ORIGINAL ARTICLE

The impact of interaction quality factors on the effectiveness of Web-based information system: the mediating role of user satisfaction

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Abstract Recently, IS researchers have focused on the assessment of Web-based information system (WBIS) at the individual level as it highly contributes to the organizations' employees. The evaluation and development of WBIS is significantly needed because the top management is in need of justifying their costly IT investment in terms of its impacts on employee performance. For this purpose, this study is primarily concerned with the development and validation of new multidimensional instrument, and also a theoretical framework for assessing the impacts of user interface quality, online communication quality, and user satisfaction on the effectiveness of Web employee portals. The effectiveness is assessed in terms of contextual performance. In a large-scale study, a sample of 384 United Nations Relief and Works Agency for Palestine Refugees respondents are gathered in order to validate and check the reliability of the adapted study instrument. The results of validity and reliability analysis provide enough confidence to proceed toward validating the proposed theoretical framework. The results of multiple-regression analysis indicate that there is a positive significant relationship between user interface quality, communication quality, user satisfaction, and effectiveness at significance level (sig. < 0.01). As another important point, the results of hierarchical regression showed that user satisfaction has a mediating role on the relationship between user interface quality, communication quality, and contextual employee performance. The findings and implications of this research are discussed. Finally, it is expected that this study would contribute to empirical studies in the fields of IS and user behavior assessment.

1 Introduction

The adoption of WBIS highly contributes to the organization performance at different levels as the use of WBIS leads to several important advantages, such as performance enhancement, efficiency increase, productivity of information exchange, improvement of service quality, and cost reduction (AlHendawi and Baharudin 2013; Alberto and Fernando 2007; De Toni and Zanutto 2006). Additionally, the implementation of Web portal system as a type of WBIS within international organizations, such as United Nations Relief and Works Agency for Palestine Refugees (UNRWA), has a significant influence on the level of organization performance, effectiveness, as well as its productivity (Gichoya 2005; Panigyrakis and Chartzipanagiotou 2006; Al-adaileh 2009).

The WBMIS is designed to view information and provide the ability to perform the organization processes where the software applications of the WBMIS should be integrated with these processes (Daniel and Ward 2005; Chan and Liu 2007). The Web employee portal is a type of WBMIS, and therefore, it could be considered as a representative for WBMIS. Moreover, employee portal system is a Web-based management information system that is intended to achieve a set of valuable objectives. First, it is designed to equip and develop the professional

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performance of employees. Second, it aims to enhance the contextual performance (i.e., interpersonal skills) of employees. Third, it intends to improve the quality of services through enhancing and integrating the electronic support, tools, and the facilities with the Web. Fourth, it seeks to provide a motivated working environment for UNRWA employees. Fifth, it aims to reduce the cost and time of both training process and communication activities. Sixth, it is deployed to enhance the relationships and information exchange between employees themselves, employee and technical support staff, employees, and top management staff.

Joinson (2003) mentioned that the interactivity of the system affects the interaction between employees positively, which in turn has a positive impact upon the satisfaction of users within organization. Therefore, enabling such a type of interaction through the inclusion of user interface and communication tools can influence the user satisfaction with the WBMIS, which positively affects the knowledge sharing among the organization staff and others (Law et al. 2007; Benbya et al. 2004; Kim et al. 2002; Jarvenpaa et al. 1999). Furthermore, the interaction quality including user interface and online communication tools has a critical effect on the user satisfaction and also the interpersonal skills toward enhancing the employee contextual performance. The contextual performance is conceptualized in terms of the interpersonal skills of system users including innovation, communication, and creativity.

Based on extensive review, there is no published study that comprehensively discusses the mediation role of user satisfaction between the quality factors, specially interaction and the contextual performance. In the context of the relationship between quality factors and performance, most of the previous studies focused on the task performance where task performance is mainly concerned with professional skills (Ling 2003).

Moreover, this study is also considered as one of the fewest that explore the direct relationship between interaction quality factors and employee performance at one of the largest international organizations which plays a semigovernmental role in providing services to millions of refugees in several critical fields. For these reasons, this study aims at developing a new model for assessing the effects of interaction design factors on the contextual performance with the mediating role of user satisfaction.

Thus, this empirical study is expected to fill the gap in IS literature and the related empirical studies. To do so, Section 2 is primarily concerned with the literature review to conceptualize and explore the relationships between study variables. Section 3 reviews the related work and provides the hypotheses and the theoretical framework that links study variables in light of this review. Section 4

Table 1 The definition of user satisfaction dimensions

User satisfaction dimensions	Definition	Adapted from
D1: Internal customer satisfaction	The extent that WBMIS helps users or employees to contribute values to internal and external customers	Torkzadeh and Doll (1999)
D2: Overall satisfaction	The user satisfaction with the overall WBMIS (portal) services	Seddon and Kiew (1994)

discusses the methodology that the researcher followed in the present study. Section 5 focuses on the goodness of the study instrument. Section 6 keeps special attention on the hypotheses testing. Section 7 provides a discussion regarding the data analysis and findings and discusses the practical and theoretical implications. Finally, the purpose, context, main findings, and contribution of the current research are concluded.

2 Theoretical foundations

This section briefly explains what has been written about the study variable: effectiveness, interaction design quality, and user satisfaction. At the end of the present section, the concepts of study's factors are summarized in Table 1.

2.1 Effectiveness

In this context of effectiveness, Thong and Yap (1996) and DeLone and McLean (1992) mentioned that although the information system effectiveness is a difficult variable to be assessed based on an accurate measure, IS effectiveness is considered the ultimate outcome of IS research (i.e., the IS dependent variable). Concerning the definition of IS effectiveness, although the IS research did not agree on a single standard definition for IS effectiveness (Hamilton and Chervany 1981; Delone and McLean 1992; Thong and Yap 1996), Hamilton and Chervany (1981) defined IS effectiveness as the degree to which the information system actually adds value toward achieving organizational goals. Also, in this context Grover et al. (1996) defined the effective system as a value-added system which influences the user behavior positively (i.e., it improves user productivity, communication, flexibility, and information management).

In efforts to conceptualize the IS effectiveness, it is highly important to mention that many researchers (e.g., Tojib et al. 2006) highlighted that employee portals have a positive impact on the organizations in numerous fields such as employee productivity and communication. UN-RWA developmental plan put the implementation of

WBMIS as one of its main objectives. The purpose of the designed WBMIS is to develop the employee interpersonal skills. Thus, within the context of this study, the IS effectiveness is conceptualized as the employee contextual performance including contextual or interpersonal performance skills (Ling 2003).

2.2 User satisfaction

Considering user satisfaction, Torkzadeh and Doll (1999) defined an equivalent term to the user satisfaction called customer satisfaction. They define it from the cognitive perspective as the extent to which the system helps users to contribute values to internal and external customers, where the internal customers are the users or the employees themselves (Lai 2006; Chang and Huang 2010). Recently, it is found that the IS research (such as Wang et al. 2007; Sugianto and Tojib 2006; Tojib et al. 2006; Muylle et al. 2004; Delone and Mclean 2003) have a special focus on the satisfaction with e-commerce or Web-based environment because most of the firms adopt the e-management and Web-based data processing in their daily work (Panigyrakis and Chartzipanagiotou 2006). In the context of Web satisfaction and e-commerce, Delone and McLean (2003) considered user satisfaction as one of the most important measures for assessing the effectiveness of the e-commerce system. Sugianto and Tojib (2006) defined the user satisfaction with portal system as an affective attitude of the users toward the portal system that they interact directly. With respect to satisfaction with e-learning system, Wang et al. (2007) considered user satisfaction as one of the important measures for assessing e-learning systems. Regarding the dimensions of user satisfaction, many researchers (such as Williams and Anderson 1991; Locke 1976) highlighted that satisfaction consists of two main components or dimensions, i.e., cognitive component (i.e., behavioral actions or thinking) and affective component (i.e., emotional attitude). With regard to the definition of user satisfaction in this study, the concept of Chia (2003) is adapted in order to comprehensively cover the emotional and behavioral parties of user satisfaction. Thus, user satisfaction will be measured through two dimensions: internal user satisfaction (adapted from Torkzadeh and Doll 1999) and overall satisfaction (adapted from Seddon and Kiew 1994). Table 1 expresses the concept and dimensions of user satisfaction.

2.3 Interaction design quality

Currently, interaction design has turned into a discipline that is concerned not only with system development, but also with product design and development (Edeholt and Löwgren 2003). Similarly, Holmlid (2009) mentioned that

Table 2 The definition of interaction design quality dimensions

User satisfaction dimensions	Definition	Adapted from
D1: user interface quality	The extent to which user interface layout such as profiling and links enables the employees to interact with the system properly	Lawson-Body et al. (2010), Muylle et al. (2004), Yoo and Donthu (2001)
D2: communication quality	The degree to which the WBMIS provides online communication tools such as feedback, discussion forum, and FAQ to allow the knowledge sharing among employees	Lawson-Body et al. (2010)

interaction design has become one of the key user-centered design disciplines. According to Cooper et al. (2007), the interaction term is created by Bill Moggridge and Bill Verplank in the mid-1980s. Verplank mentioned that the interaction design term is adapted from the user interface design as computer science term into industrial design profession term, while Cooper et al. (2007) highlighted that interaction design does not only focus on form design but also keep a great focus on the behavioral actions. Moreover, Moggridge (2007) explained that the interaction design is related to the industrial design of software products. Albrecht et al. (2005) defined the interactivity on the Internet as the degree to which the organizations participate in online exchange with others regardless of the restrictions of time and distance. The study of Lawson-Body and Limayem (2004) concluded that collaboration and communication systems are considered as interaction dimensions. Therefore, in an effort to comprehensively investigate the impact of interaction design quality, this study identifies the concept of interaction design quality as a two-dimensional factor, i.e., interface design quality and communication quality (Puntambekar 2009; Law et al. 2007).

Thus, in this study, the interaction design is defined as the degree to which WBMIS enables the organization employees to engage in online exchange with others through the user interface facilities and the available communication tools quality (Albrecht et al. 2005; Julier 2006), such as profiling, e-mail links, discussion form, feedback form, FAQ page, group subscription, Web layout, and Web site structure (Lawson-Body et al. 2010; Muylle et al. 2004; Yoo and Donthu 2001). Consequently, interaction design quality will be measured through two dimensions: user interface quality and communication tools quality, where the measures of two dimensions are

adapted from several standard scales (Lawson-Body et al. 2010; Muylle et al. 2004; Yoo and Donthu 2001). The following table expresses the concept and dimensions of interaction design quality (see Table 2).

3 Review of related work and theoretical framework

Based on Baron and Kenny (1986), there is an essentiality to satisfy four conditions: First, the independent variables (IVs) have a significant influence on the dependent variable (DV). Second, there is a significant relationship between IVs and the mediator variable (MV). Third, the mediator variable has a significant relationship with DV. Fourth, the full mediation of user satisfaction has occurred, if the independent variables do not have significant relationships with dependent variable. The following topics discuss the hypotheses that should be developed in light of both the IS-related work and the mediation conditions.

3.1 The relationship between interaction design quality and effectiveness (IVs → DV)

Some IS researchers (such as Wang and Wang 2009) found that there is no significant relationship between some parts of the interaction design and usefulness or task performance as a part of employee performance. Wang and Wang (2009) pointed out that the well-designed user interface has no effect on the perceived usefulness. Also, it is found that the colors or graphics have no relationship with the user performance of e-learning systems (Wu and Wang 2006).

However, many IS researchers (such as Lin 2010) suggested that interaction design quality including interface design has a positive relationship with usefulness or employee performance. According to Bennett and Franco (1999), factors such as availability of resources, feedback, and communication affect the motivation of staff positively, where motivation is considered as a key factor in the employee performance (Luthans 1998). Additionally, Blackler (1995) and Arvey et al. (1989) found that the interaction factors including feedback, communication, social interaction, and other personality traits affect the employee performance.

From IT/IS perspective (i.e., human–computer interaction, HCI), the interaction design quality could be represented by the user interface design or Web design quality (Zhang et al. 2004). Thus, within the context of this study, it is expected to have a significant relationship between the interaction design and effectiveness where interface design, graphics, communication, social interaction, and feedback are employed in order to examine the quality of interaction design. Consequently, there is a need to examine two

hypotheses to validate the relationships between the two dimensions: interaction design (user interface quality and communication tools quality) and the effectiveness.

H1 The user interface design has a positive effect on the effectiveness of WBMIS.

H2 The communication quality has a positive effect on the effectiveness of WBMIS.

3.2 The relationship between interaction design quality and user satisfaction (IVs → MV)

Cooper et al. (2007) highlighted that interaction design is not only concerned with the form design but also keeps highly focus on behavior where behavioral actions are affected by attitude (Davis 1989; Doll and Torkzadeh 1991). He also mentioned that interaction design is considered as one of the factors that target the desires and the satisfaction of users. Lawson-body et al. (2010) highlighted that the level of interactivity has a moderation role in the relationship between some independent factors and customer loyalty (i.e., dependent variable). Therefore, it affects the user satisfaction which is one of the determinants for effectiveness (see Sect. 2.2). Joinson (2003) mentioned that the interaction between employees influences the satisfaction of users within organizations.

Some IS researchers such as Urbach et al. (2009) found a positive influence on collaboration quality and user satisfaction. Since the interaction design is conceptualized as a two-dimensional variable, there is a need to examine the relationship between the two dimensions of interaction design (user interface quality and communication tools quality). Accordingly, within the context of the research, we propose the following two hypotheses (one for each dimension):

H3 The user interface quality has a positive effect on the user satisfaction with WBMIS.

H4 The communication quality has a positive effect on the user satisfaction with WBMIS.

3.3 The relationship between user satisfaction and effectiveness (MV → DV)

Despite the weak correlation between user satisfaction and decision-making performance (Yuthas and Young 1998), most of the previous IS studies indicated that user satisfaction has a positive influence on the effectiveness or net benefits. A meta-analytic assessment of 52 empirical studies of Petter and McLean (2009) indicated that user satisfaction is significantly related to the net benefits including task performance. Also, Petter et al. (2008) pointed in their survey study that 14 out of 14 empirical

studies found that there is a positive relationship between user satisfaction and net benefits. In terms of task performance, Wang and Liao (2008) found that there is a positive relationship between user satisfaction and task performance. Similarly, Abugabah and Sanzogni (2010) mentioned that user satisfaction has a positive influence on the efficiency as part of employee performance. Iivari (2005) indicated that user satisfaction has a positive influence on the task performance. Considering contextual performance or interpersonal skills, Balaban et al. (2013) found a significant relationship between user satisfaction and personal development as part of contextual performance.

Additionally, Chang and Chen (2009) suggested that customer satisfaction has a positive influence on the loyalty of a customer. Abugabah and Sanzogni (2009) mentioned the positive impact of ease of use as a part of satisfaction on the employee efficiency, which is a part of employee performance. Law and Ngai (2007) found a strong relationship between user satisfaction and organizational performance. Since the Web system is designed to be used by different stakeholders, customers and employees are practically system users. Accordingly, most of IS studies found a strong relationship between user satisfaction and user performance.

To ensure the significance of the relationship between user satisfaction and effectiveness in terms of performance, the hypotheses that assume the relationships between user satisfaction, task performance, and contextual performance are proposed to be examined:

H5 The user satisfaction has a positive effect on WBMIS effectiveness.

3.4 The mediating role of user satisfaction on the relationship between IVs and DV (MV → MV → DV)

In order to check whether the mediating role is full or partial mediation, there is a need to check the direct effect (i.e., IV → DV) and indirect effects (IV → MV and MV → DV). If the direct effect equals zero when mediating user satisfaction, then there is a full mediation; otherwise, there is a partial mediation. Consequently, the following hypothesis is proposed to be examined:

H6 User satisfaction mediates the relationship between user interface quality, communication quality, and contextual performance.

Based on literature review and the hypotheses development, there are links between study's variables in which the user satisfaction functions as a mediator. Therefore, the theoretical framework of the study variables is as follows:

Table 3 The adaptation of dependent variable scale

	Variable name	Adapted from (authors)
Dependent variable (DV)	WBMIS effectiveness	Torkzadeh and Doll (1999), McMurtrey et al. (2008)
Independent variable (IV)	Interaction design quality	Lawson-Body et al. (2010), Muylle et al. (2004), Yoo and Donthu (2001)
	Dim1: user interface quality (UIQ)	
	Dim2: communication quality (ComQ)	
Mediator	User satisfaction	Seddon and Kiew (1994)
		Doll and Torkzedah (1999)

4 Research methodology

This section presents the employed methodology in order to acquire empirical evidence on the relationship between variables identified in Sect. 3. It also outlines the process of generating scale items, sampling methods, procedures, and techniques of data collection in addition to statistical techniques for data analysis.

4.1 Generation of scale items

An extensive literature review was conducted to ensure that a comprehensive list of items was generated to assess the study variables included in the proposed model. Based on this review, the researcher generated an initial scale of thirty-five items are adapted from standard scales. Table 3 reveals the sources of the adapted scale's items.

4.2 Initial instrument

In order to proceed toward the validation of the theoretical model, there is an essentiality for developing an instrument (i.e., a questionnaire), including thirty-five items that are generated based on literature survey. The questionnaire consists of four dimensions: user interface quality, communication quality, user satisfaction as a mediator, and effectiveness as a dependent variable. Additionally, the questionnaire was developed using a seven-point Likert-type scale ranging from 1 = strongly disagree to 7 = strongly agree.

4.3 Validity and reliability of initial instrument

The content validity is important to ensure that the measures include an adequate set of the items that match the measured concept. To conduct content validity, it is

Table 4 Summary of results from item-to-correlation and reliability test

S. no.	Dimension/item	Reliability	Corrected item-to-total correlation
	Contextual performance (DV)	**0.943**	
B1	This system helps me identify innovative ways of doing my job		0.840
B2	This system helps finding new ways to improve the job performance		0.756
B3	This system helps creating new ideas		0.850
B4	This system helps in trying out innovative ideas		0.703
B5	This system helps in solving job problems		0.749
B6	It enables working as part of a group/team		0.731
B7	It increases the ability to take decision		0.805
B8	It helps strengthening the relationship with others		0.747
B9	It affects the ability of analyzing and evaluating		0.719
B10	It offers the ability to assess problems and choose appropriate solutions		0.817
	Interaction design quality (IVs)		
	Communication quality (CIQ)	**0.824**	
F3	The system provides a discussion form		0.655
F4	The system provides a feedback form		0.738
F5	The system presents a page of frequently asked questions (FAQs)		0.504
F6	The system provides a form to subscribe to related news groups		0.635
F10	Generally, the system contributes to the interactive capacity of the organization		0.663
	User interface quality (UIQ)	**0.804**	
F1	The employee can check general information on profile and organization via the system		0.639
F2	The system presents an organized list of specific e-mail link to each employee contact		0.540
F7	The system's services are designed to be easily accessed		0.572
F8	The system's look/appearance is unambiguous		0.642
F9	There is compatibility between graphics (colors, graphs, images) and content		0.559
	User satisfaction (MV)	**0.946**	
G1	The system satisfactorily meets the information processing needs of the area of responsibility		0.752
G2	The system is sufficient enough		0.878
G3	The system is effective enough		0.819
G4	You are well satisfied with the system as a whole		0.860
G5	The system helps improving the satisfaction of the target group		0.783
G6	The system helps improving capabilities to meet the needs of the target group		0.844
G7	The system helps in creating value for users		0.739
G8	The system allows more user orientation (i.e., target group-focused)		0.781

Bold values indicate the strength of the relationships between study variables

recommended to evaluate the questionnaire by a group of experts (Sekaran and Bougie 2009), and thus, the questionnaire is evaluated by 13 academics (including IT experts and practitioners) who worked in a closely related field. As a result of validity, they suggested eliminating several items because of redundancy and overlapping between questionnaire dimensions. Additionally, some items are rephrased to ensure easier understanding for respondents.

Considering the criterion validity, the corrected item-to-total correlations are used to delete the garbage items (Cronbach 1951). In such validity, items with item-to-total correlations <0.4 are deleted (Wang et al. 2007). After that, the reliability of each dimension is assessed by Cronbach's

alpha test. As a result of item-to-total correlation and reliability tests, no item was deleted because all items with corrected item-to-total correlations are greater than 0.4 and also the reliability of questionnaire dimensions is greater than or equals 0.8. Table 4 shows the initial scale that is used in the data collection.

Based on the reliability analysis shown in Table 4, the item-to-total correlation values are >0.5 and considered to be reasonable as well as within the acceptable range (Wang et al. 2007). Also, the reliability for each dimension is greater than 0.8. The values indicate that the questionnaire's items do not only have good correlation but also have a considerably high reliability estimates (Hair et al.

Fig. 1 Theoretical framework for assessing the mediating role of user satisfaction
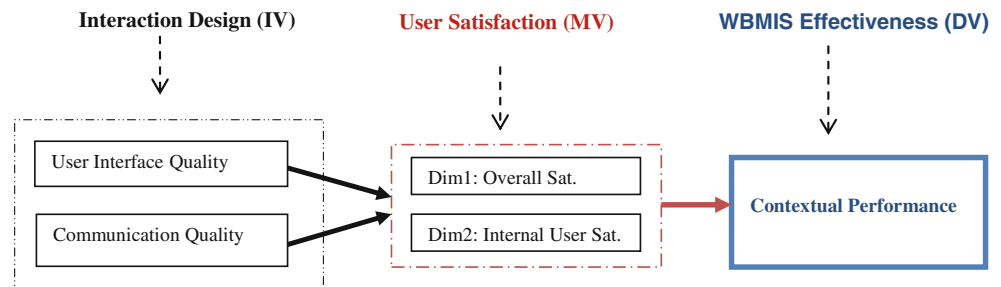
$$n = \frac{\chi 2\, NP(1-P)}{d^2(N-1)+ \chi 2\, P(1-P)}$$

Where

n	= sample size
χ^2	= Chi-square for specified confidence level at 1 degree of freedom
N	= Population size
P	= Population portion (.05 in this table)
d^2	= Desired Margin of Error (expressed as a portion).

Fig. 2 Sample size formula (*Source*: Krejcie and Morgan (1970))

2010; Wang et al. 2007). Accordingly, this instrument has solid validity and reliability to be used in the data collection process (Fig. 1).

4.4 Sample and procedure

It is important to highlight three important points: One of the research objectives is to generalize the findings, every population element (i.e., employees) has an equal opportunity of being chosen, and there is homogeneity among the population elements. This means that the simple random sampling is the most appropriate approach toward obtaining a representative sample (Sekaran and Bougie 2009; Patten 2004). Also, Nesbary (2000) indicated that the probability of representing the whole population is increased as the sample size increased. Based on the minimum required sample size suggested by Krejcie and Morgan (1970), with a population of $n = 12,000$, confidence level = 95 %, and margin of error = 5 %, the required sample size should be at least 375. Figure 2 shows the equation of Krejcie and Morgan (1970).

Regarding data analysis, 384 usable questionnaires are employed in data analysis.

5 Goodness of the instrument measures

Goodness of measures is a process for validating the instrument measures and scales before data analysis (Nunnally and Bernstein 1994). To make sure that the goodness of measures, factor analysis, convergent validity, and reliability analysis for all scales are applied, the exploratory factor analysis, multiple regressions, and hierarchical regressions are employed and conducted using SPSS in order to validate the final factor structure and examine the mediation role of user satisfaction in a more supportive manner.

5.1 Factor analysis

Sekaran and Bougie (2009) indicated that the understanding of the dimensionality of variables in the theoretical model, and the relationships between these variables are important steps in the analysis. Since contextual performance and user satisfaction scales have more than five items, it is recommended to run factor analysis to check the multidimensionality (Field 2009). The factor analysis is primarily used to examine the basic structure of the study variables in the analysis (Hair et al. 2010). Therefore, an exploratory factor analysis was conducted to check the factor structure of the 28-item instrument. The population sample (384 subjects) was tested using principal component factor analysis as the extraction method, and varimax as the orthogonal rotation method. According to Hair et al. (2010), to enhance the convergent and discriminant, five commonly used conditions are applied: (1) eigenvalue greater than or equal to 1; (2) factor loading of each item greater than or equal to 0.5, otherwise item is deleted; (3) the item with factor loading >0.5 on two or more factors is also deleted; (4) a simple factor structure; and (5) exclusion of single-item factors from the standpoint of parsimony. According to the proposed theoretical framework, the study factors are actually five: two independent variables—interaction design dimensions including user interface, communication tools; two variables included in user satisfaction as a mediator (overall satisfaction and internal user satisfaction); and one dependent variable (contextual performance). Tables 5, 6, and 7 reveal the results of factor analysis.

Based on the results of factor analysis shown in Tables 5, 6, and 7, it is clearly seen that (1) without determining the number of factors, there are four factors with eigenvalues greater than 1 as follows: two independent factors, one

Table 5 Results of factor analysis for independent variables

Item/factor	1	2
f1	0.052	0.805
f2	0.161	0.677
f3	0.789	0.167
f4	0.850	0.135
f5	0.639	0.192
f6	0.800	0.037
f7	0.152	0.718
f8	0.147	0.777
f9	0.309	0.672
f10	0.653	0.337

The results of factor analysis showed that the total variance explained is greater than 60 % and this means that the factor explains more than 60 % of total variances in items data, which is a reasonable or accepted percentage (Hair et al. 2006)

Table 6 Results of factor analysis for mediation variable

Item/factor	Loading
g1	0.754
g2	0.839
g3	0.802
g4	0.845
g5	0.815
g6	0.822
g7	0.725
g8	0.765

The results of factor analysis showed that the total variance explained is greater than 60 % and this means that the factor explains more than 60 % of total variances in items data, which is a reasonable or accepted percentage (Hair et al. 2006)

Table 7 Results of factor analysis for dependent variable

Item/factor	1
b1	0.823
b2	0.837
b3	0.856
b4	0.860
b5	0.721
b6	0.780
b7	0.794
b8	0.659
b9	0.835
b10	0.808

The results of factor analysis showed that the total variance explained is greater than 60 % and this means that the factor explains more than 60 % of total variances in items data, which is a reasonable or accepted percentage (Hair et al. 2006)

mediator factor, and one dependent factor; (2) there is a need to merge the two dimensions of user satisfaction into one dimension; (3) the interaction design quality is classified into two factors, which is totally compatible with our conceptualization in Sect. 2. To conclude, the final structure of the study instrument has four components. Therefore, the theoretical model should be restructured in order to obtain the final theoretical model structure.

As shown in Fig. 3, the framework of the study generally remained unmodified while the only change is made in user satisfaction. The proposed two dimensions of user satisfaction should be merged together in order to be consistent with the results of factor analysis. The interaction design factor remains as it is proposed in Fig. 1. For

clarity, we separate the two dimensions of interaction design because each dimension is practically considered as a separate factor.

5.2 Convergent and discriminant validity

After identifying the factor structure of the instrument scale using factor analysis, convergent validity and average variance extracted (AVE) and composite reliability are used to assess the internal consistency of the generated structure. Regarding the convergent validity, it checks whether the correlations between the factor's measures differ from zero or not. To this end, Pearson correlation matrix is employed to investigate the correlations between measures of each factor, whereas the smallest within-factor correlations are as follows: contextual performance = 0.434; user interface quality = 0.162; communication quality = 0.192; and user satisfaction = 0.445. These correlations are significantly higher than zero and have high significance level (sig. <0.01).

Concerning the AVE values, they are found to be >0.5, and also the composite validity for all scales (user interface quality, communication quality, user satisfaction, and contextual performance) is greater than 0.7. Therefore, these scales have enough convergent validity to proceed toward discriminant and reliability analysis (Hair et al. 2010). Table 8 shows the AVEs and composite validity of all scales.

Next, we proceed to test the discriminant validity. The discriminant or divergent validity is used to ensure whether the items of the construct are related to the variable that is supposed to be measured than the other variables (Sekaran and Bougie 2009). It can be examined by comparing the correlations between constructs and square root of variance extracted for a construct.

Based on Table 9, it is found that the correlations for each construct are less than the square root of variance extracted by the indicators measuring that construct, and this indicates adequate discriminant validity. In total, the results of validity test showed a reasonable convergent and discriminant validity.

5.3 Reliability analysis

Using this sample of 384 respondents, the reliability (alpha) for the instrument scales: contextual performance, user interface quality, communication quality, and user satisfaction, are 0.935, 0.802, 0.828, and 0.918, respectively. In addition, the corrected item-to-total correlations for all items are approximately ≥0.6 (Wang et al. 2007), which in turn gives an additional evidence for the validity of the instrument scales. Table 8 shows the Cronbach's alpha for all study scales.
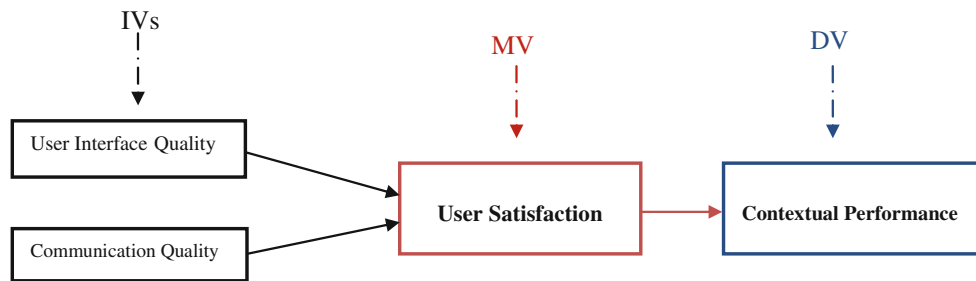
Fig. 3 The final theoretical model after factor analysis

Table 8 The AVE and composite validity and Cronbach's alpha of study variables

	AVE	Sqrt (AVE)	Composite reliability	Cronbach's alpha
Communication quality	0.595	0.771	0.8795	0.828
Contextual performance	0.636	0.797	0.9456	0.935
User interface quality	0.556	0.746	0.8614	0.802
User satisfaction	0.637	0.798	0.9333	0.918

Table 9 The correlations between study variables

	Communication quality	Contextual performance	UIQ	User satisfaction
Communication quality	1	0	0	0
Contextual performance	0.6298	1	0	0
User interface quality	0.3189	0.3957	1	0
User satisfaction	0.6147	0.7154	0.4023	1

6 Testing hypotheses

After checking the validity of the scales and conducting goodness of measures, the hypotheses of this study should be checked in order to justify the relationships between the theoretical model variables.

Practically, the multiple-regression analysis is employed in order to verify the first three conditions of mediation: IVs → DV, IVs → MV, and MV → DV. Therefore, the multiple-regression analysis is very important to check the first five hypotheses (H1, H2, H3, H4, and H5). Table 10 demonstrates the results of multiple-regression analysis of the relationships between IVs and DV (contextual performance).

Regarding the results of regression analysis of user interface quality and communication quality on the contextual performance, Table 10 demonstrates the degree to which the independent variables contributed to the dependent variable (i.e., contextual performance). It presents the

Table 10 The regression analysis of interaction quality factors on effectiveness

Independent variables (IVs)	Contextual performance (DV)	
	β	Sig.
User interface quality	**0.214**	**0.000**
Communication quality	**0.485**	**0.000**
R 0.590		
R^2 0.349		
Adjusted R^2 0.345		
F value 101.93		

Bold values indicate the strength of the relationships between study variables

β-values that indicate how much each independent variable contributes on predicting dependent variable. It is clearly seen that user interface quality and communication quality have a positive significant relationship with the contextual performance at β-values (0.214 and 0.485, respectively) and high significance level (sig. <0.01). As $R^2 = 0.349$, the independent variables explained 34.9 % of variance in contextual performance. Therefore, the results of multiple-regression analysis of the relationships between IVs and DV (IVs → DV) are significant, and thus, the first condition of the mediation is satisfied.

Concerning the second condition (IVs → MV) that represents the hypotheses H3 and H4, the multiple-regression analysis is also used to examine these hypotheses. It is found that user interface quality and communication quality are significantly correlated with user satisfaction at β-values 0.256 and 0.500, respectively. Further, as shown in Table 11, the two quality factors predict a percentage of 39.9 % of total variance explained in user satisfaction. Since the relationship between the independent variables and the mediator is significant, then the second condition of the mediation is satisfied.

Regarding the results of regression analysis of user satisfaction on effectiveness (MV → DV), Table 12 demonstrates the results of multiple-regression analysis. It is clearly seen that user satisfaction has a positive significant relationship with effectiveness ($\beta = 0.695$, sig. <0.01). Moreover, the

Table 11 The regression analysis of interaction quality factors on effectiveness

Independent variables (IVs)	User satisfaction (MV)	
	β	Sig.
User interface quality	**0.256**	**0.000**
Communication quality	**0.500**	**0.000**
R 0.631		
R^2 0.399		
Adjusted R^2 0.396		
F value 126.30		

Bold values indicate the strength of the relationships between study variables

Table 12 The regression analysis of user satisfaction on effectiveness

Predictor (MV)	Contextual performance (DV)	
	β	Sig.
User satisfaction	**0.695**	**0.000**
R 0.695		
R^2 0.483		
Adjusted R^2 0.482		
F value 357.08		

Bold values indicate the strength of the relationships between study variables

multiple-regression analysis shows that the user satisfaction predicts a percentage of 48.3 % of total variance explained in effectiveness or contextual performance.

Based on Table 12, there is a significant positive relationship between user satisfaction and contextual performance. Therefore, the third condition of the mediation is satisfied. According to Tables 10, 11, and 12, the first three conditions of mediation are satisfied, and therefore, the hypotheses H1, H2, H3, H4, and H5 are supported.

In the context of mediation hypothesis (H6), the hierarchal regression should be conducted in order to ensure how much the mediating role of user satisfaction affects the direct relationships between IVs and DV. The first step of the hierarchical regression includes the direct relationship between the independent variables (user interface quality and communication quality) and the contextual performance. In the second step, the user satisfaction is added to the two independent variables. Table 13 illustrates the results of the hierarchical regression of two models. The first model presents the direct effect of IVs on DV, while the second presents the effect of IVs and MV on DV.

Table 13 The significance and correlations of regressing IVs and MV on DV

IVs	Contextual performance (DV)			β
	Sig. (before med.)	β	Sig. (after med.)	
User interface quality	**1.445e–006**	**0.214**	**0.052**	**0.077**
Communication quality	**4.979e–025**	**0.485**	**1.181e–006**	**0.217**
R	*0.590*		*0.720*	
R^2	*0.349*		*0.522*	
Adjusted R^2	*0.345*		*0.518*	

Bold and italic values are indicate the strength of the relationships between study variables

Based on Table 13, it is obvious that the significance values of the relationships after mediation of user satisfaction are less than those before the mediation. Also, the correlations (β) between user interface and communication quality and DV are 0.214 and 0.485. However, after mediating user satisfaction, the correlations for the two quality factors (user interface and communication quality) become 0.077 and 0.217, respectively.

Additionally, the total variance explained before mediation (R^2) was 0.349. This means that the IVs predict a percentage of 34.9 % of total variance in contextual performance. But after mediation, R^2 increased to be 52.2 %; this means that user satisfaction contributes a percentage of 17.3 % in predicting the total variance in contextual performance. More details regarding hierarchal regression can be found in "Appendix."

Accordingly, after mediation the significance values of the relationship IVs → DV are decreased, and the direct correlations between IVs and DV are decreased as well. Therefore, user satisfaction has a partial mediating role on the relationship between user interface quality, communication quality, and contextual performance (Sekaran and Bougie 2009; Mackinnon and Dwyer 1993; Baron and Kenny 1986). Table 14 shows the summary of hypotheses testing.

Based on Table 14, all of the four mediation conditions are satisfied and also the study objectives are achieved. Therefore, this study provides evidence on the mediating role of user satisfaction on the relationship between user interface design, communication quality, and contextual performance.

7 Discussion and implications

This study aims at assessing the mediating role of user satisfaction on the relationship between user interface

Table 14 The summary of hypotheses testing

Hypothesis	Relationship	Status
H1	The user interface design has a positive effect on the effectiveness of WBMIS	Supported
H2	The communication quality has a positive effect on the effectiveness of WBMIS	Supported
H3	The user interface quality has a positive effect on the user satisfaction	Supported
H4	The communication quality has a positive effect on the user satisfaction	Supported
H5	The user satisfaction has a positive effect on WBMIS effectiveness	Supported
H6	User satisfaction mediates the relationship between user interface quality, communication quality, and contextual performance	Supported

quality, communication quality, and effectiveness in terms of contextual performance. So, evaluating the impacts of user interface quality and communication quality on the effectiveness and user satisfaction with WBMIS is very important in order to verify the mediation conditions. For this reason, there is a need for developing a multidimensional instrument as well as exploring the significance of the proposed theoretical framework.

The findings of the factor analysis indicate that four dimensions (user interface quality, communication quality, user satisfaction, and contextual performance) have a sense in assessing the WBMIS effectiveness. Also, the factor analysis emphasized the unidimensionality of user satisfaction as the cognitive and affective parts are found considerably related. Moreover, the results are consistent with conceptualization of interaction design quality as the factor analysis shows that there is essentiality to separate the variable into two factors (i.e., two dimensions).

The results of multiple-regression analysis reveal that the two interaction factors (user interface quality and communication quality) have significant positive relationships with user satisfaction and contextual performance. Also, the user satisfaction has a positive effect on the contextual performance. Therefore, the study findings are in line with previous IS studies (such as Petter et al. 2008; Petter and McLean 2009).

The findings of hierarchal regression showed that the correlation and prediction percentage of interaction quality factors decreased in case of considering user satisfaction as a predictor of contextual performance. It is found that user interface quality and communication quality predict a percentage of 34.9 % of the total variance in contextual performance and correlated with performance ($\beta = 0.214$ and 0.485, respectively). However, when considering the user satisfaction, the percentage of prediction increases to

52.2 % and the correlations become $\beta = 0.077$ and 0.217, respectively. Therefore, there is an increase in prediction percentage and decrease in correlations with dependent variable in case of considering satisfaction. Thus, the findings provide strong evidence on the mediating role of user satisfaction, and consequently, the findings are in line with the theoretical findings and conclusion of AlHendawi and Baharudin (2013).

It is worth mentioning that the findings of this study emphasized the role of quality factors, especially the two interaction factors (user interface quality and communication quality) as predictors for the user satisfaction. Also, it points out that the user satisfaction could act as a predictor of the contextual performance. As an important point, no published study empirically discussed the mediating role of user satisfaction between user interface quality, communication quality, and contextual performance in the field of information management and quality.

In terms of implications, the proposed theoretical framework and instrument reveal how the interaction design quality, including user interface and communication quality, influences the effectiveness of WBMIS which, in turn, leads to the following advantages: (a) As the study primarily concerned with the evaluation of interaction impact on the WBMIS effectiveness, it should be in the highest priority and large interest for the decision makers and top management level in the organizations; (b) it would help experts, practitioners, and decision makers to assess how much the availability of interaction quality improves the interpersonal skills toward the enhancement of the contextual performance; (c) it assists in evaluating the level of user satisfaction with the WBMIS which has a significant influence on the level of employee performance. So the research could have a positive impact on the organization effectiveness as a whole; (d) since the instrument comprehensively examines important factors in the field of IS and information management, it would stimulate the IS empirical research for how systems are developed and assessed; and (e) as UNRWA has played a semigovernmental role in providing the services for Palestinian refugees, it seems that this study would contribute to IS studies in other contexts, such as public sector organizations and NGOs.

Finally, the findings show that user profiling, graphics, and availability of online communication tools such as discussion and feedback forms have a significant positive effect on the user perception regarding the WBMIS, which in fact influences the interpersonal skills and performance positively. Therefore, the empirical results emphasize the validity of the proposed model and also assure the importance of assuming the interaction factors as a determinant of user satisfaction.

8 Limitations and future work

Like most of empirical studies, this study could not be without limitations. The present study has fruitfully provided significantly important results and contributed to the relationship between interaction quality factors, user satisfaction, and WBMIS effectiveness. However, the present study has some limitations that could be tackled in the future studies:

- The exploratory factor analysis is considered as satisfactory approach in developing the research's instrument; it may limit to generalize the instrument as it is not applied on elsewhere in other contexts, such as e-government and e-learning.
- Further, the user satisfaction is investigated in this study as a multidimensional concept; however, the findings showed that this concept is one dimensional as its parts are found closely related.

Therefore, we propose the following as future directions of research:

- Since the current study keeps the attention on the Web-based information systems of the organizational employees, it might be some differences between factors that affect employees and students. Consequently, it is recommended to examine the model in other contexts of Web-based information systems, such as e-learning systems and e-government.
- Reconsidering the multidimensionality check of user satisfaction concept is important in the future research.
- Based on literature review, the user characteristics could have moderation effects on the relationship between interaction quality factors and WBMIS effectiveness. So, it is suggested to examine the moderation effects of user characteristics on the relationship between quality factors and contextual performance. In addition, data mining techniques can be used to predict the user perception and performance in accordance with learning process, and therefore, it is suggested for the computer sciences and IT researchers to validate the obtained results using data mining techniques such as classification and clustering.

9 Conclusion

This paper aims at conceptualizing and developing a new theoretical framework for evaluating the impact of quality factors, particularly interaction quality, on the effectiveness of Web portal system in international organizations such as UNRWA. From a practical perception, the present research is one of the fewest studies focusing on the extent to which user interface quality and communication quality contribute to employee satisfaction as well as contextual performance. Assessing the impacts of interaction quality on satisfaction and performance brings the need for developing a multidimensional instrument. Thus, a new instrument is developed and adequately examined through testing its validity, reliability, and factor analysis. The sample of this study is a large-scale sample including the responses of 384 UNRWA employees working at different positions and departments. The results of data analysis indicate that the developed instrument has enough validity and reliability to be used for measuring the study variables. The results of multiple-regression analysis show that user interface and communication quality could be predictors to both satisfaction and performance because they have positive significant relationships with user satisfaction and contextual performance. Additionally, the findings indicate that user satisfaction has a mediating role on the relationship between user interface quality, communication quality, and WBMIS effectiveness or employee performance (sig <0.01). Therefore, the proposed framework is successfully applied and is adoptable in the fields of IS assessment and human behavior development. Since UNRWA has played a semigovernmental role in providing the most critical basic services for Palestinian refugees, it is expected that this study would contribute to empirical studies conducted in international organizations, public sector organizations, and NGOs.

Appendix: The hierarchal regression of IV, MV, and DV

Model summary

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.590(a)	0.349	0.345	1.08980
2	0.722(b)	0.522	0.518	0.93504

[a] Predictors: (constant), ComQ_Mean, UIQ_Mean

[b] Predictors: (constant), ComQ_Mean, UIQ_Mean, Sat_Mean

ANOVA(c)

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	242.115	2	121.057	101.929	0.000(a)
	Residual	452.500	381	1.188		
	Total	694.615	383			
2	Regression	362.378	3	120.793	138.158	0.000(b)
	Residual	332.236	380	0.874		
	Total	694.615	383			

[a] Predictors: (constant), ComQ_Mean, UIQ_Mean

[b] Predictors: (constant), ComQ_Mean, UIQ_Mean, Sat_Mean

[c] Dependent variable: CP_Mean

Coefficients (a)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta	B	Std. error
1	(Constant)	0.773	0.261		2.959	0.003
	UIQ_Mean	0.257	0.052	*0.214*	4.896	*0.000*
	ComQ_Mean	0.458	0.041	*0.485*	11.110	*0.000*
2	(Constant)	0.338	0.227		1.488	0.138
	UIQ_Mean	0.092	0.047	*0.077*	1.951	*0.052*
	ComQ_Mean	0.205	0.041	*0.217*	4.939	*0.000*
	Sat_Mean	0.554	0.047	*0.537*	11.728	*0.000*

[a] Dependent variable: CP_Mean

References

Abugabah A, Sanzogni L (2009) The impact of information systems on user performance: a critical review and theoretical model. In: international conference on information systems (ICIS)

Abugabah A, Sanzogni L (2010) Re-conceptualizing information systems models: an experience from ERP systems environment. Int J Infon 3(4):414421

Al-adaileh RM (2009) An evaluation of information systems success: a user perspective—the case of Jordan telecom group. Eur J Sci Res 37(2):226239

Alberto BM, Fernando LL (2007) A firm-level analysis of determinants of ICT adoption in Spain. Technovation 27:352366

Albrecht CC, Dean DL, Hansen JV (2005) Marketplace and technology standards for B2B e-commerce: progress, challenges, and the state of the art. Inf Manag 42:865875

AlHendawi K, Baharudin A (2013) Evaluating the effectiveness of web-based management information system from the perception of educationalists: an exploratory study. Inf Technol J 12(6): 1068–1078

Arvey RD, Bouchard TJ, Segal NL, Abraham LM (1989) Job satisfaction: environmental and genetic components. J Appl Psychol 74:187–192

Balaban I, Mu E et al (2013) Development of an electronic Portfolio system success model: an information systems approach. Comput Educ 60(1):396–411

Baron RM, Kenny DA (1986) The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J Pers Soc Psychol 51:11731182

Bennett S, Franco LM (1999) Public sector health worker motivation and health sector reform: a conceptual framework. Major Applied Research 5, Technical Paper No 1. Partnerships for Health Reform Project, Abt Associates Incorporated

Benbya H, Passiante G, Belbaly NA (2004) Corporate portal: a tool for knowledge management synchronization. Int J Inf Manag 24:201220

Blackler F (1995). Knowledge, knowledge work and organizations: an overview and interpretation' organization studies, 16/6, pp 1021–1046

Chan E, Liu C (2007) Corporate portals as extranet support for the construction industry in Hong Kong and nearby regions of China. ITcon 12:180190

Chang HH, Chen SW (2009) Consumer perception of interface quality, security, and loyalty in electronic commerce. Inf Manag 46(7):411–417

Chang W-J, Huang TC (2010) The impact of human resource capabilities on internal customer satisfaction and organizational effectiveness. Total Quality Manag Bus Excell 21(6): 633648

Chia CL (2003) A critical appraisal of customer satisfaction and e-commerce. Manag Audit J 18(3):202–212

Cooper A, Reimann R, Cronin D (2007) About face 3: the essentials of interaction design. Indiana, Wiley Press, Indianapolis

Cronbach LJ (1951) Coefficient alpha and the internal structure of tests. Psychometrika 16(13):297–334

Daniel EM, Ward JM (2005) Enterprise portals: addressing the organizational and individual perspectives of information systems. In: The 13th European conference on information systems (ECIS)

Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quart 13(3):319340

De Toni AF, Zanutto G (2006) Web-based information systems success: a measurement model of technology acceptance and fit. In: 2nd European conference on management of technology, international association for management of technology (IAMOT)

DeLone WH, McLean ER (1992) Information systems success: the quest for the dependent variable. Inf Syst Res 3(1):6095

DeLone WH, McLean ER (2003) The DeLone and McLean model of information systems success: a ten-year update'. J Manag Inf Syst 19(4):930

Doll WJ, Torkzadeh G (1988) The measurement of end user computing satisfaction. MIS Quart 12(2):258274

Doll WJ, Torkzadeh G (1991) The measurement of end-user computing satisfaction: theoretical considerations. MIS Quart 15(1):510

Edeholt H, Löwgren J (2003) Industrial design in a post-industrial society: A framework for understanding the relationship between industrial design and interaction design. In: 5th Conf. European academy of design

Field A (2009) Discovering statistics using SPSS, 3rd edn. Sage Publications Limited, London

Gichoya D (2005) Factors affecting the successful implementation of ICT projects in government. J e-Gov 3(4):175–184

Grover V, Jeong SR, Segars AH (1996) Information systems effectiveness: the construct space and patterns of application. Inf Manag 31(4):177–191

Hair J, Black B, Anderson R, Tatham R (2006) Multivariate data analysis, Upper Saddle River. Prentice-Hall, NJ

Hair JF, Black WC, Babin BJ, Anderson RE (2010) Multivariate data analysis: a global perspective, 7th edn. Prentice Hall, NJ

Hamilton S, Chervany NL (1981) Evaluating information system effectiveness part I: comparing evaluation approaches. MIS Quart 5(3):5569

Holmlid S (2009) Interaction design and service design: expanding a comparison of design disciplines. Nordic conference on service design and service innovation

Iivari J (2005) An empirical test of DeLone-McLean model of information systems success. DATA BASE Adv Inf Syst 36(2):8–27

Jarvenpaa SL, Tractinsky N, Saarinen L (1999) Consumer trust in an internet store: a cross-cultural validation. J Comput-Mediat Commun 5(2):1–36

Joinson AN (2003) Understanding the psychology of internet behaviour: virtual worlds. Real Lives, Palgrave Macmillan, Basingstoke

Julier G (2006) From visual culture to design culture. Design issues 22(1):64–76

Kim YJ, Chaudhury A, Rao HR (2002) A knowledge management perspective to evaluation of enterprise portals. Knowl Process Manag 9(2):5771

Krejcie RV, Morgan DW (1970) Determining Sample size for research activities. Educ Psycholo Meas, 195

Lai J-Y (2006) Assessment of employees' perceptions of service quality and satisfaction with e-business. Int J Hum Comput Stud 64(9):926–938

Law CCH, Ngai EWT (2007) ERP systems adoption: an exploratory study of the organizational factors and impacts of ERP success. Inf Manag 44(4):418–432

Law LC, Law E, Hvannberg ET, Cockton G (2007) Maturing usability: quality in software, interaction and value. Springer, Heidelberg

Lawson-Body A, Limayem M (2004) The impact of customer relationship management on customer loyalty: the moderating role of web site characteristics. J Comput-Mediat Commun 9(4):28–38

Lawson-Body A, Willoughby L, Logossah K (2010) Developing an instrument for measuring e-commerce dimensions. J Comput Inf Syst 51(2):213

Lin H-F (2010) An investigation into the effects of IS quality and top management support on ERP system usage. Total Qual Manag 21(3):335–349

Ling YY (2003) A conceptual model for selection of architects by project managers in Singapore. Int J Proj Manag 21(2):135144

Liu C-T, Du TC et al (2009) A study of the service quality of general portals. Inf Manag 46(1):52–56

Locke EA (1976) The nature and causes of job satisfaction. In: Dunnette MD (ed) Handbook of industrial and organizational psychology. Rand McNally, Chicago, pp 1297–1349

Luthans F (1998). Organisational behaviour. Manzoni J and Barsoux J (8th ed.) (2004) The set-up-to-fail syndrome: How bosses create their own poor performers. Boston: Irwin McGraw-Hill. Harvard Business Review, March–April

MacKinnon DP, Dwyer JH (1993) Estimating mediated effects in prevention studies. Evaluat Rev 17(2):144–158

McMurtrey ME, Downey JP, Zeltmann SM, Friedman WH (2008) Critical skill sets of entry level IT professionals: an empirical examination of perceptions from field personnel. J Inf Technol Educ 7:101–120

Moggridge B (2007) Designing interactions. MIT Press, Cambridge, MA

Muylle S, Moenert R, Despontin M (2004) The conceptualization and empirical validation of website user satisfaction. Inf Manag 41:213226

Nesbary DK (2000) Survey research and the world wide web. Allyn & Bacon Press, Massachusetts

Nunnally JC, Bernstein IH (1994) Psychometric theory, 3rd edn. McGraw-Hill, New York

Panigyrakis GG, Chartzipanagiotou K (2006) The impact of design characteristics and support services on the effectiveness of marketing information systems: an empirical investigation. Rev Bus Inf Syst 10(2):091100

Patten ML (2004) Understanding research methods: an overview of the essentials, 4th edn. Pyrczak Publishing, Glendale, California

Petter S, McLean ER (2009) A meta-analytic assessment of the DeLone and McLean IS success model: an examination of IS success at the individual level. Inf Manag 46(3):159–166

Petter S, DeLone W, McLean E (2008) Measuring information systems success models, dimensions, measures, and interrelationships. Eur J Inf Syst 17(3):236263

Puntambekar AA (2009). Software engineering: technical publications

Seddon PB, Kiew M-Y (1994) A partial test and development of the DeLone and McLean model of IS Success. In: The 15th international conference on information systems (ICIS)

Sekaran U, Bougie R (2009) Research methods for business: a skill-building approach, 5th edn. John Wiley & Sons, London

Sugianto L, Tojib D (2006) Modeling user satisfaction with an employee portal. Int J Bus Inf 1(2):239255

Thong JYL, Yap C (1996) Information systems effectiveness: a user satisfaction approach. Inf Process Manag 5(32):601610

Tojib DR, Sugianto LF, Sendjaya S (2006) A conceptual model for B2e portal user satisfaction. Int Conf Bus Inf, In

Torkzadeh G, Doll WJ (1999) The development of a tool for measuring the perceived impact of information technology on work. Omega Int J Manag Sci 3(27):327–339

Urbach N, Smolnik S, Riempp G (2009) A conceptual model for measuring the effectiveness of employee portals. In: The 15th Americas conference on information systems (AMCIS)

Wang Y-S, Liao Y-W (2008) Assessing eGovernment systems success: a validation of the DeLone and McLean model of information systems success. Gov Inf Quart 25(4):717–733

Wang W-T, Wang C–C (2009) An empirical study of instructor adoption of web-based learning systems. Comput Educ 53(3):761–774

Wang Y-S, Wang H-Y, Shee DY (2007) Measuring e-learning systems success in an organizational context: scale development and validation. Comput Hum Behav 23(4):17921808

Williams L, Anderson S (1991) Job Satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors. J Manag 17:601617

Wu J-H, Wang Y-M (2006) Measuring KMS success: a respecification of the DeLone and McLean model. Inf Manag 43(6):728739

Yoo B, Donthu N (2001) Developing a scale to measure the perceived quality of an internet shopping site (SiteQual). Quart J Electron Commer 2(1):3145

Yuthas K, Young ST (1998) Material matters: assessing the effectiveness of materials management IS. Inf Manag 33(3):115–124

Zhang P, Nah F, Preece J (2004) HCI studies in management information systems. Behav Inf Technol 23(3):147–151