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Measuring Mobile Portal User Satisfaction

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Abstract

With the rapid advancement of mobile technology, smart devices have challenged the extant research concerned with time and space. Based on a user's specific interests, mobile portals allow quick and easy access anywhere, anytime to a world of data, applications and services. Whilst this provides an enhanced, dynamic and personalized user experience, knowing how satisfied users are with their mobile portal is crucial to understanding users' needs, identifying important factors that can be used to improve existing mobile portals and enhancing Information Technology (IT)-related business value. The study extends research knowledge about user satisfaction to the context of mobile portals. Secondly it contributes knowledge regarding post-adoption mobile portal user satisfaction. Thirdly, the research contributes a new reliable and valid instrument to measure user satisfaction with mobile portals – a contribution to the IS research stream concerned with measurement.

Keywords mobile technology, mobile portal, instrument development, user satisfaction.

1 Introduction

Pervasive computing has become the paradigm of the decade whereby mobile technology penetrates almost every facet of our lives from education, commerce, social and health to entertainment. Enabling this mobility is cloud computing, which supports a plethora of data-applications being accessed and shared through internet connectivity. This availability and sharing of data-applications has triggered new service models and entertainment trends such as ride-sharing networks and augmented reality tools and games. These emerging trends have some implications for the safety, productivity, social life, privacy and overall well-being of end users. For example, a mobile phone is now called a smartphone because it has been embedded with multiple sensors to detect and measure spatial orientation, vibration, acceleration, as well as processors to enable other functions. As a result, the device can serve as a GPS, a sleeping pattern tracking system and a payment system. The expanding capability of a smartphone has been accompanied by the shrinking of notebook computers to a pad or tablet size. Together with software, network and data services, these devices serve as the point of access to a world of data, applications and services. In exploring these issues, we refer to mobile portals as mobile mechanisms that enable users to access the rich data-application space. Mobile portals require the hardware, software components and data services to work together to allow virtual connectedness so that end-users can perform work, social and leisure activities through a network of Information Systems (IS). In effect they are the customized, personalized screens on a mobile telephony or device that provide users with a single gateway to access the rich data-application space.

Based on users' specific interests, mobile portals allow quick and easy access anywhere, anytime to mobile content. This provides enhanced, dynamic and personalized user experiences. As users directly interact with these portals in a manner that is similar to the way in which users interact with specific computer applications, understanding of prior user satisfaction instruments has relevance. Over the last decade significant progress has been made in understanding mobile portals in terms of their development and implementation (Otair et al. 2012; Turel and Serenko 2007), adoption (Kourouthanassis 2014; Lee and Park 2013) and technical aspects (Lee et al. 2013; Parsons 2007). Yet, what is meant by user satisfaction with mobile portals is still not well understood. Moreover, there is a lack of instruments capable of measuring user satisfaction in this context. Without such an instrument it is difficult to analyze users' perspectives of the strengths and weaknesses of such portals in a manner that may contribute to improved acceptance and sustained use, and in-turn facilitate enhanced IT/business value. Hence, the objectives of this paper are twofold. Firstly, we explore the meaning of the terms mobile portal and user satisfaction in today's context of pervasive computing. Secondly, we report on development of an instrument (iMPUS) to measure the user's satisfaction with mobile portal usage (MPUS).

This remainder of the paper is organized as follows. The next section presents a summary of the literature, followed by the research design and methods adopted to rigorously develop and validate MPUS and the iMPUS. A summary of the findings follows. Finally, we conclude with discussion of the implications for both research and practice, including the limitations and areas for future research.

2 Literature Review

In the IS disciple there are two principal ways of conceptualising and measuring user satisfaction with IT or IS artefacts. The first utilises a formative scale whereby satisfaction is measured in specific domains that have been predefined and identified. The assumption here is that an overall measure of satisfaction can be obtained by summing the satisfactory scores in each domain (Bailey and Pearson 1983). The second method recognises that there are several dimensions that lead to IS satisfaction. Herein the focus is on tapping into overall satisfaction (Doll and Torkzadeh 1998) rather than summing satisfaction scores for each dimension. In this approach satisfaction is regarded as a reflective scale. We posit that mobile portal access involving the data-applications space is a multi-faceted medium whereby different services exist, such as network providers, content providers and hardware providers. Likewise, there is a myriad of interactions that are executed simultaneously by various stakeholders, such as social network users, online game players, readers, programmers and e-commerce users. In this study, the measurement instrument mobile portal user satisfaction (iMPUS) is developed using the latter approach. It is based on the view that: (1) the construct is not directly observable; and (2) that there are different types of portal users with their own standards and criteria regarding how they perceive their experience using their mobile portals. The MPUS construct includes multiple dimensions, while the iMPUS comprises multiple items to measure satisfaction such as a cognitive-judgemental process.

Mobile portals are designed to operate in an environment that involves delivering information and services anytime and anywhere. A review of the literature revealed five dimensions that distinguish them from web-based portals: ubiquity; convenience; localisation; personalisation; and device optimisation. *Ubiquity* refers to the ability of users to access information or services and perform transactions from virtually anywhere at any time and to be reachable (Gao et al. 2011; Parsons 2007). It enables personalised alert notifications such as email notifications and stock market updates. *Convenience* concerns the dexterity and accessibility provided by mobile portals to their users who are no longer restricted by time or place in obtaining services (Gao et al. 2011). Enhanced by data storage capacity, it may contribute to improved user satisfaction and loyalty (Clarke and Flaherty 2003; Seng et al. 2011). *Localization* is the ability of smart devices to identify the geographical location of users and provide them with location-specific information and services that are timely, accurate, and relevant to their needs and requests (Dholakia and Rask 2002). In contrast, web-based portals rely on IP or email addresses (Dholakia and Rask 2002). *Personalization* concerns the presentation of individually tailored information on a mobile portal based upon the user's profile, needs and preferences (Hill and Troshani 2010). Issues here include resolution, navigability and screen size issues as related to 'surf-ability' and amount of displayed material. Finally *Device Optimization* is the ability to automatically generate content in a mobile portal based upon device configurations, characteristics of the communication channel available to them and the languages and protocols that are supported (Serenko and Bontis 2004). Limitations include: size; complicated input mechanisms; battery life; computational power; memory and storage; and resolution (Siau et al. 2001).

Given the volume of mobile portal usage and their distinguishing dimensions, new understanding of their effectiveness and success is important. A review of the IS literature in the areas of service quality, website quality, website design and portal design established the relevance of 37 empirically validated user satisfaction instruments with 157 associated dimensions. Further, it demonstrated a lack of existing instruments capable of measuring MPUS. In part this was because prior widely accepted and employed instruments (e.g. Bailey and Pearson 1983; Doll and Torkzadeh 1988; Ives et al. 1983) and their underpinning construct models had been developed to assess user satisfaction in a conventional IS setting, which is not part of the mobile dynamic. As such concepts such as ubiquity, convenience, localization, personalization, and device optimization have little relevance to earlier instruments. This highlights the need to develop specific understanding of the term MPUS and in-turn leverage this understanding to develop a reliable and valid iMPUS.

3 Research Design and Methods

In keeping with existing rigorous instrument development frameworks (Churchill 1979; DeVellis 2012; Straub 1989), a four-stage development process was adopted: specification of the domain of construct; generation of items and a content validation process; an exploratory study and associated assessment of reliability; and a confirmatory study and associated assessment of reliability, convergent validity, discriminant validity, nomological validity and criterion-related validity.

3.1 Specification of the Domain Construct

Initially MPUS was framed with nine dimensions (*Customer Support Service; Content-device Fit; *Services Provision; *Perceived Usefulness; *Connectivity; Perceived Ease of Use; *Personalization; *System Adaptability;* and *Perceived Value*) that were derived by interrogation of the literature. The asterisk indicates newly defined dimensions to meet the unique characteristics of mobile portals.

These outcomes were then explored and tested through three rounds of focus groups comprising a mix of: (1) experts engaged with portal implementations or telecommunications industry; (2) researchers working in the area of user satisfaction, mobile/electronic commerce, and/or portal/IS implementation; and (3) active smart device users. The first group had between 2-10 years' experience in telecommunications or 10-15 in IT/portals; the second group had 2-5 years of experience in user satisfaction or 5-20 years of experience in IS implementation; while the third had 1-5 years' experience in using smart devices. Each focus group comprised between seven and nine individuals: Session 1 comprised nine individuals including two experts, three researchers and four users; while Sessions 2 and 3 comprised seven individuals including three experts, two researchers and two users, and two experts, one researcher and four users respectively.

Led by an independent facilitator, the focus groups were assigned a range of tasks including: examining the two key terms *'mobile portal'* and *'user satisfaction with mobile portals'* in order to validate the preliminary MPUS construct with its nine dimensions; and identify possible new dimensions for MPUS. Whilst the first session included more open-ended questions to acquire

consensus about the definitions, the second and third sessions were more confirmatory. In each case notes were taken and the sessions were recorded and partially transcribed.

Thematic analysis revealed: (1) consensus on two key terms: '*mobile portal*' being defined as the customized, personalized user interface of smart devices that allows users to seamlessly access rich data-application spaces, and '*user satisfaction with a mobile portal*' being defined as the user's overall affective attitude towards the mobile portal encompassing both the hardware and software aspects of the device; and (2) MPUS being framed with ten dimensions. This resulted in the removal of *Services Provision* as a dimension but the inclusion of *Security* and *Device Specific* as dimensions.

Reflecting on the body of literature and the purpose of this study, we define 'mobile portal' as the overall customized, personalized screens on smart devices that provides users with a single gateway to access the rich data-application space. In defining a mobile portal this way we are not referring to business vendor portals nor network buyer portals; rather, we refer to the customized, personalized screens on a mobile telephony or device.

3.2 Generation of Items and the Content Validation Process

Drawing on the resultant ten dimensions, items to measure MPUS were formed and validated. Initially 61 items were identified: 41 were composed by drawing upon the relevant literature and 20 were drawn from existing instruments. Following screening by a language expert for comprehensibility and clarity, stakeholder groups (similar to those deployed in the focus groups) used the modified Q-sort technique to sort related items into dimensions. This resulted in: (1) identification of the *Perceived Social Value* dimension; (2) regrouping of items; and (3) removal of three items. Given recognition by the focus groups of the evolutionary nature and importance of support and its importance, four items concerning *Online/Discussion forum Support* (another dimension) were added to the 58 remaining items, making a total of 62 items. We acknowledged that support is important as indicated by the focus groups. However, both the *Telephone/In-store Support* (9 items) and the *Online/Discussion Forum Support* (4 items) were excluded in this study because they related to satisfaction with specific support provided for mobile portal use rather than satisfaction with the mobile portal as a whole. Therefore, at the conclusion of the content validation process there were ten dimensions and 49 items.

3.3 Overview of the Exploratory Study and the Confirmatory Study

The ten dimensions and 49 items, which used a seven-point Likert-type scale, were populated into Qualtrics. Issues with 'missing data' were eliminated as the forced response option was used to impose completeness in submitted questionnaires. A preliminary version of iMPUS was trialled on 10 active smart device users.

Both the EFA and CFA studies relied on willing active smart device users who responded to advertisements placed around universities and postings on university/department websites and social network websites (i.e. Facebook). The online questionnaire was 'open' for approximately four months in 2012 for EFA study (249 usable out of 254 responses) and approximately three months in 2013 for CFA study (375 usable out of 377 responses). Table 1 below summarizes the demographics of EFA and CFA respondents.

	Exploratory Study		Confirmatory Study	
Characteristics	N	%	N	%
Gender				
Male	120	48.2	164	43.7
Female	129	51.8	211	56.3
Age				
18-29	215	86.3	260	69.3
30-39	21	8.4	77	20.5
40-49	10	4.0	44	11.7
>= 50	3	1.2	42	11.2
Frequency of use of mobile portal				
Daily	204	81.9	341	90.9
A few times per week	38	15.3	26	6.9
A few times per month	7	2.8	8	2.1

Rarely	0	0.0	0	0.0
Never	0	0.0	0	0.0
Primary use of mobile portal				
Communication	150	60.2	250	66.7
Entertainment	27	10.8	45	12.0
Information	70	28.1	74	19.7
Transactions	2	0.8	6	1.6

Table 1. Summary of the Demographics in the EFA and CFA.

3.4 Exploratory Study

Prior to EFA, the completed questionnaires were screened to identify and delete items that did not contribute to the overall reliability of the iMPUS. These were presented according to the predetermined conceptually related dimensions, namely:

- **Group 1:** *Perceived Value (PV)* and *Perceived Social Value (PSV)*; and
- **Group 2:** *Content-device Fit (CF), Perceived Usefulness (PU), Connectivity (CON), Perceived Ease of Use (PEOU), Personalized Interface (PI), System Adaptability (SA), Security (SEC)* and *Device Specific (DS).*

At the conclusion of the data-screening phase, all 49 items in Group 1 were retained while 14 items from Group 2 were identified as candidates for removal. Next, responses to these items were subjected to principal component analysis, which is the most frequently used extraction method for EFA (Pallant 2011). The result of this analysis: (1) supported the use of all 5 *PV* items and all 4 *PSV* items as two separate dimensions; and (2) identified six dimensions in Group 2*: PU* (comprising *PU* and *SEC*)*; DS* (comprising *SA* and *DS*)*; CON; CF; PEOU*; and *PI*. The final eight dimensions of MPUS are:

- *Perceived Value (PV):* Perceived benefits received given expenses associated with using the mobile portal
- *Perceived Social Value (PSV):* Perceived social value of using the mobile portal
- *Perceived Usefulness (PU):* Ability of the mobile portal to assist users in performing their activities securely in a timely manner
- *Device Specific (DS):* hardware and software aspects of the device that affect the mobile portal
- *Connectivity (CON):* Ability of the mobile portal to be connected from anywhere at anytime
- *Content-device Fit (CF):* Ability of the mobile portal to present content that is aesthetic, accurate, concise, relevant and reliable
- *Perceived Ease of Use (PEOU):* Given the limitations of small screen smart devices, the extent to which the mobile portal is perceived to be user-friendly or easy to navigate
- *Personalized Interface (PI):* The ability of the mobile portal to be personalized or customized by users

Table 2 summarizes the factor loadings of the final 47 items. Uni-dimensionality was achieved with significant loading of all items on a single factor. The Cronbach's coefficients for all ten dimensions were above 0.7 (Nunnally 1978), which shows that the iMPUS is a stable and reliable instrument.

		Group 1		Group 2					
				Com 1		Com 2	Com 3		Com 4
		1	2	3	4	5	6	7	8
PV	pv1	0.85							
	pv3	0.84							
	pv2	0.84							
	pv4	0.79							
	pv5	0.72							
PSV	psv2		0.95						
	psv3		0.94						
	psv4		0.93						
	psv1		0.92						
PU	sec1			0.94					
	sec2			0.93					
	sec3			0.76					
	pu1			0.74					
	pu4			0.68					
	sec4			0.58					
	pu3			0.52					
DS	ds2				0.77				
	ds3				0.74				
	ds1				0.73				
	ds4				0.72				
	ds5				0.55				
	sa2				0.53				
	sa3				0.44				
	sa1				0.43				
CON	con7					0.84			
	con3					0.81			
	con6					0.81			
	con4					0.76			
	con8					0.72			
	con2					0.72			
	con5					0.70			
	con1					0.67			
CF	cf2						0.88		
	cf4						0.87		
	cf5						0.86		
	cf3						0.80		
	cf1						0.53		
PEOU	peou1							0.94	
	peou2							0.85	
	peou3							0.81	
	peou4							0.68	
PI	pi5								0.86
	pi4								0.86
	pi2								0.84
	pi6								0.82
	pi3								0.81
	pi1								0.81
Cronbach α		0.95	0.87	0.89	0.88	0.89	0.88	0.89	0.91
Eigenvalue		4.36	2.41	7.28	1.35	4.55	5.14	1.27	4.16
Cum. Var. explained (%)		48.47	75.25	48.55	57.53	56.91	57.12	71.20	69.40

Table 2. Factor Loading of the 47 Final Items.

3.5 Confirmatory Study

The 375 usable responses collected in the second data collection phase were subjected to the maximum likelihood method (Brown 2006). Based on the exploratory study, a measurement model of eight first-order factors was developed. CFA was performed individually on the eight dimensions and then on the model as a whole. Table 3 summarizes the model fit test results after taking into consideration the empirical and theoretical rationale. For items with a large Modification Index (MI), Joreskog and Sorbom (1996)'s recommendation of co-varying the error terms or dropping one or both items was considered. As shown in Table 4, the final 42-item model had acceptable fit indices: Normed χ^2 (chi-square)=2.21; SRMR (standardized root-mean-square residual index)=0.07; TLI (Tucker-Lewis index)=0.90; and CFI (comparative fit index)=0.91. Only GFI (goodness-fit-index, 0.82) was not within an acceptable fit level, but it was close to an ideal threshold.

	PV	*PSV*	*PU*	*DS*	*CON*	*CF*	*PEOU*	*PI*	Final Model
Normed χ^2	17.18	.07	2.33	4.80	6.62	4.3	13.8	5.11	2.21
GFI	.95	1.00	.98	.97	.96	.98	.97	.97	.82
SRMR	.05	.00	.02	.04	.04	.02	.03	.03	.07
TLI or NNFI	.85	1.00	.98	.94	.92	.97	.92	.94	.90
CFI	.95	1.00	.99	.97	.96	.99	.97	.97	.91
AIC	75.53	18.07	44.61	64.39	78.95	41.48	43.6	66.9	1972.68

Table 3. Model Fit Test Results of each Hypothesized MPUS and iMPUS Dimension.

3.6 Assessment of Reliability

As shown in Table 4 below, the iMPUS has good internal consistency and is reliable as the Cronbach's α and the composite reliability scores (except for *SF*=0.76) were greater than 0.70. However, the mean inter-item correlation values were above the acceptable range, suggesting that the iMPUS may contain a number of redundant items, which provide future opportunity for refinement.

Dimension	*PV*	*PSV*	*PU*	*SF*	*CON*	*CF*	*PEOU*	*PI*	WebQual	CAS	PWOM
Cronbach's α	0.88	0.93	0.87	0.85	0.87	0.91	0.90	0.87	0.97	0.73	0.88
Composite Reliability	0.82	0.83	0.81	0.76	0.80	0.90	0.80	0.83	-	-	-
Mean Inter-Item Correlation	0.59	0.78	0.52	0.49	0.54	0.68	0.69	0.54	0.43	0.15	0.71

Table 4. Cronbach's α , Composite Reliability and Mean Inter-Item Correlation Values.

3.7 Assessment of Convergent Validity

An assessment of convergent validity was performed through correlation analysis between the iMPUS, the well-known WebQual instrument (Loiacono et al. 2007) and the average variance extracted (AVE, Chang et al. 2005). Table 5 summarizes the results from correlation analyses of assessment of validities. The convergent validity of WebQual is reasonable with 0.29 (lowest) and 0.59 (highest) at a significant level of 0.01, which is not so high as to measure the same construct. All factors (except *DS*) had AVE values exceeding 0.50. The only exception was *DS* with 0.49.

	Validity						
	Convergent	Discriminant	Criterion-Related	Nomological			
Dimension	WebQual	CAS	OVERALL	PWOM	N	AVE	% of Violation
PV	.51**	-.17**	.40**	.52**	375	0.56	0.00
PSV	.29**	.14**	.12**	.30**	375	0.76	0.00
PU	.55**	-.36**	.40**	.38**	375	0.53	29.63
DS	.54**	-.23**	.44**	.50**	375	0.49	18.06
CON	.49**	-.13**	.40**	.44**	375	0.55	36.11
CF	.63**	-.27**	.50**	.54**	375	0.68	2.70
PEOU	.59**	-.39**	.54**	.48**	375	0.69	1.97
PI	.56**	-.35**	.51**	.46**	375	0.53	18.52

** Coefficient is significant at $p < 0.01$ level (2-tailed)

Table 5. Cronbach's α, Composite Reliability and Mean Inter-Item Correlation Values.

3.8 Assessment of Discriminant Validity

Discriminant validity was assessed through the correlation matrix approach with the 16-item Computer Anxiety Scale (CAS, Cohen and Waugh 1989). The CAS has acceptable discriminant validity (0.13 the lowest) and a significant level of 0.01 (see Table 5): as expected a negative relationship was found. Furthermore, the percentages of violations for each factor were less than 50% of the potential comparisons. Therefore the adequacy of discriminant validity was achieved.

3.9 Assessment of Nomological Validity

The PWOM (Devaraj et al. 2002) construct with a reliability of 0.88 (see Table 5) was chosen to validate the iMPUS' nomological validity. Positive relationships were expected between the iMPUS' eight-dimension construct and the PWOM construct. Using correlation analysis and regression analysis a comparative assessment was performed. Drawing on Cohen's (1988) guidelines, the *PV* factor had a large correlation while the rest had medium correlations (see Table 5). Prior to multiple regression analysis, preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multi-collinearity and homoscedasticity. The total variance explained by the model as a whole was 43.9% with significance indices $F(8, 366) = 37.51$ and $p < .001$. Of the eight factors, five iMPUS factors had significant influence on the PWOM construct. When ordered from

most to least significance, the factors were as follows: (1) *DS* (β = 0.234, p <.001); (2) *PV* (β = 0.229, p <.001); (3) *PSV* (β = 0.137, p <.001); (4) *PEOU* (β = 0.133, p <.05); and *CON* (β = 0.098, p <.05). Regression analysis revealed a positive significant relationship between the iMPUS and PWOM constructs, which confirmed iMPUS' nomological validity.

4 Discussion

Identification of commonality with two established constructs, namely *PEOU* and *PU,* supports findings from prior user satisfaction studies. Yet compared to conventional IS such as computers or websites, findings about MPUS's eight dimensions extends user satisfaction research to a new IS context.

Firstly, *PV* and *PSV* were found to be separate constructs. In contrast to prior studies, results show how a mobile IT artefact increases users' productivity and effectiveness is part of *PV* instead of *PU*. In addition to economic value for money (Zeithaml 1988) and time saving (Teo 2001), user satisfaction with mobile portals extends to include users' productivity and effectiveness. Moreover, it is affected by users' perception of the cost of accessing services through their mobile portals to complete tasks and communicate. Therefore, our findings show that users' *PV* of mobile portals is affected by how their mobile portals increase their productivity and effectiveness at minimal cost.

PSV was previously conceptualized as being related to social norms i.e. responding to social pressure to use new technology (Venkatesh et al. 2003). In this study *PSV* was found to relate to the social value gained from using a mobile portal. It encompasses users' social satisfaction from interacting with their mobile portals and thus identified as an important aspect of mobile portal user satisfaction. This accords with Alshibly (2015) who concluded that social value has a significant effect on customer satisfaction.

Our findings differ from prior IS studies where *PU* is commonly associated with how the IT artefact facilitates a desired outcome (Ong et al. 2009). In this study *PU* encompasses the ability of the mobile portal to *securely* assist users in performing their activities in a *timely* manner. Given smart devices contain sensitive and privacy data, security features are important. Lost or stolen data can pose a major risk as data can be used maliciously.

Importantly the *DS* dimension is unique to MPUS. *DS* concerns the ability of the mobile portal to be optimized to ensure a faster transmission speed, simple navigation, intuitive-to-use graphical user interface, and consistent page layout, all of which affect user satisfaction (Mori 2013; Serenko and Bontis 2004). Empowering users with device adaptability to their requirements and needs boosts device performance, which raises users' satisfaction.

Likewise, *CON* is an important aspect of MPUS. Given the portability of smart devices and the fact that users perform most of their day-to-day activities from their mobile portals, they expect them to have network connectivity at all times from anywhere with minimal dropouts. Herein our findings support Woo and Fock (1999) who found that transmission quality and network aspects affected mobile phone users' satisfaction.

CF encompasses the ability of mobile portals to present content that is aesthetic, accurate, concise, relevant and reliable. Given only good quality information value-adds for users, past researchers have shown content quality (i.e. accurate, complete, current, informative, and reliable) to be an important aspect of user satisfaction (Heo 2013; Ong et al. 2009). Moreover, the limitations of small screen smart devices means *CF* has an additional dimension, as the information presented must be both relevant and compact.

Results from the confirmatory study indicate that MPUS's *PEOU* is similar to prior studies, where it is associated with how easy it is to use an IT artefact and positively related to user acceptance of the artefact (Heo 2013; Ong et al. 2009; Tojib, et al. 2008).

Finally, *PI* is regarded as a key aspect for mobile portal users. As with *CF*, limitations of the smart devices' user interfaces (i.e. size and resolution) impact the users experience when they communicate, search for information and transact (Chau and Hu 2002).

5 Implications

This study provides interesting insights into user satisfaction in the context of mobile portals (MPUS), and thereby contributes new research knowledge. Statistical testing has confirmed the multi-dimensionality of the MPUS construct with its eight empirically distinguishable dimensions: *PV, PSV,*

PU, DS, CON, CF, PEOU and *PI*. Additionally, findings have established that MPUS' *PU* and *PV* are different from that reported in prior literature and that the new dimensions, *DS* and *PI,* are needed to capture aspects of use unique to mobile portals. The research also contributes knowledge regarding mobile commerce and specifically mobile portals, which lack intensive research, particularly concerning post-adoption MPUS. Given the constant flux in a mobile environment, this study's insights into factors that affect mobile services' adoption are important. Lastly, the research contributes a new reliable and valid instrument (iMPUS) to measure user satisfaction with mobile portals. As such, this research has contributed to the research stream concerned with IS measurement. A well-developed instrument is essential, as any evaluation of possible constructs remains purely speculative until the measurement instrument has demonstrated statistical validity and reliability. Given the rigor with which the iMPUS has been developed, there is reason to have confidence in its application to different groups of users in order to gauge differences in user satisfaction.

In broad terms, the research makes several practical contributions. MPUS provides a framework that informs the desired design features of mobile portals from users' perspective. This contributes to users' acceptance and sustained use of mobile portals. For existing mobile portals, businesses can use the multi-item reflective iMPUS to gain insights into users' views of strengths and weaknesses related to their mobile portals and identify areas for improvement. The iMPUS can be applied to different groups of users to compare satisfaction levels and particular aspects of MPUS that each group find most satisfying. This informs businesses' design and tailoring related to portal improvement, new product and implementation.

6 Limitations and Future Directions

This study has several limitations. Firstly, there are limitations with respects to external validity. Data was collected from individuals who used mobile devices, which could limit generalization of the findings to conventional environments. Secondly, since respondents to the online questionnaire for the exploratory and confirmatory studies were voluntary active smart device users, non-active users did not participate. Thus, findings were unavoidably subject to self-selection bias. Consequently these findings are generalizable only to the sample population and require replication in a different dataset. Finally, the test–retest reliability could not be evaluated since this study was conducted with a single snapshot approach.

Future studies could examine whether when predicting positive word-of-mouth (PWOM), the iMPUS would capture gender differences. Such relationship analysis would further establish the nomological validity of the instrument. Further, cross-cultural validation using different large data sets for greater generalization of the iMPUS may be conducted. Test-retest reliability would be useful to examine the iMPUS' stability over time.

7 Conclusion

The aims of this study were to develop specific understanding of user satisfaction in the context of mobile portal use (MPUS) and develop a reliable and valid instrument (iMPUS) by which to measure this. The empirical results revealed the MPUS construct with 42 items grouped into eight distinct dimensions: *PV*, *PSV*, *PU, SF*, *CON*, *CF*, *PEOU* and *PI*. Preliminary psychometric evidence suggests that the resultant iMPUS is reliable and valid. By demonstrating how different mobile portals are from other forms of conventional IT, which are used for personal and business transactions, this study has increased awareness about the particularities of the mobile portal context and how it impacts upon users. In particular it has contributed new knowledge about what dimensions capture users' satisfaction with mobile portal usage and a valid instrument by which to measure these dimensions.

8 References

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Appendix 1 – Final Items of iMPUS

*Note * indicated removal of these items at the conclusion of CFA*

pv1	Using my mobile portal increases my productivity.
pv2	Using my mobile portal enhances my effectiveness.
pv3	I believe that the time I save by using my mobile portal outweighs the associated costs.
pv4	I believe that using my mobile portal to download the information I require is a good financial investment.
pv5	I believe that using my mobile portal improves the efficiency of my decision- making.
psv1	I believe that using my mobile portal helps me to feel accepted.
psv2	I believe that using my mobile portal improves the way I am perceived.
psv3	I believe that using my mobile portal makes a good impression on other people.
psv4	I believe that using my mobile portal gives me social status.
pu1	I can perform the transactions I want to perform on my mobile portal.
pu2*	I can rely on my mobile portal to supply information that I need.
pu3	I can send and receive information securely through my mobile portal.
pu4	I feel confident in using my mobile portal to perform transactions.
pu5	I feel confident that my mobile portal is secure and robust in performing the transactions I require.
pu6	I am able to set an access password to protect my mobile portal from other people accessing it.
pu7	I am able to turn on the auto lock function to protect confidential information in my mobile portal.
sf1	My mobile portal can be easily upgraded to a new version.
sf2	The features of my mobile portal remain stable even when upgraded.
sf3	My mobile portal systematically checks for application updates.
sf4*	The length of battery hours available to operate the device is adequate.
sf5*	The device is durable for an average of 1-2 years.
sf6	I can easily synchronise applications in my mobile portal with other web-based applications.

sf7	My mobile portal can easily adapt and present content to fit on my device.
sf8	I can easily back up data from my mobile portal to a secondary storage device.
con1*	I can connect to my mobile portal easily when I am indoors.
con2*	I can connect to my mobile portal easily when I am outdoors.
con3	I can connect to my mobile portal speedily from anywhere at any time.
con4	The frequency of drop-outs of my mobile portal is minimal.
con5	The freezing of my mobile portal during operation is minimal.
con6	The connection speed of my device is adequate.
con7	My mobile portal readily responds to my requests from anywhere at any time.
con8	My mobile portal is reliable in its role as the primary means of providing access to mobile services and mobile internet.
peou1	I can use my mobile portal without the need for training.
peou2	My mobile portal is user-friendly and easy to use.
peou3	My mobile portal is easy to navigate around when I use the features and applications.
peou4	When navigating within my mobile portal, I feel that I am in control of what I am doing.
cf1	The content presented by my mobile portal is visually appealing.
cf2	The content presented by my mobile portal is always accurate.
cf3	The mobile portal presents information concisely.
cf4	The content presented by my mobile portal is relevant to my enquiry.
cf5	The content presented by my mobile portal is reliable in addressing my needs.
pi1	I can readily add applications on my mobile portal.
pi2	I can easily configure individual applications in my mobile portal to my needs.
pi3	I can easily set my preferred languages in my mobile portal.
pi4	I can readily adjust the settings of my mobile portal to my needs.
pi5	I can easily delete applications in my mobile portal.
pi6	I can easily rearrange the layout of my mobile portal.