it comes to adopting new IT innovation. In this sense, a university has been regarded as a “unique” organization that is different from an organization in the corporate sector in the literature for several decades as they might be constrained by lack of resources (e.g. expertise, financial, technology) to carry out company-wide IT projects (Pollock and Cornford, 2004; Seo, 2013).

The motivation of this research is to discover the reasons for such few adopters of ERP systems among HEIs in Egypt (Soliman and Karia, 2015b). In other words, the researchers are interested in investigating the causes of the reluctance of HEIs in Egypt to adopt ERP system along with helping to provide guidelines to ERP providers, the government, and HEIs in Egypt to accelerate ERP adoption.

In conclusion, the study hopes to fill in the gap by answering the following research questions. 1) How can TOE framework be applied to ERP adoption among HEIs in Egypt? 2) To what extent TOE factors influence ERP adoption among HEIs in Egypt? 3) Which of TOE factors significantly influence ERP adoption among HEIs in Egypt?

2. Literature review and the conceptual foundation

2.1. ERP adoption status in the context of Egypt

Within the Egyptian context, there are not many studies being conducted to examine the determining factors of ERP adoption among HEIs. Previous studies discussed that the ERP systems in Egypt have merely placed a focus on two phases; pre-implementation and implementation (El Sayed et al., 2013). For instance, some scholars investigate factors affect the success of ERP (Abdelghaffar and Azim, 2010) and others identified factors contribute towards the relationship between business performance and ERP (Elragal and Al-Serafi, 2011) and the influence of cultural challenge on ERP adoption in Egypt, which differs from the other cultures from where the system of ERP is originated (El Sawah et al., 2008). However, recent surveys showed that the success rate of ERP implementations in Egypt is extremely lower than it is in western enterprises, and half of the ERP implementations in Egypt are considered as failures (Abdellatif, 2014).

Moreover, El-Seoud et al., (2014) clarified that the higher education sector in Egypt is enormous and included of public, private and foreign universities in addition to institutions of technical and skilled training. There are a lot of problems that occur in HEIs and ERP systems can emphatically contribute in changing and diminishing the impacts of these issues. Unfortunately, to date, the complete use of ERP has not been adopted by the foremost part of Higher Education sector in Egypt. To the best of our knowledge, this is the first empirical study that examines the determinants of ERP adoption using TOE theory within Higher education context in Egypt.

2.2. Theoretical background

Apparently, two theories are commonly used in innovation diffusion and adoption studies in organizations. They are the diffusion of innovation (DOI) theory (Rogers, 2003) and the TOE Framework (Tornatzky et al., 1990). However, other popular theories such as the technology acceptance model (TAM) (Davis, 1989; Davis, 1986), the theory of planned behaviour (TPB) (Ajzen, 1991), and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) are not considered in this research because they pertain to an individual’s choice.

2.2.1. Previous research on diffusion of innovation (DOI)

DOI (Rogers, 2003) is a prominent adoption model used in Information Systems (IS) research (Dedrick and West, 2004; Ilifredo, 2011; Mora-Monge et al., 2010; Shah Alam, 2009; Zhu et al., 2006). It suggests five aspects that illustrate the innovation adoption within an organization. They are: (1) relative advantage, mainly refers to the extent to which an innovation is better than the previous generation; (2) compatibility, explains the degree to which an innovation can be integrated into the present business processes, practices, and value systems; (3) complexity, describes how difficult it is to use the innovation; (4) observability, shows the extent to which the innovation is visible to others; and (5) triallability, confirms the ease of experimenting with the innovation. DOI is principally based on the technology characteristics and the users’ perceptions of the innovation
knowing that an organization is a more complex entity than an individual. Rogers (2003) suggested that innovation is a communication process using the various channels within the social system. Three factors influence the adoption of innovation in organizations. They are individual (leadership attitude toward change), internal organizational structure (centralization, complexity, interconnectedness, the number of employees, and organizational slack), and external characteristics (system openness) of the organization.

2.2.2. Previous research on TOE framework

A TOE framework is developed by (Tornatzky et al., 1990) to study the factors that may affect the adoption of technological innovation within the organization. Therefore, this framework is adopted to examine technology adoption from an organization point of view. It is proven to be relevant and consistent as a measurement scale for technology adoption studies in which it covers all contexts that need to be evaluated for technology adoption factors (Liaquat et al., 2002; Tornatzky et al., 1990). According to Tornatzky et al. (1990), this framework is divided into three main dimensions – technology, organization, and the environment. Also, this theory has been used to examine the adoption of wide varieties of new IT innovation, such as RFID (Wang et al., 2010), knowledge management systems (Lee et al., 2009), ERP Cloud (Qian et al., 2016), IT decision-making processes (Bemroider and Schmöller, 2013), Web site e-commerce (Oliveira and Martins, 2010), Medical records system (MRS) adoption (Marques et al., 2011) and ERP systems (Bradford and Florin, 2003; Dwivedi et al., 2009; Haddara and Elragal, 2013; Lotfy, 2015; Pan and Jang, 2008; Ruivo et al., 2014).

2.2.3 Previous research on combining DOI and TOE

Many studies have provided a focus on combining more than one theoretical perspective to better understand the IT adoption of new technologies (Lyytinen and Damsgaard, 2011; Oliveira and Martins, 2011; Wu et al., 2013). In the same way, to better understand the organizational decisions related to the adoption of technological innovation, the context of the study should be comprehensive and the variables tailored to the specificity of the innovation (Chau and Tam, 1997). DOI and TOE have been used widely in IT adoption studies with some consistent empirical support. In many ways, the TOE perspectives overlap with the innovation characteristics identified by Rogers. Hence, the well-meaning value of incorporating the TOE contexts to strongly support the DOI theory is well-recognized (Chau and Tam, 1997; Hsu et al., 2006; Wu et al., 2013).

Also, the context of technology is implicitly the same idea as that of Rogers (2003). Moreover, DOI’s internal and external organizational characteristics include the same measures as TOE’s organization context (Hsu et al., 2006). However, there are also main differences between the two theories. TOE does not identify the role of individual characteristics (e.g. top management support). Here, the DOI theory suggests the inclusion of top management support in the organization context. Similarly, DOI does not consider the impact of the environmental context. Due to DOI’s shortcomings, the TOE framework helps to provide a more comprehensive perspective for understanding IT adoption by including the technology, organization, and environment contexts (Zhu et al., 2006). In conclusion, these theories thus meaningfully complement each other (Oliveira and Martins, 2011; Oliveira et al., 2014).

3. Research model and hypotheses

According to the above discussion, the proposed research framework of this study in Fig. 1 demonstrates the independent variables to be categorized into three contexts, which are technology, organization, and the environment. Therefore, one of the contributions of this research is to cover the gap in the literature by examining the impact of these factors of ERP adoption among HEIs in Egypt. This research, also, investigates the attributes that are related to the adoption of ERP and their effect on competitive advantage.

3.1. Technological dimension

Kuan and Chau (2001) and Zhu et al. (2003) demonstrated to the importance of internal technology resources for successful IS adoption. Zhu et al. (2004) highlighted that given the technology-driven nature of e-business, firms that make efficient use of Internet technologies and exhibit technology readiness are more suitable to create e-business value.

Moreover, sufficient financial resources help companies to acquire the necessary IT resources and achieve successful e-business implementation (Pan and Jang, 2008; Zhu and Kraemer, 2005; Zhu et al., 2004).

In this study, “Relative advantage” is defined as “the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003). Studies discovered that this variable to be positively identified with the adoption of IS innovations (Grandon and Pearson, 2004). At the point when an IS innovation is perceived to offer a relative advantage over the firm’s current practice, it will probably be adopted (Lee, 2004). ERP systems provide many benefits to adopters regarding obliging business growth, enhancing business procedures and decreasing business working and regulatory costs (Markus and Tanis, 2000). Accordingly, in a highly competitive marketplace, these benefits make significant motivations for adopting these technologies.
H1. The greater the perceived relative advantage of ERP systems, the more likely they will be adopted by HEIs.

Compatibility of an innovation with a business is characterized as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003). Premkumar (2003) observed compatibility to be an imperative determinant of IS innovation adoption. The adoption of new technologies can convey critical changes to the work practices of businesses and resistance to change is an ordinary organizational reaction (Premkumar and Roberts, 1999). Thusly, it is imperative, particularly for HEIs, that the changes are compatible with its infrastructure, qualities and convictions.

H2. The greater the perceived compatibility of ERP systems with current infrastructure, qualities, and beliefs, the more likely they will be adopted by HEIs.

Complexity is characterized as "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003). The complexity of the technology makes more noteworthy uncertainty for successful implementation and thusly expands the risk in the adoption decision (Premkumar and Roberts, 1999). This factor has been observed to be negatively related with the adoption of IS innovations (Grover, 1993). In addition, it has been found to be an important determinant of the adoption of IS innovations in some environments like the context of small business (Thong, 1999).

H3. The lower the perceived complexity of ERP systems, the more likely they will be adopted by HEIs.

"Trialability" is defined as "the degree to which an innovation may be experimented with on limited basis" (Rogers, 2003). This component has been observed to be positively identified with e-commerce adoption (Kendall et al., 2001). The IS innovations under examination in this study are presently new to the higher education market. Subsequently, trialability is expected to be outstandingly significant.

H4. HEIs with a greater ability to experiment with ERP systems before adoption are more likely to adopt them.

"Observability" is defined as "the degree to which the results of an innovation are visible to others" (Rogers, 2003). IS innovations that have been believed to have an effect in the higher education context will probably be seen in a positive light (Dwivedi et al., 2009). Henceforth, observability is expected to be exceptionally relevant to the higher education context.

H5. The more noteworthy the observability of ERP systems with regards to the context of higher education, the more probable they will be adopted.

3.2. Organizational dimension

This dimension focuses on how organization’s characteristics and resources influence their decision to adopt technology innovation. Previous studies reported that organization dimension strongly influence on the organizational IT adoption of an innovation (Laukkanen et al., 2007). ERP system is an enterprise-wide generic solution, thus during implementation phase it requires vendors to customize the software according to HEIs’ requirements. Hence, the well understanding of how HEIs’ characteristics can be suitable for ERP system is very important in order to examine organization’s decision to adopt new IT innovation.

Top management support can be characterized through a few features, incorporating leadership involvement with the project, leadership responsibility, and organization support company support. Past research has connected leadership commitment through managerial capacity to overcoming deterrents to the adoption of IT (Oliveira and Martins, 2011). In addition, Jeyaraj et al. (2006) observed top management support to be one of the best indicators of the organizational
adoption of IS innovations. Top management can motivate change by communicating and supporting values through an explained vision for the organization (Schniederjans and Yadav, 2013). Many studies portrayed top management support to be a basic factor for creating a supportive climate for the adoption of new technologies (Premkumar and Roberts, 1999). With regards to Higher Education context, the decision-maker is very probably going to be in the top management team and his/her support is a vital key for the IT adoption to occur.

H6. The greater the top management support for ERP systems, the more likely they will be adopted by HEIs.

Organizational readiness is defined as “the availability of the needed organizational resources for adoption”. Organizational readiness, as discussed in past research on electronic data interchange (EDI) adoption, measures whether a firm has adequate IS sophistication and financial resources (Iacovou et al., 1995). In fact, monetary costs and shortage of technical experience are distinguished as two of the most critical components that hinder IS development within the organizations, especially small one (Cragg and King, 1993). IS complexity evaluates whether a firm is innovatively prepared to attempt the adoption of an IS innovation, while monetary assets express an organization’s capital available to invest in an IS innovation (Chwelos et al., 2001).

H7. The greater the financial and technological resources, the more probable ERP system will be adopted by HEIs.

Firms that do not have much IS experience might be ignorant of new technologies or might not have any desire to take a risk to adopt them. Dholakia and Kshetri (2004) proposed that technologies effectively in an organization stimulate the future adoption of another new innovation. They contend that the incremental cost and knowledge required to adopt the internet, for instance, will be much slighter if a firm already owns a computer and a telephone. Likewise, other studies have found that earlier IS experience impacts the adoption of new technologies (Kuan and Chau, 2001).

H8. The more noteworthy the IS expertise available in the organization, the more probable ERP system will be adopted by HEIs.

Organizational size has been recognized by Jeyaraj et al. (2006) as one of the best organizational indicators of adoption of IS innovations. Goode and Stevens (2000) demonstrated that business size, previously the best indicator of technology adoption, was not significantly related to IS innovation adoption. Nevertheless, the typical argument is that bigger businesses have a noteworthy need, resources, skills and experience and the capability to survive failures than smaller businesses (Levenburg et al., 2006). Hence, it can be argued that larger firms are more probably to embrace ERP systems.

H9. The larger the size of the business, the more likely ERP systems will be adopted by HEIs.

3.3. Environmental dimension

HEIs decision to adopt ERP is not limited only to internal factors (organization and technology dimensions) but also influence by external factors. Tornatzky et al. (1990) explained that environmental dimension deals with industry segment, organization’s competitors, and the regulatory environment. In this research, Competitive pressure and external IS support are described to be influences of HEIs’ adoption of ERP systems.

Competitive pressure has been explained by Jeyaraj et al. (2006) as one of the best influential predictors of IT innovations adoption within the organization. Competition in general for the adopter’s industry has a positive influence on the IT adoption of an innovative new technology (Gatignon and Robertson, 1989). Thus, this is argued to be even more evident if the innovation directly affects the competition (Kuan and Chau, 2001). Similarly, Premkumar and Ramamurthy (1995) concluded that it can be a strategic perspective to adopt new technologies to compete in the marketplace.

H10. The greater the competitive pressure, the more likely ERP systems will be adopted by HEIs.

External IS support refers to the availability of support for implementing and using IS innovations have been found to be positively influenced on IS innovation adoption (Premkumar and Roberts, 1999). DeLone (1988) claimed that External IS support to be an important determinant of IS success. With the popularity of outsourcing and the growth of third-party support, firms are more willing to adopt new IS innovations if they feel there is an adequate vendor or third-party support (Dwivedi et al., 2009).

H11. The greater the external IS support for ERP systems, the more likely they will be adopted by HEIs.

4. Competitive advantage (CA)

ERP system has become the determinant of competitive advantage for organizations around the world (Egdair et al., 2015). Other authors (Goek and Falez, 2009; Karia et al., 2006; Ram et al., 2014) mentioned the following benefits that can eventually create competitive advantage: improved decision-making capabilities; improved inventory management; improved information and knowledge management (manifested through practices such as employee education and training); information networking; and knowledge sharing. Shang and Seddon (2002) proposed five dimensions of ERP benefits namely, operational, managerial, strategic, IT infrastructure and organizational. The same author, also, explained that ERP benefit was a continuous process with returns realized at a different rate in diverse core processes.

On the contrary, ERP systems may not provide a competitive advantage when adopted directly, despite the accuracy, easy access, and timing of the
information provided by the faster processing of data (Johansson and Newman, 2010). Hence, there is a clear knowledge gap on how the adoption and implementation of ERP systems lead towards gaining the competitive advantage in the higher education sector that can thus motivate these institutions to adopt and implement ERP systems, especially in Egypt.

H12. ERP Adoption positively gives HEIs’ Competitive Advantage (CA).

5. Conclusion

As a conclusion, this study is designed to understand the determinants of ERP adoption among HEIs in Egypt. This study contributes to the technology adoption, ERP and higher education literature review by 1) extending current understanding of ERP adoption within a Higher education context unlike earlier studies that examined ERP adoption among other contexts, 2) identifying factors of ERP adoption among HEIs to gain a competitive advantage, and 3) extending the use of TOE framework within ERP adoption among HEIs. This framework is proven to be relevant and consistent as a measurement scale for technology adoption. Hence, using this framework can provide a better understanding of what influence ERP adoption among HEIs in Egypt. Practically, this study contributes a guideline to HEIs to consider on adopting ERP systems based on TOE framework. Overall, this study is important as it can help HEIs to achieve competitive advantages through the adoption of ERP. With the current economic situation being able to systematically manage business operations are vital to sustaining competitive advantage.

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