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A Practical Measure of Employee Satisfaction with B2E Portals

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Abstract

This paper presents the development of user satisfaction scale with B2E portals. A conceptual model of the B2E Portal User Satisfaction (B2EPUS) is derived from existing literatures in this domain. The procedures to generate items, to collect data for exploratory and confirmatory study, and to purify the scale are also described. In addition, the paper presents evidences of reliability, content validity, construct validity, and nomological validity. Through a rigorous multi-stage process of scale development, a reliable and valid 18-item scale measuring Usefulness, Confidentiality, Ease of Use, Convenience of Access and Portal Design dimensions has been successfully developed. This scale can be used to support a wide range of IS research as a better understanding of what constitute the B2EPUS construct has been demonstrated. Practitioners may also use the scale to evaluate the success of their B2E portal implementations.

Keywords: End-user computing, user behaviour, user attitude, user expectations, satisfaction, IS usage

Introduction

A B2E portal is a facilitating tool increasingly employed in many organizations today. It makes use of the intranet infrastructure by consolidating and personalizing information around the user's needs. The portal provides not only general corporate information, but also some applications aimed at assisting employees with specific work related tasks, such as managing benefits, insurance, and payroll check. The portal also provides many useful web links such as stocks information, weather forecasts, travel sites or shopping sites. By accessing such portals from desktops, notebooks, or PDAs, employees can manage their work as well as personal matters on their own.

As the cost of B2E portal implementation tends to be high, organizations are wary about their investments in such a portal. A common method to measure success often discussed in the literature is by measuring return on investment (Davis 2002). However, similar to other success measure approaches such as cost benefit analysis, system usage estimation, and utility analysis (Thong & Yap 1996), measuring returns on investment is often not practical. An approach proposed in this study is through the measurement of user satisfaction. The concept of user satisfaction has been adopted as it is the most widely used and the most commonly accepted surrogate measure of system success (Melone 1990; Palvia 1996; Khalifa and Liu 2004). It is believed that organizations' portal investments are considered successful, if their employees are actively using the portals because they are satisfied with their portals. Yet, a significant gap in the research literature is the lack of clear definition as well as valid measure of the B2E Portal User Satisfaction (B2EPUS) construct (Sugianto and Tojib, 2006). User satisfaction scales developed for the conventional Traditional Data Processing (TDP) environment or End User Computing (EUC) environment, such as Bailey and Pearson's (1983), Ives et al's (1983), and Doll and Torkzadeh's (1988) scales may no longer be appropriate as they do not take into account the B2E portal technology where functionalities (e.g., search and retrieval processes, work flow systems, online self service applications, and collaboration tools) are distinct from those employed within the EUC or TDP environment. Likewise, scales developed for web-based systems tend to adopt and modify earlier work and are considered not exactly applicable for portal environment. Portal applications commonly include work flow system, self service model and collaboration tool. These applications feature personalization and collaboration environment that are quite specific compared to earlier work in web-based system. Without a commonly accepted defined construct and measurements, it is difficult to develop and test theories as well as to compare results across empirical studies. An accurate measure of B2E portal success is needed in order to assist organizations in evaluating the worthiness of such portal implementation, particularly when large investments are expected.

This research aims to develop a theoretical and operational construct for latent factors that may be indicative of B2EPUS. Scale development frameworks (DeVellis 2003; Lewis et al 2005) and scale validation guidelines (Straub et al 2004) have been incorporated for developing the scale and contemporary statistical techniques such as EFA and CFA have been utilized for assessing dimensionality of the scale. Empirical testing of the scale is reported in this paper. Discussions on the findings, the implications of the research and future research avenues are also presented.

Conceptual Model for the B2EPUS Construct

The initial step in developing an appropriate measure and obtaining valid results is to develop a conceptual model of a construct (Anderson and Gerbing 1988). In designing the conceptual model for the B2EPUS construct, a careful review of the existing user satisfaction scales (e.g., Bailey and Pearson 1983; Doll and Torkzadeh 1988; Chen et al 2000; Wang 2003; Cho and Park 2001; Ong and Lai 2004; Muyille et al 2004) was conducted to identify a range of dimensions contributing to user satisfaction. These dimensions were then grouped into three main categories: Information Quality, System Quality, and System Design Quality for two reasons: (1) Information Quality and System Quality are two major categories that have been widely examined and employed by a large number of IS researchers in their end user satisfaction research (Bailey and Pearson, 1983; Doll and Torkzadeh, 1988; Yang et al, 2005) and (2) System Design Quality is another category that is increasingly being examined in websites user satisfaction studies (Yoo and Donthu, 2001). Furthermore, extant literature on B2E portals was examined to seek and identify themes pertinent to user satisfaction with B2E portals. To facilitate the review process, two broad criteria were employed. Firstly, the dimensions must be used in most measures of user satisfaction with various types of IS and IT applications. Dimensions with conceptual and empirical relevance to most general user satisfaction scales were included in the B2E portal user satisfaction domain. Secondly, the dimensions must be theoretically associated with the B2E portal characteristics, namely B2E portals must be accessible at anytime

whenever there is an internet connection; incorporate a single log-on procedure; provide role-based content to each employee; enable employees to perform more tasks electronically with the integration of self-service applications; and act as a medium of communication between the organization and its employees as well as employees and their colleagues. Our literature review resulted in the identification of nine dimensions of the B2EPUS construct as discussed below.

Ease of Use

As the use of B2E portals within organizations is voluntary, such portals should be user friendly to attract first time users. B2E portals are generally presented in a single web page interface similar to other commercial web pages. With the increasing use of the Internet in the workplace (Zhang 2005), employees are assumed to have experience in browsing the Internet web pages. Learning to use the portal is easy. This perspective is also supported by Dias (2001) who stated that portal users should be able to easily locate and access the right information (i.e. the navigation issue) with minimum training. Furthermore, previous research also revealed that end users prefer organized, clearly-structured, and easy-to-navigate sites (Eighmey and McCord 1998; Smith 2001) as these characteristics will enhance overall satisfaction (Huang et al 2004).

Layout

Through B2E portal adoption, organizations can facilitate the employees in searching and accessing relevant information. Given the role B2E portals play as the interface between the employees and the organization, effective portal design must be seen as a prerequisite for B2E initiatives. This view is supported by Zazelenchuk and Boling (2003) who stated that portal layout does affect user satisfaction.

Convenience of Access

Employees must be able to access the portals via internet regardless of time and location (Melville, 2004). Clearly, the portals provide convenience for employees, particularly those who spend more time out of the office during working hours or those who work remotely from home. They can remain updated with the organizational news, connected with their colleagues, and at the same time perform their work by accessing the portal.

Information Content

A distinguishing feature of B2E portals compared to other types of Employee Support Systems (ESS) is that portals present only relevant information to each employee based on his or her role in an organization. Furthermore, the portal undergoes frequent and regular updates so that employees are presented with current information. The four characteristics of information: relevance, reliability, accuracy, and being current, would assist employees in performing their tasks. Thus, this dimension was included in the construct following the previous studies by Bailey and Pearson (1983), Doll and Torkzadeh (1988), and Ong and Lai (2004).

Communication

B2E portals act as a medium of communication between organizations and their employees as well as employees with other colleagues. Furthermore, B2E portals also facilitate collaboration among employees. They integrate groupware applications which enable employees to share information and ideas with colleagues and collaborate through email, chat, or discussion threads. Previous studies, such as in Ong and Lai (2004), Wang (2003), and Yang et al. (2005) also reported that the ability of the system to interact with others influences user satisfaction.

Timeliness

Employees, who are working in a competitive work environment, require real time information access. Moreover, lengthy response time may cause lower user satisfaction and poor productivity (Hoxmeier and DiCesare 2000). Therefore, B2E portals are expected to be able to deliver the requested information within a reasonable response time and dimension *Timeliness* is proposed as an indicator of the B2EPUS construct.

Efficiency

This dimension was initially deduced from Chen et al (2000) along with Loiacono et al (2002). They affirmed that the extent to which the users believe that the system can fulfill their needs has an impact on user satisfaction. B2E portals can fulfill the employees’ needs by streamlining work processes, allowing them to perform their work and personal-related tasks electronically, which ultimately will increase employee productivity.

Confidentiality

Privacy and confidentiality issues have become serious concern in the online environment (Vernon 2002; Yang et al 2005). Inevitably, B2E portals are also posed with these issues as it includes ESS applications that allow employees to submit or retrieve their personal information electronically. Thus, employees need assurance that sensitive information will only be accessed by authorized people.

Security

Providing a secure access is considered critical when developing B2E portals as certain applications provided by the portals such as the ESS application deals with personnel files that are stored electronically. This type of information is sensitive and quite vulnerable to identity theft. Hence, B2E portal administrators must ensure that only authorized users are given access in order to retrieve and submit their personal information.

To conclude, there are nine dimensions that serve as the indicators of the B2EPUS construct. Although these dimensions use similar labels with those identified from the literature, the concepts measured by each dimension were modified for the B2E portal environment. In fact, some concepts are apparently unique to B2E portals, such as *Convenience of Access*, *Communication*, and *Efficiency*. Definitions of each dimension are presented in Table 1. Since there is no standard framework for developing construct measurement (Lewis et al 2005) and scales that were developed by IS researchers have not yet reached comfortable levels of validation (Boudreau et al 2001), this study attempts to develop the B2EPUS scale in a rigorous manner. Five sequential studies, namely conceptual model development, item generation, content validation, exploratory and confirmatory study were conducted in this study.

Table 1. Definition of Dimensions of the B2EPUS Construct	
Dimension: [Definition]	Major Sources
Convenience of access: The accessibility of the portal any time and anywhere through internet or mobile devices.	Huang et al. (2004), Yang et al. (2005)
Ease of use: The extent to which the portal is perceived to be user friendly: learnability, ease of navigation, training issue, feels of being in control.	Doll & Torkzadeh (1988), Harrison & Rainer (1996), Cho & Park (2001), Wang (2003), Muylle, et al (2004), Yang et al (2005)
Timeliness: The ability of the portal to deliver requested information in a reasonable response time.	Bailey & Pearson (1983) , Yoo & Donthu (2001), Muylle, et al (2004)
Efficiency: The ability of the portal to assist employees performing their tasks better and faster, hence improving their productivity and streamlining work processes.	Mawhinney & Lederer (1990), Vlahos & Ferratt (1995), Bhattacharjee (2001)
Security: The ability of the portal to provide a secure access to all applications and facilities provided.	Bailey & Pearson (1983), Yoo & Donthu (2001), Loiacono et.al. (2002), Huang et al. (2004)
Communication: The extent to which the portal can mediate interaction (i.e. information sharing and collaboration) between employees and the business as well as employees and other colleagues/ partners.	Wang (2003), Ong & Lai (2004), Yang et al. (2005).
Information content: The relevance, accuracy, currency, and reliability of information presented to employee based on his/her role in organization.	Doll & Torkzadeh (1988), Bailey & Pearson (1983), Ong& Lai (2004), Yang et al.(2005), Muylle et al (2004)
Layout: The design of the interface and display of the information.	Chin, Diehl, & Norman (1988), Cho & Park (2001), Huang et al (2004), Loiacono, et al (2002)
Confidentiality: The portal ability to provide a sense of assurance that personal information retrieved or submitted from or to the portal will not be misused by authorized people.	Bailey & Pearson (1983), Huang et al. (2004), Loiacono, et al. (2002), Yoo & Donthu (2001)

Item Generation and Content Validation Process

Multiple items were generated for each dimension to ensure reliability of the scale. Whenever appropriate, items were adopted from the existing IS scales reported in the literature. A pool of 47 items was generated, refined and then arranged in a suitable sequence for the purpose of content validation.

The assessment of content validation aims to ensure that only the most relevant and representative items were included in the B2EPUS scale (Haynes et al 1995). A common way to perform this assessment is through the use of content experts' judgment (Lynn 1986), which is essential since their expertise can facilitate the process to retain the best items which are believed to adequately measure the desired content domain (Grant and Kinney 1992).

We invited international expert panel: academics, doctorate students, portal project leaders, portal researchers, portal practitioners, and members of EDUCAUSE Web Portals Constituent Group to participate in this process. All the six experts participated in this process agreed that the nine proposed dimensions are essential in measuring the B2EPUS construct. However, using the weighted-mean score method (Fehring 1987), fifteen items were deleted from the scale. As suggested, dimension *Security* and dimension *Confidentiality* were combined and dimension *Efficiency* was renamed to *Usefulness*. Five new items were also added to ensure the completeness of the scale.

As there were some revisions made to the scale, a second round content validation procedure was conducted. This is to ensure that there was sufficient rigor in the process because many scale development practices include measures that lack content validity in the item development stage (Hinkin 1995). The expert panel recruitment process was similar to the first round. Three experts participated in the second round. The content validity of the items was quantified by calculating the Content Validity Index (CVI) for each individual item and the entire scale. For the former, three items were deleted as majority of the experts considered these items irrelevant to the designated dimensions. For the latter, the CVI value of 91.89% suggested that the 34 item- B2EPUS scale was content valid.

In keeping with the recommendation of Gatignon et al (2002), further item analysis was performed. This analysis was to ensure that redundant and unnecessary items were excluded from the scale. During this process, six more items were eliminated. Moreover, as suggested by the experts, dimension *Layout* and *Ease of Use* were combined. Similarly, dimension *Timeliness* was combined with dimension *Information Content*.

Data Collection Process

The field study was conducted in the Australian higher education sector considering that portal is an important and increasingly used tool in academic institutions (Deans and Allmen 2002) and that there has been increasing scholarly attention in higher education literature on the subject of portal use (Katz 2002). Five universities responded to our invitation emails and agreed to participate in the study.

Since it was not possible to have direct access to the employees' contact details, a non probability convenience sampling method was adopted. A university global email was sent to the university employees, inviting them to participate in the research study which was in the form of an online survey. Three hundred and two responses were collected at this stage. These responses were then randomly split into two parts: 145 cases were used for the exploratory study and the remaining 157 cases were used for the confirmatory study.

Exploratory Study

Prior to run Principal Component Analysis (PCA), we examined the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The former is significant at $p < 0.5$ and the latter is 0.901. Both exceeded the cut-off values suggested by Pallant (2005). These findings indicated that the 145 sample cases satisfied the minimum sample size required and that the data were appropriate for factor analysis. The twenty-eight items were then subjected to PCA. Promax was chosen as the rotation method since the data demonstrated high correlations among the extracted factors. Two commonly employed decision rules were applied to identify the factors underlying the construct, namely, an Eigenvalue of one as the cut-off value for extraction (Hair et al 1998) and factor loadings of less than 0.45 on all factors (Comrey and Lee 1992).

The iterative sequence of factor analysis resulted in a final scale of twenty-two items in five distinct factors. Table 2 summarizes the factor loadings for the condensed twenty-two item scale. The significant loading of all the items on

the single factor indicates uni-dimensionality. The fact that no item had multiple cross loading was found to support the preliminary discriminant validity of the scale. Furthermore, the reliability coefficients for all five factors were above 0.80, indicating acceptable reliability (Nunnally 1978).

The results of the factor analysis revealed a different pattern from the expected conceptual model. However, nearly all dimensions proposed in the initial conceptual model emerged in the PCA. The results showed that items initially generated to measure dimension *Communication* and items associated with dimension *Usefulness* form the first factor (Factor One). Careful investigation of these six items found that they measured a similar concept from two slightly different points of view: the ability of the portal to assist users in performing their tasks at work as well as providing communication facilities. Thus, Factor 1 was renamed *Usefulness*.

The EFA results also indicated that items belonging to the *Security* factor were congregated with three items associated with dimension *Information Content* factor as Factor 2. Careful examination of these items revealed that they addressed a similar concern (i.e., the portal ability to provide a sense of assurance that information submitted will remain confidential and information retrieved is trustworthy). Thus, Factor 2 was then renamed *Confidentiality*.

Next, the EFA results also indicated that items conceptually associated with the dimension *Ease of Use* were divided into two factors: Factor 3 and Factor 5. All of the items placed in Factor 3 clearly measure the user friendliness of the staff portal. Thus, Factor 3 retained its original name, *Ease of Use*. The remaining items placed in Factor 5 measure similar characteristics, i.e. the design of the portal. Hence, Factor 5 was named *Portal Design*. All of the items generated to measure *Convenience of Access* were loaded in Factor 4, retaining the original name, *Convenience of Access*.

Table 2. Factor Loading of the 22 final items					
	1	2	3	4	5
Usefulness					
Sharing or exchanging information with colleagues	0.937				
Facilitating collaboration with all colleagues	0.916				
Discussing work issues with work colleagues	0.908				
Performing more work electronically	0.792				
Streamlining work processes	0.767				
Sharing information within the whole organization	0.683				
Confidentiality					
Certainty of appropriate use for submitted information.		0.871			
Confidentiality of submitted information.		0.839			
Trustable retrieved information.		0.793			
Dependable retrieved information.		0.777			
Security of portal.		0.745			
Provided reliable information.		0.643			
Ease of Use					
Self explanatory use.			0.934		
Navigatability.			0.788		
Learnability.			0.770		
Feeling of being in control.			0.629		
Convenience of Access					
Accessible from home.				0.892	
Gaining access easily.				0.723	
Accessible 24/7.				0.693	
Portal Design					
Aesthetic design.					0.954
Attractive design.					0.949
Availability of help functions and useful button and links.					0.519
Corrected Cronbach's Alpha	0.917	0.893	0.838	0.809	0.886
Eigenvalue	8.918	3.071	2.014	1.163	1.032
Cumulative variance explained (%)	40.536	54.494	63.650	68.937	73.628

Confirmatory Study

CFA was performed using the remaining 157 cases in the data set through the application of AMOS 5 maximum likelihood method. This is to detect the unidimensionality of each factor indicating the presence of a single construct underlying a set of measures. Initially, we developed a measurement model in which the model included the identified five factors as first-order factors. The five factors were correlated, each item had a non-zero loading on its designated factors and zero loadings on other factors, and the measurement error terms associated with the item were uncorrelated.

The hypothesized five-factor model turned out to be a poor model. As listed in Table 3, the χ^2/df value showed that the initial model was a reasonable fit model; the other fit indices were all below the recommended threshold. During the respecification process, four items were deleted. As shown in Table 3, the final model of the user satisfaction with the B2E portal has eighteen items with acceptable fit indices ($\chi^2/df = 2.068$, CFI=0.934, TLI=0.919, RMSEA = 0.83, GFI= 0.845, AGFI = 0.788, RMR = 0.168, NFI = 0.881). The AIC value for the final model is the smallest, suggesting that the final model is the most parsimonious model. These findings suggest that the final model was a reasonably fit model. The final items are presented in Appendix 1.

		Respecification Round				
	Threshold	Initial Model	First Model	Second Model	Third Model	Fourth Model
χ^2	Smaller is better	572.860	460.253	364.494	315.671	258.522
df		199	179	160	142	125
P value	p> 0.05	p< 0.05	p< 0.05	p< 0.05	p< 0.05	p< 0.05
χ^2/df	$1 < \chi^2/df < 3$	2.879	2.571	2.278	2.223	2.068
GFI	> 0.90	0.754	0.782	0.811	0.827	0.845
AGFI	> 0.80	0.687	0.719	0.752	0.768	0.788
RMR	< 0.10	0.213	0.206	0.192	0.194	0.168
RMSEA	0.05 – 0.08	0.110	0.100	0.091	0.089	0.083
TLI	> 0.90	0.829	0.861	0.892	0.902	0.919
NFI	> 0.90	0.793	0.882	0.850	0.863	0.881
CFI	> 0.90	0.853	0.881	0.909	0.919	0.934
AIC	Smaller is better	680.860	564.253	464.494	411.671	350.522
CAIC	Smaller is better	899.897	775.178	667.306	606.371	537.109

Assessing Reliability and Validity

Reliability Assessment

The reliability of the scale is assessed through the investigation of the Cronbach's alpha, composite reliability, and the average variance extracted. Both the Cronbach's alpha and the composite reliability have a threshold of 0.70 (Segars 1997). The average variance extracted (AVE) shows the amount of variance captured by a construct as compared to the variance caused by the measurement error (Bagozzi 1994). The value of AVE should exceed 0.50 to indicate that the variance explained by the construct is larger than the measurement error (Chang and King 2005). Table 4 indicates that all factors showed a good composite reliability as all the values meet the threshold of 0.700. This suggested that all items were reliable in measuring their respective factors. The Cronbach's alpha and the AVE values for all factors, except for factor *Convenience of Access* demonstrated acceptable reliability level as well. Although the Cronbach's Alpha and the AVE values for factor *Convenience of Access* failed to meet the recommended minimum value, its value discrepancy of 0.009 for the Cronbach's alpha and 0.049 for the AVE led us to believe that the items was reasonably reliable to assess the respective factor. Hence, it can be concluded that all the eighteen items were reliable in measuring their respective factors.

Assessment of Convergent Validity

Convergent validity refers to the extent to which the items appear to be indicators of a single underlying construct (Salisbury et al 2002). The existence of such validity is identified by significant factor loadings (Segars and Grover 1998). As demonstrated in Table 4, all standardized factor loadings were positive, significant, and above the threshold value of 0.40 (Gefen et al 2000). These showed that each factor of the scale had convergent validity.

Table 4. Assessment of Reliability and Convergent Validity					
Factor	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
Usefulness			0.926	0.929	0.767
	Item 1	0.900			
	Item 2	0.933			
	Item 3	0.922			
	Item 4	0.732			
Confidentiality			0.880	0.885	0.614
	Item 5	0.613			
	Item 6	0.939			
	Item 7	0.956			
	Item 8	0.613			
	Item 9	0.723			
Ease of Use			0.808	0.816	0.602
	Item 10	0.882			
	Item 11	0.601			
	Item 12	0.816			
Convenience of Access			0.691	0.700	0.451
	Item 13	0.497			
	Item 14	0.855			
	Item 15	0.612			
Portal Design			0.915	0.921	0.795
	Item 16	0.958			
	Item 17	0.832			
	Item 18	0.880			

Assessment of Discriminant Validity

The χ^2 statistic of the unconstrained CFA model (where all constructs are freely correlated) is compared with that of constrained models where the correlation between pairs of factors is set to one. Significance difference in χ^2 between the unconstrained and constrained models provides proof of discriminant validity between the constrained pair of constructs. With the difference in degree of freedom of 1, a χ^2 difference greater than 3.84 ($p < 0.05$) would suggest the two factors are statistically different (Salisbury et al 2002).

Tests of all possible pairs of factors were conducted and the results are presented in Table 5. The results revealed that all combinations had significant chi-square differences, except for two models which have chi-square differences far below the threshold value. They were the models in which factor *Usefulness - Ease of Use* and factor *Usefulness - Portal Design* were constrained. Comparing these two models with the original model, it could be seen that statistically, all the three models were acceptable. However, conceptually the original model was the best model to describe the B2EPUS construct. Therefore, discriminant validity of the scale was established.

Discriminant validity between the five factors of the B2E portal user satisfaction scale was analyzed by examining factor correlations (Kline 2001) and performing chi-square difference tests (Chang and King, 2005). Table 6 shows that all factor correlations were below 0.80, confirming the discriminant validity of the scale (Bhattacharjee 2001).

Table 5. Assessment of Discriminant Validity

Variables constrained	None	UF,CF	UF,EU	UF,CA	UF,DS	CF,EU	CF,CA	CF,DS	EU,CA	EU,DS	CA,DS
χ^2	258.522	280.284	258.791	289.118	259.404	267.755	287.731	267.254	268.438	267.787	270.460
df	125	126	126	126	126	126	126	126	126	126	126
P value	--	21.762	0.269	30.596	0.882	9.233	29.209	8.732	9.916	9.265	11.938
χ^2/df	2.068	2.224	2.054	2.295	2.059	2.125	2.284	2.121	2.130	2.125	2.147
GFI	0.845	0.834	0.845	0.826	0.845	0.840	0.832	0.839	0.838	0.843	0.834
CFI	0.934	0.924	0.934	0.934	0.930	0.920	0.930	0.929	0.930	0.930	0.928
TLI	0.919	0.907	0.920	0.902	0.920	0.915	0.903	0.915	0.914	0.915	0.913
RMSEA	0.083	0.089	0.082	0.091	0.082	0.085	0.091	0.085	0.085	0.085	0.086

*) $p < 0.05$, UF = Usefulness, CF = Confidentiality, EU= Ease of Use, DS = Portal Design, CA = Convenience of Access

Table 6. Assessment of Discriminant Validity Using Factor Correlations

	Usefulness	Confidentiality	Ease of Use	Convenience of Access	Portal Design
Usefulness	1				
Confidentiality	0.343	1			
Ease of Use	0.513	0.479	1		
Convenience of Access	0.291	0.661	0.591	1	
Portal Design	0.598	0.422	0.717	0.451	1

Assessment of Criterion Related Validity

The criterion-related validity was assessed by the correlation between the total scores on the scale (sum for eighteen items) and the measures of the valid criterion (sum for two global items). In this study, the two global items used were 'In general, I am satisfied with the staff portal' and 'In general, the staff portal is successful'. These items were initially adopted from Doll and Torkzadeh (1988).

A positive relationship was expected between the total score and the valid criterion if the scale was capable of measuring the B2E portal user satisfaction construct. The eighteen-item scale had a criterion-validity of 0.711 and a significance level of 0.01, representing an acceptable criterion-related validity.

Assessment of Nomological Validity

To assess nomological validity of the B2EPUS scale, this study adopted prior literature suggesting there is a positive relationship between user satisfaction construct and system use (e.g Baroudi et al 1986; Fraser and Salter 1995; Igbaria and Tan 1997). Hence, it is expected that a positive relationship between user satisfaction (i.e. the B2EPUS construct) and system use (i.e. the B2E Portal Use construct) does exist.

Our approach to measure system use was adopted from Teo et al (1997), and Doll and Torkzadeh (1998). We developed six new items to assess the generic use of B2E portals, namely to check and reply emails, to communicate with colleagues, to obtain organizational news, to search for information, to perform work-related and personal-related tasks (see Appendix 2). A seven-point Likert-type scale (1 = Strongly disagree, 2 = Moderately disagree, 3 = Slightly disagree, 4 = Neutral, 5 = Slightly agree, 6 = Moderately agree, 7 = Strongly agree) was used to measure these items. In order to assess the relationship between the B2EPUS construct and the B2E Portal Use construct, Pearson correlation coefficient was calculated. Prior to this, the reliability of the B2E Portal Use measures was calculated. The coefficient alpha (α) of 0.845 clearly suggests that these six items are highly reliable. Having performed the correlation analysis, it was revealed that there was a strong positive correlation between the two constructs ($r = 0.628$, $n=157$, $p<0.01$). This finding was aligned with prior research and hence the nomological validity of the B2EPUS scale was confirmed.

Discussions

The finding of the exploratory study suggested that the rotated five-factor solution met the following three criteria: simplicity (Sethi and King 1991), interpretability (Lederer and Sethi 1992), and a reasonable percent of variance explained (Bernstein 1988; Straub 1989). Except for *Convenience of Access*, the interpretation of the other four factors was inconsistent with the expected conceptual model shown in Figure 1. *Security* and *Information Content* did not emerge as separate factors; *Usefulness* and *Communication* appeared as one factor; *Ease of Use* was separated into two factors. This finding was aligned with other scale development studies reported in IS research, including Moore and Benbasat (1991), Doll and Torkzadeh (1998), and Yang et al (2005). They all experienced the same concern, in that their empirical model appeared to be different from the conceptual model.

A number of possible explanations for this inclination in the current study are as follows. Firstly, while conceptually different, items measuring *Usefulness* and *Communication* may be viewed identically by respondents. This was likely to happen if the respondents perceive the B2E portal as a useful tool which enables them to perform their work electronically and to communicate with their colleagues. Secondly, respondents might have difficulty in making a sound independent assessment of *Information Content* and *Security*. They may perceive that, as the B2E portal provides a sense of assurance that any information submitted to the portal will remain confidential; the portal will present reliable, dependable, and trustworthy information. Consequently, a causal relationship between the two dimensions may exist. Thirdly, the fact that *Ease of Use* emerged as two factors may mean that the respondents viewed the items assigned to *Ease of Use* as two item-groups of unrelated constructs. The respondents were able to clearly differentiate one item-group as measuring user friendliness of the portal (i.e. *Ease of Use*) and the other group as measuring design of the portal (i.e. *Portal Design*). Nevertheless, this finding is aligned with previous research conducted by Muylle et al (2004) who found that *Ease of Use* and *Website Layout* were indeed two separate constructs. More importantly, the Confirmatory Factor Analysis (CFA) undertaken in this study confirmed the stability of these five factors.

The finding of this study also concludes that the most frequently applied user satisfaction scales: the User Information Satisfaction (UIS) scale proposed by Ives et al (1983) and End User Computing Satisfaction (EUCS) scale developed by Doll and Torkzadeh (1988) are not appropriate for measuring user satisfaction with B2E portals. Although *Information Content* in the UIS and EUCS constructs appears to be a part of *Confidentiality* in the B2EPUS construct and *Ease of Use* in the EUCS construct is similar to the one in the B2EPUS construct; *Confidentiality*, *Usefulness*, *Convenience of Access*, and *Portal Design* are distinct dimensions formulating the B2EPUS construct. Specifically, both the UIS and EUCS scales exclude these dimensions which are unique to the B2EPUS scale. Consequently, the developed B2EPUS scale provides a significant contribution to the IS research community as researchers can utilize an appropriate measure when assessing user satisfaction with B2E portals.

Implications and Directions for Future Research

The B2EPUS scale developed in this study contributes to enrich the existing body of knowledge in the IS field. The development of the B2EPUS construct is based on psychometrically sound measurement, a prerequisite of any theoretical advancement (Schwab 1980). To the best of our knowledge, this was the first study that attempted to operationalize the B2EPUS construct into conceptually distinct indicators which can be observed and assessed. The findings provided a better understanding of the multidimensionality of the B2EPUS construct. More importantly, this study serves as the groundwork for expanding research on user satisfaction studies within a web-based environment. The widely use of the internet wireless technologies promote the predominant use of web-based systems within organizations. Hence, studies of user satisfaction with portals are worth investigating to make better use of the available technology.

Although the resulting scale has been subjected to rigorous development and validation procedures, the study is not without limitations. Firstly, the participating organizations were mainly derived from Australian higher education industry. While the survey participants were B2E portal users, confirming that they generally possess characteristics of the typical B2E portal users, they were nevertheless not entirely representative as they were mainly derived from one specific industry. Furthermore, subjects participated based on their availability and willingness to complete the online survey. Hence, the voluntary nature of this study and the fact that those participants were from one specific industry potentially limited the results of this study. Therefore, future research could utilize the B2EPUS scale with new data sets in other context.

Conclusions

This study has employed a rigorous scale development process to develop a scale that measures user satisfaction with B2E portals. The result is a parsimonious, eighteen-item scale, comprising five dimensions: *Usefulness*, *Confidentiality*, *Ease of Use*, *Convenience of Access*, and *Portal Design*. The developed scale also demonstrated acceptable level of reliability and validity, including content validity, construct validity, criterion-related validity, and nomological validity. Practitioners and researchers are encouraged to utilize the scale considering it is a practical, accessible, and easily administered measure which can be used in an organizational setting for various purposes.

Appendix 1: The Final Eighteen Items of the B2EPUS Scale

1. The staff portal enables me to share or exchange project/task information with my team colleagues.
2. The staff portal facilitates my collaboration work with all colleagues.
3. The staff portal enables me to discuss work or project issues with my immediate work colleagues.
4. The staff portal enables me to share general information via email or on website with other colleagues in the whole organization.
5. I feel confident in submitting personal information through the staff portal because it will be properly used by authorized people.
6. The information presented on the portal can be trusted.
7. Information presented on the portal is dependable.
8. I feel the staff portal is secure.
9. I can rely on the information presented on the staff portal to carry out my tasks.
10. No training on the use of staff portal is necessary as the portal use is self explanatory.
11. The staff portal is easy to navigate, back forward and backward.
12. When I am navigating the staff portal, I feel that I am in control of what I am doing.
13. The staff portal is accessible from my home through internet connection.
14. Gaining access to the staff portal is easy.
15. The staff portal is accessible 24 hours a day, 7 days a week.
16. The staff portal is aesthetically designed.
17. The design of the staff portal is attractive.
18. The staff portal is user friendly with many help functions and useful button and links.

Appendix 2: Six Items Measuring the B2E Portal Use Construct

1. Since the staff portal is now available, I prefer to access the portal to check and reply my emails.
2. Since the staff portal is now available, I prefer to access the portal to communicate with my colleagues.
3. Since the staff portal is now available, I prefer to access the portal to get the latest organizational news.
4. Since the staff portal is now available, I prefer to access the portal to search for any information I need.
5. Since the staff portal is now available, I prefer to access the portal to perform my job related tasks.
6. Since the staff portal is now available, I prefer to access the portal to perform my personal related tasks.

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