Towards Development of an Instrument to Measure Mobile Portal User Satisfaction

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Abstract

The usage of mobile phones and their related Internet transactional activity through mobile portals (m-portals) are an everyday activity for increasing numbers of people. However, unlike investigation of users’ attitudes to more static computing devices, user satisfaction with m-portals is yet to be researched. In addressing this gap, this research draws upon knowledge gained from Stage One of a project that used focus groups to establish the dimensions and items regarded as relevant for measuring m-portal user satisfaction. Based on this, the results from Stage Two, namely the development and validation of a multiple-item instrument for measuring user satisfaction with m-portals are now reported. The theoretical contribution of this study concerns development of an instrument to measure user satisfaction in the context of m-portals. This extends knowledge in the measurement stream of Information Systems research. Moreover, through measured understanding of user attitudes to post adoption of m-portals, findings inform the m-commerce stream of research.

Keywords: mobile technology, m-portal, instrument development, user satisfaction.
1 INTRODUCTION

The proliferation of mobile devices, which include Apple’s iPhone and iPad and Samsung’s Galaxy, allow users to investigate, transact and communicate via the Internet using various operating systems. In 2011, worldwide mobile data traffic grew by 133% such that this activity was “8 times the size of the entire global Internet in 2000” (Perez 2012, 1). In 2012 it was predicted that there would be more mobile connected devices in the world than people (Perez 2012), with vendors supplying 1.7 billion mobile phones in this year (Leonard 2012). Related activity has seen an 80% increase in mobile retail and travel spending in 2011, which was expected to double by the end of 2012 (Huynh 2012).

Given the quantum of devices and the scale of related transactional activity, research in this field is topical, timely and constantly evolving. To date, research has explored: (1) factors and issues that affect the adoption of m-commerce and mobile services (Hung et al. 2003; Blechar et al. 2005; Yang 2005; Bina et al. 2008; Liu 2008); (2) factors that influence the adoption of specific mobile applications (Brown et al. 2003; Kleijnen et al. 2003; Mallat et al. 2004; Luarn & Lin 2005; Laukkonen 2007); (3) technologies and applications of m-commerce, for example 3G networks and personalisation technologies (Barnett et al. 2000; Gunsaekaran & Ngai 2003; Kumar & Zahn 2003); (4) customer loyalty with respect to m-commerce (Lin & Wang 2006; Cyr et al. 2006); and (5) m-commerce user requirements (Buyukozkan 2009). As such there is a quantum of research regarding user attitudes to mobile devices and m-commerce more generally, but not user attitudes to their personalised accessibility, namely mobile portals (henceforth, m-portals). Yet as facilitators, m-portals play a strategic role in m-commerce (Barnes 2002; Gao & Damsgaard 2005). Formed by aggregating mobile applications and content from various providers, m-portals act as the prime “supplier” or “gateway” to mobile internet and mobile services for small screen mobile device users. Accordingly by exploring user satisfaction with m-portals, this research addresses an identified research gap.

Centred on this premise, and drawing upon related theoretical and empirical research, the study reports on development and validation of an instrument to measure m-portal user satisfaction. Stage One of the research, which involved focus groups and a related literature review, established the underpinning dimensions regarded as relevant to measuring m-portal user satisfaction (Seng et al. 2011). Leveraging this, the objective of this paper is as follows:

*Using the identified dimensions and items, to develop and test a multiple-item instrument for measuring user satisfaction with m-portals.*

By achieving this objective, the research extends prior understanding of user satisfaction to the context of m-portals. Specifically, development of this instrument means that the measurement stream within the Information Systems (IS) literature will have a new instrument by which to measure user satisfaction with a new and evolving IS activity, which will extend current understanding of user satisfaction. For practitioners, this research provides a simple to administer instrument that permits evaluation of the success in terms of users’ satisfaction with their company’s m-portal, and opportunity to identify areas for improvement.

Drawing upon the knowledge gained from Stage One, the results from Stage Two concerned with development and validation of the proposed multiple-item instrument for measuring user satisfaction with m-portals are now reported. The outcome from Stage Two was confirmation of a stable and reliable 60-item instrument with seven dimensions: perceived usefulness; perceived value; perceived social value; personalised interface; connectivity; ease of use; and support.

The paper proceeds in the following manner. After presenting a critique of the relevant literature to derive the salient characteristics of user satisfaction that apply to m-portal user satisfaction, the research approach used to generate and validate the instrument items, together with an exploratory study of their validity, are outlined. Next through discussion of construct validation, results regarding the reliability and effectiveness of the instrument are reported. The paper concludes with a summary of the study’s contribution to theory and practice, together with discussion of limitations and how the research will be extended.
2 M-PORTALS: CHARACTERISTICS AND USER SATISFACTION

2.1 Towards an Understanding of Portals and M-Portals

In general terms, a ‘portal’ refers to a doorway or gate through which someone will pass in order to get to another place. Despite no unique definition of the term in the IS field, a portal generally refers to an entry point or a webpage for accessing content and services on the Internet. Further, portals differ from traditional webpages in that traditional webpages primarily provide static information, while portals provide “seamless access to a variety of goods and services via a single interface based on a predefined profile of preferences” (Lazar 2000, 52). In recent years there has been increasing growth in the role of portal technology in computing, with service providers rolling out portals that allow users to create customised websites that display information of interest such as stock quotes, news articles, sports, retail and travel, and permit transactional activity.

Whilst the concept of portals should not be limited to the Internet (Smith 2004), the spectrum of internet portals has grown to include: business portals (Eckerson 1999); business-to-employee portals (Ransdell 2000); corporate portals (Benbya et al. 2004); enterprise portals (Dettlor 2000); enterprise information portals (Shilakes & Tylman 1998); internet and web portals (Vlachogiannis et al. 2007); and m-portals (Barnes 2002; Clarke & Flaherty 2003; Turel & Serenko 2007).

Essentially m-portals, which are the focus in this study, are portals that are specifically designed for small screen mobile device users, representing the main “gateway” to mobile internet and mobile services for such users, with mobile applications (apps) enabling these internet services (Kaasinen et al. 2000). Due to their physical size, these devices offer mobility being compact enough to be carried everywhere (cf. large screen devices), but suffer from limitations such as small screens, complicated text input mechanisms and shorter battery life. As a result m-portals are characterised by a much greater degree of customisation and personalisation than both public and corporate portals, with users tailoring their portals to individual needs and habits in order to present timely, right and concise information (Muller-Veerse 2000; Siu et al. 2001; Barnes 2002).

2.2 Unique Characteristics of M-Portals Derived from the Literature

M-portals deliver information and services anytime and anywhere. A review of the literature revealed five dimensions that distinguish them from web-based portals. These are: ubiquity; convenience; localisation; personalisation; and device optimisation.

- **Ubiquity** – the ability to access information or services and perform transactions from virtually anywhere at any time (Muller-Veerse 2000; Watson et al. 2002; Parsons 2007; Seng et al. 2011). This characteristic enables personalised alert notifications i.e. changes to airline flights, auction alerts, email notifications and stock market updates.

- **Convenience** – the dexterity and accessibility provided by m-portals’ lack of restriction to time and place (cf web-based portals – Dholakia & Rask 2002). This is enhanced by data storage capacity and translates into an improved quality of life, which may contribute to improved user satisfaction and loyalty (Clarke & Flaherty 2003; Serenko & Bontis 2004; Seng et al. 2011).

- **Localisation** – the ability to identify a user’s geographic location and hence offer location-specific information and services (i.e. suggestions of local restaurants and petrol stations) that are timely, accurate, and relevant to needs and requests (Tsalgatidou et al. 2000; Seng et al. 2011). This contrasts with web-based portals that rely on IP or email addresses (Dholakia & Rask 2002).

- **Personalisation** – given individual ownership, m-portals may be tailored to a user’s profile, needs and preferences. Thus usage can be analysed for targeted marketing and personalised service. Resolution, navigability and screen size issues make ‘single click’ access difficult and restrict both ‘surf-ability’ and the amount of information displayed (Barnett et al. 2000; Parsons 2007).

- **Device optimisation** – dependent upon device configurations (i.e. screen size, memory and CPU), bandwidth, languages and protocols (Seng et al. 2011), this captures the ability to automatically generate content on m-portals. Here user satisfaction may relate to faster transmission speeds, simple navigation, intuitive-to-use graphical user interfaces and consistent page layouts (Serenko
& Bontis 2004). It may also include limitations like size; complicated text input mechanisms; shorter battery life; computational power; memory and storage; and resolution (Siau et al. 2001).

Given the volume of m-portal usage and their distinguishing dimensions, new understanding of their effectiveness and success is important. In this regard the most widely used measure of IS effectiveness and success is user satisfaction (Powers & Dickson 1973; Bailey & Pearson 1983; Ives & Olson 1984; Doll & Torkzadeh 1988; DeLone & McLean 1992, 2003; Gelderman 1998).

2.3 Existing Approaches to Measure User Satisfaction

In investigating this central construct, namely user satisfaction, it is important to commence by reviewing its meaning. User satisfaction has been defined in the literature as “the extent to which users believe that the IS available to them meets their information requirements” (Ives et al. 1983, 785); or as “the affective attitude towards a specific computer application by someone who interacts with the application directly” (Doll & Torkzadeh 1988, 261). As m-portal users directly interact with these portals in a manner that is similar to the way users interact with a specific computer application, prior understanding of the construct is relevant to this research. Thus, in the context of this study, m-portal user satisfaction (MPUS) is defined as an affective attitude displayed by the user towards the m-portal with which he/she directly interacts.

A review of existing IS user satisfaction studies identified two broad streams of research that have been brought about by a shift from mainframes to personal computers, from centralisation to decentralisation, and subsequently from rapid Internet growth. The first stream of research concerns user satisfaction with the overall IS, whilst the second stream concerns user satisfaction with a web-based IS. Comparison of these (see Table 1 below) indicates greater relevance to this research from studies concerned with web-based IS, but even this differs from the context of m-portals. Moreover, the lack of studies that directly address the unique characteristics of m-portals validates the stated objective, namely to develop a new instrument.

In Stage One, by comparing the dimensions identified in the user satisfaction instruments (see Table 1 for a summary) with the characteristics of m-portals, nine dimensions were derived that were likely to be relevant for measuring MPUS. These included: customer support service; content-device fit; perceived usefulness; connectivity; ease of use; and four new dimensions more specifically related to m-portals, services provision; personalisation; system adaptability; and perceived value. The meaning and relevance of these dimensions were then explored through three focus groups.

2.4 An Overview of Stage One and its Outcomes

Focus group research, which involves discussion in which specific sets of issues are explored (Barbour & Kitzinger, 1999) through explicit use of group interaction (Stewart et al. 2007), was used in Stage One to: (1) examine the meaning of the terms “mobile portal” and “user satisfaction”; and (2) identify, from a user’s perspective, the dimensions that influence user satisfaction. There were nine participants in the first focus group (two experts, three researchers and four users), and seven participants in both the second (three experts, two researchers and two users) and third (two experts, one researcher and four users).
<table>
<thead>
<tr>
<th>Quality-Related Components of User Satisfaction</th>
<th>Studies Measuring User Satisfaction with Overall IS</th>
<th>Studies Measuring User Satisfaction with Web-based IS</th>
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</thead>
<tbody>
<tr>
<td>EDP Staff and Service</td>
<td>Overall EDP Staff and Service Satisfaction</td>
<td>Customer Support</td>
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<tr>
<td>Communication with Support Services</td>
<td>Support Factor</td>
<td>Service Quality</td>
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<tr>
<td>Information Quality</td>
<td>Information Product</td>
<td>Information Product</td>
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<td></td>
<td>Information/Output Product Satisfaction</td>
<td>Information/Output Product Satisfaction</td>
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<td></td>
<td>Output Quality</td>
<td>Content</td>
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<td></td>
<td>Content</td>
<td>Information Characteristics**</td>
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<td>Information Characteristic</td>
<td>Format</td>
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<td></td>
<td>Timeliness</td>
<td>Product Characteristics</td>
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<tr>
<td>Information Product</td>
<td>Format</td>
<td>Additional Information Service</td>
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<td></td>
<td>Timeliness</td>
<td>Tactility</td>
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<td></td>
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<td>Information Accuracy</td>
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<td>System Quality</td>
<td>Ease of Use</td>
<td>Accessibility</td>
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<td></td>
<td>Reliability</td>
<td>Usability</td>
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<td></td>
<td>Accuracy</td>
<td>Security</td>
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<td></td>
<td>Usability</td>
<td>Language</td>
</tr>
<tr>
<td>Others</td>
<td>Knowledge and Involvement</td>
<td>Use-system Relationship</td>
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<tr>
<td></td>
<td>Consumer Service</td>
<td>Delivery</td>
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<td>Delivery Time and Charge</td>
<td>Price</td>
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<tr>
<td></td>
<td>Program Support</td>
<td>Service Quality</td>
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<td></td>
<td>Purchase Process</td>
<td>Service Quality</td>
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<td></td>
<td>Payment Methods</td>
<td>Service Quality</td>
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<td></td>
<td>Purchase Result</td>
<td>Service Quality</td>
</tr>
<tr>
<td></td>
<td>Delivery</td>
<td>Service Quality</td>
</tr>
</tbody>
</table>

Table 1. Dimensions Identified from Existing User Satisfaction Instruments Framed According to DeLone and McLean (2003) and the Aforementioned Research Streams
Within the focus groups, exploration of understanding about m-portals achieved a consensus that they were defined as the customised, personalised user interface of wireless small screen mobile devices like smart phones that allow users to seamlessly access mobile content and mobile services. Hence MPUS was understood as the user’s overall affective attitude towards the mobile portal as a whole, which encompasses both the hardware and software aspects of the device. Initially the focus groups identified a total of 17 dimensions related to MPUS, which included the new dimensions: coverage; speed of response; multi-language support; security; backups; battery hours; multi-tasking; reliability of device; and synchronisation (the original services provision dimension was not identified as a dimension by the focus groups. One reason for this could be that it was seen as being related to suppliers rather than users). Of these coverage and speed of response were grouped with connectivity, whilst multi-language support was amalgamated into system adaptability. The remaining 14 dimensions (customer service support; content-device fit; perceived usefulness; connectivity; ease of use; personalisation; system adaptability; perceived value; security; backups; battery hours; multi-tasking; reliability of device; and synchronisation) were further refined. At the conclusion of the focus groups there was consensus that there were 10 dimensions for MPUS, namely: support; content-device fit; perceived usefulness; connectivity; ease of use; personalised interface; system adaptability; perceived value; security; and device specific.

Using these dimensions as the basis for development of the instrument by which to measure MPUS, Stage Two involved formulation and validation of the items (see below).

3 RESEARCH APPROACH

3.1 Formulation of the Instrument Items

Drawing on the outcomes from Stage One, the next stage involved developing items that are capable of tapping into aspects of the 10 dimensions for MPUS (see Section 2.4). Research suggests that the number of items initially generated should be many more than that needed for the final version of the instrument (DeVellis 2012), with their construction being framed to ensure focus, brevity, and clarity (Alreck & Settle 2004). Regarding focus, each item should be designed to gather a single piece of information; brevity is needed since long questions are more difficult for respondents to process and understand; and clarity ensures that the meaning of the item is obvious to respondents.

A deductive approach was used to guide composition of the items. This requires an understanding of the phenomenon under investigation, together with a thorough review of the literature. Where appropriate, preference was given to adapting items from existing IS instruments since employing items that have already been empirically tested can enhance reliability and validity of the resultant instrument. Where deficiencies were identified, new items were composed by drawing upon the relevant IS literature, with these reviewed by a language expert who was employed to edit all of the items to ensure understandability because the MPUS instrument will be completed by both non-technical and technical mobile phone users. In total there were 61 items: 41 were developed, whilst the remaining 20 items were drawn from existing instruments contained in the literature. The language expert re-worded 11 items.

Next, these items were reviewed by expert panels (DeVellis 2012; Gable & Wolf 1993) through two rounds of the modified Q-sort technique.

3.2 Modified Q-sort Technique used to Validate the MPUS Instrument Items

The modified Q-sort technique reveals patterns of subjective perspectives across individuals (Brouwer 1999; Smith 2001) after respondent rankings (Q-sample), which are obtained through respondents (P-set) rank-ordering a sample of statements (Q-set) that are then subjected to factor analysis. Key features that require consideration when using the modified Q-sort technique include: development of the Q-set, selection of the P-set, Q-sorting and evaluation. Table 2 outlines how these features were operationalised in this study.
<table>
<thead>
<tr>
<th>Key Feature</th>
<th>Operationalisation of These Modified Q-sort Features in This Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of the P-set</td>
<td>In total 61 items were generated, 41 being developed items.</td>
</tr>
<tr>
<td>Selection of the P-set</td>
<td>The P-set is not random. Respondents must have a clear and distinct viewpoint regarding the problem in order to be able to better define a dimension (Brown 1993). As the Q-sort technique requires only a limited number of respondents, the size of the P-set is not important; rather there must be enough respondents to establish the existence of a dimension for comparative purposes (Brouwer 1999).</td>
</tr>
<tr>
<td>Q-sorting</td>
<td><strong>Session 1</strong> – respondents performed two tasks: a grouping task in which similar items were clustered together, and a naming task. The grouping task began with each respondent reading a description of the task. Next, for the Q-set, a set of 61 cards (each containing one item) was spread face-up across a table in a random sequence. Each respondent then proceeded to group cards together so that groups contained items that seemed to describe the same underlying concept. This grouping task was repeated till all of the cards were clustered. Following the grouping task, each respondent reviewed each item within a resultant cluster and derived a label that best described that cluster. This naming task was repeated for all clusters.</td>
</tr>
<tr>
<td>Evaluation</td>
<td><strong>Session 2</strong> – respondents performed one grouping task in which similar items were clustered together. The grouping task involved 11 items that were found by the first Q-sort session to be multi-dimensional (i.e. they captured multiple concepts). The task began with each respondent reading a description of the task and the 6 different concepts. Next, for the Q-set, a set of 11 cards (each containing one item) was spread face-up across the table in a random sequence. Each respondent then proceeded to group cards together so that groups contained items that seemed to describe 1 of the 6 underlying concepts. This grouping task was repeated until all of the cards were in a cluster.</td>
</tr>
</tbody>
</table>

Evaluation comprised the following two steps:
1. Data collected from each of the respondents was entered into a spreadsheet, with each respondent’s groupings entered as a correlation matrix on a multi-dimensional spreadsheet, with one spreadsheet layer per respondent. An additional layer was created to compute the average correlation for each item, that is each cell entered symmetrically.
2. The ‘correlation’ spreadsheet was analysed to identify statements that were ambiguous, redundant, or multi-dimensional as well as missing concepts.

Table 2. Operationalisation of the Key Features of Modified Q-sort

After the first Q-sort session, 11 distinct clusters were identified and 2 items were removed. The 11 items identified as being multi-dimensional underwent a second Q-sort session where 1 item was removed, 1 was re-grouped to the device specific dimension, 1 to perceived usefulness, 2 to connectivity, and 6 remained unchanged. At the conclusion of the two Q-sort sessions, 58 items remained and were grouped into 11 dimensions: support; content-device fit; perceived usefulness; connectivity; ease of use; personalised interface; system adaptability; perceived value; perceived social value; security; and device specific. Due to focus group recognition of the evolutionary nature of support and its importance, 4 items on online support were added to the 58 remaining items, making a total of 62 items.

3.3 Exploratory Study

The main purpose of Stage Two was to identify the underlying dimensions of the MPUS instrument. In order to perform statistical procedures, a large amount of data is necessary. Thus use of a survey, a
Exploratory factor analysis (EFA) was performed on the 254 responses collected using Version 20 of the SPSS software. Prior to this, the 62 items were reviewed in terms of their statistical characteristics (frequencies; means; and standard deviations) and inter-correlations with other items to identify items that do not contribute to appreciation of the performance of the instrument as a whole. The outcome was retention of all 62 items. EFA involved four steps (see Table 4 below for an overview and operationalisation in this study).

### Key Feature | Operationalisation of These Survey Design Features in This Study
--- | ---
**Data Collection Technique** | An online survey was employed because it provides a cost-effective, convenient, accurate and faster response than traditional surveys, with higher participation (Couper 2000; Denscombe 2007; de Vaus 2002; Alreck & Settle 2004). Prior to administration, a preliminary version of the MPUS instrument was pilot tested with 10 mobile phone/device users, with feedback sought on understandability and time taken to complete the survey. Whilst feedback about understandability was positive, these users suggested completion time could be reduced from 25 minutes to 15 minutes.

**Unit of Analysis** | The unit of analysis was the individual or m-portal user.

**Sampling Method** | Non-probability convenience sampling was chosen as respondents were selected from the population based on their accessibility and/or availability (Neuman 2011). Consequently the study relied on willing m-portal users to respond to advertisements placed around universities and shopping centres; and postings on university/department websites and social network websites (e.g. Facebook).

**Sampling Size** | In total 254 responses were received, which fell within the minimum sample size recommended by Gorsuch (1983) of ratio of five to one.

**Survey Design** | The online survey was created using Qualtrics with the forced response option imposed to ensure completeness of submitted surveys. The survey comprised three sections:

  - Section 1 included three screening questions with **Binary options (yes/no)**. Respondents who satisfactorily passed the screening questions were able to continue with the survey, while those who did not were directed to the end of the survey.
  - Section 2 comprised the resultant 62 items from the modified Q-sort. Respondent attitudes to these items were measured using a seven-point Likert scale (1 strongly disagree – 7 strongly agree) to enable variability in responses to be acquired and the ceiling effect minimised (Zimet et al. 1988).
  - Section 3 probed for respondent’s personal information (i.e. age group, sex etc.). Most questions in this section were closed-ended questions with respondents given specific options.

### Table 3. Operationalisation of the Key Features of Survey Research

<table>
<thead>
<tr>
<th>Step</th>
<th>Operationalisation of the EFA Steps in This Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data assessment suitability</strong></td>
<td>Data is suitable if the following 3 criteria are met: (1) an inspection of the correlation matrix shows that the coefficients are greater than .3; (2) Bartlett’s test of sphericity (Bartlett 1954) is significant; and (3) Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy exceeds the recommended value of .6 (Kaiser 1970, 1974). All were met in this study.</td>
</tr>
</tbody>
</table>

**Choice of extraction technique** | Principal component analysis was chosen as the extraction technique as it is the most frequently used extraction method for EFA (Pallant 2011). |

**Selection of factors for rotation** | Three techniques were employed to help in deciding which items to retain: (1) Kaiser’s criterion or the eigenvalue rule suggests that items with an eigenvalue of 1.0 or more should be retained; (2) Catell’s (1966) scree test suggests that all factors above the “elbow” of the screeplot should be retained; (3) Horn’s (1965) Parallel Analysis suggests that eigenvalues that exceed the corresponding values from the random data set should be retained. |

**Choice of rotation strategy of factors** | Oblique rotation (Direct Oblimin) was selected as this method produces a pattern matrix which is commonly used when looking for a simple structure. |
4 RESULTS

The 62 items (see Appendix A) that comprised the MPUS instrument were analysed according to the predetermined conceptually related constructs (formally referred to as dimensions). Group 1 comprised perceived value (PV) and perceived social value (PSV); Group 2 comprised content-device fit (CF), perceived usefulness (PU), connectivity (CON), ease of use (EU), perceived security (SEC), system adaptability (SA), security (SEC) and device specific (DS); and Group 3 comprised support. Group 3 was analysed solely for reliability as it represented a discrete domain.

4.1 Group 1

Group 1’s 9 items (concerned with PV and PSV) were subjected to Principal Components Analysis (PCA) using the SPSS software. Prior to this the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The KMO value was .83, exceeding the recommended value of .6 (Kaiser 1970, 1974) and Bartlett’s Test of Sphericity (Bartlett 1954) reached significance, supporting the factorability of the correlation matrix.

PCA revealed the presence of two components with eigenvalues exceeding 1, the first explaining 50% of the variance and the second 26% of the variance. An inspection of the screeplot revealed a clear break after the second component suggesting the retention of two components. This was supported by the results of Parallel Analysis, which showed two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (9 variables x 254 respondents).

To aid interpretation of these two components, oblimin rotation was performed. The rotation solution revealed the presence of a simple structure (Thurstone 1947), with both components showing a number of strong loadings and all variables loading substantially on to one component. Component 1 comprised all items from the PV dimension, while Component 2 comprised all items from the PSV dimension. There was a weak positive correlation between the two factors (r=.312). The results of this analysis support use of the PV items and the PSV items as separate sub-dimensions.

4.2 Group 2

Like Group 1, Group 2’s 40 items (concerned with CF, PU, CON, EU, PI, SA, SEC and DS) were subjected to PCA using the SPSS software and the suitability of the data for factor analysis assessed. The KMO value was .92, exceeding the recommended value of .6 (Kaiser 1970, 1974) and Bartlett’s Test of Sphericity reached statistical significance, supporting the factorability of the correlation matrix.

PCA revealed the presence of eight components with eigenvalues exceeding 1, with these explaining 36.8%, 9.8%, 5.8%, 4.5%, 3.7%, 3%, 2.8% and 2.7% of the variance respectively. An inspection of the screeplot failed to provide any clear indication of the number of components that should be retained. The results of Parallel Analysis showed four components, with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (40 variables x 254 respondents).

To assist this analysis, a forced three-component solution and a forced four-component solution were carried out. Inspection of the pattern matrix of both solutions led to the forced four-component solution being chosen as there was less cross loadings between items. This solution explained 56.8% of the variance, with Component 1 contributing 36.8%, Component 2 9.8%, Component 3 5.8% and
Component 4 4.5%. Inspection of the pattern matrix revealed that items from the $DS$, $SEC$, $SA$ and $PU$ dimensions made up Component 1, although a number of items (SA3, SEC3, SEC4 and SA4) also showed cross loadings with Component 4. Component 2 comprised all items from the $CON$ dimension. Component 3 comprised all items from the $CF$ and $EU$ dimensions. Component 4 comprised items from the $PI$ dimension.

Based on these pattern loadings, the following actions were taken to refine the sub-dimensions. SA3 was retained in Component 1 due to its dominant loading on this component. Despite relatively low loadings (less than .5), SEC3 and SEC4 were considered to be conceptually important and thus were retained in Component 1. SA4 (My mobile can support sending and receiving content in multi-language) was removed from the instrument as it failed to show a clear loading on one component, instead having a cross loading on both Component 1 and Component 4. Item PU2 (I can obtain the information that I want quickly on my mobile portal) failed to load above .4 on any component and thus was removed from the instrument.

Following the removal of SA4 and PU2, PCA was conducted again. The final four-component solution explained a total of 57.3% of the variance. All items could be clearly allocated to a specific component with all loadings above .4. Whilst inspection of the component correlation matrix revealed a number of moderate relationships amongst the components, they were not so strong that they should be combined.

### 4.3 Assessment of Internal Consistency Reliability

According to Nunnally (1978), an instrument has good internal consistency if the Cronbach alpha coefficient reported is greater than .8. As shown in Table 5 below, this coefficient is greater than .8 for all of the dimensions in the MPUS instrument.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Cronbach's Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Value (PV)</td>
<td>.873</td>
</tr>
<tr>
<td>Perceived Social Value (PSV)</td>
<td>.954</td>
</tr>
<tr>
<td>Perceived Usefulness (PU - new name for Component 1 of Group 2)</td>
<td>.921</td>
</tr>
<tr>
<td>Connectivity (CON)</td>
<td>.889</td>
</tr>
<tr>
<td>Ease of Use (EU - new name for Component 3 of Group 2)</td>
<td>.905</td>
</tr>
<tr>
<td>Personalised Interface (PI)</td>
<td>.912</td>
</tr>
<tr>
<td>Telephone/Instore Support (TIS)*</td>
<td>.946</td>
</tr>
<tr>
<td>Online/Discussion Support (ODS)*</td>
<td>.897</td>
</tr>
</tbody>
</table>

* Sub-dimension of Support

Table 5. Cronbach Alpha Scores of the Dimensions Contained in MPUS

## 5 DISCUSSION

The outcome of the modified Q-sort sessions was identification of 11 dimensions that were thought to define MPUS, with 62 items grouped under these 11 dimensions. Next, using a survey, 254 usable responses were received, with results from the PCA performed on this data confirming a stable and reliable model with seven dimensions: $PV$; $PSV$; $PU$; $CON$; $EU$; $PI$ and $Support$. Two items were omitted in the process bringing the number of survey items to 60. The resultant instrument (see Appendix A) contributes to the user satisfaction literature by introducing a new reliable and stable instrument by which to measure user satisfaction with m-portals. Specifically, the significance of the exploratory study reported in this paper has been the provision of a better understanding of the appropriate dimensions that tap into user satisfaction with m-portals. The findings also support prior user satisfaction studies through identified commonality with three previously established dimensions, namely $PU$, $EU$, and $Support$.

Results from the exploratory study indicate that in the context of this study there is more importance
attributed to $EU$ than in notions of the term. In particular it covers the $CF$ dimension, which refers to the ability of the m-portal to present content that is aesthetic, accurate, concise, relevant and reliable. Given m-portals are associated with small screen mobile devices, how the m-portal displays its content will affect the user’s perceived ease of use of the m-portal. Likewise, the notion of $PU$ is different in this study compared with other IS studies. In prior IS studies $PU$ is commonly associated with how the IT artifact facilitates a desired outcome. In this study $PU$ encompasses the ability of the m-portal to assist users in performing their activities in a timely manner, which relies on both hardware and software aspects of the device. Thus, aspects of the device that affect the m-portal ($DS$) also influence user’s perceived usefulness of it. Similarly, the ability to perform transactions securely from the m-portal ($SEC$), and the degree to which m-portal providers adapt content and the way it is presented to different device capabilities ($SA$) all affect perceived usefulness. In other words, the communication technology today has advanced to a level that IS usability requires information delivery that is real time, secured and effective for multi-platform.

6 CONCLUSION

The objective of this study was to develop and test a multiple-item instrument for measuring user satisfaction with m-portals. Consequently this paper has reported on the results obtained from Stage Two, wherein the resultant instrument comprises 60 items that have been grouped into seven dimensions: $PV$; $PSV$; $PU$; $CON$; $EU$; $PI$ and Support (comprising TIS and ODS).

As is common in studies that use survey data collection, this study exhibits limitations such as questions about the representativeness of the research sample and non-response bias. Despite these limitations, the practical contribution arising from this study concerns identification of the dimensions that affect users’ experience with m-portals. This finding serves as valuable input that can be used to enhance users’ experience with their m-portal. A practical implication of this is that in order to facilitate MPUS, data and service providers must ensure uninterrupted connectivity to m-portals both indoors and outdoors together with security. From a managerial perspective, this study delivers a simple to administer instrument that allows success, in terms of user’s satisfaction with the company’s current m-portal, to be ascertained and creates opportunities to identify areas for improvement. Furthermore researchers can apply the instrument to different groups of users to compare satisfaction levels.

In its current form the measurement instrument requires further refinement through testing on wider groups of m-portal users and statistically analysing the results from this. Thus, the next phase of this study will be a confirmatory study. Herein through extending the existing structure of the MPUS instrument, it will be fascinating to explore if there are gender differences in user’ satisfaction with m-portals and through a nomological network of the user satisfaction construct, to examine continuance intention and positive word of mouth.

APPENDIX A

The final 60 items that comprise the MPUS instrument are as follows:

- **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** My mobile portal can be easily upgraded to a new version.
- **PU5** The features of my mobile portal remain stable even when upgraded.
- **PU6** My mobile portal systematically checks for application updates.
- **PU7** I feel confident in using my mobile portal to perform transactions.
- **PU8** I feel confident that my mobile portal is secure and robust in performing the transactions I require.
- **PU9** I am able to set an access password to protect my mobile portal from other people accessing it.
- **PU10** I am able to turn on the auto lock function to protect confidential information in my mobile...
portal.
PU11 The length of battery hours available to operate the device is adequate.
PU12 The device is durable for an average of 1-2 years.
PU13 I can easily synchronise applications in my mobile portal with other web-based applications.
PU14 My mobile portal can easily adapt and present content to fit on my device.
PU15 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.

ES1 I can use my mobile portal without the need for training.
ES2 My mobile portal is user-friendly and easy to use.
ES3 My mobile portal is easy to navigate around when I use the features and applications.
ES4 When navigating within my mobile portal, I feel that I am in control of what I am doing.
ES5 The content presented by my mobile portal is visually appealing.
ES6 The content presented by my mobile portal is always accurate.
ES7 The mobile portal presents information concisely.
ES8 The content presented by my mobile portal is relevant to my enquiry.
ES9 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.
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.
TIS1 When I have a mobile portal problem/enquiry, I do not have to wait long to talk with support staff.
TIS2 The support staff greet me in an appropriate manner.
TIS3 The support staff treat me courteously during my discussion.
TIS4 The support staff are empathetic to my problem/enquiry.
TIS5 The support staff understand my problem/enquiry.
TIS6 The support staff usually have the technical skill to address my problem/enquiry.
TIS7 The support staff are prompt in solving my problem/enquiry or if problem/enquiry is too complex, they are able to refer me to the appropriate area.
TIS8 The support staff conclude the conversation in an appropriate manner.
TIS9 The support staff are prompt in providing follow up to the problem/enquiry that they cannot resolve at the time.
ODS1 I can find solutions to most of my problems/enquiries using the online support/discussion forums.
The problems/enquiries I have posted, have been responded to promptly.
The problems/enquiries I have posted, have been readily understood.
The problems/enquiries I have posted, have been promptly solved.

References


