Modeling the Determinants Influencing the Diffusion of Mobile Internet

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Abstract Understanding individual acceptance and use of Information and Communication Technology (ICT) is one of the most mature streams of information systems research. In Information Technology and Information System research, numerous theories are used to understand users' adoption of new technologies. Various models were developed including the Innovation Diffusion Theory, Theory of Reasoned Action, Theory of Planned Behavior, Technology Acceptance Model, and recently, the Unified Theory of Acceptance and Use of Technology. This research composes a new hybrid theoretical framework to identify the factors affecting the acceptance and use of Mobile Internet -as an ICT application- in a consumer context. The proposed model incorporates eight constructs: Performance Expectancy (PE), Effort Expectancy (EE), Facilitating Conditions (FC), Social Influences (SI), Perceived Value (PV), Perceived Playfulness (PP), Attention Focus (AF), and Behavioral intention (BI). Individual differences—namely, age, gender, education, income, and experience are moderating the effects of these constructs on behavioral intention and technology use.

1. Introduction
Information and communications technology or information and communication technology (ICT), is often used as an extended synonym for Information Technology (IT), but is a more specific term that stresses the role of unified communications and the integration of telecommunications, computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information [1]. ICT is an interdisciplinary area of research driven and shaped by the fast development of computing, communication, and Internet-related technologies, which have a great impact on our societies and daily lives. Over the last few decades there has been an increase in ICT research, which has changed and shaped the way societies and organizations operate and produce their goods and services. It is not only the generation of new technology but also, and perhaps even to a higher extent, its diffusion throughout the economy which affects productivity growth at the macro-level.

Technology adoption was defined as the use, or acceptance of a new technology, or new product [2]. Moreover, understanding individual acceptance and use of information technology is one of the most
mature streams of information systems research. The Internet and mobile technology, the two most
dynamic technological forces in modern information and communication technologies are converging into
one ubiquitous mobile Internet service, which will change our way of both doing business and dealing
with our daily routine activities. There is no doubt that the mobile Internet service is moving toward the
new generation on which enables mobile users to enjoy a variety of new and upgraded multimedia mobile
services.

According to a recent study by on global mobile data traffic forecast, Smartphones represent only 12
percent of total global handsets in use today, but they represent over 82 percent of total global handset
traffic [3]. Moreover, the number of mobile phone subscriptions reached almost 6,000 million at the end of
2011, representing a penetration rate of 86.7 percent worldwide and 78.8 percent in developing countries
[4]. Hence, during the period from Sep. 2011 to Sep. 2012, on an average around 265,000 applications
were registered in the US App Store [5], and 140,000 application were registered in Android Market
during same period [6].

2. ICT Acceptance and Use
As the use of information and communication technology (ICT) expands globally, there is need for further
research into cultural aspects and implications of ICT. The acceptance of Information Technology (IT) has
become a fundamental part of the research plan for most organizations [7]. A better understanding of the
factors contributing to the acceptance or rejection of information technology is the first step toward the
solution of the problem.

User acceptance is often the pivotal factor and a central focus of Information Systems (IS)
implementation research in determining the success or failure of an information technology product [8, 9,
10, 11, 7]. Availability of information technology does not necessarily lead to its acceptance. Most
information system failures result from a lack of user acceptance rather than poor quality of the system
[12, 7, 11].

Previous research into user acceptance of information technology has mainly concentrated on users' attitudes toward acceptance while neglecting the role of social norms. It was also noticed that few IT
characteristics were researched and these were not approached in a coherent manner [9, 10, 7, 11]. Thus, it
was recognized that the study would need to consider a broad range of IT characteristics and investigate
the normative side of the equation besides that of attitudes toward usage.

In the technologically developed world, IT adoption is faced by barriers, such as the lack of top
management support, poor quality IS design and inadequately motivated and capable users [13]. In the
developing world, the same barriers appear to be often impenetrable [14, 15]. In addition, problems found
in developing counties are attributed to a lack of national infrastructure [16], capital resources, or
government policies set in place to prevent technology transfer [17]. Although there are isolated reports of
countries where sufficient resources and government support exist, the technology has failed to be
effectively transferred [17]. While the uses of IT are varied, the common tie of technology use in the
developing counties is one of limited diffusion [17].

3. Review of Technology Acceptance Theories
In ICT research, numerous theories are used to understand users’ adoption of new technologies.
Researchers have attempted to predict and explain user behavior across many IS and IT domains, seeking
to investigate and develop theory as to how to improve usage and examine what inhibits usage and
intention to use the technology [18]. To develop the conceptual framework for our model it is useful to
draw comparisons between the various theories. The theories based on intention of ICT adoption such as
Technology Acceptance Model –TAM- [20,21] and Theory of Planned Behavior –TPB- [18] have shown
that the adoption and usage of an IT system is eventually determined by the users’ personal beliefs and attitudes toward the technology. Other models such as IDT state that user’s perception of the characteristics of an innovation is more significant [22].

3.1 Innovation Diffusion Theory (IDT)
Innovation Diffusion Theory (IDT) notes that relative advantage, complexity, compatibility, trialability and observability predict user adoption [23]. Rogers defined an innovation as an idea or practice that is perceived as new by the adopting organization [22]. Braun argued that Rogers Innovation Diffusion Theory (IDT) analyzed the process of diffusion, and mapped the impact of a combination of social, economic, and technical forces on that process [24]. There is a general agreement among researchers that IDT is a suitable and valid theory for examining the process of adoption.

3.2 Theory of Reasoned Action (TRA)
The theory of reasoned action is a widely studied model from social psychology which is concerned with the determinants of consciously intended behaviors [25, 26]. The foundation of the TRA conceptual framework is provided by the distinction between beliefs, attitudes, intentions, and behaviors. The major concern of the conceptual framework, however, is with the relations between these variables, as shown in figure 1.

![Figure 1 Theory of Reasoned Action [26].](image)

According to TRA, a person’s performance of a specified behavior is determined by his or her behavioral intention to perform the behavior, and behavioral intention is jointly determined by the person’s attitude and subjective norms concerning the behavior in question.

3.3 Theory of Planned Behavior (TPB)
The theory of planned behavior goes beyond the theory of reasoned action (TRA) and incorporates a further construction, specifically perceived behavior control (PBC); this accounts for those situations where control over the target behavior is not fully volitional [27]. TPB is considered as to be among the more influential of the theories in predicting and explaining behavior [28]. Various studies showed the applicability of TPB to various domains, and verified the ability of this theory in providing a valuable framework to explain and predict the accepting of new information technology [29].

3.4 Technology Acceptance Model (TAM)
Originally introduced by Fred Davis as early as in the 1980s, the Technology Acceptance Model (TAM) sought to measure the willingness of people to accept and adopt new information technology innovations of that era, such as the electronic mail systems [20]. The model had two main determinants
which explained IT adoption: Perceived Usefulness and Perceived Ease of Use. In his work, Davis defined them as “the degree to which a person believes that using a particular system would enhance his or her job performance” and “the degree to which a person believes that using a particular system would be free of effort”, respectively [20]. Contrary to his hypothesis, Davis reported that the relationship between perceived usefulness and adoption was significantly stronger than that of between perceived ease of use and adoption [20]. Furthermore, he noted that perceived ease of use might even precede perceived usefulness, suggesting the existence of a causal relationship instead of the independence of the determinants.

Figure 2 The earliest Technology Acceptance Model [20].

Figure 2 above suggests an interpretation that respondents tend to consider the usefulness of a new system before making a decision to use it. However, the easier the system is perceived to be, the more useful it becomes in the minds of the people, thus improving the overall perception and leading to increased usage. Still, there is a certain limitation to how usage is measured in the study, as Davis duly stated [20].

3.5 Unified Theory of Acceptance and Use of Technology (UTAUT)
UTAUT was developed by Venkatesh et al. to predict user adoption of an information technology [18]. UTAUT integrated eight theories, including the TAM, IDT, the theory of reasoned action (TRA), the motivational model, the theory of planned behavior (TPB), a model combining the TAM and TPB, the model of PC utilization and social cognitive theory (SCT). With empirical analysis, Venkatesh et al. [18] found that performance expectancy; effort expectancy, social influence and facilitating conditions are the main factors determining user adoption. Among them, performance expectancy is similar to perceived usefulness and relative advantage. Effort expectancy is similar to perceived ease of use and complexity. Social influence is similar to subjective norm. Since its inception, UTAUT has been used to explain user adoption of a variety of information technologies, including location-based services [19], mobile technologies [30], mobile banking [31], Internet banking, and health information technologies [32].

As can be seen from figure 3, the UTAUT streamlined the social influence concepts presented in TAM2 and moved some of the elements such as experience and voluntariness of use into background variables (moderating effects).
4. Proposed Model
Due to the relatively low adoption rate of ICT, extant research has paid much attention to prior work [18, 33, 34] when identifying the factors affecting mobile user behavior.

**Performance Expectancy** reflects the perceived utility associated with using mobile Internet. Mobile Internet frees users from temporal and spatial limitations, and enables them to acquire information or services at anytime from anywhere. This can improve users’ living and working performance and efficiency.

**Effort Expectancy** reflects the perceived difficulty of using mobile Internet. The constraints of mobile terminals such as small screens and inconvenient input have made it relatively difficult for users to search for information on mobile Internet.

**Social Influence** reflects the effect of referees’ opinion on individual user behavior [34]. According to social influence theory, users tend to comply with other important referees’ opinions [35]. Thus when others who are important to a user recommend him or her to use mobile Internet, he or she may follow their suggestions.

**Facilitating Conditions** mean that users have the resources and knowledge necessary to use mobile Internet. Users need to bear the costs of using mobile Internet, such as communication fees and service fees.

**Perceived Value** is defined as the consumer’s overall assessment of the utility of a product based on perceptions of what is received and what is given.

**Perceived Playfulness** reflects the pleasure and enjoyment associated with using technology. Perceived enjoyment is an intrinsic motivation that emphasizes the usage process, whereas perceived usefulness is an extrinsic motivation that emphasizes the outcome [36]. In addition, perceived enjoyment may also facilitate continuance usage.

**Attention Focus** reflects a user's immersion when using ICT such as mobile Internet. Mobile users often perform multiple tasks on movement, such as listening to music and accessing mobile Internet. Thus
their attention allocated to mobile Internet may be limited. If they cannot focus their attention, their experience may be affected [34].

**Behavioral Intention** is defined as a person’s perceived likelihood or “subjective probability that he or she will engage in a given behavior” (Committee on Communication for Behavior Change in the 21st Century, 2002, p. 31). With increasing experience, consumers have more opportunities to reinforce their habit because they have more time to encounter the cues and perform the associated behavior [37].

Figure 4 presents the research model including the seven constructs and the behavioral intentions to accept and use the mobile Internet as well as gender, age, education, experience and income as moderator variables.

![Figure 4 The Proposed Research Model.](image)

5. Conclusion
This research clearly shows the need for a thorough understanding of user attitudes and preferences towards mobile Internet acceptance. As more technological innovations are introduced in rapid succession and an increased number of those innovations are failing, profound insights in the determinants towards adoption and use become more important. The research problem domain was discussed and the researcher’s assumptions of the influential effects on mobile Internet acceptance and use are being explored. Also, the research justifications and contribution to the body of knowledge were briefly discussed. The framework presented within this article sets the goal to contribute to technology acceptance research by providing a comprehensive model, although it consists of a limited number of adoption and use determinants.
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