Enterprise Resource Planning (ERP) Systems and ERP Quality Factors: A Literature Review

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Abstract

Enterprise Resource Planning (ERP) systems are the largest software packages of Information System (IS) adopted by many organisations to seek improvement in their employee's productivity and gain competitive advantage. The purpose of the study is to highlight the current state of literature on ERP system with specific focus on ERP quality factors representing System Quality (SQ), Information Quality (IQ), Service Quality (SRQ). The study also highlights the exemplary measures (scale) applied in various studies to evaluate ERP systems in many settings.The study will enable the researchers to understand ERP quality factors and its impact while utilizing and evaluating the ERP system. Lastly, the study summaries recent empirical work on each quality factor and based on these studies recommendations are provided for future research.

Keywords: Enterprise Resource Planning (ERP) Systems, ERP Quality Factors, System Quality (SQ), Information Quality (IQ), Service Quality (SRQ), Review

Introduction

Enterprise Resource Planning (ERP) systems are business management systems, comprising of a set of comprehensive software of Information System (IS) designed to integrate and manage all business functions within an organization, these set include applications for human resources, financial and accounting, sales and distribution, project management, material management, supply chain management (SCM), quality management (Shehab, Sharp, Supramaniam, & Spedding, 2004).

The main theme of ERP system is the centralization of information through centralized database. ERP system are Information system software modules sharing a central database and information is

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flown between them, which contain functionalities for sales and marketing, development and product design, field service, production, inventory control, distribution, process design, management, and procurement industrial facilities management, quality, manufacturing, human resource, finance and accounting, and information services (Upadhyay & Dan, 2008; Xu, Yu, Lim, & Hock, 2010). Moreover, ERP systems are the most comprehensive business information systems that has come to surface, and provide solid informational foundation for operational processing as well as decision making with the condition to implement successfully(Fadlalla& Amani, 2015).

ERP system implementation has led to better performance (Chung, Hua Tan, Lenny Koh, Law, & Ngai, 2007). These systems brought enormous benefits to organizations such as increased productivity, improve access to accurate and timely information, enhance work flow, reduce reliance on paper, knowledge sharing, tight control, (Bhamangol, Nandavadekar, & Khilari, 2011), as well as automate business processes by coordinating and integrating the information across departments (Monk, 2009). And these benefits are clear evidence; why larger organizations with large amount of data are attracted to these systems.

Literature review in academic field is considered to be very useful to look at the whole research field, to underline the important studies and provide guidelines for future research. Thus, the objective of this paper is to shed light on the ERP systems literature focusing on ERP quality factors representing system quality, information quality, service quality. The study will enable the researchers to understand ERP quality factors and its impact while utilizing and evaluating the ERP system.

Literature Review

The purpose of this section is to place our literature review in line with existing knowledge about ERP systems in general and ERP systems quality factors in particular. Then the set of ERP quality factors i.e. system quality, information quality and service quality will be discussed separately.

Enterprise Resource Planning (ERP) Systems

Enterprise Resource Planning applications are packages of Information System (IS), designed to establish the sharing of organizational data resources. (Klaus, Rosemann, & Gable, 2000). According to (Grabski, Leech, & Schmidt, 2011; Kumar, Maheshwari, and Kumar, 2003; Ngai, Law, & Wat, 2008; Umble, Haft, and Umble, 2003) ERP systems are integrated, complex innovations. Historically, the name of Enterprise Resource Planning (Kumar, Van Hillegersberg, & Experiences) was originated from material requirements planning (MRP)

and Manufacturing resource planning (MRPII). In 1970s MRP were developed to plan the product or parts requirements according to the master productions schedule. Following this, in 1980s manufacturing resource planning (MRP II) was introduced. MRP II included areas like project management, shop floor and distribution management, engineering human resource, and finance.

With the enhancement of these systems ERP came to surface in late 1980s and early 1990s. MRP, MRP II and ERP integrated business processes such as manufacturing, project management, financial, distribution, inventor management, human resource, maintenance and service, accounting and transportation providing visibility and consistency to the enterprise. In 1990s more functions and modules were added by vendors leading to the birth of extended ERPs (Rashid, Hossain, & Patrick, 2002) and they have become more among practitioners (Davenport, 1998). According to (Nizamani, Khoumbati, Ismaili, & Nizamani, 2014) now a days the term extended ERP systems are introduced. The nature of these systems is efficient and advance to process sales, human resources, procurement, manufacture, finance, CRM, operating planning, inventory management and material management. The concepts are ERP systems are summaries in table 1.

Table 1: Summary of ERP concepts

Concept / Definition	Author (s)
ERP system is a business management system comprises of set of software that integrate and manage all business functions within organization	(Zornada & Velkavrh, 2005)
Enterprise Resource Planning systems are integrated and complex innovations	(Grabski *et al.*, 2011; Umble *et al.*, 2003)
ERP are comprehensive information system that support the information needs of all the business functions, in real time, including human resources, finance, marketing, operations, customer information, sales and supply chain	(Seng Woo, 2007)
ERP is generally termed as a system that automate key business functions through integration and support decision making accordingly	(Razmi, Sangari, & Ghodsi, 2009)
A set of business modules or applications, that links organization's units like humane resource, finance, manufacture, accounting into one single integrated system providing a platform for flow of information across all units of the business with the use of internet as medium.	(Beheshti, 2006)
ERP systems are configurable information system packages, which are design to integrate business functions.	(Wu & Wang, 2006)
ERP system are set of software designed to integrate all business functions within organization.	(Shehab *et al.*, 2004)

ERP is an integrated system where a unique database provide flow for information continuously and consistently for the entire company.	(Wadate, 2014)
ERP system is a customizable enterprise wide packages able to integrate all organization's functions to single system with a common database.	(Cardoso, Bostrom, & Sheth, 2004)
ERP systems are business software packages which integrate all needed information of the organization and efficiently and enables them to use resources effectively and efficiently (human resources, financial, material etc.)	(Fui-Hoon Nah, Lee-Shang Lau, & Kuang, 2001)
A packaged business software that automate and integrate the business processes of an organization, manage a common database across enterprise and access information in real time environment.	(Marnewick & Labuschagne, 2005)

ERP Quality Factors

In Information System (IS) related literature, quality itself is relatively "ill-defined" (Nelson, Todd, & Wixom, 2005). Many authors argue that quality factors are self-defined or empirically derived(Dawi, Jusoh, Nor, & Qureshi, 2016; Qureshi, Khan, & Zaman, 2012). According to Rai, Lang, and Welker (2002) system quality is " the degree to which a system is user friendly", information quality is " the degree in which information generated possess content, accuracy, and format", and service quality is " human delivered service quality". Petter, DeLone, and McLean (2008) describe SQ is "performance of the IS in terms of reliability, convenience, ease of use, functionality, and other system metrics", IQ is "characteristics of the output offered by the IS, such as accuracy, timeliness, and completeness" and SRQ is "support to users by the IS department, often measured by the responsiveness, reliability, and empathy of the support organization".

Ding (2010) provide a unified view of IS quality concepts from marketing exchange perspective. They explained that quality in information systems is a capability that can provide benefits to users in tangible or intangible manners and define them as IQ: "the capability of information output to benefit users", SQ: "the capability of an IT object to process and deliver information for benefit of users" and SRQ: "the capability of a service to benefit users". Recently, the quality factors are used in conjunction to evaluate the IS success in different context and settings such as m-banking (Tam & Oliveira, 2016), ERP benefits (Yeh, Yang, & Lin, 2007), IT outsourcing (Gorla & Somers, 2014), organizational impact (Gorla, Somers, & Wong, 2010), E-learning (Mohammadi, 2015), e-portfolio (Abdullah, Ward, & Ahmed, 2016),

human resource information system (Shahibi, Saidin, & Izhar, 2016), library (TandiLwoga, 2013).

The quality factors for this study are based on Delone and McLean (2003) IS success model and they recommend that system quality, information quality and service quality be assessed. These factors are explained individually in the next section.

ERP System Quality (SQ)

System quality is defined as the degree in which the functionalities of the system can satisfy the needs of the users, with ease and encountering minimal problems.(Chang, Li, Hung, & Hwang, 2005; Delone & McLean, 2003). Bravo, Santana, and Rodon (2016) define SQ as the technological factors regarding the extent to which IS is simple to understand and use and how the system performs from a technical and design perspective. These functionalities are: consistency of the user interface, ease of use, ease of learning, quality of documentation, and the quality and maintainability of the program code, ease of learning (Chang *et al.*, 2005; Delone & McLean, 2003; Wang & Liao, 2008; Wang, 2008). System quality is desirable characteristics of an information system (Petter *et al.*, 2008), because its enable the system to provide easy and prompt information access (Schaupp, Carter, & McBride, 2010), reflect good quality design (Hsieh, Huang, & Yen, 2013), ensure secure and reliable function (Teo, Srivastava, & Jiang, 2008), provide system infrastructure support (Venkatesh, Sykes, & Venkatraman, 2014), ability to fulfil expected performance (Weerakkody, El-Haddadeh, Al-Sobhi, Shareef, & Dwivedi, 2013), and improve efficiency and effectiveness (Karkin & Janssen, 2014).

A common measure of SQ is ease of use used in studies. However, many other studies proposed and used different measures to capture SQ construct as a whole shown in table 2.

Table 2: Exemplary measures of System Quality

Studies	Measures
DeLone and McLean (1992)	"realization of user expectations, response time, Flexibility of system, perceived usefulness of IS, usefulness of DSS features, usefulness of specific functions, stored record error rate, system accessibility, resource utilization, investment utilization, IS sophistication (use of new technology), reliability, Convenience of access, ease of learning, ease of use, integration of systems
Seddon (1997)	bug in the system, user friendly, consistency of the user interface, ease of use, ease to learn, quality of the program code, response rate in interactive system, documentation of the program code, maintainability

	of the program code
McKinney, Yoon, and Zahedi (2002)	Access, ease of use, interactivity, navigation,
Delone and McLean (2003)	ease-of-use, functionality, reliability, flexibility, data quality, portability, integration, importance, adaptability, availability, response time, usability (e-Commerce)
Sedera and Gable (2004)	Access, Customization, Ease of Learning, ease of use, Flexibility, Integration, sophistication, system accuracy
Iivari (2005)	Convenience, Flexibility, Integration, response time,
Nelson *et al.* (2005)	Reliability, Flexibility, Accessibility, response time, integration
Gable, Sedera, and Chan (2008)	Access, Customization, Data Accuracy, Ease of Learning, ease of use, efficiency, Flexibility, Integration, reliability, sophistication, system accuracy
Tsai, Chen, Hwang, and Hsu (2010)	Data Accuracy, Database content, Data Currency, System Accuracy, Response time
Urbach, Smolnik, and Riempp (2010)	Navigation, Search-ability, structure, usability, functionality, accessibility

Previous literature exists on the importance of system quality to evaluate the IS success, acceptance and performance in conjunction with other constructs. In this regard, Tam and Oliveira (2016) investigate the functionalities of the ERP factors of D & M IS success model (1992, 2003) and factors from TTF as direct and moderating affect to evaluate the impact of mobile-banking on individual performance. The result reveal that use and user satisfaction are key precedents of individual performance and also TTF has moderating effect over use to user performance. Moreover, user satisfaction is affected by ERP quality factors IQ, SQ, SRQ providing new insight to managers to apply strategies for retention of users or attract new potential users. The study further pave ways for integration of IS models for better investigation of ERP systems.

While predicting ERP adoption and satisfaction determinants, Costa, Ferreira, Bento, and Aparicio (2016) propose a model comprising of variables from D&M and TAM with training and Management support aiming to investigate determinants effecting user satisfaction, adoption and understand ERP user perspective on such matters. The ERP system adoption constructs: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Actual Use (USE) and Behavioural Intention (BI) were included from TAM, while System Quality (SQ) and User Satisfaction (US) from D&M IS success model. The outcome shows the validation of the model and predict that training, and top management support has

impact on behavioural intention to use the system and the overall user satisfaction. In addition, to their results system quality is found to be a decisive factor of user satisfaction on individual user in ERP adoption. The proposed model further suggests investigating the influence of strength of systems quality with other constructs.

In the context of higher education, Abugabah, Sanzogni, and Alfarraj (2015) conducted a study to evaluate the impact of ERP systems on the performance of users in universities to understand the ERP phenomenon and further determine these works in complex environment. For this a synthesized model is developed comprising of constructs from D & M IS Success model, TAM and TTF. The result indicates that ERP systems has impact on the performance of user in higher education in significant way. The result, further highlight that the ERP's system quality, information quality and task technology fit are most significant factors that affect the performance of user in ERP environment. Although, the study factors highlight majority portion of the variance in user performance, but part of the variance still remains unexplained. Similarly, more empirical studies on system quality are shown in table 3.

Table 3: Empirical Studies on System Quality

Objective and Findings	Dimensions	Source
To investigate the functionalities of the ERP factors of D & M IS success model and factors from TTF as direct and moderating affect to evaluate the impact of mobile-banking on individual performance (user performance). The result revealed that use and user satisfaction are key precedents of individual performance and also TTF has moderating effect over use to user performance. Moreover, user satisfaction is affected by ERP quality factors IQ, SQ, SRQ providing new insight to managers to apply strategies for retention of users or attract new potential users.	Adapted from Urbach *et al.* (2010)	(Tam & Oliveira, 2016)
To investigate determinants effecting user satisfaction and ERP user adoption and understand ERP user perspective on such matters. The ERP system adoption constructs: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Actual Use (USE) and Behavioral Intention (BI) were included from TAM, while System Quality (SQ) and User Satisfaction (US) from D&M IS success model. The outcome shows the validation of the model and predicting that training, and top	Adapted from (Urbach *et al.*, 2010)	(Costa *et al.*, 2016)

management support has impact on behavioral intention to use the system and the overall user satisfaction. In addition, to their results system quality is found a decisive factor of user satisfaction on individual user in ERP adoption.		
This paper examines the success of the online public grievance redressal system (OPGRS) from the user perspective by measuring intention to use and user satisfaction. The developed model consists of constructs IQ, SQ, SRQ, PU, PEOU, perceived risk, and behavioral intention from IS success model and Seddon model. It is evident from the empirical finding that the system is a success.	Adapted from Delone and McLean (2003)	(Rana, Dwivedi, Williams, & Weerakkody, 2015)
To evaluate the impact of ERP systems on the performance of users in higher education institutions to understand the ERP phenomenon in these institutions and further determine these works in complex environment. For this a synthesized model is developed comprising of constructs from D & M IS Success model, TAM and TTF. The result indicates that ERP systems impact on the performance of user in higher education in significant way. The result, further highlight that the ERP's system quality, information quality and task technology fit are most significant factors that affect the performance of user in ERP environment.	Adapted from Goodhue and Thompson (1995) and Goodhue, Klein, and March (2000)	(Abugabah *et al.*, 2015)
This study analyses the linkage between performance measures of enterprise resource planning (ERP) systems and earnings management and propose an integrated model based on IS success model. The study found that the relationship between the performance of ERP systems and earnings management depends on system quality after ERP implementation.	Adapted from Delone and McLean (2003)	(Tsai, Lee, Liu, Lin, & Chou, 2012)
The study investigated the impact of ERP systems on user performance in higher education. For this a synthesized model is developed comprising constructs from D & M IS Success model, TAM and task technology fit. The result indicates that ERP systems impact on the performance of user in higher	Adapted from Goodhue and Thompson (1995) and Goodhue *et al.* (2000)	Abugabah, Sansogni, and Alfarraj

education in significant way. The result, further highlight that the ERP's system quality, information quality and task technology fit are most significant factors that affect the performance of user in ERP environment.		(2013)
To examine the role of quality factors in intention to continue using the e-learning among student in public higher education. The study found that IQ, SQ and SRQ are most important factors of behavioral intention while using e-learning among students. Moreover, SQ shows a considerable impact on their intention to use e-learning.	Adapted from DeLone and McLean (1992)	(Ramayah, Ahmad, & Lo, 2010)
To evaluate the impact of IS quality factors (SQ, IQ) and top management support on usage of ERP system. the study applies D & M success model and Seddon's model as theoretical base. The result indicates that both SQ and IQ are important and significant factors of ERP system usage via PU. In addition, SQ measures such as response time, reliability, integration, accessibility, and flexibility increase beliefs about ERP system usefulness.	Adapted from Delone and McLean (2003)	(Lin, 2010)
This study is conducted to explore the link between ERP quality constructs (SQ, IQ, SRQ) and its impact on organization. The result shows that, either directly or indirectly IS quality factors influence the organization impact.	Created by authors (system flexibility, system sophistication)	(Gorla *et al.*, 2010)

ERP Information Quality (IQ)

Information Quality (IQ) refers to the quality of the outputs the information system produces in reports and on-screen (DeLone & McLean, 1992), in other words, the desirable characteristics of an information system's output. Moores (2012) defined information quality as combination of end-user's perceptions of accuracy, content, format, and timeliness. In other context, this construct is to estimate that system is free of errors, whether it provide the information necessary for the user to complete their task within time, and the format of information is easy to read. Bravo *et al.* (2016) called it, technical factor regarding the relevance, timeliness and accuracy of information generated by the IS.

Information quality is important to ensure high quality information to users and that is viewed as key determinant for user acceptant

(McKinney *et al.*, 2002). In the communication theory, IQ belongs to the semantic level of information, which concerns the interpretation of the meaning by the sender, as compared with the intended meaning by the receive (Floropoulos, Spathis, Halvatzis, & Tsipouridou, 2010). IQ assess the actual information as features produced by the IS, and the degree this information matches the needs of the users in terms of reliability, relevance, accuracy, completeness, precision of information, conciseness and currency (Rai *et al.*, 2002). These features have been studies in IS research. Delone and McLean (2003) described IQ as the relevance, completeness, ease of understanding, personalization and security for measuring e-commerce systems success. some of the key measures for information quality are shown in table 4.

Table 4: Exemplary Measures of Information Quality

Studies	Measures
DeLone and McLean (1992)	"accuracy, relevance, format, conciseness, completeness, reliability, timeliness, sufficiency, understandability, relevance, comparability, usefulness"
Rainer Jr and Watson (1995)	"accuracy, Conciseness, Relevance, Timeliness,
Seddon (1997)	"useful format, accuracy, understandable, sufficient, up-to-date, timely, precise, meet the need"
McKinney *et al.* (2002)	Adequacy, Reliability, Scope, Timeliness, Understandability, Usefulness
Delone and McLean (2003)	"accuracy, timeliness, completeness, relevance, consistency, ease of understanding, personalization, security"
Sedera and Gable (2004)	"availability, usability, understandability, relevance, format, conciseness"
Iivari (2005)	"completeness, reliability, precision, currency, format of output"
Nelson *et al.* (2005)	Complete, accuracy, format, currency
Gable *et al.* (2008)	"importance, availability, usability, understandability, relevance, format, content accuracy, conciseness, timeliness, uniqueness"
Petter *et al.* (2008)	"accuracy, relevance, understandability, completeness, currency, competitive intelligence, dynamic content, content personalization, variety of information"
Tsai *et al.* (2010)	Reliability, Timeliness, Usableness, Understandability, Relevance
Urbach *et al.* (2010)	Usefulness, understandability, interestingness, reliability, completeness, timeliness

Although, the acknowledgement of information system acceptance is an important antecedent for effective emergency management, comparatively, little research exists to examine this aspect of technology acceptance. To fill this gap, Prasanna and Huggins (2016) propose a model by combining the strength of TAM and UTAUT, to investigate how a range of IS acceptance factors (such as Facilitation conditions, information quality, effort expectancy, social influence, performance expectancy, and symbolic adoption) affect the end user perception in accepting of emergency operations centre information system. after collecting data from end users, the analysis indicates that technology acceptance factors of effort expectancy, performance expectancy, information system, and social influence explain variance in symbolic adoption, which is the combination of psychological attachment and mental acceptance towards an information system. It is also observed that technology acceptance is affected by end-user profile characteristics such as age, gender, and user experience.

Bravo *et al.* (2016) examine the impact of technology on performance (system usefulness) by combining the role of automation of tasks (automating role) and informing role (supplier of information) and thus studies the influence of IQ and SQ on performance. For this purpose, they propose a model to evaluate the mediation effect of both roles between technological factors (IQ and SQ) and usefulness. After analysis of the data using structure equations model, the result indicates that IQ explains usefulness through both roles. Furthermore, system's level of intervention explains usefulness and system quality explains through the automating role and the informing role respectively.

Through the lens of the IS success model, Chen, Jubilado, Capistrano, and Yen (2015) investigated citizens' tendency to use e-governmental website services in the context of online tax filing system. In addition to the constructs of IS success model, attributes which act as important antecedents to model such as trust in government, trust in technology, trust in e-government website, and prior experience with government services, are analysed. The results indicate that prior experience, trust in technology and trust in government directly affect trust in e-government websites, which in turn influence all IS quality factors. Moreover, among three IS quality dimensions, IQ was found to be the most significantly and consistently influence perceptions of usefulness and user satisfaction.

In the library technologies, TandiLwoga (2013) conducted a study to re-specify and validate the IS success model to investigate adoption of library technologies. This study examines that how ERP quality factors (IQ, SQ, SRQ) affecting satisfaction, user perceived

benefits and intention to re-use the library application. The findings of the study confirm the validity of the IS model for library adoption assessment. The findings further reveal that intention to reuse of the users is important and accurately predicts the usage behaviour. The study also confirms the effect of quality constructs on perceived benefits and intention to reuse. Similarly, based on IS success model, Noorman Masrek, Jamaludin, and Awang Mukhtar (2010) propose a model to examine the effectiveness of a specific library portal for students in terms of information quality. The findings show that all the information quality attributes namely comprehensiveness, completeness, accuracy; reliability, timeliness, and appropriateness of format are rated highly by students, along with other quality factors (system quality and service quality). Similarly, empirical studies on information quality are depicted in table 5.

Table 5: Empirical studies on Information Quality

Objectives and Findings	Dimensions	Source
To examine IS acceptance in emergency management. A model is proposed comprising of the variables from TAM and UTAUT. The analysis indicates that technology acceptance factors of effort expectancy, performance expectancy, information system, and social influence explain variance in symbolic adoption. It is also observed that technology acceptance is affected by end-user profile characteristics such as age, gender, and user experience.	Adapted from Moores (2012)	(Prasanna & Huggins, 2016)
To examine the impact of technology on performance (usefulness) by combining the role of automation of tasks (automating role) and Informing role (supplier of information) and thus studies the influence of IQ and SQ on performance (system usefulness). For this purpose, they propose a model to evaluate the mediation effect of both roles between technological factors (IQ and SQ) and usefulness. After analysis of the data using structure equations model, the result indicates that IQ explains usefulness through both roles. Furthermore, system's level of intervention explains usefulness and system quality explains through the automating role and the informing role respectively.	Adapted from Kositanurit, Ngwenyama, and Osei-Bryson (2006)	(Bravo *et al.*, 2016)
To investigate citizens' tendency to use e-governmental website services in the context of online tax filing system. In addition to the	Adapted from Chang *et al.* (2005),	(Chen *et al.*, 2015)

constructs of IS success model, attributes which act as important antecedents to model such as trust in government, trust in technology, trust in e-government website, and prior experience with government services, are analyzed. The results indicate that prior experience, trust in technology and trust in government directly affect trust in e-government websites, which in turn influence all IS quality factors. Moreover, among three IS quality dimensions, IQ was found to be the most significantly and consistently influence perceptions of usefulness and user satisfaction.	Delone and McLean (2003), Rai *et al.* (2002), Teo *et al.* (2008), Wang and Liao (2008)	
To re-specify and validate the IS success model to investigate adoption of library technologies. This study examines that how ERP quality factors (IQ, SQ, SRQ) affecting satisfaction, user perceived benefits and intention to re-use the library application. The findings of the study confirm the validity of the IS model for library adoption assessment. The findings further reveal that intention to reuse of the users is important and accurately predicts the usage behavior. The study also confirms the effect of quality constructs on perceived benefits and intention to reuse.	Adapted from Delone and McLean (2003), Noorman Masrek *et al.* (2010)	(Tandi Lwoga, 2013)
The study develops and test a model of IT acceptance by revisiting the TAM. The model compares the role of attitude, compatibility and use to measure IT acceptance. The result reveal that the quality of the information provided by the system and the extent to which the user feels they have the technical support to make use the system is both significant.	Adapted from Ajzen and Fishbein (1975)	(Moores, 2012)
To examine the effectiveness of a specific library portal for students in terms of information quality. The findings show that all the information quality attributes namely comprehensiveness, completeness, accuracy, reliability, timeliness, and appropriateness of format are rated highly by students, along with other quality factors (system quality and service quality).	Adapted from Ahn, Ryu, and Han (2005), Noorman bin Masrek (2007), Roca, Chiu, and Martínez (2006)	(Noorman Masrek *et al.*, 2010)
The purpose of this paper is to investigate the success of TAXIS from the perspective of expert employees, who work in public taxation	Adapted from DeLone and	(Floropoulos *et al.*, 2010)

agencies. The model developed includes the constructs of information, system and service quality, perceived usefulness and user satisfaction. The results provide evidence that there are strong connections between the five success constructs. All hypothesized relationships are supported, except for the relationship between system quality and user satisfaction.	McLean (1992), Delone and McLean (2003)	
The purpose of the study is to examine the usage of e-learning in public sector universities. The authors adapted quality part of the D & M (2003) model to evaluate its effect on behavioral intention. The findings of the research conclude that system quality, information quality, and service quality are determinants of behavioral intention and all quality factors shows considerable influence on behavioral intention in the usage of e-learning system. this indicate that sufficient and updated information provided by e-learning system will enhance the behavioral intentions of the student towards the system.	Adapted from DeLone and McLean (1992), Lee, Kim, and Kim (2007)	(Ramayah *et al.*, 2010)
The goal of this research is to empirically test the relationships among the constructs/dimensions in a re-specified ERP system success model. The research model is based on D & M (1992) model. The result found support for SQ and SRQ on individual impact. Surprisingly, Information Quality is a major determinant of ERP success in adopting organizations; this data did not find support for such a claim.	Adapted from DeLone and McLean (1992), Gable, Sedera, and Chan (2003), Gable *et al.* (2008)	(Ifinedo, Rapp, Ifinedo, & Sundberg, 2010)

ERP Service Quality (SRQ)

Service quality refers to the overall quality of the support that system users receive from the IS department and IT support personnel (Delone & McLean, 2003). Scholars, such as Pitt, Watson, and Kavan (1995) highlighted a drawback in the commonly used US success measures, which focus on system rather service by IS departments or vendors. In this response, the inclusion was made by Delone and McLean (2003) as dimension in their reformulated model with clarification that IQ and SQ are important to measure the success of single information technology (IT), and for the measurement of overall success of the IS SRQ is essential. Hence, they adapt an SERQUAL, the instrument developed by Parasuraman, Zeithaml, and Berry (1988) to assess SQ in the IS domain via five dimensions: tangibility, reliability,

responsiveness, assurance, and empathy and define. Table 6 depicts different measures of service quality used in literature.

Table 6: Exemplary Measures of Service Quality

Studies	Measures
Pitt *et al.* (1995)	tangibles: physical facilities, equipment, and appearance of personnel reliability: ability to perform the promised service dependably and accurately responsiveness: willingness to help customers and provide prompt service assurance: knowledge and courtesy of employees and their ability to inspire trust and confidence empathy: Caring, individualized attention the service provider gives its customers
Delone and McLean (2003)	IS has up-to-date hardware and software" (tangible) IS is dependable" (reliability) " IS employees give prompt service to users (responsiveness) IS employees have the knowledge to do their job well (assurance) "IS has users' best interests at heart" (empathy)
Parasuraman, Zeithaml, and Malhotra (2005)	Efficiency, System availability, Fulfilment, Privacy, Responsiveness, Compensation, Contact
Yang, Cai, Zhou, and Zhou (2005)	Usability, Usefulness of content, Adequacy of information, Accessibility, Interaction
Chang and King (2005)	Flexibility, interpersonal quality, intrinsic quality, IS training, responsiveness
Petter *et al.* (2008)	responsiveness, accuracy, reliability, technical competence, empathy of the personnel staff
Chen, Chen, and Tsai (2009)	Usability, Privacy and security, adequacy, appearance
Urbach *et al.* (2010)	Responsiveness, empathy, reliability, assurance

In recent years, researchers began to include service quality as measure of IS success, due to the expand role of the IS department and the important of IS (Chiu, Chiu, & Chang, 2007). Service quality is important to both services and industry for the success in competitive market and in ERP environment service quality is contributing to its success (Yeh *et al.*, 2007).

Based on the Delone and McLean (2003) IS success model, Hsu, Yen, and Chung (2015) propose a model comprising of three quality factors to assess ERP post-implementation success at individual level with a special focus on service quality. The study concludes that all

quality factors demonstrate significant impacts on ERP post-implementation success. They further, conclude that satisfying the hedonic needs of users with human delivered service could generate the extend use of the system.

In the e-service context, Xu, Benbasat, and Cenfetelli (2013) integrate IQ, SQ, and SRQ to first check perceptions among them and also to examine how quality constructs influence the behavioural beliefs that affects IT adoption. The results of their hypotheses indicate that IQ and SQ can directly and indirectly improve SRQ in e-service context and their combine impact on usage intention. In addition, the result shows that customers relied less on system quality and more on information quality (which itself is affected by SQ) in forming a perception of service quality. Finally, they proposed to explore the quality dimensions in more details.

Service quality is very important to student's satisfaction in higher education. Saleem, Moosa, Imam, and Ahmed Khan (2017) conducted a study to evaluate the student's satisfaction with the quality of service provided by higher educational institutions. The study also examines the influence of price, university reputation and their culture on student satisfaction. The result shows that university culture strengthen the relationship between service quality provide by institutions to satisfy students, while price and university reputation has negative impact on their relationship. Table 7 summarises empirical studies on service quality.

Table 7: Empirical studies on Service Quality

Objective and Findings	Dimensions	Source
The study investigate how ERP qualities affect its post implementation success from user's perspective. SRQ in conjunction with IQ and SQ significantly affects ERP post-implementation success in terms of user satisfaction. Moreover, SRQ promote ERP's post-implementation success by increasing employees' extended use.	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Hsu *et al.*, 2015)
The study integrates object-based beliefs with behavior-based beliefs in one model to examine e-service adoption. The relationship of three quality constructs (IQ, SQ, SRQ) are also tested. The results indicate that IQ and SQ can directly and indirectly improve SRQ in e-service context and	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Xu *et al.*, 2013)

their combine impact on usage intention.		
The purpose of this paper is to investigate service quality in higher education in Thailand. Specifically, this study investigates the five dimensions of SERVQUAL instrumentation.	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Yousapronpaiboon, 2014)
Develop a conceptual framework to investigate the ERP selection criteria to service quality provided by suppliers and consultants and thus how these influence ERP implementation successes. the study suggested that enhanced SRQ and SQ increase user perspective (user satisfaction, individual impact) and ERP success.	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Tsai, Lee, Shen, & Lin, 2012)
This study focused on the service quality of Higher Educational Institutes (HEIs) to attain student satisfaction through the moderating effect of university reputation, price and university culture. Conclusively, the association between service quality and student satisfaction is positively strengthened by the university culture, while price and university reputation negatively strengthened the relationship.	Tangibles, empathy, assurance, responsiveness, reliability, competence, content, outcome	(Saleem *et al.*, 2017)
The purpose of the study is to examine the dimension of service quality and information quality that contribute to the overall perceived service quality in m-commerce.	Reliability, Personalization, perceived risk	(Salameh, Hassan, Alekam, & Alkafagi, 2015)
To examine the effect of consumer characteristics on service quality for self-service kiosks (self-checkouts) in terms of actual use. The study found that service quality for self-service kiosks important to make consumers to actually use these operations for both genders.	Time convenience, ease of use, control, enjoyment	(Lee, Fairhurst, & Cho, 2013)
This study explores the mediating effect of IT governance (ITG)- value delivery between service quality	(SERVQUAL) Tangibility, Reliability,	(Tsai, Chou, Leu, Chen, & Tsaur, 2015)

(quality of vendor service, quality of consultant service) and ERP performance. Their result shows that value provides an effective measure of ERP performance under ITG framework and also provide mediating effects of value deliver between service quality and ERP performance.	Responsiveness, Assurance, Empathy	
The main objective of this study was to examine the effect of service quality on customer satisfaction. This study posits and develops an instrument of service quality, and examines the relationship between perceived service quality and customer satisfaction. The results of this study indicated that service quality is an important antecedent of customer satisfaction.	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Mohammad & Alhamadani, 2011)
The purpose of this paper is to assess the service quality perceptions and expectations of international postgraduate students studying in selected Malaysian universities. Five factors in the form of professionalism, reliability, hospitality, tangibles, and commitment were uncovered. This study was able to show that international postgraduate students in five Malaysian universities have negative perceptions of education service quality in their universities, as students' expectations were not met in the performance of education services.	Professionalism, reliability, hospitality, tangibles, commitment (modified based on SERVQUAL)	(Shekarchizadeh, Rasli, &Hon-Tat, 2011)
This paper assesses the quality of services to users in academic libraries in developing countries using SERVQUAL model. The purpose was to expose the service areas where the desires of library users are not met, ascertain the causes, and suggest corrective measures. The result shows that the level of expected services was	(SERVQUAL) Tangibility, Reliability, Responsiveness, Assurance, Empathy	(Markovic & Raspor, 2010)

greater than the actual services received. Inadequate funds, misappropriation, and lack of modern infrastructure, among others, negatively affect efficient services in academic libraries in developing countries.		
This study conducted two sets of analyses to develop and validate an instrument that measured the service quality of general portals plus its effect on customer satisfaction. The results indicated that the instrument is a four-factor model that includes adequacy of information, appearance, usability, and privacy and security. However, only the first two factors are significantly associated with customer satisfaction.	Usability, Privacy and security, adequacy of information, appearance	(Chen *et al.*, 2009)

Discussion &Conclusion

This review provides guidance to researchers with an insight to published articles on ERP systems with focus on ERP quality factors. It also provides a better understanding to ERP quality factors, which can be applied towards the evaluation of these systems in the future. In conclusion, ERP quality factors are used singularly and in conjunction to study the overall ERP system acceptance, adoption, utilization. Over the years, a number of studies applied system quality, information quality, and service quality to explain ERP success in different setting but the focus can be found on system quality and information quality ignoring service quality. Therefore, a bitter fit among ERP quality factors is needed as their potential impact on the perception of users is still an ongoing debate (Wang & Lai, 2014). In summary, it is recommendedto evaluate the intangible aspects of the system using ERP quality factors especially service quality provided by IT department to assess the performance of users (Alsaleh & Bageel, 2016).

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