Evaluation of the Egyptian knowledge bank using the information systems success model

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ABSTRACT

The appearance of the coronavirus pandemic had several implications on the educational process, which caused students, at all educational levels, to resort to digital libraries as the available educational opportunity in this challenging time. This study sheds light on the Egyptian Knowledge Bank (EKB) as one of the largest digital libraries in the world. It empirically evaluates the EKB, using the updated Information Systems Success (ISS) model proposed by DeLone and McLean (2003), among postgraduate business students in the context of Egyptian universities with a sample of 245 students. The results indicate that all nine hypotheses derived from the research model are supported and significant, contributing either directly or indirectly to the success of the EKB. Hence, the results confirm the validity of the ISS model in measuring the success of the EKB. These findings highlight as well the significance of investing more deeply in digital libraries as a coping mechanism for the educational recovery process from COVID-19 and the importance of creating awareness among students about digital libraries in order to sustain the learning process in a safe environment.

Introduction

The Sustainable Development Goals (SDGs) are a call for action by the United Nations (UN) Member States to put an end to poverty, protect the planet and ensure that all people have a high quality of life by 2030 (UNDP, 2021). Education has always been an essential human right and a primary indicator of progress across SDGs. In the Education 2030 Framework for Action, SDG 4 aims to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all' (UNDP, 2021).

The Egyptian Government responded to the UN 2030 agenda by taking an initiative and launching an integrated development plan called Egypt Vision 2030. In alignment with the SDGs, the Egypt Vision 2030 deals with three main dimensions; economic, social, and environmental (MPED, 2020). The social dimension aims to promote human development through two main pillars, namely education and health. With regards to education, Egypt Vision 2030 has set three main objectives: (1) improve Egypt's ranking to become among the top 30 countries in the quality of basic education indicator; (2) reduce the illiteracy rate to zero; and (3) place 10 Egyptian universities among the top 500 universities around the world (MPED, 2020).

The Egyptian Knowledge Bank (EKB) was a response to Egypt 2030 Vision to create and develop a knowledge-based society in order to fulfil the educational objectives. Launched in 2016, the EKB is one of the largest digital libraries in the world that grants unlimited resources, free of charge, in the form of electronic books and magazines, databases, browsers, videos, and pictures, along with computer programs, in all specializations of interest, exclusively for domestic Egyptian users (EKB, 2021). The EKB has four sub-portals that are customized to address a wide range of internet users: children, students, researchers, and general readers.

The aim of the EKB is to develop scientific research for researchers as well as human knowledge for youth, and provide teachers with the necessary tools and techniques that attract students to learn and prosper. Based on regional efforts, the EKB will merge with two Arab digital libraries namely; the Saudi Digital Library and the Dubai Digital Library, therefore creating the Arab Digital Union (El-Bakry, 2018).

The importance of this research is based on two main reasons: its timing and its topic. The timing is crucial with regard to the appearance of the coronavirus pandemic which had profound implications, not only health wise, but also educationally, economically, and socially. On the educational level, the pandemic caused the largest disturbance of

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education in history, imposing a lockdown of the educational establishments around the world for several months, in order to mitigate the spread of the coronavirus.

Consequently, all countries had to renew their commitments to the SDGs and test their ability to deal and respond to the universal and large-scale crisis (OECD, 2020). This pandemic has caused almost 120 countries to stop face-to-face learning and shift to digital learning (Azzi-Huck & Shmis, 2020; Shahzad et al., 2021) to adhere to social distancing.

Prior to the coronavirus pandemic, digitalization was gradually shaping the educational environment. However, the pandemic fast paced the digitalization trend in education. Digital education allowed countries to maintain the learning process and get back on track with the attainment of the SDG 4. Hence, digital libraries came into the limelight as a coping mechanism for the educational recovery process from COVID-19. The educational process, taking place virtually, caused both academic staff and students to resort to digital libraries, as the available educational opportunity in this challenging time, in order to sustain the learning process in a safe environment.

Concerning the topic, despite the considerable attention that digital libraries have received in the literature, (i.e., Afthanorhan et al., 2020; Bilal & Bachir, 2007; Soltani-Nejad et al., 2020; Thong et al., 2002; Xu & Du, 2018) a minimal amount of research has been conducted regarding the EKB, and these researches were strictly conducted from the perspective of librarianship (i.e., Eldakar & Kenawy, 2020; Mansour, 2020). Thus, to advance research and practice in this domain, researchers have to address and explore the success of the EKB with respect to the revolution of virtual education which evolved due to the spread of the coronavirus pandemic. Therefore, this study attempts to fill the research gap by evaluating the EKB using the Information System (IS) Success Model (DeLone & McLean, 1992) with regards to postgraduate business students from selected universities in Egypt.

The IS Success Model is among the most influential models in predicting and explaining the system's success. It has been used and validated solely across different situations (e.g., culture) with different control factors (e.g., gender) and different subjects (e.g., undergraduate students) or in conjunction with other theories such as Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Theory of Planned Behavior (TPB), leading its proponents to believe in its robustness (Alzahrani et al., 2019; Cho et al., 2015; Dalle et al., 2020; Dirgantari et al., 2020; Jaafreh, 2017).

The IS Success Model has been applied to measure Enterprise Resource Planning (ERP) system success, e-procurement application, e-government application on the user perspective, e-banking application use success, user developed application domain, e-commerce, and m-banking (Chen, 2010; Floropoulos et al., 2010; Gotoh, 2009; Hsu & Chen, 2007; McGill et al., 2003; Rana et al., 2015; Sambasivan et al., 2010; Scott & DeLone, 2009; Wang & Liao, 2008). In the e-learning domain, the IS Success Model has also been applied universally to measure and identify important success factors when it comes to evaluate the success of various e-learning systems (Almarashdeh, 2016; Alzahrani et al., 2019; Aparicio et al., 2017; Cidral et al., 2018; Freeze et al., 2010; Holsapple & Lee-Post, 2006; Lin, 2007; Lin & Lee, 2006; Yakubu & Dasuki, 2018).

Most of the IS Success Model researches were conducted in the context of developed countries where circumstances are quite different from those of the developing ones such as Egypt. In the Egyptian context, a limited literature used the IS Success Model, e.g., Abdelsalam et al. (2012) measured the success of the local e-government projects; Zaied (2012) measured the success of public sectors; and Ghanem et al. (2020) measured the success of the tourism sector. In the light of the above, it could be argued that it is time for both academics and practitioners to evaluate the success of the EKB using IS Success Model.

Theoretical background

In attempt to measure the complex and dependent variables in IS research, DeLone and McLean (1992) proposed the IS Success Model to establish a scientific foundation for IS research and to identify crucial factors that affect the IS success (DeLone & McLean, 1992; McGill et al., 2003; Shahzad et al., 2021). Using the three levels of information suggested by Shannon and Weaver (1949), along with Mason's expansion of the effectiveness or influence level (Mason, 1978), DeLone and McLean defined six distinct dimensions of IS success namely: (1) system quality; (2) information quality; (3) use; (4) user satisfaction; (5) individual impact; and (6) organizational impact, in order to measure the dependent constructs of IS success. The IS Success Model received attention from researchers since its first publication in 1992. The contribution from many IS researchers (i.e., Brynjolfsson, 1996; Clemons et al., 1993; Clemons & Row, 1993; Myers et al., 1997; Pitt et al., 1995; Rai et al., 2002; Seddon, 1997) persuaded DeLone and McLean to verify and extend the earlier model of IS success.

Hence, the updated DeLone and McLean (2003) IS Success Model which is still used today includes the following six interrelated constructs that determine IS success: three dimensions of quality (namely: system, information, and service); (intention to) use; user satisfaction; and net benefits. In addition, a new aspect of this model is the feedback links from net benefit to both intention to use and user satisfaction constructs. Diagrammatically, the updated DeLone and McLean (2003) IS Success Model is illustrated in Fig. 1.

As proposed in the theoretical model (Fig. 1), the three independent variables (system quality, information quality, and service quality) significantly affect system usage and user satisfaction, both of which further predict the system success. In other words, high-quality system will be associated with more use, more user satisfaction, and positive net benefits.

System quality

The system quality dimension focuses typically on the performance or the desired features and the serviceability aspects of the IS system in use or under investigation (Urbach & Müller, 2012). DeLone and McLean (2016) measured the system quality by: ease of use, availability, flexibility, reliability, usefulness, and response time. Even though there are several measures for system quality which are such as accessibility, response time, user friendly, reliability, accuracy system, adaptability and availability, ease of learning, ease of use, efficiency, flexibility, systems feature, integration of systems, sophistication, and interactivity, researchers usually choose among the measures with respect to the context of the study. Previous studies have proved that the system quality dimension had a significant positive effect on the system satisfaction and usage in the e-learning context (Alsabawy et al., 2013; Alzahrani et al., 2019; Aparicio et al., 2017; Freeze et al., 2010; Hassanzadeh et al., 2012; Islam, 2012; Kim et al., 2012; Mohammadi, 2015; Motaghian et al., 2013; Shahzad et al., 2021; Tajuddin et al., 2013; Wang & Chiu, 2011; Yakubu & Dasuki, 2018).

Information quality

The information quality dimension refers to the output characteristics of the information system. How information quality is defined depends on the type of information system being used (Shahzad et al., 2021). In the e-learning context, information quality is defined as the precision alongside accuracy of the information provided by the system. In other words, the correct information should be available at the right time to the right person (Muda & Erlina, 2019; Shahzad et al., 2021). Consistent measures for information quality in the e-learning domain include: relevance, usefulness, understandability, accuracy, reliability, currency, completeness and timeliness. Information quality has proved to be an essential quality antecedent that impacts user satisfaction and
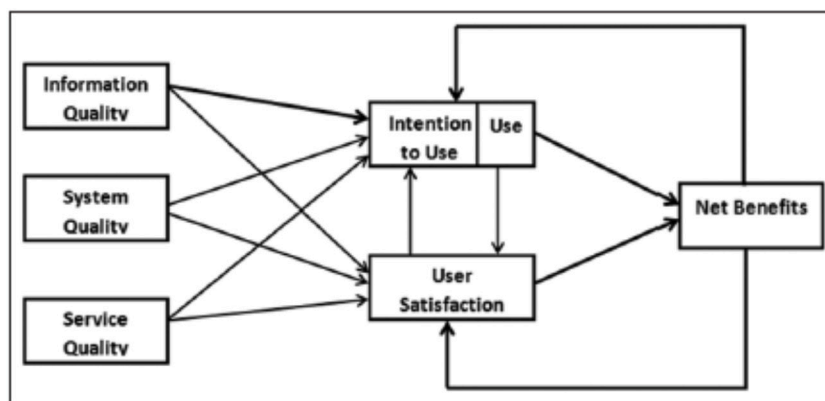
Fig. 1. Updated model of IS success by DeLone and McLean (2003).

system usage (Alzahrani et al., 2019; Cidral et al., 2018; Hassanzadeh et al., 2012; Kim et al., 2012; Lin & Lee, 2006; Machado-Da-Silva et al., 2014; Mohammadi, 2015; Wang & Chiu, 2011).

Service quality

The service quality dimension was the addition to the updated IS Success Model DeLone and McLean (2003) and it refers to the quality of the assistance that the users receive from the IS department and the IT support personnel. Initially, ten dimensions were used to measure service quality, which later transformed into five consistent measures which are: tangibles, reliability, responsibility, assurance, and empathy. In several researches, service quality has been found to have a significant positive effect on satisfaction and on system usage in the e-learning context (Alzahrani et al., 2019; Chiu et al., 2016; Machado-Da-Silva et al., 2014; Poulova & Simonova, 2014; Roca et al., 2006; Shahzad et al., 2021; Tajuddin et al., 2013; Wang & Chiu, 2011; Xu et al., 2014; Yakubu & Dasuki, 2018).

System usage

System usage refers to the e-learner's evaluation of their usage of the information system with respect to the total time spent on the system, the reasons for using the system and the degree of use (DeLone & McLean, 2003). System usage also refers to the navigation of the e-learner within the digital system, as well as the information searched and retrieved.

In the IS Success Model, system usage and intention to use are utilized alternatively. However, "intention to use" is an attitude, whereas "system usage" is the actual behavior which is considered as the variable closer in meaning to success (DeLone & McLean, 2003). Thus, this study adopts system usage instead of intention to use.

User satisfaction

The user satisfaction dimension refers to the user's level of satisfaction when using the IS. This is an important indication of the success of the IS (Urbach & Müller, 2012). In the context of e-learning, the user of the IS is satisfied when the IS successfully meets their learning needs and provides them with the information they have been searching for (Alzahrani et al., 2019; Freeze et al., 2010; Hassanzadeh et al., 2012; Shahzad et al., 2021; Yakubu & Dasuki, 2018).

Net benefits

Lastly, the net benefits dimension, which is an innovative variable, united two dimensions of impact (organizational and individual), in the original model, into one. This overall dependent variable of DeLone and McLean (2003) IS Success Model, refers to the degree to which IS contributes to the success of individuals, groups, organizations, industries, and/or nations.

Research model and hypotheses

The purpose of this study is to evaluate the success of the EKB using the updated IS Success Model proposed by DeLone and McLean (2003). To reduce model complexity, the feedback links from net benefit to system usage and user satisfaction are excluded from this study. Based on Hair et al. (2014) recommendation, it is not allowed to include circular relationships or loops of relationships between latent variables in the structural model. Consequently, the following nine hypotheses were formulated as depicted in the Fig. 2 below:

H1. : SYstem Quality (SYQ) has a significant positive influence on the System Usage (SU) of the EKB.

H2. : SYstem Quality (SYQ) has a significant positive influence on the User Satisfaction (US) of the EKB.

H3. : Information Quality (IQ) has a significant positive influence on the System Usage (SU) of the EKB.

H4. : Information Quality (IQ) has a significant positive influence on the User Satisfaction (US) of the EKB.

H5. : SErvice Quality (SEQ) has a significant positive influence on the System Usage (SU) of the EKB.

H6. : SErvice Quality (SEQ) has a significant positive influence on the User Satisfaction (US) of the EKB.

H7. : System Usage (SU) of EKB has a significant positive influence on the User Satisfaction (US) of the EKB.

H8. : System Usage (SU) of EKB has a significant positive influence on the Net Benefits (NB) of the EKB.

H9. : User Satisfaction (US) of EKB has a significant positive influence on the Net Benefits (NB) of the EKB.

Research methodology

Questionnaire

For the purpose of evaluating the EKB success, a quantitative study, involving the administration of a survey, was used to collect data on the six constructs that were defined in the hypothesized model. In this regard, the researchers prepared a questionnaire in the English language since all postgraduate business students are familiar with English and are asked to meet specific English language requirements in order to be eligible for postgraduate studies in Egypt. A review of instruments used
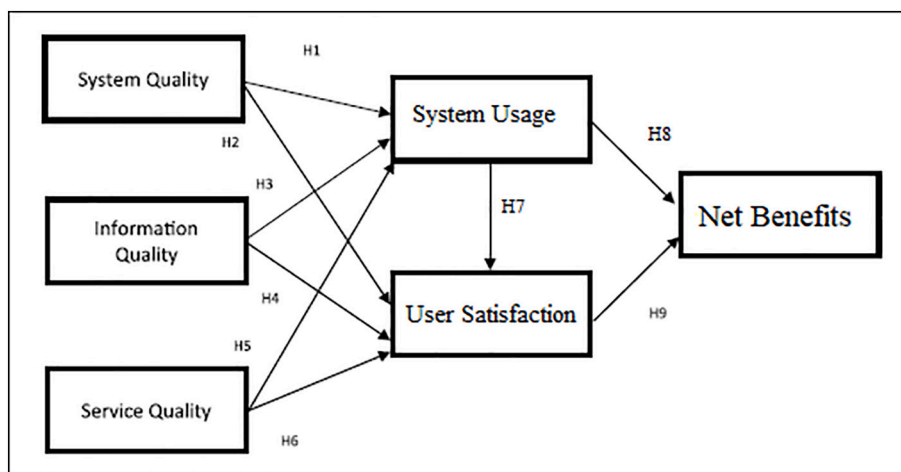
Fig. 2. Hypothesized research model.

in previous studies (DeLone & McLean, 2003) regarding the model variables was undertaken. Based on this review, the survey items were adapted and reworded to the context of the EKB.

The survey structure is divided into three sections: The first section concerns the demographic data of the participants. The second section focuses on the four items illustrating the general question regarding the participants' experience of using the EKB. The third section contains statements regarding the factors used in the conceptual model (see Table A.1). All constructs were measured using 21 items: four items (functionality, availability, ease of use, and reliability) were used to measure the system quality variable. Another four (accuracy, ease of understanding, comprehension, and security) measured information quality, four more items (resources, responsiveness, knowledge, and empathy) were used to operationalize service quality of the EKB support staff. The construct system usage was measured by three items (dependency, nature of use, and frequency), user satisfaction was also measured by three (satisfaction with education needs, efficiency satisfaction, effectiveness satisfaction, and meeting expectations), and finally, net benefits was operationalized using the last three items (time saving, enhanced performance, and cost saving). All items were measured with the 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. The Likert scale was used since it is one of the most frequently encountered formats for measuring attitudes (Bryman & Bell, 2011).

Participants and sampling size

The research population of this study is public universities in Egypt. According to the Central Agency for Public Mobilization Statistics (CAPMAS, 2020), 97.1% of the total numbers of students enrolled in postgraduate business studies are in public universities, among which the top three are: Cairo, Alexandria, and Ain Shams universities where students come from different provinces in Egypt, thus these universities reflect various viewpoints. In addition, the structure of the educational process in the Egyptian public universities, particularly business schools, is homogeneous. Consequently, these three universities were selected for the purpose of this study and the target subjects are the postgraduate business students who are mandatory registered in the Scientific Research & Higher Education portal of the EKB. Table 1 shows the number of students enrolled in postgraduate business studies (Diploma - Master's - PHD) in the three selected universities according to CAPMAS (2020).

The decision regarding the sample size in this study was based on the selected statistical analysis method, Structural Equation Modeling (SEM). The SEM requires an appropriate sample size, not less than 200, which is recommended by Hair et al. (2010), in order to provide

Table 1
The number of students enrolled in postgraduate business studies in the three selected universities.

University	Diploma	Master's	PhD	Total
Cairo	1508	149	123	1780
Alexandria	1955	532	115	2602
Ain Shams	2979	301	355	3635
				8017

parameter estimates with any degree of confidence and guarantee a robust SEM. Therefore, to get the required sample size and ensure a satisfactory return, a total of 300 questionnaires were distributed equally with the help of the coordinators across the three universities.

Data analysis and results

Response rate and non-response bias

The response rate for the survey analysed here is 82%, 300 surveys were randomly distributed among respondents and 245 valid surveys returned. Further nine surveys were discarded because too many items were substantially incomplete. McMillan and Schumacher (1989, p. 296) argue that in surveys that attain a 60% return rate or better, the non-respondents will probably not affect the results appreciably. So, it is reasonable to assume that any non-response bias is small enough to be ignored.

Descriptive statistics

Table 2 provides the respondents' demographic profile. This profile reveals that the gender factor showed that male participants have a more response rate of 57% as compared to females (43%). The distribution of the participants according to their age is as follows: 44% were under 35

Table 2
Demographic profile.

Variable	Category	Frequency	Percentage
Gender	Male	105	57%
	Female	140	43%
Age	Under 35 years	108	44%
	35–45	115	47%
	Over 45 years	22	9%
Program enrolled	Diploma	24	10%
	Master's	135	55%
	Doctorate	86	35%

years, 47% were aged 35–45, and 9% were over 45 years. Regarding the distribution of the respondents by the program enrolled, the data revealed that the majority (55%) were registered in master's degree, followed by 35% in doctorate while 10% in diploma programs.

In terms of experience in using EKB, almost half the respondents (51%) have attended a workshop on EKB prior to their enrolment in their postgraduate studies, the majority of the respondents (60%) confirmed that their usage of EKB increased during the COVID19 pandemic, 89% of the respondents stated that the main EKB advantage is the free access to world-class publications, and finally 80% of the respondents did not cite any disadvantage of using the EKB, while 18% stated that the EKB is not accessible outside Egypt and the remaining 2% stated that the load and response time is slow.

Reliability and validity

The measurements are subjected to reliability and validity analyses prior to the research model testing and path analysis.

The traditional method applied in this study to test the internal consistency reliability is Cronbach's Alpha (α) which was proposed by Nunnally (1978). According to Nunnally and Bernstein (1994), internal reliability can be achieved when the Cronbach's α value is 0.7 or higher. The results, in Table 3, indicate the alphas of all the constructs are higher than 0.87, which supports the reliability of the measures used in this study.

Validity was applied in this study through measures of convergent validity and discriminant validity. Convergent validity involves the degree to which individual items reflecting a construct converge comparing to items measuring different constructs. It is assessed through Composite Reliability (CR) and Average Variance Extracted (AVE). As shown in Table 3, the testing results of CR and AVE have exceeded the recommended value of 0.7 for CR and 0.5 for AVE as suggested by Hair et al. (2010), demonstrating adequate convergent validity.

In addition, the discriminant validity of the constructs used in this study is presented in Table 3. The guideline for the discriminant validity is that the square root of AVE for each construct should be greater than the correlation values of the construct with other constructs (Fornell & Larcker, 1981). As reported in Table 3, all constructs across the samples passed the guideline supporting their discriminant validity.

In order to test the unidimensionality of the scale items, a confirmatory factor analysis was conducted on the measurement model. Unidimensionality is aimed to drop the item that consists of less contribution on these factors. As shown below in Table A.1, the factor loadings are ranged from 0.65 (IQ4) to 0.92 (SEQ3, SU3, and NB3). Hence, the unidimensionality is achieved since all the items exceeded the recommended cut-off value of 0.50, suggested by Hair et al. (2010).

Evaluating model estimates and goodness-of-fit

The estimation of the structural model is constructed through the Linear Structural RELations (LISREL) version 10.10. It is worth mentioning that there is no single statistical test in SEM that can best describe the strength of the model's predictions (Byrne, 2010).

Accordingly, multiple-fit indices should be used to assess goodness-of-fit. Table 4 shows that actual values of the seven measures of fit (x^2/df, GFI, AGFI, CFI, NFI, TLI=NNFI, and RMSEA) exceed the recommended values which suggest that the measurement model fits the data well.

Structural model results and discussion

The structural model is evaluated by assessing the R-Square (variance accounted for) and the path coefficient. Table 5 presents the results of the hypotheses tested by SEM and the explanatory power of the model which is evaluated by the R^2.

As listed in Table 5, all hypotheses presented in the research model, H1 through H9, achieved a significance level between 0.001 and 0.05. The three dimensions of quality (namely: system, information, and service) had a significant positive effect on system usage and user satisfaction. Consequently, H1, H2, H3, H4, H5, and H6 are confirmed. This finding is in line with the previous studies (e.g., DeLone & McLean, 2003; Alshibly, 2014).

Among the three dimensions of quality, information quality has the largest effect on system usage with path coefficient (β = 0.51, $P <$ 0.001), followed by system quality (β = 0.23, $P < 0.01$) and service quality (β = 0.21, P < 0.01). This goes in line with the previous research (e.g., Cidral et al., 2018; Freeze et al., 2010; Petter & McLean, 2009; Shahzad et al., 2021) which emphasized that information quality, such as a clear interface and useful search results, has the greatest effect on the willingness to continue using the system. With respect to user satisfaction, system quality has a relatively larger effect with path coefficient (β = 0.29, $P < 0.001$) compared to information quality (β = 0.12, $P < 0.05$) and service quality (β = 0.20, P < 0.01). This goes in line with the previous research (e.g., Freeze et al., 2010; Huang et al., 2015; Petter & McLean, 2009) which emphasized that user satisfaction is greatly influenced by availability, reliability, response time, and design functionalities.

In addition, system usage has a significant effect on user satisfaction with path coefficient (β = 0.23, $P < 0.001$). Thus, H7 was supported. In other words, the more frequently the system user uses the EKB, the higher the user satisfaction is with the EKB. This goes in line with the

Table 4
Measurement model fit indices.

Goodness-of-fit measures	Recommended value by Byrne (2010)	Actual value
Ratio between Chi-square and degrees of freedom (x^2/df)	≤3	1.66
Goodness of Fit Index (GFI)	≥0.90	0.90
Adjusted Goodness of Fit Index (AGFI)	≥0.80	0.87
Comparative Fit Index (CFI)	≥0.90	0.98
Normed Fit Index (NFI)	≥0.90	0.96
Tucker-Lewis fit index (TLI), also known as the Non-Normed Fit Index (NNFI)	≥0.90	0.98
Root Mean Square Error of Approximation (RMSEA)	≤0.08	0.05

Table 3
Composite Reliability (CR), Cronbach's alpha (α), Average Variance Extracted (AVE), and factor correlations matrix.

Construct	CR	α	AVE	Factor correlation coefficients					
				1	*2*	*3*	*4*	*5*	*6*
1. System quality	0.89	0.87	0.64	**0.80**					
2. Information quality	0.82	0.80	0.53	0.39	**0.73**				
3. Service quality	0.92	0.90	0.71	0.27	0.57	**0.84**			
4. System usage	0.92	0.91	0.77	0.48	0.51	0.54	**0.88**		
5. User satisfaction	0.89	0.88	0.72	0.50	0.51	0.47	0.57	**0.85**	
6. Net benefits	0.91	0.90	0.77	0.44	0.40	0.36	0.51	0.58	**0.87**

Note: Diagonals represent the square root of the AVE.

Table 5
Structural model results.

Construct	R^2	H	Path description	Path coefficient	Result
System usage	0.44	1	SU ← SYQ	0.23**	Supported
		3	SU ← IQ	0.51***	Supported
		5	SU ← SEQ	0.21**	Supported
User satisfaction	0.59	2	US ← SYQ	0.29***	Supported
		4	US ← IQ	0.12*	Supported
		6	US ← SEQ	0.20**	Supported
		7	US ← SU	0.23**	Supported
Net benefits	0.40	8	NB ← SU	0.23***	Supported
		9	NB ← US	0.38***	Supported

Significance codes:
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

previous research (e.g., Alshibly, 2014; DeLone & McLean, 2003; Freeze et al., 2010; Huang et al., 2015; Petter & McLean, 2009).

Finally, both system usage and user satisfaction had a significant influence on net benefits. Therefore, H8 and H9 were supported (β = 0.23, P < 0.001 and β = 0.38, P < 0.001, respectively) which emphasized that the increase in both system usage of the EKB and the user satisfaction regarding the EKB service would lead to more benefits to the various users such as the researchers, students, and staff. This goes in line with the previous research (e.g., Alshibly, 2014; DeLone & McLean, 2003; Freeze et al., 2010; Huang et al., 2015; Petter & McLean, 2009).

On the other hand, the three endogenous variables, namely; system usage, user satisfaction, and net benefits, are tested in the model. Net benefits are determined by system usage and user satisfaction in an explanatory power (R^2) of 0.40. In other words, the aforementioned variables explain 40% of the variance in net benefits which indicate that there may be other factors or variables required in the explanation of net benefits. Moreover, the user satisfaction is explained by the explanatory power of 0.59 by system quality, information quality, service quality, and system usage. However, the explained variance of system usage was 0.44 which much lower than that of user satisfaction.

Exploratory analysis

In addition, an exploratory analysis is performed to examine mediation effect of system usage and user satisfaction between the three dimensions of quality and net benefits. Baron and Kenny (1986) asserted that the evidence for mediation is strongest when there is an indirect effect but no direct effect, which they call "full mediation". As shown in Table 6, when system usage and user satisfaction are included into the model, the effects of the three dimensions of quality on net benefits sharply, decrease, even become insignificant. This indicates the mediation effects of system usage and user satisfaction (Baron & Kenny, 1986). Thus, three dimensions of quality may have no direct effect on net benefits, but indirectly affect system success through system usage and user satisfaction.

Table 6
Testing mediation effect.

Path description	Path coefficient	
	Direct effect	Indirect effect
System quality → net benefits	0.14*	0.33***
Information quality → net benefits	0.02	0.19*
Service quality → net benefits	0.03	0.17*

Significance codes:
* $p < 0.05$.
*** $p < 0.001$.

Conclusion

The main purpose of this study is to examine empirically the success of the Egyptian Knowledge Bank as a digital library among postgraduate business students in the context of Egyptian universities using the updated IS Success Model proposed by DeLone and McLean (2003). As mentioned previously, six constructs were measured, namely (1) system quality, (2) information quality, (3) service quality, (4) system usage, (5) user satisfaction, and (6) net benefits. This study used the interrelationships between the three constructs: system usage, user satisfaction, and net benefits as indicators of the success of the EKB. In other words, if the EKB has numerous net benefits to its users, it will lead to a high system usage and create a high level of satisfaction among users, and consequently, it will be a successful digital library. The results of the study indicates that all nine hypotheses derived from the research model are supported and significant, contributing either directly or indirectly to the success of the EKB. Subsequently, the results reveal that system quality, information quality, and service quality significantly affect system usage and user satisfaction, both of which further predict the net benefits. These significant results are generally supported by the existing literature and confirm previous findings (e.g., Alshibly, 2014; Cidral et al., 2018; DeLone & McLean, 2003; Freeze et al., 2010; Huang et al., 2015; Petter & McLean, 2009; Shahzad et al., 2021).

With regards to the three dimensions of quality, the results show that (1) they have no direct effect on net benefits, in fact, they indirectly affect net benefits through system usage and user satisfaction; (2) information quality had the largest effect on system usage; and (3) system quality had the highest impact on user satisfaction.

Theoretical and practical implications

From a theoretical perspective, the current study contributes to the existing literature in several ways. First, it is considered as a pioneer study in terms of evaluating the success of the EKB by using the updated IS Success Model. Second, the results provide the validity of the IS Success model for the case of the EKB. Finally, it presents a theoretical understanding regarding the importance of the variables of the study in explaining the success of the EKB in the context of Egyptian universities, more specifically, it examines the mediation effect of system usage and user satisfaction between the three dimensions of quality and net benefits. The results indicate that these three dimensions have no direct effect on net benefits, but they indirectly affect the net benefits through system usage and user satisfaction.

In addition, the results of this study have several valuable practical implications which may address the policy makers at the macro level and the EKB officials, at the micro level: (1) investing more in digital libraries as a key to enhance the educational recovery process from COVID-19; (2) allowing the Egyptians abroad to use the EKB, even for a fee; (3) holding more workshops in schools and universities to create awareness among students about the EKB usage and benefits in order to sustain the learning process and stay committed to achieving the educational objectives of Egypt Vision 2030; and (4) accelerating the establishment of the Arab Digital Union with the increasing need for these digital libraries, and as an emerging solution to share knowledge among universities, institutes, and research centres.

Limitations and future research

As in all research, there are few limitations with regards to this study which call for future research in order to reach a better assessment of the EKB. As mentioned earlier, the EKB has four sub-portals to address a wide range of internet users; children, students, researchers and general readers' portals. Since this study adopts the researchers' sub-portal solely, it is recommended for future research to examine other sub-portals in order to obtain a complete picture regarding the EKB success. Another limitation is related to the sample of this study which was

collected from a single postgraduate school, business studies, and gathered from the three selected Egyptian public universities. This setting may limit the generalizability of this study's findings; therefore, future research should expand the sample size by including other postgraduate schools in Egypt. Finally, and due to the COVID-19 pandemic, the current research employed a quantitative-based study using questionnaires and statistical evidence. In this regard, future research may consider using a different methodology, such as a qualitative study based on interviews, which will allow for a more in-depth evaluation regarding the EKB.

CRediT authorship contribution statement

Ahmed Farouk AbdelKader: Conceptualization, methodology,

validation, formal analysis, resources, investigation, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision, project administration.

Mentalla Hossameldin Sayed: Conceptualization, methodology, validation, writing—original draft preparation, visualization, project administration.

Declaration of competing interest

None.

Data availability

I have attached the data within the research manuscript itself

Appendix A

Table A.1
Factor loadings (λ).

Items	Statements	λ
SYQ1	The EKB provides high-speed information access	0.72
SYQ2	EKB is always available so I can use it whenever I want	0.90
SYQ3	EKB is user friendly	0.79
SYQ4	EKB is reliable	0.78
IQ1	The EKB provides information that is accurate	0.72
IQ2	The EKB provides information that is easy to understand	0.82
IQ3	The EKB provides sufficient information	0.70
IQ4	The EKB provides information that is secure	0.65
SEQ1	The EKB support staff have the resources required to ensure it is available and usable at all times	0.83
SEQ2	The EKB support staff gives me prompt service by responding quickly to my request for help	0.85
SEQ3	The EKB support staff have the knowledge to support my requests when needed	0.92
SEQ4	The EKB support staff shows empathy towards me while responding to my requests	0.76
SU1	I depend upon the EKB	0.83
SU2	I use many of the functions in the EKB	0.92
SU3	I frequently use the EKB	0.89
US1	The EKB satisfies my educational needs	0.79
US2	I am satisfied with The EKB effectiveness and efficiency	0.90
US3	The EKB has met my expectations	0.84
NB1	The EKB enables me to reduce time that I would use to search information	0.91
NB2	The EKB is an important and valuable aid to my research project/assignment	0.78
NB3	The EKB decreases the costs of obtaining electronic resources	0.92

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