A Model of User Adoption of Mobile Portals

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Abstract: The purpose of the study is to present a conceptual model of user adoption of mobile portals. This model identifies factors which may potentially influence an individual's decision whether to start or continue utilizing wireless portals. The major distinction of the proposed model from those of prior MIS technology adoption projects is that it includes not only widely employed MIS constructs but also the perceived value construct of a mobile portal. This construct is adapted from the marketing literature. It reflects the perceived level of a wireless service quality relative to the airtime cost. The rationale for the introduction of perceived value in terms of an individual's direct financial expenses lies in the unique nature of mobile communication devices usage. The proposed model also identifies two individual-specific antecedents and five portal-specific antecedents of those key constructs because they may potentially explicate the variance of users' perceptions of portal experiences. In addition, the paper presents a survey of real-life users of mobile portals, designs a questionnaire, and selects appropriate data analysis techniques.

Keywords: mobile portal, technology adoption, TAM, perceived value

Introduction

In today's increasingly global, digital, networked, and flexible economy, technological innovations represent a substantial investment for both organizations, which embark on implementations of technical discoveries, and individuals, who take chances on utilizing unfamiliar systems and applications. From an organization's point of view, new projects are often associated with high uncertainty and financial risks. From an individual's perspective, the usage of novel technologies requires that people spend a considerable amount of time learning new interface designs and previously unknown features which they may never utilize, changing their human-computer interaction behavior, and, finally, either accepting or rejecting the system.

Traditionally, the issue of individual-level technology adoption and use has been quite attractive to the Management Information Systems (MIS) research community. Since the seventies, MIS scholars have concentrated their efforts on discovering the factors that might facilitate the integration of computer systems into business (Legris, Ingham and Collerette 2003). From the mid-eighties, many researchers sought to conceptualize, empirically validate, and extend various end-user adoption frameworks (Plouffe, Hulland and Vandenbosch 2001). The most widely accepted examples of these models are: the Technology Acceptance Model (TAM) (Davis 1989) and its recent extension referred to as TAM2 (Venkatesh and Davis 2000); End-User Computing Satisfaction (EUCS) (Doll and Torkzadeh 1988); Perceived Characteristics of Innovating (PCI) (Moore and Benbasat 1991); the Prior Experience Model (Taylor and Todd 1995a); the Personal Computing Model (Thompson, Higgins and Howell 1991); and the Task-Technology Fit Model (Goodhue 1995; Goodhue and Thompson 1995). During the

1990s, there has been a growing interest in the influence of users' individual differences on their technology acceptance decisions (Agarwal and Karahanna 2000; Agarwal and Prasad 1998; Agarwal and Prasad 1999; Thatcher and Perrewe 2002; Webster and Martocchio 1992). As such, factors underlying reasons why individuals accept of reject particular technological innovations have been studies in virtually all areas. Especially, it is crucial to investigate user acceptance decisions at early stages of technology development because this research provides guidelines for both scholars and practitioners and leads to the creation of really useful and acceptable innovative products and services.

For the past five years, many countries have witnessed the rapid diffusion of mobile telephones and services since the technological advances of the twentieth century have laid the foundation for this new type of computer-mediated communication (Dholakia and Dholakia 2003). As indicated by the growing body of research, mobile commerce has been thoroughly studied by many academics throughout the globe (Buellingen and Woerter 2002; Kumar and Zahn 2003; Mennecke and Strader 2003). There are several journals, conferences, and book editions devoted to this topic. Among these different research initiatives, many studies attempted to investigate the issue of user adoption of mobile commerce and services. For example, Anil et al. (2003) determined general concerns of individuals towards mCommerce, found factors of mCommerce success, and identified mostly required mobile services. Hung, Ku and Chang (2003) conducted an empirical study of the critical factors of WAP adoption. Kleijnen, de Ruyter and Wetzels (2003) focused on the adoption process of mobile gaming services. Astroth (2003) analyzed factors for user acceptance of location-based services. Pedersen and

Nysveen (2003) attempted to explain user acceptance decisions towards a mobile parking service.

As demonstrated by this previous research, many investigations explored user adoption decisions with respect to most categories of mobile devices and various types of services. However, prior investigations did not address the issue of user acceptance of mobile portals (mPortals). Since mPortals are only appearing in the wireless Internet, it is very important to offer insights on user acceptance of this technology. The study attempts to bridge that void by suggesting a conceptual model of user adoption of mobile portals and offering methodology which may be utilized to subject this model to a comprehensive reliability and validity testing.

The rest of this paper is structured as follows. Chapter 2 (next chapter) introduces mobile portals and offers reasons why they should be studied. Chapter 3 covers five distinct characteristics of mPortals. Chapter 4 introduces the conceptual model of user adoption of mPortals and justifies the selection of its components. Chapter 5 develops a methodologically sound survey which may be employed to test the viability and fruitfulness of this model. Chapter 6 facilitates a discussion based on a study's findings and describes several avenues for future research.

What are Mobile Portals?

According to the American Heritage Dictionary (1992), a portal (the word portal is derived from the Latin word 'porta') is a doorway, entrance, or gate which someone will pass in order to get to another place. Currently, the word 'portal' is mostly used in terms of the Internet. It is a webpage, or a collection of webpages, which serve as a

starting point for a Web user exploring cyberspace. A portal helps people navigate their way to a particular website or other sources of interest. A portal is not the point of destination; rather it is the point of entry in search for information. In many cases, a portal is necessary to utilize in order to get to the desired location. In recent years, there has been strong interest in studying various types of portals that emerged on the Web. For instance, previous researchers analyzed the use and adoption of enterprise portals (Eckerson 1999) and library portals (Detlor et al. 2003). By the year 2006, over twenty-five million wireless portal users are expected that represents a significant proportion of all mobile commerce users (Carroll 2000). It is the worldwide use and high growth rate that emphasizes the importance of the role that portals play in everyday lives of most Internet users.

Mobile portals, sometimes referred to as 'portable portals' or 'personal mobility portals', are webpages especially designed to assist wireless users in their interactions with Web-based materials (Clarke III and Flaherty 2003). MPortals are often designed by tailoring Internet content to the format of mobile networks or developed from scratch for wireless networks only. Sometimes, mPortals are created by aggregating several applications together, for example, email, calendars, instant messaging, and content from different information providers in order to combine as much functionality as possible. MPortals are relatively easy to create for the presentation of very specific or well-structured information such as stock quotes, headlines, and weather (Carroll 2000). However, the incorporation of mPortals containing complex, unrelated, and text-rich information is very tricky. Users of mPortals are often challenged by hard to find and scattered pieces of information that are difficult to locate given a small size of mobile

devices such as a PDA or a cell phone. The first generation mPortals offered services such as news, sports, email, entertainment, travel information, and direction assistance. The contemporary portals also provide extended leisure services, such as games, TV and movie listings, nightlife information, community services, music, health, dating, and even auctions. A few high-end mPortals offer mobile information management services such as calendars, timetables, and contact information. Several mobile portals provide mobile shopping facilities (GSA 2002). Mobile portal technologies are mostly driven by capabilities of mobile devices such as PDAs and cell phones. On the one hand, mPortals offer tremendous opportunities; on the other hand, they had many limitations.

In order to ease a tedious task of information location, many mPortal providers embed search engines in their mobile websites. This approach allows individuals to focus on a pull rather than a push information retrieval technology (Gohring 1999). For example, customers may not only navigate through a wireless portal, but also query location-based Yellow Pages and local events databases to find directions, traffic information, or a specific business in a certain area. Such services employ search-engines designed to query geographical databases to deliver location-relevant content. This increases customer satisfaction with the service and strengthens a connection between wireless operators and mobile consumers. For instance, Handspring, Inc. implemented a mobile portal which has a Google search engine interface. The presentation of results returned by this search engine is tailored to the small size of mobile device interfaces.

The segment of mobile portals attracts large numbers of business players from outside telecommunications industry, for example, news broadcasters, financial companies, and entertainment providers because they believe that portals are an

important part of the mobile services value chain (Buellingen and Woerter 2002). MPortals are relatively easy to build. Currently, given the availability of design tools and development environments for wireless content, the creation of mobile portals requires little learning and efforts (Chartier 2003). For example, Microsoft presents ASP.NET mobile controls which extend the previous Microsoft Mobile Internet Toolkit. This toolkit presents a comprehensive and easy to use development environment for mobile content including mPortals.

However, despite the relative ease of use of the creation of mPortals and their rapid proliferation on the mobile market, mPortals are different from regular Internet websites. As such, they have several unique characteristics that may potentially influence the whole design process as well as the rate of user adoption of this technology. The following section discusses mPortal characteristics in more detail.

Unique Characteristics of Mobile Portals

The mobility-afforded devices such as PDAs and cell-phones allow mPortal users to realize additional values that regular Internet users are not able to achieve. Mobile portals deliver information anytime, anyplace, and on any types of devices. According to a recent paper by Clarke and Flaherty (2003) and a survey of mobile portals by the Global Mobile Suppliers Association (GSA 2002), mPortals differ from traditional eCommerce or eBusiness portals in five dimensions: ubiquity, convenience, localization, personalization, and device optimization. Figure 1 presents a framework of unique characteristics of mPortals.

Insert Figure 1 about here.

Ubiquity is the ability of mobile devices to receive information and perform transactions at any location in real-time. As such, users of mPortals may have a presence anywhere, or in several places simultaneously, with the degree of Internet access comparable to fixed line technologies. Although the bandwidth of wireless communications channels is lower than that of regular Internet connections, mobile portals are not expected to suffer significantly because of that since most transmitted information is text-based and it contains little graphics. Communication is totally independent of a user's location which is very important for obtaining timely information. Thus, mPortals may leverage the benefit of ubiquity by introducing new services that traditional portals may not offer. For example, they may offer stock alerts, email notifications, and auction updates which are specified by an individual during the personalization process. Although similar services have been offered by regular portals, the use of mobile devices offers new advantages to users, especially those who travel frequently.

Convenience is the agility and accessibility provided by wireless devices that further differentiates mobile portals. Users of mobile devices are no longer limited by time or place while accessing wireless services. The key benefit of mPortal convenience is the ability to utilize this technology when other business or leisure activities are restricted. For example, many people use their mobile devices when they commute, got stuck in traffic, and wait in lines. In these situations, mPortals act as time savers by allowing performing tasks that a person would do anyway but on the account of other important activities. This translates into at improved quality of life and leaves more time

for work and leisure. In addition, such services increase customer satisfaction and build loyalty which is a key factor for the future success of mobile commerce.

Localization is the presentation of location-specific information which is timely, accurate, and important. The workings of mobile devices include obtaining the geographical location of a user that creates an additional advantage of mPortals over traditional portals. Currently, most wireless PDAs and cell phones supply service providers with an accurate location of a user in most countries by utilizing cellular triangulation and global positioning technologies. As such, service providers can precisely identify the location of a mobile user and send back only location-specific information based on user needs and requests. MPortals may serve as a point of consolidation of customer information and dissimilate location-relevant information about local services, businesses, and opportunities. For example, a tourist from the US visiting a new city may send a request to a service provider for a list of restaurants located in his or her geographical area, for example, downtown Toronto. By knowing the location of this individual, the service provider will automatically generate a mobile portal of restaurants located in a particular area of Toronto.

Personalization is the presentation of person-specific information based on an individual's profile, needs, and preferences. Personalization a key feature of most eCommerce and mCommerce business models because it offers real values for a customer and creates a perception of high-quality service. Personalization of mobile portals is relatively easy to achieve since most mobile devices are carried by a single user. This device may contain a user's profile which lists his or her preferences, needs, and habits. In addition, service providers may analyze the patterns of device usage by

employing datamining techniques in order to obtain more information about an individual to provide personalized service. For instance, a person may explicitly indicate in the preference module of a cell phone that he or she is interested in obtaining information on sports. In addition, a service provider may notice that this individual often looks for the latest news on baseball. Thus, when creating a personalized news portal for this person, a service provider may devote a substantial part of this portal to baseball news which may be highly appreciated by the user.

Device optimization is an automatic generation of an mPortal content based on device configuration, such as screen size, memory, and CPU, characteristics of a communications channel, such as bandwidth, and supported languages and protocols. Since service providers know in detail about a device, bandwidth, and supported languages, they may optimize the content of their portals to each user individually in order to achieve fast transmission speed, simple navigation, intuitive-to-use graphical user interface, and consistent page layout. Thus, device optimization is expected to facilitate the usage of mPortals, to increase user satisfaction with mobile portals, and to build customer loyalty in the long run.

All these five characteristics play an important role in users adoption decisions of mobile portals and, therefore, may be utilized in the creation of a study's conceptual model. In addition, previous human-computer interaction, innovation, marketing, and management information systems literature offers several other factors that may offer insights on the topic under investigation. The following section attempts to consolidate all those findings under a unified umbrella of a model of mPortal adoption by individual users.

Conceptual Model

The investigation introduces a conceptual model for measuring and predicting user adoption of mobile portals built upon the convergence of the Technology Acceptance Model (TAM) (Davis 1989; Davis, Bagozzi and Warshaw 1989), innovation theories (Agarwal and Prasad 1998), trust research (Gefen, Karahanna and Straub 2003), prior experience investigations (Taylor and Todd 1995a; Wiedenbeck and Davis 1997), self-efficacy studies (Agarwal, Sambamurthy and Stair 2000; Compeau and Higgins 1995; Thatcher and Perrewe 2002), and mobile portal research (Clarke III and Flaherty 2003; GSA 2002) and that aim to explain user adoption decisions. This study conducts a comprehensive literature review of those areas and reconciles different points of views from various disciplines such as management information systems, human-computer interaction, psychology, and social sciences. Figure 2 presents the model. The following subsections of the paper describe components of this model and the way they interact with each other in more detail.

Insert Figure 2 about here.

Technology Acceptance Model

The **Technology Acceptance Model** (Davis 1989; Davis, Bagozzi and Warshaw 1989) is one of the most frequently utilized end-user technology adoption frameworks in the MIS literature. It identifies and measures key factors that influence individuals' decisions whether to accept or reject particular information or computer technologies. According to TAM, a person's actual system usage is mostly influenced by his or her behavioral intentions toward usage. Behavioral usage intentions, in turn, are influenced

by two key beliefs: 1) perceived usefulness of the system, and 2) perceived ease of use of the system. TAM defines **perceived ease of use** as "the degree to which a person believes that using a particular system would be free of physical and mental effort" and **perceived usefulness** of the system as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). Perceived ease of use also affects perceived usefulness of the system; all ease being equal, individuals find the system more useful if it is easier to use.

With respect to the purpose of this study, the major advantage and distinction of TAM is two-fold. First, as demonstrated by a substantial body of prior research, TAM may be successfully applied to investigations concerning user adoption behavior in virtually any computer-related field. Secondly, it provides the basis for building technology acceptance frameworks in very narrow areas. TAM can be extended by incorporating novel domain-specific constructs and antecedents to accommodate a variety of factors that affect people's acceptance decisions with respect to newer technologies such as mobile portals.

The viability of TAM has been successfully tested in various technology acceptance studies in different areas (Adams, Nelson and Todd 1992; Bhattacherjee 2001; Hendrickson, Massey and Cronan 1993; Subramanian 1994; Szajna 1994; Szajna 1996; Taylor and Todd 1995a; Taylor and Todd 1995b) including the Internet, World Wide Web (Moon and Kim 2001), and electronic commerce (Devaraj, Fan and Kohli 2002; Gefen and Straub 2000; Koufaris 2002). As such, it is suggested that TAM's constructs: 1) perceived usefulness of a mobile portal, 2) perceived ease of use of a mobile portal, and 3) behavioral usage intentions should be included in a general

conceptual model of user adoption of mPortals. The following hypotheses present the relationships among those constructs:

H1: Perceived usefulness of a mobile portal will have a positive direct effect on behavioral usage intentions towards this mobile portal.

H2: Perceived ease of use of a mobile portal will have a positive direct effect on behavioral usage intentions towards this mobile portal.

H3: Perceived ease of use of a mobile portal will have a positive direct effect on perceived usefulness of this mobile portal.

Despite the success and extensive adoption of the original TAM, MIS researchers have continued investigating the factors that influence the key constructs of this model. A better comprehension of the antecedents and determinants would allow both researchers and practitioners to understand the underlying reasons driving user acceptance of particular information technologies. The latest meta-analysis of the key projects that supports the viability of TAM conducted by Legris, Ingham, and Collerette (2003) suggests that significant factors are not included in TAM. Therefore, this study continues investigating important TAM's antecedents as well as other constructs that may potentially influence an individual's adoption decisions regarding mobile portals.

Trust

Trust is someone's assurance that he or she may predict actions of the third party, may rely upon those actions, and that those actions will follow a predictable pattern in the future, especially under risky circumstances and when no explicit guaranty is provided (Jones 2002). As supported by a substantial body of prior research, trust is the key to

success for both eCommerce and mCommerce (Dahlberg, Mallat and Öörni 2003; Grandison and Sloman 2000; Hertzum et al. 2002; Papadopoulou et al. 2001). Trust is a major enabler of wireless transactions because of a natural human need to understand the social surroundings of the virtual environment. It is very important for a mobile portal user to believe in the integrity, credibility, security, authenticity, reliability, and honesty of a service provider.

Based on the prior trust and technology acceptance research, Gefen, Karahanna and Straub (2003) introduced trust as another construct of the Davis' TAM. An empirical investigation that included 213 subjects confirmed the positive relationship between trust and intended usage of eCommerce websites. That study also discovered that perceived ease of use of the site positively influences the degree of trust to this site. First, high ease of use of a website allows people quickly and effortlessly to locate necessary information. Second, high ease of use is associated with good site's usability which manifests a provider's intentions to invest into the customer-eVendor relationship. By following a similar line of reasoning, Dahlberg, Mallat and Öörni (2003) proposed the applications of this trust-enhanced technology acceptance model to investigate user acceptance of mobile payment solutions.

With regards to this study, trust is introduced as an additional construct of the suggested model. It is hypothesized that the trust-TAM causal relationships may potentially explain a greater proportion of the variance in user behavioral intentions towards mobile portals. The following hypotheses outline this trust-TAM relationship:

H4: Perceived ease of use of a mobile portal will have a positive direct effect on perceived trust towards this mobile portal.

H5: Perceived trust towards a mobile portal will have a positive direct effect on perceived usefulness of this mobile portal.

H6: Perceived trust towards a mobile portal will have a positive direct effect on behavioral usage intentions towards this mobile portal.

Perceived Self-Expressiveness

In a proposed conceptual model, perceived self-expressiveness is included as an additional independent construct. **Self-expressiveness** is a "persistent pattern or style in exhibiting nonverbal and verbal expressions that often but not always appear to be emotion related; this pattern or style is usually measured in terms of frequency of occurrence" (Halberstadt et al. 1995, p. 93). For the past year, the concept of self-expressiveness has been thoroughly investigated in human-computer interaction and computer-mediated-communications research. For example, Bozionelos (2001) discovered a strong positive relationship between a degree of self-expressiveness and the extent of someone's interest in computers. The study empirically proved that people who are highly expressive benefit from the positive attributes associated with computer usage more that those who are less expressive. Bozionelos (2002) concluded that self-expressiveness is an independent research construct.

Several studies included the self-expressiveness construct into mobile commerce investigations. For example, Pedersen and Nysveen (2003) found that perceived self-expressiveness has a strong positive effect on someone's usage intentions regarding a mobile parking service. Pedersen and Nysveen (2002) concluded that self-expressiveness also affects teenagers' behavioral usage intentions towards text messaging services.

Based on those findings, this study proposes that the degree of self-expressiveness potentially influences the level of an individual's usage intentions with regards to a mobile portal:

H7: The degree of self-expressiveness of a person will have a positive direct effect on behavioral usage intentions towards this mobile portal.

Perceived Value

As of today, many technology adoption investigations do not consider an individual's perceptions of value of an information technology system or service. There are at least two reasons that explain this methodological imperfection. First, some studies utilize a convenience rather than a probabilistic sampling method. For example, they involve college and university students in experiments and surveys. On the one hand, those students represent a broad population of potential technology adopters. On the other hand, their perceptions do not necessarily reflect potential risks and costs that may be anticipated. Second, in most cases, researchers provide respondents with the technology of interest at no financial cost to the subjects. In many investigations, individuals have already acquired an information system, and researchers measure adoption of innovation after the decision to adopt the technology has already been made which makes project's findings an *ex post* descriptor rather than a predictor of behavior (Agarwal and Prasad 1998). For instance, Anandarajan, Simmers and Igbaria, (2000) explored factors influencing Internet usage and perceptions in workplace by surveying part-time MBA students. Atkinson and Kydd (1997) empirically investigated individual characteristics of WWW users by surveying students who were already familiar with the Internet. Venkatesh et al. (2003) analyzed IT adoption decisions of employees who were presented

a new technology in the working environment rather then purchased it. There is no doubt that these projects accurately depicted the factors influencing system adoption and usage. However, those approaches cannot be directly adapted to predict the usage of mobile portals because of a different user-system interaction concept.

The rationale behind this argument lies in the distinct nature of the usage of mobile communications devices. When a person accesses a traditional Internet portal, for example, Yahoo!, he or she uses those services at no cost. In sharp contrast, when someone utilizes a mobile portal to obtain important, time-sensitive, or location-specific information, he or she pays for airtime even if all portal services are free. This cost of obtaining information substantially differentiates the use of mobile portals from regular portals. Thus, in addition to traditional MIS technology acceptance constructs, other factors that consider expenses associated with airtime usage should be accounted for.

The concept of perceive value has been recognized as an important construct of most customer satisfaction models. According to the marketing literature, **perceived value** is a perceived level of product or service quality relative to the price paid (Fornell et al. 1996). On the macro-level, the incorporation of perceived value adds price information into a proposed model and increases the comparability of customer satisfaction survey results across firms, industries, and sectors. Because of its importance, this construct is often discussed and utilized in various quality management studies (Kanji and Wallace 2000; Zeithaml 1988). For example, Gorst, Wallace, and Kanji (1999) utilized perceived value in their empirical investigation of the degree of delegates' satisfaction at the Sheffield World Congress. Netemeyer et al. (2003) defined *perceived value for the cost* as a customer's overall assessment of the utility of a product based on

perceptions of what's received (e.g., quality) and what is given (e.g., price and non-monetary costs) relative to other products. In other words, perceived value involves the trade-off of 'what I get' for 'what I give'.

Many information technology acceptance studies analyzed an individual's perceptions of a system's value under the labels of cost-benefit, cost-effectiveness, cost-minimization, and cost-utility analyses. Risk assessments are often included in the calculations of users' values (Greer, Bustard and Sunazuka 1999; Greer and Ruhe 2003). For example, Vlahos, Ferratt and Knoepfle (2003) measured the managers' perceptions of value of computer-based information systems by analyzing their decision roles, steps, tasks, and metal models in making decisions. Jiao and Tseng (2003) suggested that the customer-perceived value of customization of an IT product is the sum of all product's utilities for every customizable feature. Krishnan and Ramaswamy (1998), in their study of marketing information systems, measured customer satisfaction with perceived competitive business value delivered by a system as a composite measure of satisfaction with increased market share and grows of revenues. These studies, however, do not accurately reflect a price-based marketing approach to the perceived value construct.

The perceived value construct is independent of other factors that measure an individual's level of perception of a product or a service quality. For example, it does not correlate with the functional (i.e., performance), emotional, and social dimensions of a customer's perceptions (Sweeney and Soutar 2001). High perceived value does not lead to user satisfaction that differentiates this approach from the End User Computing Satisfaction Model (Doll and Torkzadeh 1988; Doll, Xia and Torkzadeh 1994). As such,

perceived value is not included in the contemporary information technology acceptance models.

With respect to the purpose of this study, it is hypothesized that the introduction of the perceived value construct may account for a significant proportion of variance in user adoption decisions towards wireless portals. Thus, perceived value of using a portal should be included in the model because it accounts for the perceived quality of received information given expenses associated with obtaining this information through a mobile portal:

H8: Perceived value of a mobile portal will have a positive direct effect on behavioral usage intentions towards this mobile portal.

MPortal-Specific Antecedents

The significant literature base in human-computer interaction and information systems research suggests that the characteristics of an innovation as well as people's individual cognitive differences significantly influence a person's decision whether to start or continue utilizing a particular software technology (Agarwal and Prasad 1997; Agarwal and Prasad 1999; Davis 1989; Mason and Mitroff 1973; Taylor and Todd 1995b; Venkatesh and Davis 2000; Webster and Martocchio 1992). The research presented in this study intends to serve as a conceptual model for measuring and predicting users' adoption of mobile portals. This model views an individual as a unit of adoption and it explains his or her personal adoption decisions. As such, two independent categories of a model's antecedents are suggested: 1) mobile portal-specific antecedents,

and 2) individual-specific antecedents. This subsection discusses the former type of antecedents and the next subsection covers the latter category.

Recall this study brings together five characteristics of mobile portals discussed in literature: ubiquity, convenience, localization, personalization (Clarke III and Flaherty 2003), and device optimization (GSA 2002). The purpose of ubiquity, convenience, localization, and personalization of a mobile portal is to deliver services that regular mPortals cannot implement which increases the perceived value and usefulness of a portal:

H9: The degree of ubiquity of a mobile portal will have a positive direct effect on the perceived usefulness of this mobile portal;

H10: The degree of convenience of a mobile portal will have a positive direct effect on the perceived usefulness of this mobile portal;

H11: The degree of localization of a mobile portal will have a positive direct effect on the perceived usefulness of this mobile portal; and,

H12: The degree of personalization of a mobile portal will have a positive direct effect on the perceived usefulness of this mobile portal.

The goal of device optimization is to present the content of a mobile portal in a convenient and efficient way depending on the type of a device. The presentation of device optimized information of a mobile portal reduces transmission time, eases navigation, and facilitates fast usage of a device. Therefore, it is proposed that the degree of device optimization of the content of a mobile portal positively affects the extent of perceived ease of use:

H13: The degree of device optimization of a mobile portal will have a positive direct effect on the perceived ease of use of this mobile portal.

Individual-Specific Antecedents

Two individual-specific antecedents of the model are suggested: personal innovativeness in the domain of information technology (PIIT) (Agarwal and Prasad 1998) and self-efficacy (Agarwal et al. 2000; Compeau and Higgins 1995; Thatcher and Perrewe 2002).

Personal innovativeness in information technology (PIIT) is the first individual-specific antecedent. PIIT is the domain-specific individual trait which reflects the willingness of a person to try out a new information technology (Agarwal and Prasad 1998). Prior research demonstrates that individual characteristics play an important role in people's decisions to accept or reject innovations (Roehrich 2002; Rogers 1962; Rogers 1995; Tornatzky, Fleischer and Chakrabarti 1990). Some users may be highly predisposed towards adopting innovations whereas others may prefer to continue exploring familiar avenues.

The theory conceptualizes PIIT as "a trait, i.e., a relatively stable descriptor of individuals that is invariant across situational considerations" (Agarwal and Prasad 1998, p. 206). Agarwal and Prasad's study hypothesizes and empirically proves that PIIT serves as a key moderator for both antecedents and consequences of usage perceptions. Despite its newness, the concept of personal innovativeness in IT has already received considerable attention, recognition, and support in academia. For example, Karahanna et al. (2002) concluded that personal innovativeness is one of the factors that influences a

person's perceived relative advantage of using Group Support Systems. Limayem, Khalifa, and Frini (2000) provided strong support for the positive effect of personal innovativeness on someone's attitudes and intentions to shop online. Agarwal and Karahanna (2000) hypothesized, tested, and empirically confirmed that the degree of personal innovativeness in information technology, mediated by the level of cognitive absorption of an individual, has a substantial positive effect on both perceived usefulness and perceived ease of use of the system.

More importantly, PIIT has already been incorporated into several models that explicate factors affecting user adoption decisions regarding wireless devices and services. For example, Lee, Kim and Chung (2002) hypothesized and empirically supported that PIIT has positive direct impact on the degree of perceived usefulness of mobile Internet. Hung, Ku and Chang (Hung et al. 2003) confirmed that PIIT directly affects an individual's attitude towards the usage of wireless application protocol services. Based on those findings, it is hypothesized that:

H14: The degree of an individual's personal innovativeness in the domain of information technology will have a positive direct effect on the perceived ease of use of a mobile portal.

Prior experience has been found an important determinant of behavior in various situations (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975). Psychology and social sciences research suggests that knowledge obtained from past behavior shapes people's actions because previous experience makes knowledge more accessible in memory which implies that information technology usage may be more effectively modeled for experienced users (Taylor and Todd 1995a). There are significant differences in system

adoption behavior between experienced and inexperienced computer users. Human-computer interaction research demonstrates that people identify effective patterns of interacting with software applications, remember them, and apply those patterns across a variety of situations (Dix et al. 1989). Other investigations argue that prior experience with a direct manipulation interface of a system positively affects the perceptions of ease of use, and that users' attitudes towards software are strongly influenced by their past history of usage (Wiedenbeck and Davis 1997). Since a mobile portal represents a direct manipulation interface (Shneiderman 1997), it is hypothesized that the degree of previous experience with mobile devices positively affects usage adoption decisions towards mPortals. However, direct experience with a device of a mobile portal is excluded from this study. The rationale behind this argument lies in the assumption that prior experience is closely related to self-efficacy which has been often investigated in various technology adoption projects.

Perceived self-efficacy is the second component of individual antecedents. **Self-efficacy** refers to "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura 1997, p. 3). In other words, it is a person's conviction that he or she can successfully execute the desired behavior to achieve a desirable result. Computer self-efficacy refers to individuals' judgments of their capabilities to use computers in diverse situations (Thatcher and Perrewe 2002). Previous research suggests that an individual's perception of a particular system use is anchored to his or her level of computer self-efficacy (Venkatesh and Davis 1996). Individuals with a high level of computer self-efficacy form more positive perceptions of an information system than those with a low level of computer self-efficacy. Self-efficacy judgments in a

narrow domain of computing play an important role in determining the usage of specific software tools. For example, Agarwal, Sambamurthy and Stair (2000) concluded that people with high perceptions of self-efficacy of Lotus 1-2-3 perceive this application easy to use. Recently, the concept of self-efficacy has been utilized in the domain of mobile commerce (Hung et al. 2003; Lee et al. 2002; Pedersen and Ling 2003; Pedersen and Nysveen 2002). By following the line of reasoning suggested by those studies, it is proposed that:

H15: The degree of an individual's self-efficacy with a mobile device will have a positive direct effect on the perceived ease of use of a mobile portal.

In order to test these hypotheses and to prove the validity of the suggested conceptual model, the study proposes a survey of real-life users of mobile portals.

Methodology

Recall the purpose of the project is to suggest a conceptual model of user adoption of mobile portals. In order to reach this objective, relevant literature was reviewed and a study's model was formulated. In order to empirically validate this model, an empirical investigation is suggested by utilizing methodologically sound instruments.

Instrument and Survey Design

The study employs nine independent and five dependent variables. The independent variables are: 1) PIIT, 2) self-efficacy, 3) ubiquity, 4) convenience, 5) localization, 6) personalization, 7) device optimization, 8) perceived expressiveness, and 9) perceived value. The dependent variables are: 1) perceived trust, 2) perceived

usefulness, 3) perceived ease of use, 4) behavioral intentions, and 5) mPortal usage. The questionnaire of the study is presented in Appendix I. The rest of this subsection discusses the selection of the questionnaire items in more detail. Consistent with the MIS guidelines for scale creation and use (Straub 1989), constructs of this model are measured by employing previously validated and reliable instruments.

The self-report instrument for measuring the degree of **PIIT** has been operationalized by Agarwal and Prasad (1998) in the form of a four-item questionnaire. Both the instrument developers and succeeding researchers find this tool highly reliable and valid (Agarwal and Karahanna 2000; Agarwal et al. 2000; Thatcher and Perrewe 2002). Thus, the original PIIT scale is applied in this study with no modifications.

The initial ten-item **self-efficacy** scale was created by Compeau and Higgins (1995) and tested in several subsequent studies (Thatcher and Perrewe 2002). Pedersen and Nysveen (2002) adapted this scale to measure the extent of self-efficacy of text messaging users. This study, in turn, adapts this scale to measure the extent of one's self-efficacy with a mobile device.

Device optimization is measured by a degree to which a mobile portal provider customizes the information and the way it is presented depending on the category of a user's device as well as the type of wireless connection. The score is measured on a seven-item Likert scale, and it is provided by researchers. Thus, this item is not included in the questionnaire.

The **self-expressiveness** instrument was originated by Halberstadt et al. (Halberstadt et al. 1995) and tested subjected to reliability and validity testing (Bozionelos 2001; Bozionelos 2002). This investigation adapts the perceived

expressiveness scale for mCommerce suggested by Pedersen and Nysveen (2002) to reflect the nature of mPortal users.

According to customer satisfaction research, the **perceived value** of a product or a service is measured relative to a price (i.e., rating of quality given price and rating of price given quality) (Fornell et al. 1996). With respect to the use of mPortals, three categories of direct and indirect of costs are identified: 1) airtime for which an individual pays in order to access a mobile portal, 2) learning time or time spent to understand the portal's navigation, and, 3) one's efforts to locate required information. Items 2 and 3 are excluded from the suggested instrument because they are accurately and consistently reflected by TAM's constructs. Thus, the only direct financial expense is airtime paid to access a mobile portal.

Based on the review of marketing and MIS literature, three questions were created to measure an individual's perceptions of the decision to spend his or her airtime to access an mPortal: 1) "considering the airtime expenses to access the mobile portal, I believe that using that mobile portal was a good idea"; 2) "I believe that using that portal was a good investment of airtime"; and, 3) "I regret spending airtime on accessing that portal." As suggested by instrument design principles, the scale employs one reverse-scaled item (question 3).

The instrument to measure the level of **perceived trust** of a user to an mPortal provider is adapted from the trust-enabled TAM model by Gefen et al. (2003). Only the items that were retained in the final version of the questionnaire are utilized. The questions are adjusted to reflect the nature of mobile portal users.

The initial Likert scales for measuring perceived usefulness, perceived ease of use, and behavioral intentions were first introduced by Davis (1989). Initially, **perceived usefulness** and **perceived ease of use** were realized in the form of two 14-item set of questions. Since then, various pre-tests and assessments of these scales have reduced the number of items at first to ten and then later to only six items per construct. In 1989, Davis, Bagozzi, and Warshaw further streamlined these scales to two four-item questions.

A **behavioral intentions** measurement scale was first implemented as the following single statement: "I presently intend to actively use WriteOne regularly in the MBA program." Afterwards, it was transformed into two questions positioned on a 7-item Likert scale: "Assuming I had access to the system, I intend to use it", and "Given that I had access to the system, I predict that I would use it" (Venkatesh and Davis 2000). Since their inception, these above-mentioned scales have been utilized across numerous technology adoption studies and subjected to successful reliability and validity testing (Mathieson 1991; Segars and Grover 1993; Taylor and Todd 1995b). As such, this study utilizes the validated and reliable TAM scales.

As of today, the mCommerce research community has not created the instruments for measuring the degrees of ubiquity, convenience, localization, and personalization of a mobile portal. The extent of the actual mPortal usage is not measured in the questionnaire. As suggested by the previous technology adoption research, behavioral intentions accurately reflect future system or application usage.

Data Analysis Techniques

Consistent with most previous TAM-based investigations, this study is expected to utilize Partial Least Squares (PLS) as a major data analysis technique. Several arguments support this decision (Chin 1998; Gefen, Straub and Boudreau 2000). First, the objective of data analysis is to test a set of path-specific hypotheses which is best addressed in PLS. Secondly, PLS works well with small data samples. Thirdly, PLS is well-suited for exploratory research. Lastly, since PLS has been traditionally utilized in TAM-based investigations, the usage of this statistical tool will allow comparing the predictive power of the proposed conceptual model with those of preceding projects. It is for those reasons this study employs PLS for data analysis and hypotheses testing.

Respondents and Sample Size

Respondents for this study should be randomly chosen from a broad population of current user of Web-enabled mobile devices and who frequently access mobile portals. No discriminatory criteria should be used with respect to age, sex, device experience, mCommerce or eCommerce attitudes, etc. In order to control for device-specificity, the users of each type of wireless device should be surveyed separately.

Since PLS is recommended for data analysis, the minimum sample size requirement for PLS is determined by finding the larger of two possibilities: 1) a construct with the largest number of indicators (i.e., number of items in the most complex construct), or 2) a dependent construct with the highest number of independent constructs impacting it (i.e., the maximum number of arrows pointing out to one dependent

construct). The minimum sample size should be at least ten times the larger number of these possibilities (Chin 1998).

In this study, perceived trust is the construct which has the largest number of indicators (5); therefore, the PLS minimum sample size is at least 50 valid responses. However, it is suggested to exceed the minimum sample size threshold and to survey at least 100 individuals.

Discussion and Conclusions

The purpose of the study is to discover factors that may provide insights on reasons why individuals adopt mobile portals, to build a preliminary conceptual model, and to design a methodologically sound survey which will be utilized to test this model. As such, the investigation suggests that five distinct latent variables: perceived expressiveness, perceived trust, perceived ease of use, perceived usefulness, and perceived value of a mobile portal are key constructs of the model which explicate user adoption behavior. In addition, the study suggests that individual-specific antecedents, such as personal innovativeness in the domain in information technology and self-efficacy with mobile devices, and mPortal-specific antecedents, such as ubiquity, convenience, localization, personalization, and device optimization potentially influence the perceived ease of use or the perceived usefulness of an mPortal.

The major advantage of this model is two-fold. The first is that it investigates an unexplored area of user adoption of mobile portals. As of today, mCommerce projects have not considered mPortals as a subject of adoption. The second advantage of the model is that it brings together several different disciplines such as innovation,

management information systems, mobile commerce research, and marketing. Especially, it should be noted that prior technology adoption investigations have not directly considered the perceived value of an IT service. Given that a user of a mobile portal is expected to pay for airtime while using a portal, the introduction of this construct is expected to increase the total variance explained by the model and, therefore, to improve the model's predictive power.

This study has several limitations. First, it is believed that not all factors that explicate users' adoption decisions have been identified. Since this is the first investigation in the area, there is no significant body of literature on which to base justifications of the constructs of a proposed model. Secondly, since the degree of device optimization is measured by researchers, significant intra-rater reliability coefficients should be obtained to make sure that each researcher analyzes the degree of optimization of the same device identically. Thirdly, this study does not operationalize four key variables that play a role of the model's antecedents. Lastly, the same airtime expenses may be perceived differently by different individuals. As such, the perceived value construct may suffer of multicolinearity. For example, the perception of airtime costs may depend on an individual's income. This means the structural equation modeling techniques will not provide statistically reliable results.

With respect to future work, several avenues may be explored. First, future researchers should design valid and reliable instruments for measuring the degree of ubiquity, convenience, localization, and personalization of a mobile portal. At least one pre-test is required to test those constructs. Second, scholars should develop guidelines by which to assess the extent of device optimization. Another pre-test is required to estimate

the consistency of this scale. Third, researchers should conduct a pilot test of the conceptual model by utilizing the minimum sample size of 50 respondents. A PLS analysis should be performed and loadings of items on their respective constructs estimated. After that, items with loadings below the suggested threshold of 0.7 should be removed from the next version of the questionnaire and a final full-scale study involving at least 100 respondents should be conducted. The model should be adjusted based on a survey's findings. Last, future scholars should review the results and to create guidelines for the development of really useful mobile portals.

In general, many researchers are encouraged by the fast growth of the wireless market and the development of mobile commerce business models. It is believed that the investigations of factors that affect individuals' decisions towards adopting mobile technologies, including mobile portals, will potentially contribute to the creation of widely accepted mobile products and services.

Appendix I.
Questionnaire.

A. The questions below ask you to describe your behaviors in the context of **information technologies**. Information technologies are computer systems concerned with all aspects of managing and processing information. Information technologies include personal computers, software applications, telecommunications networks (e.g., the Internet and Email), etc. Please indicate the number that best matches you opinion.

PIIT1. If I heard about a new information technology, I would look for ways to experiment with it.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

PIIT2. Among my peers, I am usually the first to try out new information technologies.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

PIIT3. In general, I am hesitant to try out new information technologies. (R)

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

PIIT4. I like to experiment with new information technologies.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

B. Please answer these questions with respect to your experience with mobile devices, e.g., a cell phone or a PDA.

Self-efficacy

SE1. I am able to use mobile devices without help of others.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

SE2. I have the necessary time to make mobile devices useful to me.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

SE3. I have the knowledge and skills required to use mobile devices.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

SE4. I am able to use mobile devices well on my own.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

C. Please answer these questions with respect to your experience with mobile portals in general.

Expressiveness

EX1. Mobile portals are something I often talk with others about or use together with others.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EX2. Mobile portals are something I often show to other people.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EX3. I express my personality by using mobile portals.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EX4. Using mobile portals gives me status.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

D. Please answer these questions with respect to your experience with a mobile portal that you most frequently use.

Perceived Value

PV1. Considering the airtime expenses to access the mobile portal, I believe that using that mobile portal was a good idea.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

PV2. I believe that using that portal was a good investment of airtime.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

PV3. I regret spending airtime on accessing that portal. (R)

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

Perceived Trust

T1. Based on my experience with the mobile portal, I know that the portal service provider is honest.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

T2. Based on my experience with the mobile portal, I know that the portal service provider cares about customers.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

T3. Based on my experience with the mobile portal, I know that the portal service provider is not opportunistic.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

T4. Based on my experience with the mobile portal, I know that the portal service provider is predictable.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

T5. Based on my experience with the mobile portal, I know that the portal service provider knows its market.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

Perceived Usefulness

U1. Using the mobile portal improves my wireless Internet performance.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

U2. Using the mobile portal increases my productivity.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

U3. Using the mobile portal enhances my effectiveness.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

U4. I find the mobile portal useful.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

Ease of Use

EOU1. My interaction with the mobile portal is clear and understandable.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EOU2. Interacting with the mobile portal does not require a lot of my mental effort.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EOU3. I find the mobile portal easy to use.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

EOU4. In find it easy to get the mobile portal to do what I want it to do.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

Behavioral Intentions

BI1. Assuming I have access to the mobile portal, I intend to use it.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

BI2. Given that I have access to the mobile portal, I predict that I would use it.

strongly disagree			neutral			strongly agree
-3	-2	-1	0	+1	+2	+3

(R) – reverse-scaled items.

Figure 1. Unique Characteristics of mPortals. Adapted from Clarke and Flaherty (2003) and GSA (2002)

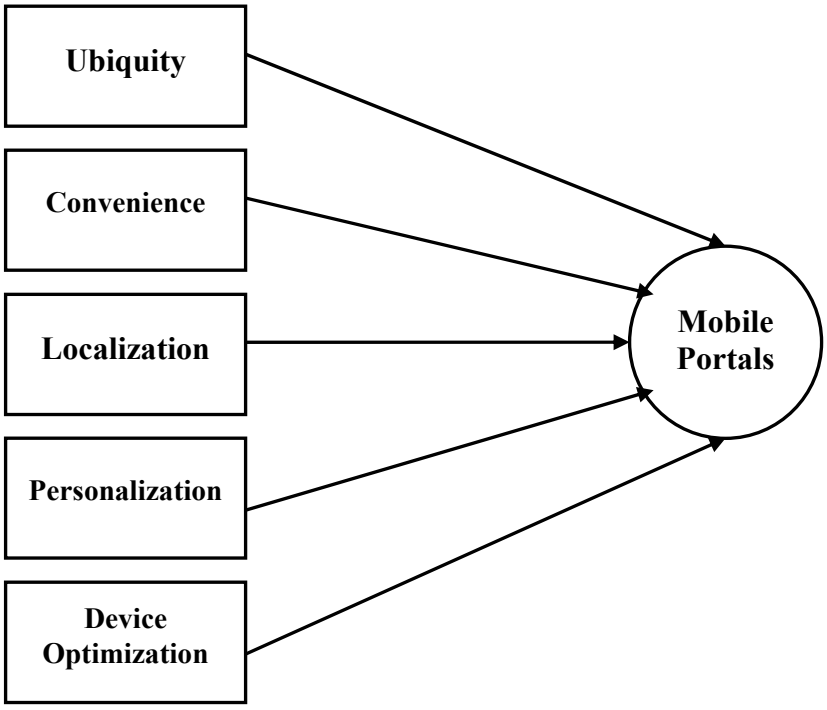
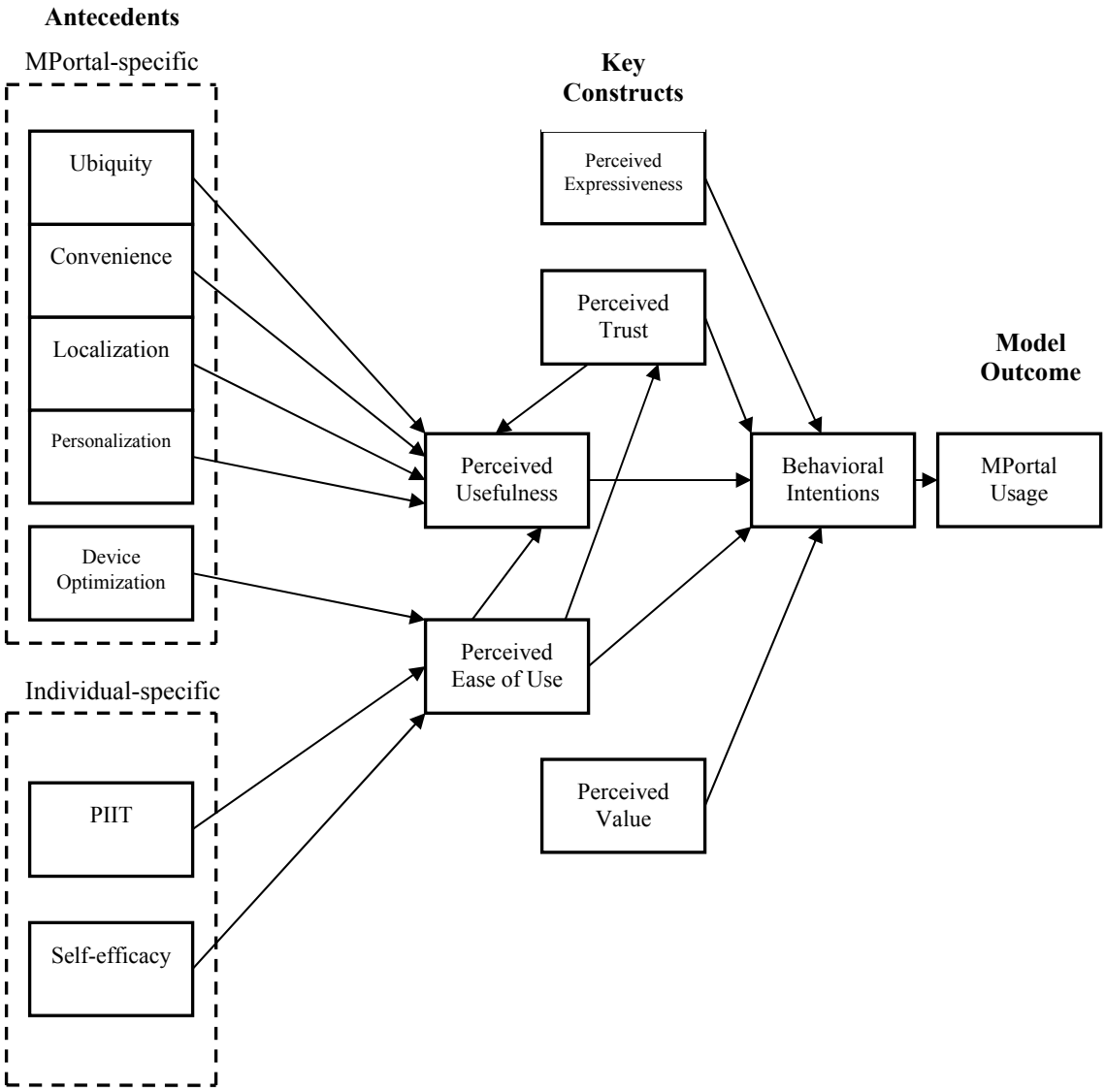


Figure 2. A Conceptual Model of User Adoption of Mobile Portals



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