



Postgraduate thesis
Information and Communication Technology

Adoption of M-Commerce

By:

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Abstract

The development of ICT in recent years, and speed of this development is extremely rapid. ICT also spreads widely and influences deeply not only economic activities of business, households and governments but also various areas of people's daily life. The adoption rate of mobile Internet was estimated by analogy to adoption pattern.

This study examines patterns of mobile commerce adoption and usage in early adopters. One hundred and ninety mobile users were surveyed about their pattern of usage, demographic and socioeconomic characteristics, perception about the technology, and their motivation to use mobile phone services.

A model which is based on modified theory of planned behavior (TPB), Technology acceptance model (TAM), and TRA is used to hypothesises a model of MCommerce. We found that TPB and TAM most useful in explaining MCommerce acceptance on early adopter.

Preface

The Master thesis is a part of the Information Communication Technology (ICT), master of engineering degree at Agder University Collage in Grimstad, Norway.

The idea of doing a report on this subject of diffusion and adoption behavioral came to me after discussing it with Professor Jose Gonzales. I found the subject interesting and tried to find something to write about in adoption and mobile phones framework. Later I contacted Professor Per. E. Pedersen and we found this subject: Adoption of MCommerce. This paper is the largest of many challenges taken on during my studies in Agder –Grimstad.

I would like to thank Professor Per E. Pedersen, My supervisor, for being very supportive and helpful during the work process. I appreciate the great interest he has shown for the study and all the effort he has put into guiding in writing process.

Spring 2002. Grimstad.

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1. Introduction

The first chapter introduces the reader to the problem setting and the chosen problem. We will define the problem that leads us to our purpose.

1.1 Background

Forecasts concerning the use of mobile internet and technology, in general, are difficult to make. The Internet is fundamentally unpredictable.

Recently, there has been a highly prolific stream of theoretical research on the acceptance and use of information technology (IT). This model, known as the technology acceptance model (TAM), is widely regarded as a relatively robust theoretical model for explaining IT use. From a practitioner perspective, TAM is useful for predicting if users will adopt new information technology. Replication of the original work by Davis (1986) suggest that TAM may hold across technologies as well as persons, settings, and time, the latter being requirement for robust theories. Reinforcing this robustness, TAM ha also been show to demonstrate good predictive validity. The theoretical base underlying the study draws on TAM for die basic structure of the model.

There have been a number of researches and theories for predicting behavior of end-user adoption of technologies. Some of these researches draw its theoretical underpinnings from the adoption and diffusion of innovation literature, where individuals' perceptions bout using an innovation are said to influence usage (Roger, 1994).

The diffusion process consists of four key elements: an innovation, the social system on which the innovation impacts, the communication channels of the social system and time (Roger 1983). Roger's theory of the diffusion of innovation (Roger 1962, 1983, 1995) provides a useful conceptual framework for understanding how the adoption of IT might operate in a group, and has been previously applied to describe how beef producers approached the adoption of e-commerce (Gregor & Jones 1999).

Other significant theoretical models that attempt to explain the relationship between user attitudes; perception, beliefs, and eventual system use include the theory of reasoned action (TRA), the theory of planned behavior (TPB). Recent work has been focused on empirically testing these models to determine their relative explanatory power (Mathieson 1991; Davis et al. 1989; Taylor and Todd, 1995). In the domain of

information technology, the technology acceptance model has a garnered support. Drawing upon and modifying TRA, TAM posits that acceptance and use of an information technology innovation is predicated upon an individual's beliefs about such use, mediated by the individual's affective response to the innovation. This model of technology acceptance is well grounded in the social psychology literature and also has the additional desirable characteristic of parsimony. The relationship embodied in TAM among belief empirically confirmed in a number of studies, although a few exceptions to the original formulation of TAM have been found (e.g., Davis, et al, 1989; Taylor and Todd, 1995).

The technology Acceptance model used by Davis determined IT adoption, implementation and diffusion in terms of perceived ease of use and perceived usefulness. Ajzen discusses technology adoption in terms of the Theory of Planned Behavior (TPB) where behavior is a direct function of behavior intention and perceived behavior control. He further suggests that subjective norm help to form intention. A limitation of the TPB model is that the relationship between the belief structure and determinants of intention are not particularly well understood causing some inconsistency in result.

An alternative to the TPB model was suggested by Taylor and Todd. The Decomposed Theory of planned behavior attempts to overcome limitation of the earlier version, particularly in relation to attitudinal, normative and control beliefs that are decomposed into multi-dimensional belief constructs.

Social interactions are instrument in generating shared meaning and mutual understanding in an organization and thereby provide an important basis for subsequent pattern of behavior. Acknowledging the importance of such influences, dominant technology acceptance theories such as TRA and TPB include construct of subjective norm as a key antecedent of behavioral intentions to use a mobile internet.

While the technology is becoming mature, social definition of it is still undergoing social explanation. As its comprehension increases and its use creeps into more and more untraditional areas of life one is forced to reinterpret and expand their nations of telephony. Studies have shown that individual differences (e.g. gender, age, education and professional orientation) play an important role in the how information technology is used (Zmud, 1979).

1.2 Purpose

Purpose of this study was to identify how Mobile commerce may be adopted from early adopter's behavior perspective by applying existing diffusion and adoption theories.

1.3 Methodology

Chapter 1 leads the reader into the topic and problem area, we explain what we try to achieve with the study. *Chapter 2* the topic of Mobile commerce and also present some definitions and limitations we have felt necessary. Description of business model and marked segment was also included in the chapter. *Chapter 3* falls within a conversational disposition by presenting basic diffusion and adoption theories to the reader. The aim of the theoretical framework is to provide a solid base of established theories to aid in the explanations of early adopter behavior studies. *Chapter 4* contains the structural model with founded hypotheses. *Chapter 5*: in this chapter we discuss about the items founded from the structural model and results from measures. *Chapter 6* goes into more in depth analyze the result from survey and discuss the result on the model. *Chapter 7* presents our general conclusion. This chapter will be consists a conclusion from all chapters.

2. M-Commerce

In this chapter we have described and discussed the emerging technologies that enable to shift to the Mobile Commerce paradigm. It describes mobile commerce services, applications and marked segments.

2.1 Technology Shift

Use of packet switch technology has maximized bandwidth efficiency enabling multiple users to share the same bandwidth, thus resulting in overall lower cost.

GPRS and Third generation (3G) technologies will improve the bandwidth issue. This could prove the catalyst for mCommerce penetration providing packet switch networks with larger bandwidth and therefore data richer and faster application. Application will also need to appear in significant quantity, as well compatible mobile handset, if the growth is to be sustained. The new packet based wireless network e.g. GPRS also allow the mobile phone to be in a standby, or ready mode, able to instantly transfer and receive data. With EDGE and third generation (3G) wireless technology, will consumer has additional incentive to use wireless data services.

Despite attempts by content providers, financial institutions and Web portals to position themselves for capturing revenues from 3G mobile communication services, mobile operators remain in pole position for dominating the value chain.

2.2 The MCommerce

There have been different definitions of mCommerce. Lehman Brothers (1995) define mCommerce as *“the use of mobile hand-held devices to communicate, inform, transact and entertain using text and data via connection to public and private networks”* (20). Their reason for using such a broad definition is because the borders between messaging and commerce have become too blurred to separate these categories. Another definition is *“finance transaction especially buying and selling: trading”* (21). Durlacher research’s use a fairly broad definition as they as more distinct and is as follows: *“any transaction with a monetary value that is conducted via a mobile telecommunication network”* (22)

MCommerce contributes the potential to deliver most of what the internet can offer, plus the advantage of mobility. MCommerce gives mobile communication devices as mobile phones and personal digital assistants (PDA) the ability to pay for goods and services.

2.3 Service categories

Mobile commerce is an emerging discipline involving applications, mobile device, middleware, and wireless networks. While most of existing eCommerce application can be modified to run a wireless environment, mCommerce also involves many more new applications that become possible only due to the wireless infrastructure.

These applications include mobile financial services, user and location specific mobile advertising, mobile inventory management, wireless business re-engineering, and mobile interactive games. In addition to device and wireless constraints, mobile commerce would also be impacted by the dependability of wireless infrastructure.

MCommerce existing and futures possible application include:

- Mobile banking service (check account information, money transfer)
- Mobile trade service (stock quotes, selling/buying)
- Credit card information (account balance)
- Life insurance account information (account information, money transfer)
- Airline (online reservation, mileage account check)
- Travel (online reservation, timetables)
- Concert ticket reservation (online or telephone booking)
- Sales (online books, CDs)
- Entertainment (games)

- News/information (headline, sports, weather, horse racing information, business, technology, regional)
- Database, application (yellow pages, dictionary, restaurant guide)
- Location based application (area information and guides)

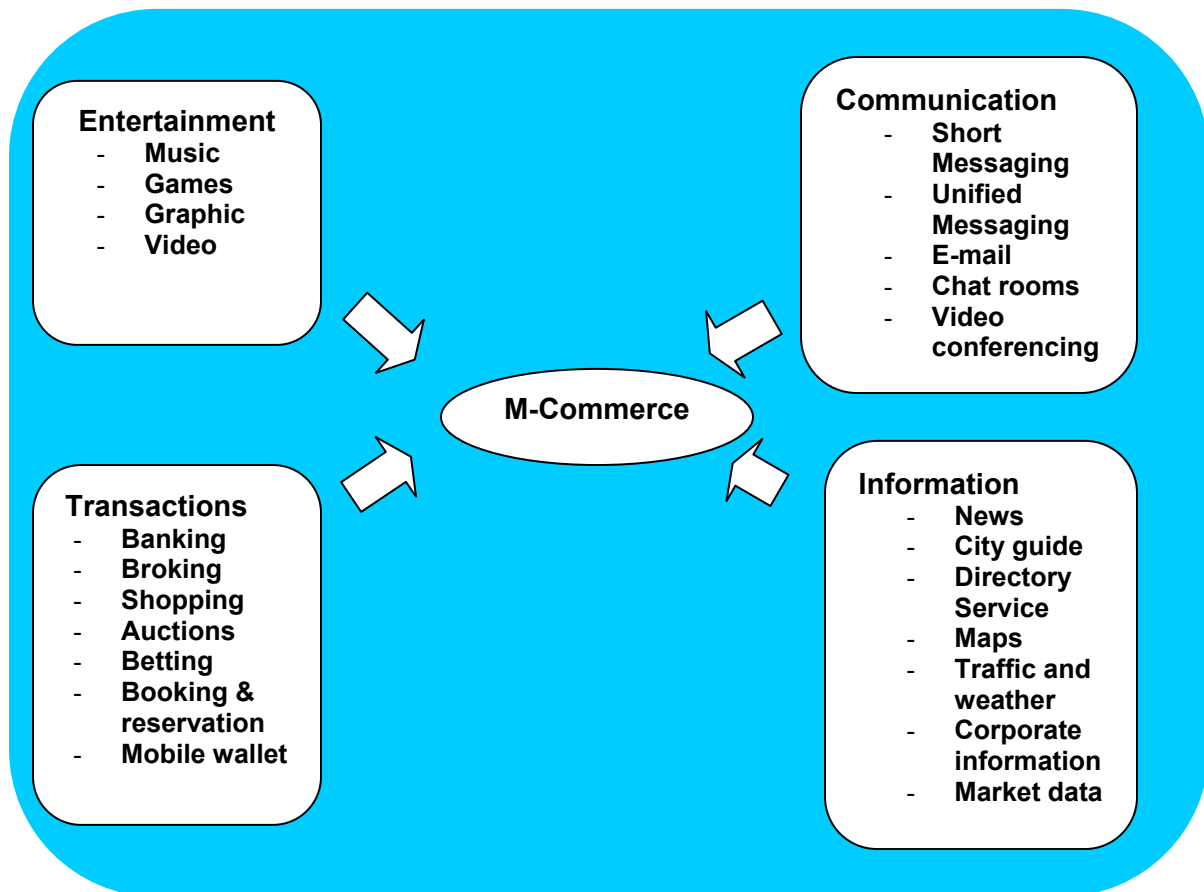


Figure 1: A possible categorization of Mobil Commerce services.
 Source: Lawrence Selling

Already DoCoMo has started constructing an experimental system for fourth-generation packed wireless communication which will be launch commercially by 2010. 4G networks require bandwidth in the region of 100 MHZ. We mean that until that time, will several new generations of I-mode and WAP be available.

2.4 Marked segments

Technologies standards play an important role in many high technology industries. In industries such as telecommunications in era of globalization setting or at least influencing technical standards making has become one of the core strategic challenges. The recent growth of consumer retailing over the Internet draws attention to the electronic economy. However, businesses also conduct other business processes over computer networks, and many have been doing so far some times. The current development of e-business on markets can be described as the addition of sales via the internet besides existing retail forms. A market place in its basic form is a place where buyer and seller meet to exchange vale.

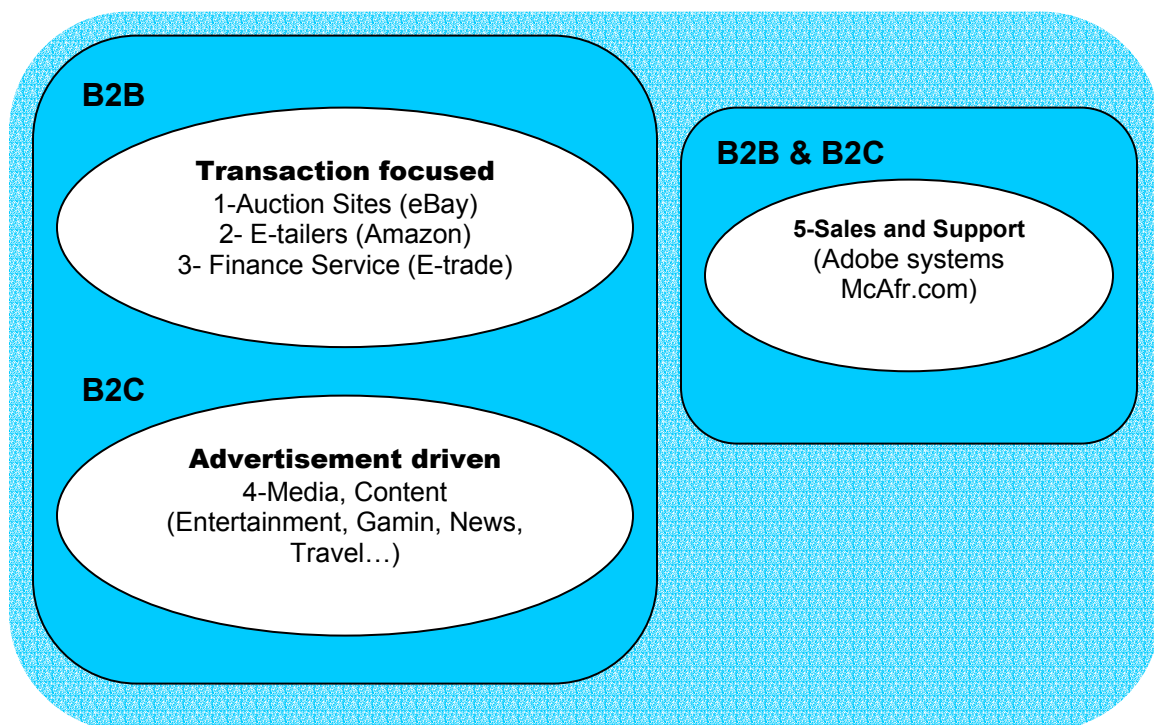


Figure 1.2: Electronic marked

2.4.1 E-business

E-business is the undertaking of a business transaction through a network. Such transactions might include selecting goods, ordering, invoicing and payment. This may also involve the agreement of contacts, the arrangement of delivery, and the declaration of tax and after sales service.

Electronic Commerce offers a number of significant advantages:

- A new on-line channel to increase the visibility and image of an organization to both existing and new customers
- A reduction in sales and administrative cost (lower stock levels need to be held and less paper handling requires less human intervention)
- More efficient information transfer (easier to change prices, easier to update products, efficient search for products of one company: online catalog/database)
- Allows any-to-any (Participants can regulate information they reveal).

In addition to these will transaction costs less when the internet makes the opportunities like: Less time spent by people in purchasing / selling, Greater standardization, fewer errors.

2.4.2 B2B

E-Commerce will only really be useful for business-to-business transaction where there is the right degree of consensus between the companies and industries on issues such as product description or the order and payment process to be used. Without this, there is too much of a risk of one company's computers not understanding data sent by those of its trading partners. A business – to business electronic marketplace has several buyers and sellers. The B2B E-Market is an area on the internet where a trusted intermediary offers industry information and trading functionality to registering companies.

B2B represent man-to-many initiative, that is, they are open to many buyers and many sellers. In this area (B2B) mobile application has become the norm of stock management, order talking and tracking, customer management, inventory tracking.

2.4.3 B2C

In the B2C area, m-commerce is still in its infancy. This is due to the limitations of present, intermediate technologies such as WAP, and to the relative lack of compelling contents and services.

Certain B2C services (e.g. online banking) may charge a small monthly fee, but it is similar to that of comparable offline service (e.g., maintenance fee for checking accounts) and are waived under certain circumstances (e.g., if a minimum balance criterion is met), hence monetary cost is not a constraint on B2C e-commerce acceptance (Bhattacharjee 2000). The largest segment of business to consumer e-commerce is that transfer of intangible goods that are delivered directly to the consumer's computer over the network.

2.5 Value chain

The different steps within the value chain proposed may not always be clear-cut. The same actor may play several roles, but we have chosen to categorize them based on their main focus.



Figure 2.3: Value chain
Source: Durlacher

The figure above is showing the; Muller-Versee's value chain model. This model has the general content of production on mobile internet. It's been made on the structure on existing mobile services.

Infrastructure and equipment vendor: makes the communication infrastructure for the mobile systems. Among leading suppliers for mobile network infrastructure equipment is: Motorola, Ericsson, Siemens, and Nokia.

Application vendors – make software and applications that can be run on the Mobile Internet infrastructure. Here we include both platform vendors and developers.

Application Developer- According to Durlacher, applications for the mobile environment are currently being built primarily on Windows CE, symbain's EPOC32currently currently most of the applications

Content providers – make the content that the user is actually interested in. The rest of the value chain roles are about how the user gets it.

Mobile portal provider – will include both content aggregators as well as portals. The role is to aggregate and personalize information and services the user is looking for in an optimized way for the mobile environment.

Mobile network operator – runs the physical network needed. Each country has its own telecom operators.

Mobile service provider – offers the end customer the mobile service.

Terminal vendor – makes the device that the user will be handling. A terminal can take on all sorts of forms.

3. Theoretical Framework

This chapter aims to give the reader a basic knowledge of Technology Models, based on diffusion-and adoption theory. The chapter is primarily based on the TAM model and adoption theory by Everett M. Rogers. Since this thesis is based on adoption theories, we believe that it is important that the reader has basic knowledge of diffusion-and adoption theories. In the following chapter we will therefore present the most important elements of these theories.

3.1 Introduction

Rogers' work, which includes a meta-analysis of a diversity of innovations studied in diverse contexts. Among these studies the adoption of family planning and new agricultural techniques, can be characterized as an information-centric view of the diffusion of innovations. According to Rogers (1995), information about the existence of innovations flows through social systems where potential adopters are situated. Although Rogers' model has been utilized to predict and explain technology diffusion in the contexts of information systems, innovations, in the domain of information technology specifically, the technology acceptance model (TAM) has garnered significant empirical support (Davis et al. 1989, Taylor and Todd 1995). Drawing upon the theory of reasoned action (Ajzen and Fishbein 1980), TAM posits that technology adoption decisions (i.e., individual intentions to use the technology) are driven by an individual's affective response (attitude) toward the use of the innovation.

Tomatzky and Klein (1982) found that Roger's three innovation characteristics perceived advantage, compatibility and complexity were consistently related to adoption behavior. Indeed, Davis derived constructs: perceived usefulness of the technology and perceived ease of use of the technology from the diffusion of innovation perspective (Roger 1995).

This chapter aims to give the reader a basic knowledge of the diffusion- and adoption theories. The chapter is primarily based on Acceptance technology models. The diffusion and adoption theory is primary based on Everett M. Rogers. With the help of the groundwork laid out by these researchers and complementing literature within the field, we try to guide the reader through the difficulties of the diffusion of Innovations and adoption of end-user services. The chapter is relatively theoretical.

3.2 Diffusion theory

Following chapter describes the literature on the diffusion of innovations. Rogers' (1995) theory of diffusion provides underlying support for the links between the methods by which a software product is developed, the context, the characteristics of the product developed, and the eventual adoption, or otherwise of the product. This theory is in four parts:

1- The innovation 2- The communication channel on social system 3- social system on which the innovation impacts 4- Time

3.2.1 The Innovation

All products have originally been perceived as new to the world, which was at the time when the product or innovation was introduced on the market. "An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" Rogers (1983). This means that a product that is perceived as new to an individual does not necessarily have to be new on the market. It could just be that, despite the knowledge about the innovation, he or she has not developed a favorable or unfavorable attitude towards it nor have they adopted or rejected it (Roger 1985 p.11).

What makes an innovation successful? Innovation diffusion theory is defined in five critical characteristics.

Relative Advantage: The degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social-prestige factors, convenience, and satisfaction are also important components.

Compatibility: The degree to which an innovation is perceived as being consistent with the existing values, past experience, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible.

Complexity: The degree to which an innovation is perceived as difficult to understand and use. Some innovations are rapidly understood by most members of a social system; others are more complicated and will be adopted more slowly. New ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understandings.

Trialability: The degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are not divisible.

Observability: The degree to which the result of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it.

3.2.2 Communication channels

The second main element in diffusion of new idea is the communication channel. Information about an innovation must be in communicated from one to another. This communication can be via mass media or via personal communication. Rogers defines diffusion as an inherently social process which can be transmitted via Interpersonal channels, where personal will adopt an innovation on the basis of a subject evaluation of an individual like themselves, or mass media channels, such as news paper, television and radio. To illustrate one can use the Bass model (1968). This model assumes that two type of communication channels influence potential adopters: mass media channel and Interpersonal channels. We will discuss the Bass mode later in this chapter.

3.2.3 Social System

The social or cultural structure affects the diffusion and adoption of innovation in a system. A social system is defined as “a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal (Roger 1995, p. 23). The diffusion of an innovation through a social system (like an organization) will be affected by *norm* of the group. In addition, the opinion *leaders* within that social system will affect adoption. The change *agent* also influences on whether the innovation is adopted. Finally, result of adoption of an innovation will also influence the adoption of the innovation. Factors that can affect the process are: the structure of the social system, norms, the role of opinion leaders and the consequence of the innovation (Roger 1995, p.23).

3.2.4 Time

Time influences diffusion of innovation in three major ways: 1- *Innovation Decision Process* 2- *Rate of Adoption* 3- *Adopter Categories*

3.2.4.1 Innovation Decision Theory

The stages through which a technological innovation passes are: 1-knowledge 2.persuasion 3.decision 4.implementation 5.confirmation.

A potential adopter passes through certain stages before decision is made on whether to adopt or reject an innovation. Roger has been one of the number of researchers who has focused upon the adoption process, which he defines as the “the process through which an individual or other decision-maker unit passes from first knowledge of an innovation, to forming an attitude toward the innovation to a decision or rejection to implementation of the new idea, and to confirmation of this decision” (Frambach, 1993).

The innovation adoption process defined by Roger is the process through which an individual or other decision making unit passes from knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision (figure 3.1).

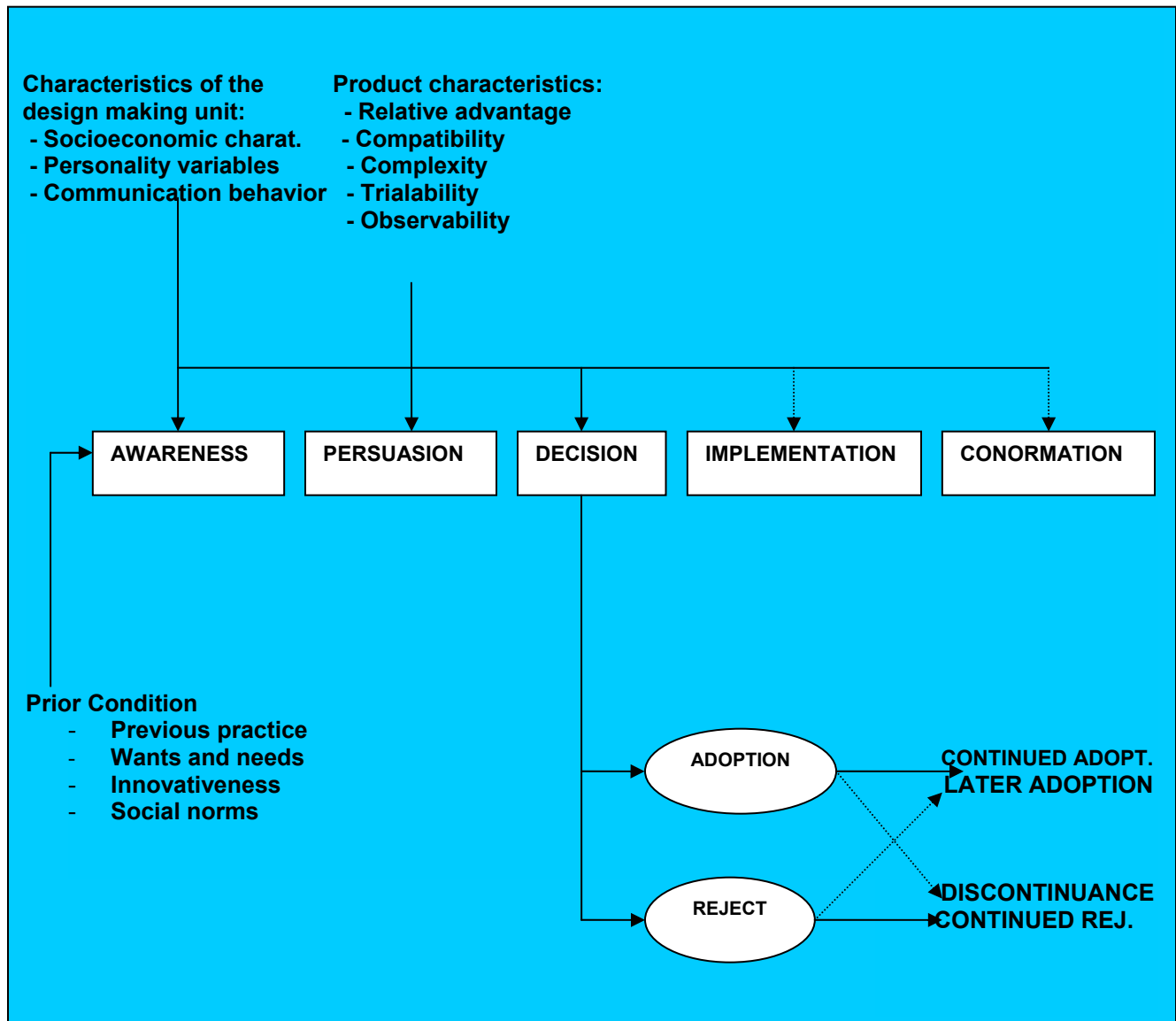


Figure 3.1: A model of stage in the innovation-Decision Process.

Source: (Roger 1995), p. 163

As the figure 3.1 shows there are five stages in innovation decision process. These are:

1-*Knowledge*: Socio-economic characteristics, Personality variables and communication behavior all relate to innovativeness. Innovativeness is the degree to which an individual or other adoption unit is relatively early in adopting new ideas compared to other members of a system (Roger 1995, p.252). According to Roger

early adopters have more formal education than later adopters and are more likely to be (socio-economic characteristics).

2- Persuasion: The potential adopter's attitude towards the innovation is formed in this stage. By anticipating and predicting future use satisfaction and risk of adoption, the potential adopter develop positive or negative attitudes to the innovation, which play important role of modifying the final decision. Perceived attitudes of an innovation as its relative advantage, compatibility and complexity are especially important here (Roger 1995, p. 167). This stage has been most significant in this rapport, which has been used in the survey and in the model analysis chapter.

3- Decision: The decision stage occurs when an individual engages in activities that lead to adoption or rejection of the innovation. In this stage the adopter starts to actively seek out information about the innovation that assists the decision making.

4- Implementation stage: In this stage, mental information processing and decision-making come to an end, but the behavioral change begins.

5-Confirmation stage: After the adoption of innovations, the adopter keeps evaluating the results of his / her decision. If the level of satisfaction is significant enough, the use if innovation will continue; however, it is also possible that the rejection occurs after adoption. In the latter case, the reverse of previous decision is called "discontinuance".

The time frames for adopting an innovation can be compressed or fairly lengthy. For example, awareness of an innovation may precede the decision to adopt by months or years. Rogers (1995) has data showing awareness preceding the adoption of hybrid seed corn by about 1.7 years for early adopters and by as much as 3.1 years for later adopters. Further, the decision to adopt and the implementation of the decision may be separate acts and may be separated in time (Reed, Erickson, Ford and Hall, 1996).

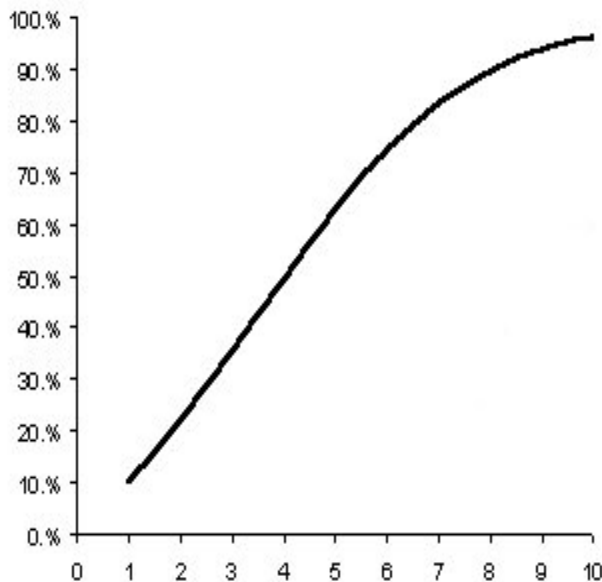
3.2.4.2 Rate of adoption

The adoption literature used more general innovation characteristics for explaining adoption rates (e.g. Roger 1995; Moore and Benbasat 1991). The diffusion and adoption of new ideas and new product often follows S-shaped growth pattern. We have decided to use the Bass model in this part of the rapport.

3.2.4.2.1 Bass Diffusion Model

Bass (1969) proposed and tested an epidemiological model for the diffusion of consumer doables and other innovation. The Bass Model shows you how a new product or idea spreads through the user community. A no uniform

innovation diffusion model for forecasting first adoptions of a new product is proposed. An extension of the Bass model, the proposed model overcomes three limitations of the existing single-adoption diffusion models.



After its conception, an innovation spreads slowly at first - usually through the work of *change agents*, who actively promote it - then picks up speed as more and more people adopt it. Eventually it reaches a saturation level, where virtually everyone who is going to adopt the innovation has done so.

A key point, early in the process, is called *take-off*. After the forward-thinking *change agents* have adopted the innovation, they work to communicate it to others in the society..

Figure 3. 2: The standard Bass curve for the diffusion of innovations over time

When the number of early adopters reaches a critical mass - between 5 and 15% - the process is probably irreversible. According to Rogers the take-off appears when about 10-15 percent of the potential market has adopted the innovation.

Three parameters of the curves are:

- *The market potential*; the total number of people who will eventually use the product
- *The coefficient of external influence*; the likelihood that somebody who is not yet using the product will start using it because of mass media coverage or other external factors.
- *The coefficient of internal influence*; the likelihood that somebody who is not yet using the product will start using it because of "word-of-mouth" or other influence from those already using the product.

An extension of the Bass model, the proposed model overcomes three limitations of the existing single-adoption diffusion models. The current models generally assume that the word-of-mouth effect remains constant over the entire diffusion span. However, for most innovations, the word-of-mouth effect is likely to increase,

decrease or remain constant over time. Word of mouth has been found as a strong bond for effectiveness in interpersonal influence in Bhattacharjee's TPB model (see Bhattacharjee 2000).

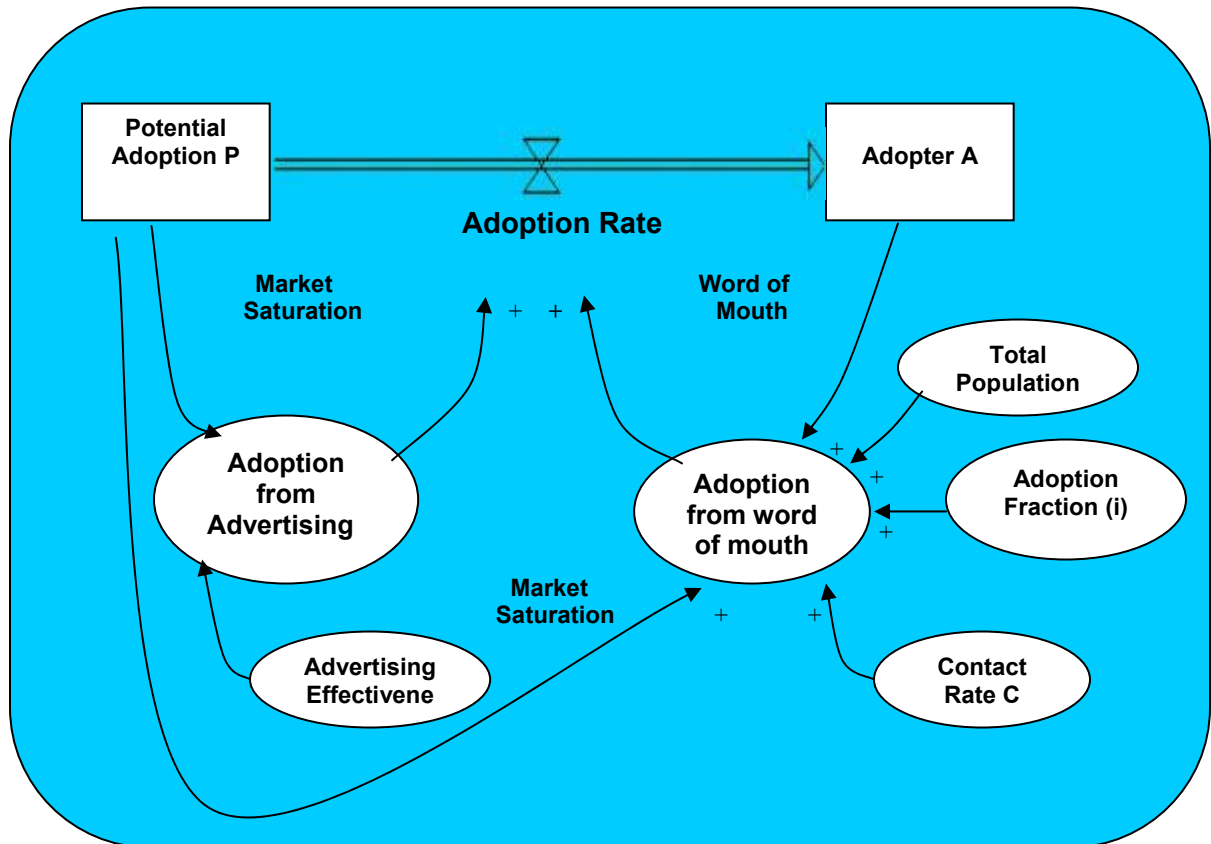


Figure 3.3: Bass diffusion model Adoption factor
Source: Business Dynamic – Sterman, J.

The original Bass model was introduced primarily as a tool for forecasting sales of new products, and Bass did not specify the nature of the feedback at the operational level.

In Figure 3.3 the total adoption rate is the sum of adoptions resulting from word of mouth and adoptions resulting from advertising and any other external influences.

Bass assumed the probability that a potential adopter will adopt as the result of exposure to a given amount of advertising and the volume of advertising and other external influences each period are constant. Therefore the external influences cause a constant fraction of the potential adopter population to adopt each time period.

According to Bass when an innovation introduces and the adoption population is zero, the only source of adoption will be external influences such as advertising. The advertising effect will be largest at the start of the diffusion process and steadily diminish as the pool of potential adopters is depleted.

3.2.4.3 Adoption Segment Categories

Product adoption timelines typically range from a few days or weeks for some, to several decades or longer for others depending on the innovation and the characteristics of the market for that innovation. Adopters are generally categorized into one of five groups: innovators, early adopters, the early majority, the late majority, and laggards

Innovators are a very small group and they pursue technology aggressively. They purchase and use new technologies out of pure interest in the technology.

Early adopters appreciate the potential benefits of technology and will utilize technology when they see that its benefits match their own needs and desires. Both the innovators and early adopters learn about and make decisions about technology based on information received through broadcast channels. Our rapport is about adoption of early adopter behavior and this point is most significant and disputable.

The **early majority** has an interest in technology but is driven by practicality. They will wait and see if a technology delivers on its promises. They will not adopt just because they have been exposed to program information. Also, they want to reference (talk with, work with, know about) others of the early majority, not just innovators and early adopters, before they buy. Thus, getting the early majority on board requires different transformation efforts and a different level of effort than attracting the innovators and early adopters.

Late majority: Skeptical, adopt new ideas just after the average member of a system. The pressure of peers is necessary to motivate adoption. Adoption may be both an economic necessity for the late majority, and the result of increasing network pressure from peers.

The leggend: Traditional, last in a social system to adopt an innovation pays little attention to the opinions of others. When they finally adopt an innovation, the innovators have likely already introduced another idea or technology.

These five categories of adopters form a bell-shaped frequency curve. If the frequency curve is converted to a cumulative curve showing adopter distribution, we then get a classical, S-shaped curve (Figure 3.4).

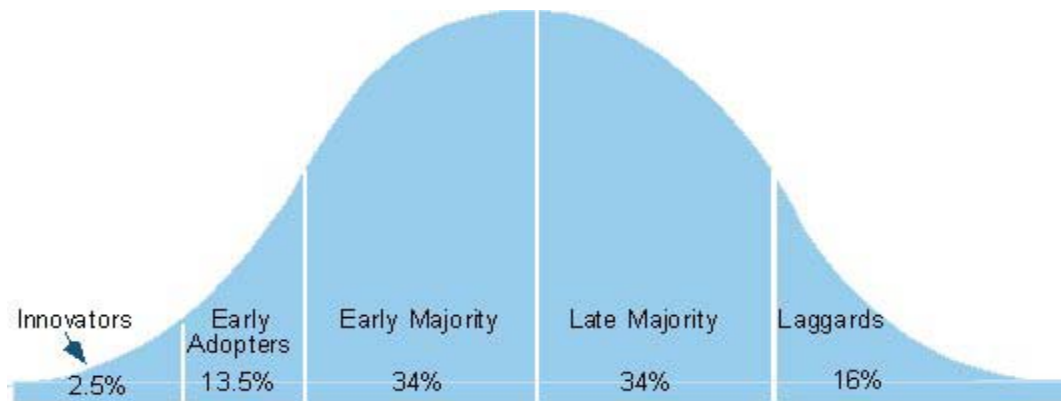


Figure 3.4: Categories of adopters
Source: Rogers (1983) Diffusion of Innovation

Rogers (1983) has developed a detailed profile of "ideal types" for each of the adopter categories on the basis of demographic, socioeconomic, and personality characteristics. The adopter categories are analogous to the grouping of consumers in a market segmentation study.

A considerable amount of research has been conducted to validate the profiles of these adopter categories. The majority part of the model is based on major and discontinuous innovations and examines the correlation between variables such as age, education, dogmatism, social participation, and income with time of adoption. From these studies, Rogers (1983) has developed thirty one generalizations of adopter characteristics. For example, "*early adopters have more years of education than later adopters*". In marketing, these generalizations have been used as the basis of a prescriptive guideline for speeding up the diffusion process.

3.3 The Adoption theory

In this part of our rapport we are going to describe a modification of Technology Acceptance Model to describe usage behavior.

3.3.1 TAM

There have been a number of studies applied to understand end-user as a technology. Among the studies that have been proposed and examined, the Technology Acceptance Model (TAM), originated by Davis (1985), appears to be the most promising. TAM was developed by Davis (1986) to explain computer-usage behavior. The theoretical basis of the model was Fishbein and Ajzen (1975) Theory of Reasoned action (TRA).

TAM has been used in many different researches for its parsimonious, IT-specific, and designed to provide sufficient explanation for and a prediction of a diverse user population's acceptance of a wide array of IT within various organizational context.

TAM has a well-researched and validated inventory of psychometric measurements, making its use operationally appealing. And finally, TAM is a dominate model for investigating user technology acceptance, has a fairly satisfactory empirical support for its overall explanatory power, and has posited individual causal links across a considerable variety of technologies, users, and organizational contexts. TAM provides a quick and inexpensive way to gather general information about individuals' perceptions of a system (Mathieson 1991).

3.3.2 Theory of Reasoned Action (TRA)

Theory of Reason action (TRA) explains the process of adoption of an innovation, which can be a new information system, such as mobile communication. TRA is based on social psychology... "... a person's performance of a specific action is determined by his or her Behavioral Intention (BI) to perform it, which is determined by the person's Attitude (A) and subjective Norm (SN) concerning the action "(Fishbein, M. and Ajzen, 1975).

According to TRA, the attitude towards a behavior is determined by the person's beliefs that the behavior will lead to certain outcomes.

3.3.3 Theory of acceptance Model (TAM)

Technology Acceptance Model (TAM) has been extensively applied and utilized in the studies of technology adoption and diffusion at individual levels (Davis, 1989; Agarwal 1999; Lucas & spilter, 1999; Venkatesh & Davis 2000).

Davis (1989) adapted the TRA model to develop the technology Acceptance (TAM), which is specifically meant to explain computer usage behavior. The basic constructs in TAM are Perceived usefulness and Perception of use. The construct, Perceived Usefulness, means a person's perception of using an information system that benefits him or her in an organizational context.

The other construct, Perceived Ease of Use, can be interpreted as a person's perception of the extent of the effort required utilizing an information system.

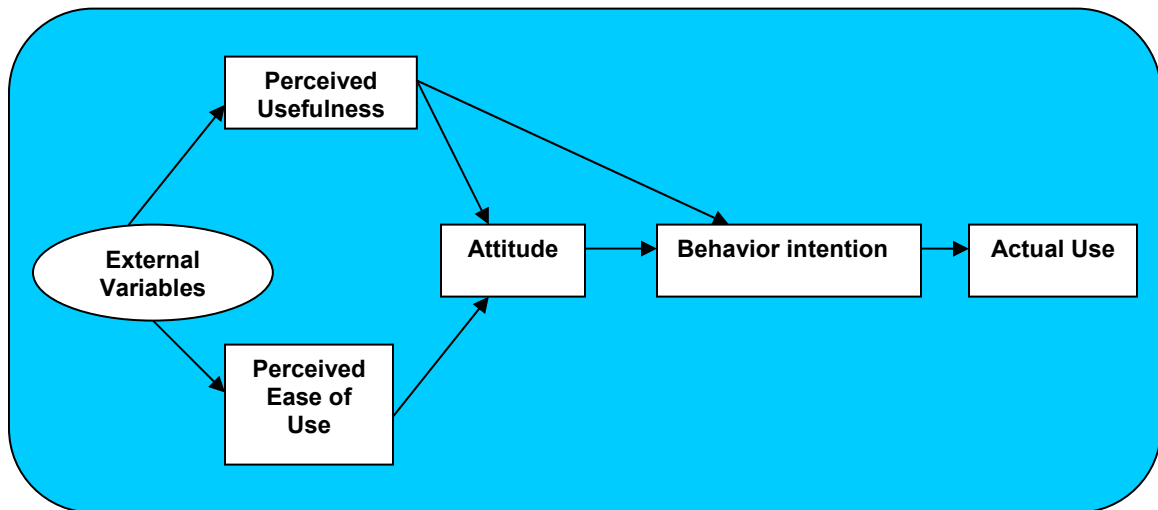


Figure 3.5: The Technology acceptance model (TAM)
 Source : Davis (1986)

With using various theories and models in background, such as expectancy theory, innovation research, and the channel disposition model, TAM supposed that computer usage was determined by behavior intention to use a system, which was jointly determined by a person's attitude towards using the system and its perceived

usefulness (Figure 3.5). This attitude was also jointly determined by both perceived friendliness and perceived usefulness. In addition, both perceived usefulness and perceived user friendliness were influenced by external variables.

3.3.4 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) was an extenuation of TRA theory by Ajzen (1985, 1989 and 1991) to study the adoption intention of people on innovation. Similar to TRA, TPB except an additional construct, Perceived Behavioral Control (PBC), has been added. In fact, TPB was derived with the knowledge from TRA, namely that the behavior of a person is affected by his or her intention to perform something.

Crucial for predicting the behavior of an end-user and a user's acceptance of a system is the knowledge of what attributes or beliefs lie behind a person to construct or formulate the intention. TPB defines intentions in terms of three beliefs structure: attitude (predisposition toward a particular object, event, or act, that is subsequently manifested in actual behavior), and behavior control (perception of internal or external constraints affecting the behavior)(Battachjee 2000).

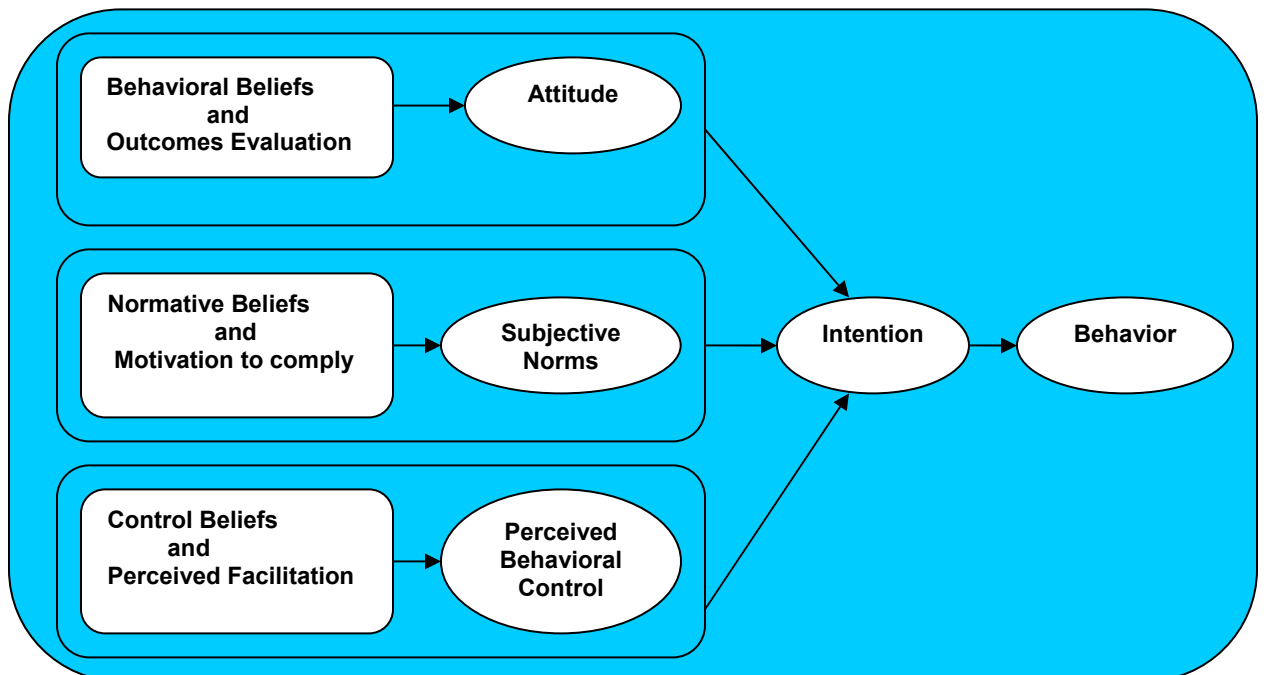


Figure 3.6: The Theory of Planned behavior.
Source: Mathieson 1991

The figure 3.123 postulates that individual's behavior results first from the intention to perform a given behavior. This intention is in turn caused by three central factors described by Ajzen (1991): "1-attitude towards behavior, 2. subjective norms on the perception an individual has about normative beliefs of other norms related to the behavior, and 3- perceived behavioral controls, or the factors believed to be constraining or facilitating an individual's behavior.

TPB was been tested by Schifter and Ajzen (1985), to the prediction of weight loss behavior. Ajzen and Madden (1986) used TPB to predict student's decision about attending class to earn a good grade.

3.4 Social Science Research

The introduction of mall and portable telecommunication devices, connected through cellular networks, had already changed the people organize their social relationship, both at work and at home (Heddon, 1997). Following chapter intends to categorize research conducted in industry research, sociology marketing and mobile information on end-user behavior when adopting mobile services (3G).

Mobile devices hold the potential to transform patterns of information consumption and communication in everyday life, but the potential is only realized through widespread consumer uptake of mobile technologies. The behaviors of the mobile consumer are therefore important in any understanding of the process of technological innovation and diffusion.

3.3.1 Domestication Research:

The term domestication in our study is about how information and communication technologies (ICT) find place in our live. The concept was originally used to provide framework for thinking about ICT in the home rather than portable ones.

3.3.2 Context

Frequently we observe several “distinctions” in end-user behavior of adoption studies. There are a numerous of these studies which has focused in demographic variables and we have found demographic variables are most relative in our study.

Pedersen (2001) divides five conceptual context distinctions in mobile end-user service adoption studies. We found demographic variables most relevant in our study. However some other points have been also explained.

1- Work and leisure. 2- demographic groups. 3- private and public. 4- Dynamic roles (role and identities).

3.3.2.1 Work and leisure: Some studies have focused on the changing in organizational structure that mobile technologies make possible. These can be from changing task and job attributes, to changing relationship of authority. It can also be from control and sociality within organizations to the effect of mobile technology on the work /

leisure (121). As mobile phone have diffused into private and leisure sphere, conception of the mobile conception of the mobile consumer have changed.

3.3.2.2 Demographic groups: Studies have how that individual differences (demographic variables) play in important role in the how information technology is used. Studies in the area marketing have also confirmed the importance of demographic variables (Assael 1981). Demographic variables refer to a broad spectrum of personal characteristics including intellectual abilities, domain-specific knowledge, sex, age, experience, education, professional orientation, and organizational level.

Gender: A review of social networking literature shows that it is woman who often have larger and more complex network (Moore 1990).

On the one hand, it is the responsibility of woman to maintain the ongoing expressive production of the household, the family and the circle of friends. In addition, women rely on their female friends and kin for emotional support. Classie and Rowe report that women use the telephone twice as much as men. Future, the woman is often the “social administrator” for the home via her role as the one that has responsibility answering the telephone. One can go so far as to suggest that to study social network is to study the significance of women’s contributions (Ling 1998).

In contrast to this explanation, early adopters are more likely to be male.

Fashion: Social psychologists study the role of the individual within society, the influence of individuals on social institutions and processes, and the influence of social institutions and process on the individual. When investigating the fashion phenomenon, we soon discover the importance of differentiation in individual fashion adoption. However, most fashion adopters also strive to be similar in their fashion choices to other social groups. Pedersen (2001) argue that theory of fashion should be added in External influence variable.

Many social researchers have looked at the importance of fashion teenage life. From ethno-methodological studies of young people’s local mobile usage in the context of everyday life, to studies of the interaction coordination of young people’s local relationship with their families and each other, emerging research is tracing how mobile communications impact on the lives of young people.

Young people and Adolescent: Typically lead-segments composed of technologically conscious young people. Younger people seem to even desire new technologies and enjoy mastering them, whereas for elder segments new technologies tend to pose some fears. Some researchers discussed about the emphasis on difference between teenagers and other distinction made between young people and other social groups; by implication placing all teenagers in the same identity and behavioral categories, and implying the formation of youth subculture.

According to Alexander (2000) the symbolic identity or fashion and style becomes even more important as a catalyst for social interaction within teen subculture.

In the parents' view, the teenager's mobile handset is acquired because of security reasons, or in order to improve the teen's accessibility to parents.

3.3.2.3 Private and public: Among many interesting social and cultural phenomena that have been resulted from rapid diffusion and utilization of mobile phone in everybody life, one of the most visible is talking private issues in public, like Sony walkman (Shin Ling 1998), studies of telecommunication in restaurant (Ling 1999). Other examples could be public transportation, train and bus, one can easily overhear adjacent passengers phone talk.

According to Ling (1999) boundaries of public and private worlds, the interactions considered appropriate to them and the conventions of behavior encouraged and proscribed within them, are considerably altered by mobile communications.

3.3.3.4 Dynamic: The last categorization of context distinction is as Pedersen (2001) point out "the different between roles in different context and social network". Rogers (2001) defines dynamic consumer as self identifying data: consensually provided, acquired by trickery the click-tail. A mobile phone, for example, could be used for keeping in touch whilst also signifying an image of the use of the kind of person one is wishes to be seen to be. Giddens' (1991) suggestion about the self-identity and how mobile phone can create identity is: "*A self-identity has to be created and more or less continually reordered against the backdrop of shifting experiences of day-to-day life and the fragmenting tendencies of modern institutions.*" .

4. Model

We start to define the differences between IS adoption models to give an understanding to the reason why we choused the structure model.

4.1 Differences between adoption models

It's maybe correct to say that evaluation and comparison of the different theories reveals that they are not so different in terms of their differential predictions. Most differences really amount to emphasis on one construct over another. Drawing upon the theoretical foundation of TRA, Davis (1989) proposed that the theory be specially modified for the domain of IT in form of a now widely accepted interpretation of IT acceptance: the technology acceptance model (TAM). In the TAM, as in the TRA, attitude predicts intention, and intentions predict behavior. Unlike TRA, TAM does not include a subjective norm component as a determinant of intention because of its uncertain theoretical and empirical psychometric status (Davis et al., 1989). Subjective norm can create the direct effects to norm on intentions from indirect effects via attitude (Fishbein & Ajzen 1975). Comparing with TRA, Technology Acceptance Model (TAM) is more oriented to analyze the human behavior on using information system.

TRA and TPB were formulated as generalization of a wide area of individual behaviors, including the use of information technology.

In both theories Attitude is influenced by belief about the consequence of execute the behavior weighted by the individual's evaluation of each consequence. Depended variable of interest in both theories is visible and both posit that behavior is influenced of subjective norms. Attitude and intention have the same definition in both TAM and TPB. Both theories predict behavior from intention. Mathieson also found TAM as a quick and inexpensive in compare to TPB.

Other suggestion about the differences is by Mathieson. Mathieson (1991) found three main differences between TAM and TPB; their varying degree of generality, TAM does not explicitly include any social variables, and finally the models treat behavioral control differently.

Recently have several TPB-based studies found strong correlations among behavioral beliefs (Taylor and Todd 1995). TAM-based studies indicate strong correlation between use friendliness and usefulness, leading Davis et al. to propose a direct empirical link from use friendliness to usefulness.

4.2 The Model

The research model for this study is adopted from Pedersen's model (2001) which is based on TAM plus an extension subjective norm, and TPB model.

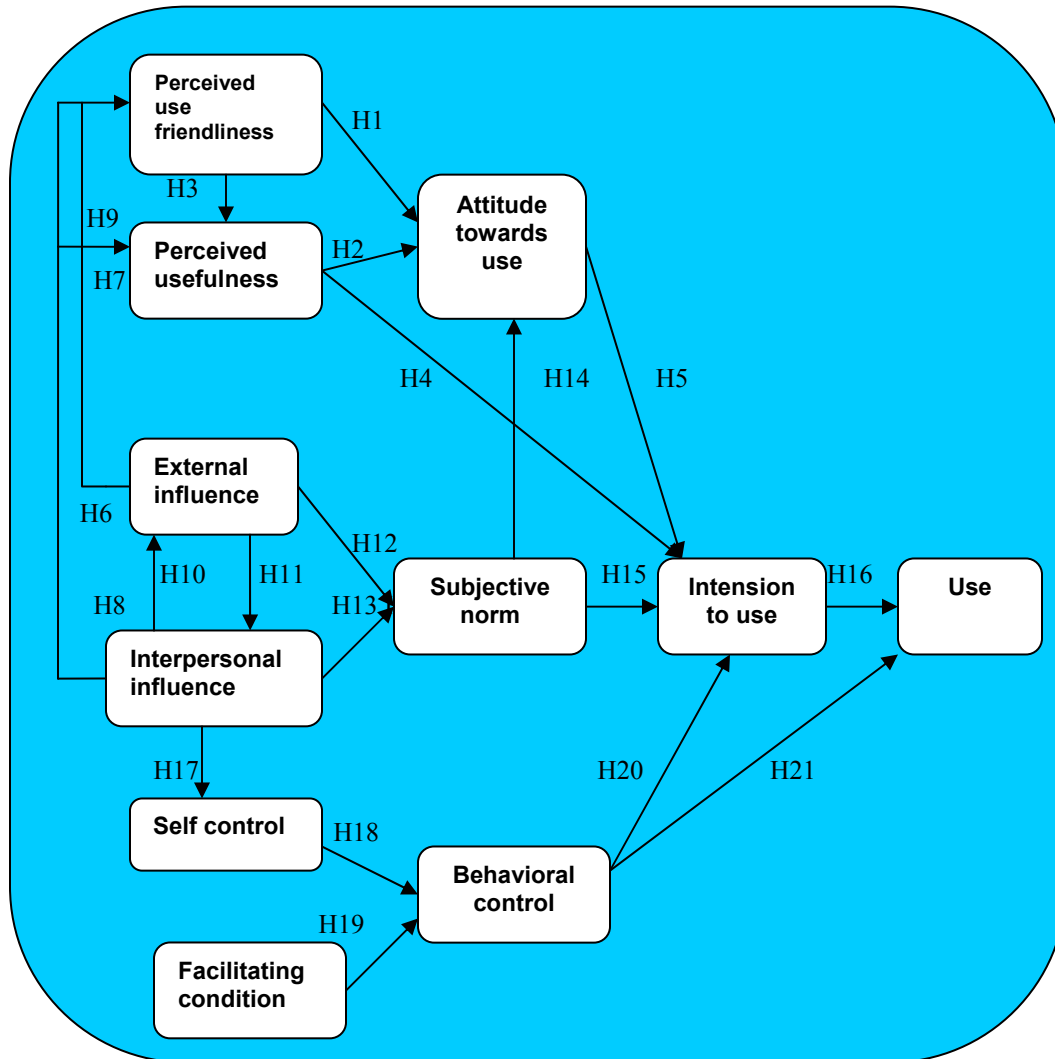


Figure 4.1: Research model and hypotheses.
 Source: Pedersen 2001.

As figure 4.1 noted, Attitude, perceived use friendliness, and perceived usefulness represent TAM model. Subjective norm represent TRA. External influence and Interpersonal influence has effect on subjective norm, as Battarachejee (2000). Behavior control is adopted from TPB model. In this model self control includes self efficacy.

4.2.1 Hypotheses

TAM used in this as the baseline model and results is in following hypothesized relationship:

Hypotheses	
H1	Perceived ease of use has direct effect on attitude.
H2	Perceived usefulness has direct effect on attitude.
H3	Perceived ease of use has direct effect on perceived usefulness
H4	Perceived usefulness has direct effect on Intention to use.
H5	Attitude to use has direct effect on intention to use.
H6	External influence has direct effect on Perceived ease of use.
H7	External influence has direct effect on Perceived usefulness
H8	Interpersonal influence has direct effect on Perceived ease of use
H9	Interpersonal influence has direct effect on Perceived usefulness

Table 4.1 Hypotheses from TAM in the model

TRA was formulated as generalized explanations of a board range of individual behavior, including the use of information. Hypotheses used in TRA are:

Hypotheses	
H10	Interpersonal influence has direct effect on External influence.
H11	External influence has direct effect on Interpersonal influence
H12	External influence has direct effect on subjective norm.
H13	Interpersonal influence has direct effect on subjective norm
H14	Subjective norm has direct effect on Attitude towards use
H15	Subjective norm has direct effect on intention to use
H16	Intention to use has direct effect on Actual use.

Table 4.2 Hypotheses from TRA in the model

Based on TPB, Behavior control has effect on intention to use. Bhattacharjee found facilitating condition had effect on behavior control. In the model self-efficacy is included in self control.

Hypotheses	
H17	Interpersonal influence has direct effect on Self control
H18	Self Control has direct effect on Behavioral control
H19	Facilitating condition has direct effect on behavioral control
H20	Behavioral control has direct effect on intention to use
H21	Behavioral control has direct effect on actual se

Table 4.3 Hypotheses from TPB in the model

5. Methodology

This basic of this chapter is a survey of early mobile services adopters which was sent to discussion forums, news groups and news-servers online. Primary data were collected by means of a questionnaire that was especially developed for this study.

5.1 Introduction

A selection of the survey question was replicated from TAM, TPB and TRA models. In addition the questions designed to measure attitude and intention to technology, the survey included question designed to provide information about demographical variables. A number of surveys of demographic variables were included to provide the behavior towards legal services and questions designed to assess community awareness of the mobile commerce services.

The main aim of the survey was to gather community opinion concerning a range of issues which may affect usage of MCommerce services in world area. Given the reliability of the TAM model's predictive value in other research setting, it was adopted for the evaluation of the mobile commerce service.

5.2 Data collection and procedure

The work of this chapter has been made in collaboration with Professor Per. E. Pedersen. Together we discussed the questions before sending them. The survey database was designed and posted on line by Pedersen (Appendix 1).

Data for this study was collected using a questionnaire survey in which respondents were recruited from discussion forum groups on web or newsgroups on news servers. The four-page survey consisted of a numerous questions; each representing a component of the research (Figure 4.1) the questions were selected for their theoretical importance as well as their potential relevance to practice. From the 579 visited the survey site 232 completed responses were returned.

Individual were asked to indicate the extent of agreement or disagreement with various statements concerning mobile services on a seven –point scale ranging from (1) strongly agree to (7) strongly disagree.

The data collected through the survey was coded to simplify comparative and correlation analysis. Descriptive and comparative analyses were derived using the SPSS's General Table function to reduce table displaying cross tabulations and subgroup statistics, and SPSS's frequency function to summarize the number of times different values of a variable occur.

Forum	N	Newsgroups	N
undefined(0)	9	Alt.cellular(15-18)	6
www.forum.nokia.com (2)	7	Uk.telecom(19-20)	5
www.esato.com (3)	18	De.com(45)	1
www.microsoft.com (4)	10	Dk.marked(24)	1
www.reviewcentre.com (5)	1	Dk.teknik(25)	4
www.wirelessinanutshel.com	9	Fr.reseaux.telecoms(26,27)	1
www.bringthand.com (13)(73-76)	15	No.it.telekom.mobil(28)	11
www.pdastreet.com (14)(77-81)	27	Tw.bbs.ree.mobilecomm(29)	4
www.howardforums.com (47-49)	19	Uk.adverts.telecom.mobile(30)	2
www.pocketpcpassion.com (59)	2	Aus.comms.mobile(32)	8
www.syllas.com (61)	3	Pl.mise.telefonia.gsm (34)	1
clubs.yahoo.com (62-64)	10	Hr.ponuda.gsm (35)	1
www.mobildebat.dk (67)	2	Hr.alt.cellula.gsm (37)	1
debat.passagen.se/mobile (39)	1	Es.technica.redes.telefonia.movi (38)	2
www.forum.siemens.com (69)	2	It.tle(33,42)	1
forum.hardware.no (72)	1	comp.sys.palmtops.pilot (46)	3
www.handyfragen.de (82)	5	Se.sator.sys.handdator (86)	2
cell.exchange.ph (51)	1	Swnet teknikk.elefone (87)	3
forums.internet.com (54)	1	Sfnet.viestinta.matkapuhelimet (91)	5
www.mobilecomputing.com (56)	1	Keitai-L (92)	18
www.popularwireless.com (60)	1	Tokyo-mobile (93)	1
www.itavisen.no (88)	6		

Table 5.1 Forum and news group data base

Table 4.1 shows the all 85 forums where identified Individual were asked to indicate the extent of agreement to disagreement with various statements concerning mobile services on a seven-point scale ranging from (1) to (7) strongly agree to disagree.

Of the users, 90.50% were male, 9.5 % were female. Most of the responded users were between age categories 20-39. Most of them are well educated. This result is indicated in the table above.

Age		Education		Geographical position	
0-19	9.4	Primary / Middle level	1.6	Africa	0.5
20-29	45.8	Secondary / High school	16.1	America (North)	33.9
30-39	31.3	University / college 1-3 yrs	30.7	America (South)	0.5
40-49	10.4	University/college 4 years or more	51.6	Asia	9.9
50-59	10.1			Europe	48.4
60 and above	0.0			Oceania	6.8

Table 5.2: Some dates about demographic variables

According to Roger (1995), there is inconsistent evidence about the relationship of age and innovation adoption. Early adopters there are high educated and mostly men. Our result is in accordance with the Roger's theory about early adopter.

5.3 Measure

In the base of Pedersen's model (figure 4.1) we found 11 items relevant to other study. These items above are defined from those questions in survey, which includes questions in these categories. All measurement scales showed high reliability. Cronbach α was used to assess the reliability of all multi-items scales.

Perceived User friendliness: Perceived "User friendliness" or "ease of use" "refers to the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p.320). Davis et al. (1989) identified ease of use as an important determinate of system usage. A construct that is the opposite of perceived user friendliness is complexity which is defined by Rogers (1995).

Perceived usefulness: Davis (1989) defines perceived usefulness as "the degree to which a person believes that using particular system would enhance his or her job performance (p. 320).

Attitude toward use: Davis et al. defines Attitude to using a system as "the degree of evaluative affect that an individual associate with using the target system in his / hers job". Attitudes can be conceptualized in terms of values. That is individual develops particular values about behaviors.

Both Perceived usefulness, perceived userfriendliness, were measured using from Davis (1989). Attitude to used was measured by the both Davis (1989), Todd and Taylor (1995) and Battacherjee (2000). These Three items are basic for TAM model, and were measured in five items. As table 4.1 shows, reliabilities for these three items are almost like.

User friendliness	Usefulness	Attitude towards use
Learning use mobile commerce service is easy to me	Using mobile commerce service makes me save time	Good / bad
It is easy to make the mobile commerce service is clear and understandable	Mobile commerce service make me a better consumer	Wise / foolish
My interaction with mobile commerce services is clear and understandable	Using mobile commerce service improves my efficacy as a consumer	Favorable / unfavorable
I find it easy to interact with mobile commerce services	Mobile commerce services are useful to me as a consumer	Beneficial/ harmful
I find it easy to use mobile commerce services	Mobile commerce services increase my effectiveness as a consumer	Positive/negative
$\alpha = 0.92$	$\alpha = 0.92$	$\alpha = 0.91$

Table 5.3: Measure of the TAM part of the model

Interpersonal and external influence: Roger (1985) states: channels can be classified as mass-media or interpersonal, and that in general, interpersonal communication channel are more efficacious for the development of perceptions about the innovation. Bhattacharjee's definition about *external influence* and interpersonal influence is as: "External influence refers to mass media reports, expert opinions, and other *non-personal* information considered by adopters in making a "rational" acceptance decision, while interpersonal influence refers to word-of-mouth influence by friends, colleagues, superiors, and other prior adopters known to the potential adopters" (Bhattacharjee 2000).

Subjective norm: Defined as "person perception hat most people who to him think he should or not should perform that behavior in question "(Fishbein and Ajzen 1975, p. 320). Subjective norm reflects the perceived option of referent others. "Referent other "is people or group whose beliefs many important to the individual.

Measure of the interpersonal influence was adopted from Taylor and Todd (1995). Measure of external influence was measured by the Bhattacharjee (2000). The measure of subjective norm was based upon on Mathieson (1991) and Bhattacharjee (2000).

Bhattacharjee (2000) states both External influence and Interpersonal influence have influence to subjective norm.

External influence	Interpersonal influence	Subjective norm
Media is full of reports, articles and news suggesting using mobile commerce service is a good idea	Almost all of my friends use mobile commerce services	People important to me think I should use mobile commerce services
In my profession it is advisable to use mobile commerce service	My friend/colleagues think that we should all use mobile commerce services	People whose opinion I value prefer me to use mobile commerce service
$\alpha = 0.71$	$\alpha = 0.86$	$\alpha = 0.93$

Table 5.4: Measures of the subjective norm

Self control:

Someone's ability to get things done when it is need, commonly called self-control. In our study we use Pedersen's (2002) definition as: "self control is related to time dependence when an individual chooses not to consume something today because the utility is believed to be higher from consuming the good at a later point in time.

Self efficacy : The concept of self-efficacy is recognized as one of Bandura's most important contributes to psychology and field of health behavior change in general. (Bandura 1977). According Bandura (1997, 1986) self-efficacy is a belief in one's capability to perform certain actions, is a major determinate of choice of activities, degree of effort, period of persistence, and level of performance in the face of challenging situation.

Facilitating condition: with facilitating control we mean belief about availability of resources to facilitate that behavior. This includes ...

Behavioral Control: Perceived behavioral control refers to people's perception of their ability to perform a given behavior.

Both Measures of self-control and self efficacy and behavior control was adopted by Bhattacharjee (2000) and Taylor and Todd (1995). The Cronbach's α value for the TPB part of the model is also given in table.4.4

Concept	Cronbach's
Facilitating control	
I am given the necessary support and assistance to use mobile commerce service	
I have financial and technological resources required to use mobile commerce service	
I have access to software, hardware and network services required	
The mobile commerce services I use are well integrated and provided in a stable service infrastructure	
My service provider / operator facilitating the use of mobile commerce service	
There are no compatibility problems related to the mobile commerce services I use	$\alpha = 0.82$
Behavioral Control	
I feel free to use tat kind of mobile service I like to	
Using mobile commerce service is entirely within my control	
I have the necessary means and resources to use mobile commerce services	$\alpha = 0.82$

Table 5.5: Measure of the TPB model

Concept	Cronbach's
Self-Control	
I am able to use mobile commerce services without help of others	
I have necessary time to make mobile commerce services useful to me	
I have the knowledge and skills required to use mobile commerce services.	
I am able to use mobile commerce services reasonably well on my own	$\alpha = 0.86$
Self efficacy	
Generally speaking I want to do what my friends think I should do	
Generally speaking I want to do what my superiors think I should do	
My friends / colleagues and I use the same kinds of mobile services	$\alpha = 0.89$

Table 5.6: Self efficacy and Self control measurement

From the results we found out that self efficacy and self control has separate measurements.

Component	Self1	Self 2	Self 3	Self 4	Self 5	Self 6	Self 7
1	0.84				0.77	0.86	0.86
2		0.86	0.83	0.74			

Table 5.7 Components of Self-control items

As the table 5.7 indicates, self efficacy has and self control has different measurement. It means that self-efficacy should be seen separated from self-control. Therefore we added self efficacy as a new items in the structural model.

The measure of actual of use and intention to use by using 30 mobile commerce services organized along the consumer life cycle. Table 5.8 shows the three questions which has been of highest attentions among adopters.

Actual use	
Direct product / service download/ buying to mobile device (ring tones, logos, music download)	51.3
Searching "yellow pages" or other commercial directory using a mobile device	39.1
Alert service related to commercial matters such as offers, warnings etc.	37.4

Table 5.8 Actual use

As we see from the table, downloading logos and music have been most important in our result from the survey.

6. Result & Analysis

This analysis chapter starts with statistical result from the survey. The chapter continues an overreaching analysis from the result from the survey. Later we discuss about the decomposed model which is a result from the statistical result in chapter5.

6.1 Result

Once the proposed measurement model was consistent with the data, the hypothesized structural paths where estimated. The result of the multivariate test of the structural model is presented in Tables 5.1. The table shows the path coefficient which is standardized regression coefficient.

The data set involved responses from users of Microsoft word (chi-square/ degree of freedom, goodness-of-fit index (GFI), adjusted goodness-of-fit index (CFI), and root mean square residual (RMSR) were used as measures for goodness of fit. The literature suggest that, for a good model fit, chi-square degree of freedom should be less than 3.0, GFI, NFI, NNFI, and CFI should be greater than 0.90, AGFI should be greater than 0.80, and RMSR should be less than 0.10 (12,33).

Research model evaluation involved the assessment of the structural model. For this task, the data obtained was used to test 21 hypotheses of this study as well as to investigate related issues.

6.2 Demographic variables

General demographic variables such as age, gender, education, income, etc have a relationship with the way people make us of product, service and facilities that are available for them in their environment. In this part of our paper will we discuss the result from the survey table 5.2, and 5.3.

6.2.1 Age

In contrast to importance on age in adoption studies, we haven't found a significant result in age category. However the most significant observation from the result was on age category 20-29 and 30-39.

	N	Mean
Actual use		
20-29	104	7.78
30-39	101	7.30
Intention to use		
20-29	103	14.90
30-39	84	15.36
EOU		
20-29	101	24.13
30-39	98	23.40
Usefulness		
20-29	102	23.72
30-39	97	22.56
Attitude		
20-29	103	13.10
30-39	101	13.77
Subjective Norm		
20-29	101	9.90
30-39	98	9.53
Behavior Control		
20-29	101	15.36
30-39	84	16.19

Table 6.2 Result from Ages in Demographical Variables

As the table 6.2 shows there's not much differences between the adopters actual use, intention of use, ease of use, usefulness, attitude and behavioral control. The differences are less than can be disputable. However our result supports the theoretical definition.

According to Roger (1995), there is inconsistent evidence about the relationship of age and the innovation adoption. He notes that about half of the studies on the subject show no relationship. Neither Sindi (1992) nor Lucas (1975) found that age had no direct effect on attitude and intention toward using the system.

Roger's adoption segment theory explains early adopter as mostly men, high educated and youth. Our result supports this theory. As the table 5.3 shows the highest percent in age category are 20-29 and high educated.

6.2.2 Continents

While 33.9 percent of our responded were from North America, result from Europe indicated more significant in our study. About half part of the responded was from European countries, which mostly are from North Europe.

	N	Mean
Actual use		
Europe	92	7.34
US	63	8.06
Asia	19	8.74
Intention to use		
Europe	91	15.41
US	62	14.87
Asia	19	16.42
Attitude		
Europe	92	13.55
US	62	13.35
Asia	19	12.79

Table 6.3 Geographical Continent

There have been some researchers about “why US teens are slower to adopt cell phones than their European and Japanese peers. “ The statistical numbers of adopters in Japan and Europe are almost the same while in US we observed a much lower percentage. In Finland 90 percent of teens between the ages of 13 and 18 own mobile phones.

According to NTT DoCoMo, In Japan over 70 percent of its I-mode revenues is received from users in their teens and early 20s. In the US, only 25% of those aged 10-19 use mobile phones. Our results indicate the same among the early adopters; 92 responded from Europe, 63 from US.

As the table 6.3 shows, most of those who responded are from Europe and US. There is a much larger number of European and American responded compared to Asia.

When we tried to find out the reason for the difference in our results between them, we found some distinctions in the Europeans and Americans norm, and culture. People are part of a system of value norms and attitudes that are part of the larger culture of their country. As attitude and culture values change rather slowly, they are an important factor to take into account when introducing new technologies. Our result indicates that that European mobile phone user's has the highest number of user among early adopters.

One of the reasons for mobile user is development in technology standards. In Europe and Japan GSM has become the dominant standard, and where services can be used more consistently across standards. Among factor which made SMS successful in Europe and Japan may be that the mobile messaging standard has not been defined in the US as it has been elsewhere. In Europe SMS is a part of GSM and in Japan I-mode had the same role. Our results indicate that the percentage of intention to use in Asia is more than other places.

In addition, the development of mobile services and application is happening in Europe and Japan, not in US. We were actually expecting that responses from Asia could be more since Japan and East Asia has the most subscribers in the world. We believe that language is among the factors since the database was designed in English. However Actual use and intention to use were been most supported by Asia's users.

6.2.3 Gender

As the table 6.3 notes, there is a much larger number of men respondents compared to women. While it may be necessary to balance gender equity principles with differences to rural cultural attitudes, it is important to maintain the focus on women's need and access if the mobile commerce is to meet it objectives.

Women's readiness to seek legal information and advice depends on their ability to define personal problems as legal issues, their awareness of their legal rights, and their familiarity with the legal systems. Similarly, community members' readiness to adopt new technologies may depend on awareness of technology and training in its use.

Our result indicates that early adopters are mostly men (90.5% men, 9.5% women). We believe that in later stage (late adopter) women role will be more significant. This suggests a need for awareness raising and training in the use of mCommerce

6.3 Hypothesis testing

Many of models hypothesized relationships are supported. The result shows parviz relationship between items. We believe that the main result of the parviz relationship is not far to results by multivariate test.

Hypotheses	Beta (β)	(R) ²	t-value
1	.26**	.07	3.77
2	.49**	.24	7.89
3	.41**	.17	6.22
4	.46**	.22	7.07
5	.46**	.21	6.99
6	.096	.04	1.29
7	.44**	.19	6.81
8	.096	.01	1.29
9	.20**	.04	2.74
10	.41**	.17	6.11
11	.41**	.175	6.11
12	.46**	.21	7.17
13	.54**	.29	8.48
14	.28**	.08	4.14
15	.28**	.08	3.88
16	.38**	.14	5.50
17	.56**	.31	9.04
18	.024	.00	0.33
19	.56**	.31	8.81
20	.53**	.29	8.52
21	.25**	.06	3.47

Table 6.4 Hypotheses testing

R² values represent the percent of the variance of the particular dependent variable that is explained by the antecedent variables.

Figure 5.1 illustrates many of the significant structural relationships among the study variables. Consistent with hypotheses H1, H2, perceived of usefulness and perceived ease of use both has a positive relationship with attitude toward use. In addition H3 is positive as expected. In TAM part of the model perceived usefulness has the strongest direct effect, and it's attitude toward use.

Consistent with hypotheses H10 and H11 External influence and interpersonal influence has mutual positive relationship.

Attitude has effect on intention to use as it does in TAM model (H5)

Both H7 and H9, external influence and interpersonal influence have strong direct effect to perceived usefulness. Inconsistence with expectation Interpersonal influence (H8) has no significant effect on perceived ease of use, In addition External influence relationship with perceived ease of use (H6) were no significant.

External influence and internal influence has effect on subjective norm, as it did in Bhattacharjee (2000). We found H15, H16 positive as it does in TRA.

Subjective norm has effect on attitude (H14), as interpersonal influence does to self control (H17).

Contrary to expectation, self control has no significant effect on behavior control. When we tested the result we found self control's effect on subjective norm was significant ($R = 0.24$). We tested self-efficacy; we found the effect on behavior control was significant. ($R = 0.425$).

As expected behavior control has positive relationship with both intention to use and use (H20, H21). Facilitating condition's effect to behavior control is also strong.

6.4 Model Analysis

Intention of use been recognized as an important mediator in the relationship between behaviors and other factors such as attitude, subjective norm and behavior control (Ajzen and Fishbein 1980, Ajzen 1985). The path from the intention to use to attitude was significant.

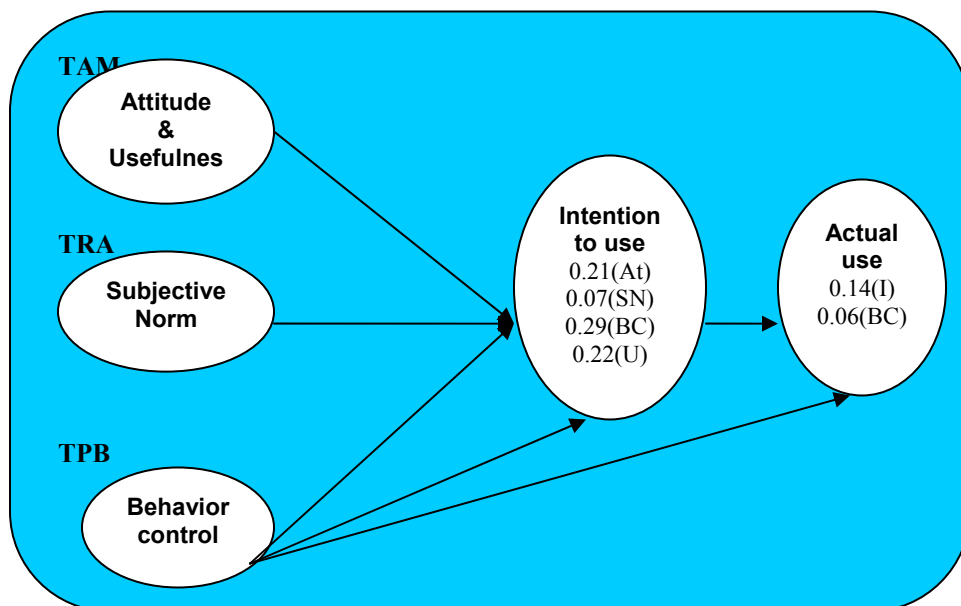


Figure 6.7 TPB model. Intention to use analysis.

Intention was predicted by attitude and behavior control, but not subjective norm. This suggests that social pressure did not influence early adopter's decision to use mobile phone. Behavior control had a slightly stronger effect on intention than attitude.

Intention of use has long been recognized as an important mediator in the relationship between behavior and other factors such as attitude, subjective norm and behavior control (Ajzen and Fishbein 1980, Ajzen 1985). Our results show that the path from behavior control to intention to use was the most significant in the model.

When it's about TAM, previous studies employ attitude and belief about ease of use and usefulness to explain intention to use. Similar to previous finding the results reinforced the role of perceived and ease of use as fundamental driver. The results from ease of use ($R = 0.26$) and usefulness ($R = 0.24$) on attitude, was almost the same.

TAM allows a direct link from perceived usefulness to intention to use. As the figure (6.2) notes, Perceived usefulness has a significant effect on behavioral intention through both perceived usefulness and attitude ($R = 0.22$).

Indeed, neither Davis et al (1989) nor Mathieson (1991) found a significant influence of subjective norm on intention to use. Our results show the same ($R = 0.07$). Subjective norm is influenced by external influence and Subjective norm is influenced by external influence and interpersonal influence. Our result shows that Interpersonal influence has stronger effect on subjective norm ($R = 0.29$) than External influence ($R = 0.21$). This includes word of mouth which we believe is important in the relationship interpersonal influence. According to Roger (1985) social pressure, has stronger influence in early and late majority period of adoption.

The result wasn't any surprising. We believe that Interpersonal influence and external influence is not significant in early adopter stage of adoption. This also suggests that social pressure did not effect early adopter's decisions to use mobile phones.

Behavior control has the strongest effect on intention to use ($R = 0.29$). This includes self-efficacy and facilitating condition. Self efficacy and facilitating conditions, has a strong indirect intention to use. Several factors influence individual's self-efficacy, including persuasion by others, observing other' behaviour (modelling), previous experience with performing the behavior, and direct physiological feedback.

Among factors which influence an individual's facilitating condition is security on the mobile internet, the price for available services. Other significant factors are development on technological and applications on mobile service. Roger's theory about compatibility in innovation characteristics can also be seen as a factor in TPB's facilitating condition.

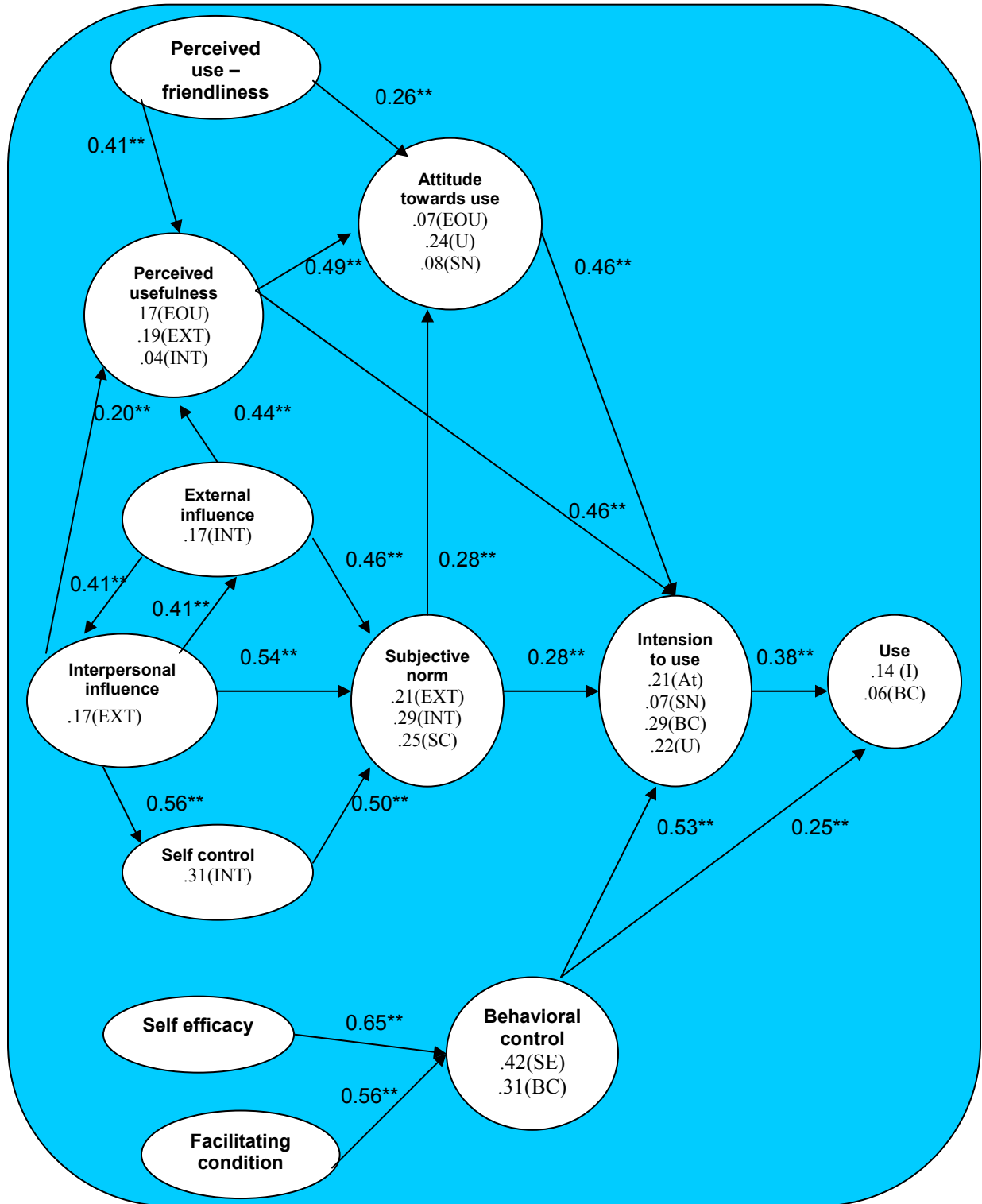


Figure 6. 2: Decomposed TPB model.

Table Path significance: $p < 0.05$ *, $p < 0.1$ **

7. Conclusion & Discussion

The conclusion of the study will present a summary of the all chapters. Discussion part of this chapter contains the evaluation of results.

7.1 Conclusion

This paper is a study conducted to test a theoretical model of MCommerce adoption and use. The technology acceptance model examined here is valuable in understanding and explaining how users' perception affects their motivation to use mobile phones. In general, the result suggests that Behavior control and later, Attitude are the most significant factor that affect early adopters to use the mobile phones.

In chapter 2 we described what MCommerce services. We believe that advances in wireless technology, application and services, which are among factors in facilitating condition concept, will increase the number of devices and consumers. The shift in technological advances, thus directly affects the user experience.

Current models of technology acceptance have their roots in different theoretical perspectives, most notably Innovation Diffusion Theory (Rogers 1983) which can be expected to influence user adoption of the technology. We found some links between diffusion models (Rogers's theory and Bass models) and acceptance models. Our theoretical chapter provides an overview off the various theoretical lenses through which prior research has approached the problem of individual acceptance of information communication technologies.

In the present study, no significant differences are found in the responses provided by age groups or by gender. However the early adopting groups will includes mobile professionals and youth. Our theoretical research seems to support this nation, since these groups are highly domain specific innovative. Most of our survey visited was from Europe and later US. Subscriber of mobile internet in US will increase when it becomes as a standard in the country.

The conclusion of this study is not revolutionizing finding that could be summed up in two or three point. However, many interesting aspects have been found.

7.2 Discussion

The research shows that perhaps the most important factor in MCommerce adoption is the individual's behavior control, mainly represented by self-efficacy and facilitating conditions.

The findings indicate that perceived usefulness is a key intervening variable linking the exogenous variables external influences, attitude and intention to use. The importance of perceived usefulness is further illustrated by its direct effect on intention to use. In addition, our results suggest that there is no direct relationship between perceived ease of use on intention. The individual's intention to use mobile commerce depends on usefulness and attitude, not how easy the mobile phone is to use. In other words mobile phones are self explanation and easy to use.

Perhaps one of the most interesting results from this study was to separate self-control and self-efficacy. Later we found a link to behavioral control and subjective norm. Self-efficacy explained the most variances in behavioral control, and facilitating condition after it. Taylor and Todd (1995) found stronger effect size for facilitating condition. When we tested self-efficacy's relationship to behavior control we found ($R = 0.43$, $Beta = 0.66$).

Our result supported both H20 (link between Behavior control to intention of use) and H21 (link between Behavior control to Actual use). Previous research, including Mathieson (1991) and Taylor and Todd (1995), did not compared link between behavior control and intention to use assess the explanatory power above and beyond the usefulness to intention link.

The result indicates that Subjective norm has no strong effect to actual use. We also found a link between behavior control to actual use but it was not significant. Our result has a little explanation for Actual use in the model. We believe that this is a lack in this study which should be working on later.

Among other lack which we found during writing the report are the in demographical variables. The lack in this part of the study is that many users in Asia couldn't answer the survey because of the language. Since this exception is because of the most of subscribers of mobile internet are in east-Asia. Result in demographical variables, explains little about women's attitude and intention to use. In other words this study doesn't explain women's motivation to the mobile phone use.

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Acronyms:

3G	3 Generation of Mobile Network
B2B	Business to Business
B2C	Business to Consumer
E- business	Electronic Business
EDGE	Enhanced Data Rates for GSM Evolution
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
ICT	Information Communication Technology
IT	Information Technology
IS	Information System
PDA	Personal Digital Assistant
SPSS	Statistical Package for the Social Sciences
TAM	Theory of Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UMTS	Universal Mobile Telecommunication System