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An empirical study on the adoption of information appliances with a focus on interactive TV

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Abstract

Home-style information appliances are expected to increase in number and variety rapidly in the near future. User adoption of new technology for information appliances may be different from adoption of other technologies in that the appliances are mainly used at home by consumers who have never encountered such technology before.

We developed a theoretical model of technology adoption specific to interactive TV, a representative example of information appliances, based on prior research regarding general technology acceptance. We also conducted a large-scale online survey to test the validity of the proposed model. The results from pretest and pilot studies indicated that measures for the proposed model met content validity, reliability and construct validity. Finally, results from LISREL analysis indicated that three factors influencing behavioral intention were attitude, subjective norm and perceived behavioral control. Attitude was influenced by attitudinal belief, which could be measured by perceived usefulness, trialability, result demonstrability, image and enjoyment. Subjective norm was influenced by normative belief, which could be measured by belief from family and belief from friends. Perceived behavioral control was influenced by control belief, which could be measured by rapidity of change in technology, cost and ease of use. This paper concludes with statements of implications and limitations of the study results.
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Keywords: Technology adoption; Information appliance; Interactive TV; Behavioral intention; Attitude; Subjective norm; Perceived behavioral control

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1. Introduction

The environment for information technology is changing from focus on the personal computer (PC) to the post-PC era (Bergman, 2000; Hennessy, 1999). The post-PC era implies that accessing information no longer means sitting in front of a computer screen, but carrying out this process at any time in any place through the use of a wide variety of platforms (Norman, 1998). For example, it will be possible to look up the perfect recipe and lay it out in front of you in your home kitchen by connecting to the Internet using a platform installed in your refrigerator. Or you will be able to watch TV from the comfort of your couch and at the same time purchase the costume of the star you are viewing at that very moment.

Computer devices that make possible information activities by adding network functions to home appliances are referred to "information appliances" (Norman, 1998; Mohageg and Wagner, 2000). Using a definition of "appliance" as a tool designed to perform special services in the home environment, Norman defined the information appliance as a specialized appliance conveying information, including for example knowledge, photos, movies or sound (Norman, 1998). Based on the definition of a traditional appliance, Mohageg and Wagner suggested that an information appliance is an extended computer device that can enable a user efficiently to carry out a limited series of activities (Mohageg and Wagner, 2000). Within such parameters, Lewis defined the information appliance as a networking appliance or a computerized appliance Lewis, 1998.

Among the many available information appliances, interactive TV is representative since it utilizes a network added to a TV, which is the representative form of the home appliance. For example, Vos defined interactive TV as a home television with interactive functions in which the TV meets interactive technology (Vos, 2000). At Independent Television Commissions (ITC), interactive TV was defined as a service that allows the user to select all available information and enables one to 'pull' the selected information at any desired time in terms of the contents a person wishes to see and also in terms of control levels regarding viewing time (2000). Therefore, interactive TV can be characterized as a representative information appliance using interactive service through a network.

Many experts take a very optimistic view of the growth capability of the interactive TV industry (e.g., Kim, 2001a,b,c; O'Brien, 2001). The domestic market size in Korea is estimated to be 0.2 million in 2001, 0.4 million in 2002, and over 2.5 million in 2005 (Kim, 2001a,b,c). In addition, the international market is expected to achieve continuous high growth in the range of 22 million in 2001, 88 million in 2003, and 259 million in 2005 (O'Brien, 2001). This expectation matches research results from Strategy Analytics, which show that 38 million people in the world will use interactive TV by year 2003 and 265 million by year 2005 (O'Brien, 2001).

Although interactive TV has a strong potential to be the representative information appliance of the future, Internet TV, a predecessor of interactive TV, have failed in the market (Kim, 2001a,b,c). Internet TV was a service that allowed people to use the Internet through a set-top box connected to a traditional TV (Kim, 2001a,b,c). It has been argued that Internet TV was not accepted by users because its

marketers did not understand what users wanted from the new technology. This experience carries implications that, if the way consumers accept a technology is not well understood beforehand, even a great technology and an innovative product can easily fail in the real world.

In particular, users behave with motives different from those regarding existing technologies in that an information appliance involves the advent of a technology which has never before appeared and in that it must be accepted not in business circumstances but in the home surroundings. What affects a user's technology adoption behavior has been much studied in the field of management information systems (Adams et al., 1992; Chang and Cheung, 2001; Davis, 1989; Karahanna et al., 1999; Segars and Grover, 1993; Venkatesh, 2001), in marketing (Babin et al., 1994; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982), in social psychology (Fazio et al., 1982; Zanna and Rempel, 1988), and in organizational behavior (Ajzen, 1991; Fishbein and Ajzen, 1975). However, a scientific study that suggests an appropriate technology adoption model reflecting all the features of a home appliance that has not entered into use has never before been conducted. Lack of study specific to the information appliance is detrimental to the potential market success of interactive TV, since interactive TV has many features that differ from office computers used for general business purposes. First, information appliances are different from existing information technologies usually utilized in the business environment because such information appliances are mostly used arbitrarily in the home environment. In such a situation, the use of information appliances must be enjoyable and pleasant in addition to being effective and efficient (Babin et al., 1994). Second, the population group that has impact on the adoption decision is not a commercial or institutional organization such as a company or school, but friends and family at home (Randolph, 1999). Friends and family that are formed within any social system is quite different from an organization formed for purposes of profit and managerial efficiency. Finally, because of spending priorities and their relationship to information appliances in the home economy, it is very important to consider cost and risk factors regarding purchase of information appliances (Venkatesh, 2001). Thus, because information appliances differ from existing information technologies in the above three important ways, and because people have different behavioral intentions regarding different technologies, the adoption behavior toward information appliances will appear unlike existing adoption behavior toward technology in general (Yang and Choi, 2001). It is necessary to understand these differences clearly in order to help concretely in the process of developing interactive TV technology and its marketing by manufacturers. In order to make the differences more explicit, our research model includes the elements presented by Venkatesh (2001) that were found to influence technology acceptance in home environment and those presented by Karahanna et al. (1999) that were also found to influence perceived behavioral control.

Our main research question is what the critical factors are for people to adopt Interactive TV. We believe that Interactive TV may have different critical factors compared to conventional information systems because it is mainly used in home environment and it has never been used before. Thus, the primary objective of this

study is to propose a new technology adoption model that can be adapted for the potential user in home circumstances, with a focus on interactive TV. To attain this objective, a new model specific to interactive TV adoption behavior was proposed based on prior research in information systems and marketing. The newly proposed model was then verified empirically through a survey of potential users of interactive TV. We also provided practical implications regarding what factors must be focused upon in order to influence the behavioral intention of a user's adoption of the technology when a new home appliance is developed and presented in the marketplace.

This paper consists of four sections. The first section explains briefly the information appliance and interactive TV. The second section describes the theoretical background of the technology adoption model. The following section explains the procedures and results of the survey. Finally, this paper ends with a discussion of the results of our research.

2. Technology adoption model

As shown in the definition of the information appliance, this technology can be understood as a kind of information technology from the perspective of the fusion of computer and network functions with existing home appliances. For example, interactive TV is a fusion of existing TV, the information processing functions of a computer, and the networking functions of the Internet. An information appliance such as interactive TV, therefore, can be regarded as a representative example of convergence, the most important phenomenon among recent trends in information technology (Wirtz, 1999). This means that the difference between information appliances in homes and information systems in corporations is no longer as wide as in the past. It is therefore important to investigate prior studies of technology adoption regarding information technology in order to identify factors affecting technology adoption behavior toward information appliances. These studies presented important variables affecting general technology adoption, although they were not models reflecting the features of information appliances specifically.

Among the studies concerned with technology adoption behavior, the first model to reveal the fact that human behavioral intention is affected by personal attitude or social norms was The Theory of Reasoned Action (TRA) of Fishbein and Ajzen (1975). But the TRA model reveals a weakness, in that somewhat abstract concepts such as "belief and evaluation" were used as factors influencing attitude. Davis suggested the Technology Adoption Model (TAM), which provided more concrete concepts such as "perceived usefulness of system" and "ease of use" as factors influencing the adoption of information systems (Davis, 1989). However, TAM does not include social factors which may have important influences on attitude. Accordingly, many models to supplement TAM have recently been proposed. For example, Malhotra's study, which claimed that social factors influence behavioral intention in technology adoption, added social affection to TAM, and consequently proposed a new model which adopted the advantages of both TAM and TRA

(Malhotra and Dennis, 1999). Kwon and Chidambaram also added a variable, "delight," as a factor influencing technology adoption behavior (Kwon and Chidambaram, 2000). Their study implied that, similarly to external motives (i.e. perceived usefulness), internal motives (i.e. delight and enjoyment) exerted great influence on actual technology adoption behavior.

In addition, Ajzen proposed a Technology of Planned Behavior (TPB) model in attempting better to explain human technology adoption behavior. According to his model, personal or external factors are important to promote or control the result of technology adoption behavior. However, the TPB model has a demerit in that it does not exhibit sub-constructs to measure these factors in a concrete way.

All the above research models were examined only with real users using specific technologies at the time of research. However, to predict technology adoption behavior for a never-before-used information appliance, such as interactive TV, a new model of technology adoption behavior for potential users is required. Karahanna et al. (1999) recognized that potential users are different from real users. To demonstrate the difference between the behavioral intentions of potential users and of real users, he applied the same technology adoption behavioral model to both and carried out a survey (Karahanna et al., 1999). In the results, they established that the behavior of potential users is quite different from that of real users. However, their model was verified only in a commercial organization environment similar to those utilized for other research models above. For example, as normative beliefs $\times$ motivation vomply (NBMC) factors, which influence technology adoption attitude, they used the effect of the CEO, the supervisor, the MIS department, and local computer experts; but those variables are applicable only in business circumstances. To explain technology adoption behavior in home surroundings, it is imperative to change the measures of most constructs and adjust them to home surroundings.

With the intention of adjusting the TPB model to home surroundings, Venkatesh (2001) collected qualitative data through phone interviews. On the basis of those data, he identified and arranged important variables which influence technology adoption behavior of home appliances. However, his study has a limitation in that those variables were not designed to be clear in their relationship to whatever practical influence they exert on adoption intentions toward information appliances.

In summary, most studies of existing technology adoption models have been processed with a focus on real users and business environments. Those studies have not considered two important factors for information appliances: potential users and the home environment. Thus, with these technology adoption behavior models, it will be very difficult to construct direct forecasts of technology adoption behavior regarding information appliances.

Because the definition of information appliance was originally derived from that of home appliance, the use and environment of information appliances resemble those of electric home appliances. The technology adoption behavior for electric home appliances appears to be unlike that for appliances in business surroundings. The nature of the use of the technology, and attitudes toward that use, are produced by the interaction between the social space of the environment and the technological space (Venkatesh, 1996); the distinctions of space make technology adoption

behavior in the home different from that in the business organization. For example, the social space of a business environment includes seniors, juniors and peers, but the social space of the home environment is comprised of friend and family members. Moreover, unlike the business environment, the home environment is influenced in technology adoption by entertainment including aspects of joy and/or pleasure, which means that even the motive for adopting technology in the home environment can clearly be distinguished as different from that for the business environment (Babin et al., 1994; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982; Venkatesh, 2001).

In addition, the technology adoption behavior of potential users who have never experienced a corresponding technology is very different from the behavior of real users who have done so. First, Fazio et al. (1982) argued that there is a difference in predictable validity between those who are experienced and pre-experienced subjects, when their attitudes are measured by the same measurement tool. Second, Zanna and Rempel (1988) claimed that attitude is constructed based on three factors: information about past behavior, information about emotion, and cognitive information; he proposed indirectly that past behaviors and relevant information make an impact on attitude. Karahanna et al. (1999) claimed that the types of indirect experience that potential users had differed markedly from the direct experiences of experienced users. Given the technology adoption behavior models for experienced users in formal organizations, it will be difficult to forecast technology adoption behavior regarding information appliances for potential users in the home environment.

Therefore, the aim of this study is to propose and verify a technology adoption model for interactive TV which reflects the features of electric home appliances for potential users, utilizing as a starting point extant studies on technology adoption behavior.

3. Research model

Based on constructs for behavior leading to technology adoption, this study proposes a research model for determining technology adoption attitudes focusing on interactive TV, as shown in Fig. 1.

Most existing theories after the TRA model have empirically verified that attitude has a direct influence on behavioral intention toward technology adoption (Ajzen, 1991; Chang and Cheung, 2001; Davis, 1989; Jeong and Lambert, 2001; Karahanna et al., 1999; Kwon and Chidambaram, 2000; Lau et al., 2001; Limayem et al., 2000; Morris and Dillon, 1997; Randolph, 1999; Segars and Grover, 1993; Venkatesh, 2001; Xia and Lee, 2000). Behavioral intention indicates the strength of the subject's plan to adopt the technology in the future (Chang and Cheung, 2001; Limayem et al., 2000; Taylor and Todd, 1995). Attitude indicates how positively or negatively the potential user thinks of a particular technology (Ajzen, 1991; Morris and Dillon, 1997). Based on these existing theories, we established the first hypothesis to verify

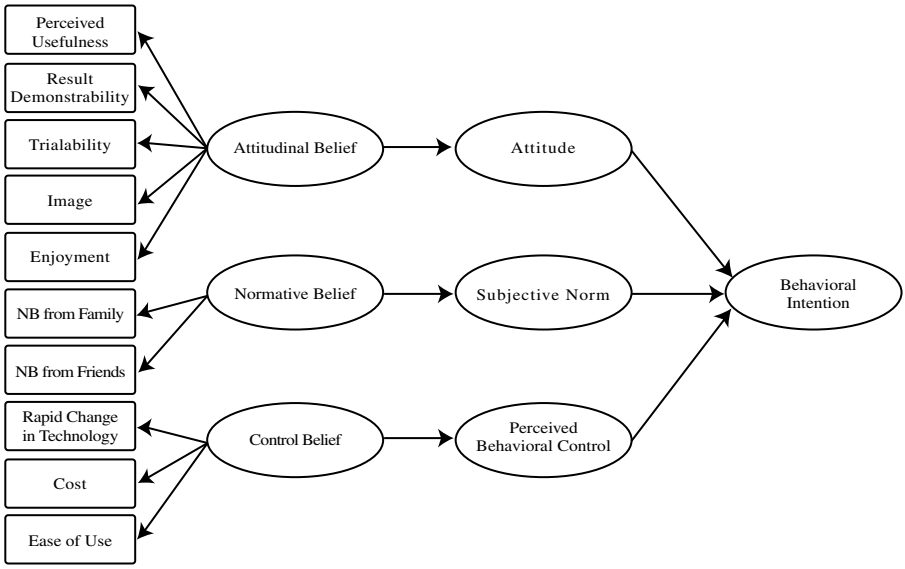

Fig. 1. Technology adoption model for information appliance.

the fact that positive or negative attitude has an effect on the subject's intention to use interactive TV.

*h*1: Attitude about interactive TV will affect behavioral intention toward technology adoption for interactive TV.

Most existing theories after the TRA model have empirically verified that subjective norms have a direct influence on behavioral intention toward technology adoption (Ajzen, 1991; Chang and Cheung, 2001; Karahanna et al., 1999; Kwon and Chidambaram, 2000; Lau et al., 2001; Limayem et al., 2000; Morris and Dillon, 1997; Randolph, 1999; Segars and Grover, 1993; Venkatesh, 2001; Xia and Lee, 2000). Subjective norm is defined as the degree to which people most important to the subject think that it is necessary to adopt the technology (Ajzen, 1991; Chang and Cheung, 2001; Fishbein and Ajzen, 1975). Especially because information appliances like interactive TV have never actually been experienced by users, these social phenomena can more commonly appear in interactive TV (Karahanna et al., 1999). In addition, because interactive TV is for common use as a home appliance in the home environment, when a user decides to adopt it, he or she has to consider the opinions of friend and family members. Accordingly, for interactive TV, we established hypothesis 2 to verify the fact that subjective norm has an effect on intention to accept technology.

*h*2: The subjective norm of a potential user regarding interactive TV will affect behavioral intention regarding technology adoption for interactive TV.

In addition to the factors of attitude and subjective norm, the user accepts a technology affected by perceived behavioral control over the system, i.e. how much control the user thinks he or she will have in manipulating the system. In the TAM theory, ease of use was proposed as a control factor that has an impact on attitude. Ajzen (1991) generalized the conditions and presented the concept of perceived behavioral control. Perceived behavioral control is defined as the degree to which a person recognizes that the use of interactive TV is under his or her own control. In the specific case of interactive TV, which will be used by people of various ages and various occupations, we established the third hypothesis: that the perceived behavioral control has a direct influence on the intention of the user to adopt interactive TV.

*h*3: Perceived behavioral control that the subject will have over interactive TV will affect behavioral intention toward technology adoption for interactive TV.

People want to behave reasonably, and thus a consumer's attitude toward a certain technology is affected by attitudinal belief (Ajzen, 1991; Chang and Cheung, 2001; Davis, 1989; Jeong and Lambert, 2001; Karahanna et al., 1999; Kwon and Chidambaram, 2000; Lau et al., 2001; Limayem et al., 2000; Morris and Dillon, 1997; Randolph, 1999; Segars and Grover, 1993; Venkatesh, 2001; Xia and Lee, 2000). Attitudinal belief indicates the user's belief that a technology possesses a particular attribute or that a particular behavior will cause a particular result (Ajzen, 1991; Chang and Cheung, 2001; Randolph, 1999). Attitude about the technology of interactive TV is affected by attitudinal belief. To verify this, we established the fourth hypothesis.

*h*4: Attitudinal belief that a person has about interactive TV will affect attitude toward technology adoption for interactive TV.

In addition, a person is certain to have subjective norms about a given technology due to individual normative beliefs (Ajzen, 1991; Chang and Cheung, 2001; Jeong and Lambert, 2001; Karahanna et al., 1999; Kwon and Chidambaram, 2000; Lau et al., 2001; Limayem et al., 2000; Morris and Dillon, 1997; Randolph, 1999; Segars and Grover, 1993; Venkatesh, 2001; Xia and Lee, 2000). Normative belief indicates a belief about a motive that harmonizes with other normative expectations. A subjective norm toward interactive TV technology is also affected by normative belief about interactive TV technology. To verify this, we established the following hypothesis:

*h*5: A person's normative belief about interactive TV will affect the subjective norm of technology adoption for interactive TV.

Control belief is the degree to which a person believes that he or she can control the promoting or interrupting factors affecting the behavioral outcome in the use of interactive TV (Ajzen, 1991; Chang and Cheung, 2001; Venkatesh, 2001). Control belief differs from perceived behavioral control in that control belief is a kind of

belief that is formed prior to a person's recognition, whereas perceived behavioral control is constructed after the person recognizes interactive TV. Therefore, perceived behavioral control is affected by individual control belief (Ajzen, 1991; Limayem et al., 2000; Randolph, 1999; Segars and Grover, 1993; Venkatesh, 2001). It is hypothesized that perceived behavioral control of interactive TV can also be affected by control belief.

*h*6: A person's control belief about interactive TV will affect perceived behavioral control of technology adoption for interactive TV.

In addition, in this study, we established five sub-hypotheses stating that attitudinal belief will be formed by five factors: perceived usefulness, trialability, result demonstrability, image, and enjoyment.

A representative construct of attitudinal belief is perceived usefulness (Davis, 1989; Karahanna et al., 1999; Morris and Dillon, 1997; Segars and Grover, 1993). This is defined as the degree of perception to which adoption of a technology will be perceived as more useful than not (Davis, 1989; Karahanna et al., 1999; Morris and Dillon, 1997; Segars and Grover, 1993). Therefore, if a user perceives that adopting interactive TV will be more useful than not, he or she will have positive attitudinal belief toward interactive TV. For this, hypothesis 4-1 was established:

*h*4-1: Perceived usefulness of interactive TV will constitute attitudinal belief of the potential user.

Trialability means the degree of possible trial within limited range before a person decides to accept the corresponding technology (Karahanna et al., 1999; Venkatesh, 2001; Xia and Lee, 2000). If a person can try out the technology before deciding to accept interactive TV, he/she will develop a stronger attitudinal belief about the technology, either in a positive or in a negative way depending on the quality of interactive TV (Karahanna et al., 1999; Venkatesh, 2001; Xia and Lee, 2000). To verify this, we established hypothesis 4-2:

*h*4-2: Trialability for interactive TV will constitute attitudinal belief of the potential user.

Result demonstrability means the degree to which a person can observe the result of adopting or refusing the corresponding technology and can communicate that to others (Karahanna et al., 1999; Xia and Lee, 2000; Venkatesh, 2001). If probable results can be observed and are likely to be communicated by others, the attitude toward the technology will be stronger, either to the positive direction or to the negative direction according to the quality of interactive TV (Karahanna et al., 1999; Xia and Lee, 2000; Venkatesh, 2001). This result demonstrability will have an important impact on attitude especially because interactive TV is not an already experienced technology (Karahanna et al., 1999). To verify this effect, hypothesis 4-3 was established:

*h*4-3: Result demonstrability for interactive TV will constitute attitudinal belief in the potential user.

Image is the degree of perception that adoption of a corresponding technology will increase social position or image (Karahanna et al., 1999; Randolph, 1999). It is reasonable that, if adopting interactive TV will enhance one's social image, the attitude toward adopting interactive TV will be positive (Karahanna et al., 1999; Randolph, 1999). Because electric home appliances are perceived as representative assets and regarded as symbols of affluence, the image of interactive TV will considerably affect attitudinal belief. For verification, hypothesis 4-4 was established:

*h*4-4: Image regarding interactive TV will constitute attitudinal belief in the potential user.

Enjoyment can be defined as the degree to which the user considers the technology itself to be enjoyable (Kwon and Chidambaram, 2000; Sheth et al., 1991; Sweeney and Soutar, 2001; Venkatesh, 2001). If the user can experience enjoyment through the adoption of interactive TV, attitude toward its adoption will present as positive (Kwon and Chidambaram, 2000; Sheth et al., 1991; Sweeney and Soutar, 2001; Venkatesh, 2001). Furthermore, since a main function of interactive TV is to provide entertainment, hypothesis 4-5 is proposed:

*h*4-5: Enjoyment of interactive TV will constitute attitudinal belief in the potential user.

As was mentioned before, the social space for interactive TV consists of friends and families rather than supervisors and assistants. It has been found that the expectations of family members were playing an important role in decision making about home appliances (Randolph, 1999; Venkatesh, 2001).

*h*5-1: Expectation of family members about interactive TV will constitute normative belief in the potential user.

Another important group in the decision making process regarding home appliances is friends. Their expectations about home appliances were found to be an important factor (Karahanna et al., 1999; Limayem et al., 2000).

*h*5-2: Expectation of friends about interactive TV will constitute normative belief in the potential user.

Finally, in this study we established three sub-hypotheses stating that three factors will form the control belief: fear of obsolescence, cost, and ease of use.

If the technology of interactive TV changes rapidly, the user's fear of that process will be high and perceived behavioral control will be low (Lau et al., 2001; Venkatesh, 2001). The fear of rapid change in technology means the fear of resultant

obsolescence (Lau et al., 2001; Venkatesh, 2001). Because a new information appliance such as interactive TV is an as-yet unexperienced technology, how or when the technology changes will not be predictable and will be a representative construct which can determine control belief. To verify this, we established hypothesis 6-1:

*h*6-1: Rapid change in technology and/or fear of obsolescence will constitute control belief in the potential user.

If a cost must be paid for adopting a technology, the perception that the price of interactive TV is high or belief that the price will decline will be representative control beliefs which will affect perceived behavioral control (Sweeney and Soutar, 2001; Venkatesh, 2001). One belief about cost means that the current price is too high for adopting the technology and that it will soon decline (Sweeney and Soutar, 2001; Venkatesh, 2001). Because interactive TV is one of the most expensive home appliances, such a cost factor will certainly play a significant role. Hypothesis 6-2 was established to verify this:

*h*6-2: Cost of interactive TV will constitute control belief in the potential user.

Perceived ease of use can be defined as a degree of freedom from effort in the use of a targeted technology (Davis, 1989; Karahanna et al., 1999; Morris and Dillon, 1997; Segars and Grover, 1993; Venkatesh, 2001). If using interactive TV is perceived as easy, perceived behavioral control will be high (Davis, 1989; Karahanna et al., 1999; Morris and Dillon, 1997; Segars and Grover, 1993; Venkatesh, 2001). Moreover, in the case of a home appliance for a specific purpose such as interactive TV, ease of use can be a highly significant factor in the user's achievement of desired results (Karahanna et al., 1999). Therefore, the hypothesis 6-3 was presented as below:

*h*6-3: Ease of use of interactive TV will constitute control belief in the potential user.

In summary, this research model was designed after modifying and complementing existing models with fit for the features of interactive TV. The modifications were made in all three constructs influencing behavioral intention. First, in terms of attitudinal belief, we added the observation variable"enjoyment", which has not previously been considered important in most existing models targeting companies and institutions. The objectives of such studies have been technologies primarily intended for profit and management efficiency, such as office PCs and business machines. However, because interactive TV will be adopted for entertainment at home, the variable of enjoyment will have more influence than in other existing models (Babin et al., 1994; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982; Venkatesh, 2001). Second, in terms of normative belief, we added the observation variable of expectations of family and friends. In existing research, because the models are based on the business environment, fellow workers and superiors were used as sources for normative belief formed among people important or

influential to the users. However, the environment for using information appliances is not the business office but the home environment, where primary consumers are family members (Karahanna et al., 1999; Limayem et al., 2000; Randolph, 1999; Venkatesh, 2001). Finally, in terms of control belief, we added "rapid change in technology" and "cost" factors, which were scarcely measured concretely in previous models based on the business environment. The reason for this inclusion is that relative obsolescence, caused by rapid change in technology, begins to rise as a particularly important factor for the home environment (Venkatesh, 2001).

4. Research method

In order to test the proposed research model, we conducted an online survey in which the subjects were potential users of interactive TV. Most questions used in the survey were borrowed from prior studies that had proved the validity and reliability of the questions. However, questions for two constructs, rapid change in technology and cost, were developed by the authors based on past qualitative studies because they had not yet been verified through empirical studies. All questions were presented with the seven-point Likert scale.

4.1. Pretest

To assure the content validity of the questionnaire, people in the general TV viewer population and experts in the interactive TV industry were recruited for pretest. First, the pretest using 24 people from the general TV viewer population was conducted over a period of 2 days. Results were examined to determine whether there were obscure or misleading expressions in the questionnaire. We then conducted the second pretest using industry experts, over a period of three weeks. The subjects for interview were industry experts with more than five years of experience in companies manufacturing interactive TVs; in cable TV companies, broadcasting companies, and content-producing companies. Through the interviews with general TV viewers and industry experts, we confirmed that our questionnaire appropriately expressed constructs relevant to the adoption of interactive TV technology.

4.2. Pilot study

We conducted a pilot test in order to obtain the validity and reliability of the questions developed from the pretest. First, we conducted a written survey using one-on-one interviews with 78 undergraduate and graduate students. As a result of the pilot test, we constructed the final set of research questions after deleting several questions that did not contribute to the research constructs. The final set of questions used in our main survey is presented in Table 1 below.

Table 1
Constructs and corresponding questions

Construct	Questions
Perceived usefulness (PU)	1. Using interactive TV service will improve my job performance. 2. Interactive TV service will be useful to my life in general. 3. Using interactive TV service will enhance my effectiveness on the job.
Trialability (TR)	1. I will be able to experience interactive TV service in advance through other media. 2. I will be able to test interactive TV sufficiently before deciding to purchase it. 3. When I try out interactive TV service, I will be able to use it enough to know what I can do with it.
Result demonstrability (DM)	1. I will communicate with others about the strengths and weaknesses of interactive TV service. 2. After using interactive TV service, I will talk to others about the effect.
Image (IM)	1. Using interactive TV service will enhance my social status. 2. Using interactive TV service will give me more privileges than others using ordinary TV. 3. I think that using interactive TV is a symbol of high class society.
Enjoyment (EN)	1. I will certainly enjoy interactive TV service. 2. Interactive TV service will relax my mind. 3. Interactive TV service will give me a good feeling.
Attitude (AT)	1. Using interactive TV service is good. 2. I like to use interactive TV service. 3. Using interactive TV service is interesting. 4. Using interactive TV service is pleasant.
Subjective norm (SN)	1. People who are important to me will think that I should use interactive TV service. 2. People who affect me expect me to use interactive TV service.
Normative belief (NB)	1. My family will think that we should use interactive TV service. 2. My friends will think that I should use interactive TV service.
Perceived behavioral control (PBC)	1. I can use interactive TV service without any help. 2. With interactive TV, I can easily find my favorite TV programs and services. 3. I will use interactive TV service perfectly. 4. I can control most functions of interactive TV service.
Rapid change in technology and/or fear of obsolescence (QT)	1. When I buy a set-top box for interactive TV service, it will soon be an obsolescent model. 2. A new model of interactive TV will appear soon after I buy one now.
Cost (CO)	1. I will delay purchasing a set-top box until the price becomes lower. 2. People will not want to purchase set-top-box for interactive TV service because the price is so high.

(*continued on next page*)

Table 1 (*continued*)

Construct	Questions
Ease of use (EU)	1. Learning to use interactive TV service will be easy for me. 2. I will be skillful in using interactive TV service. 3. I will find using interactive TV service easy for me.
Behavioral intention (INT)	1. I intend to use interactive TV service as soon as possible. 2. I will use interactive TV service soon after starting it. 3. It is very likely I will buy a set-top box for interactive TV service as soon as it is available. 4. I will use interactive TV service consistently for buying products and gathering information.

4.3. Online survey

In order to measure technology adoption behavior proper to interactive TV, we conducted a national-scale online survey (http://www.tbiz.or.kr). We induced as many people as possible to participate in the survey by banner advertisements at three famous portal websites in Korea. We examined ID numbers in order to avoid double responses, and used an error-check routine to increase data integrity.

A total of 2591 people responded to the questionnaire. After data-filtering to eliminate untruthful responses, the number of effective responses came to 2291. The demographic distribution of the effective respondents is shown in (Fig. 2).

More male respondents participated in the survey than female respondents (59% vs. 41%). In terms of age, the below-twenties group comprised 17.44% of the total and the respondents between twenty and thirty comprised 49.15% of the total. Those between thirty and forty comprised 25.71%, and those over forty 7.7%. The distributions of gender and age reflect the characteristics of the general population using the Internet in Korea.

4.4. Validity and reliability of questions

We conducted explorative factor analysis to test the convergent validity of the survey questions. The results are shown in Tables 2 and 3. As shown in Table 2, the

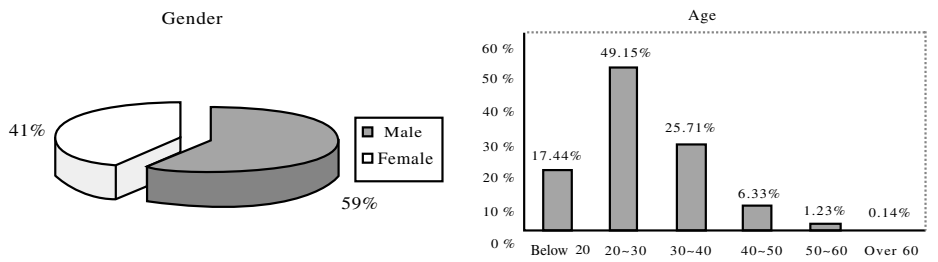

Fig. 2. The demographic distribution of effective respondents.

Table 2
The first result of explorative factor analysis of latent variables

	Factors			Cronbach α coefficient
	FA1	FA2	FA3	
Perceived behavioral control 3	**0.877**	0.239	0.109	0.8767
Perceived behavioral control 4	**0.855**	0.186	0.166	
Perceived behavioral control 2	**0.809**	0.352	0.028	
Perceived behavioral control 1	**0.671**	0.247	0.277	
Attitude 3	0.360	**0.806**	0.106	0.8967
Attitude 1	0.280	**0.786**	0.236	
Attitude 4	0.260	**0.784**	0.335	
Attitude 2	0.204	**0.775**	0.335	
Subjective norm 2	0.181	0.266	**0.891**	0.8985
Subjective norm 1	0.147	0.304	**0.884**	

Table 3
The second result of explorative factor analysis of latent variables

	Factors									Cronbach α coefficient
	FA1	FA2	FAS	FA4	FAS	FA6	FA7	FA8	FA9	
PU2	**0.843**	0.121	0.158	0.170	0.142	0.129	0.031	0.118	0.097	0.8931
PU3	**0.838**	0.111	0.126	0.186	0.151	0.128	0.048	0.142	0.046	
PU1	**0.815**	0.169	0.080	0.215	0.181	0.046	0.099	0.107	0.048	
EU3	0.110	**0.824**	0.078	0.171	0.141	0.106	0.086	0.127	0.116	0.8491
EU1	0.181	**0.781**	0.080	0.171	0.208	0.110	0.141	0.164	0.179	
EU2	0.148	**0.758**	0.006	0.180	0.091	0.062	0.233	0.141	0.148	
Im3	0.023	−0.016	**0.846**	0.011	0.120	0.227	−0.038	−0.042	0.010	0.7760
Im1	0.135	0.037	**0.825**	0.053	0.135	0.210	0.012	0.106	0.032	
Im2	0.267	0.171	**0.658**	0.179	0.263	−0.035	0.024	0.193	0.037	
TR2	0.160	0.156	0.079	**0.853**	0.116	0.056	0.054	0.118	0.111	0.7727
TR3	0.222	0.197	0.064	**0.755**	0.171	0.009	0.112	0.187	0.011	
TR1	0.319	0.202	0.076	**0.585**	0.012	0.202	0.092	0.190	0.154	
En1	0.094	0.180	0.141	0.086	**0.739**	0.279	0.027	0.107	0.129	0.7917
En2	0.191	0.121	0.316	0.099	**0.731**	0.279	0.044	0.052	0.040	
En3	0.349	0.178	0.152	0.185	**0.670**	0.110	0.092	0.181	0.045	
NB1	0.176	0.134	0.243	0.106	0.310	**0.797**	−0.013	0.093	0.070	0.8775
NB2	0.136	0.131	0.284	0.088	0.306	**0.790**	0.089	0.092	0.061	
CO1	0.070	0.113	0.022	0.067	0.002	−0.041	**0.880**	0.030	0.171	0.7738
CO2	0.067	0.254	−0.048	0.121	0.074	0.051	**0.767**	0.131	0.232	
DM2	0.148	0.176	0.100	0.180	0.119	0.133	0.065	**0.833**	0.050	0.7468
DM1	0.220	0.223	0.089	0.256	0.146	0.029	0.121	**0.747**	0.147	
QT1	0.072	0.149	0.047	0.097	0.083	0.118	0.163	0.067	**0.876**	0.7470
QT2	0.099	0.258	0.017	0.113	0.088	−0.019	0.345	0.113	**0.736**	

Table 4
The result of average variance extracted

	Attitudinal belief	Normative belief	Control belief
Attitudinal belief	**0.656**		
Normative belief	0.442	**0.834**	
Control belief	0.448	0.464	**0.747**

questions converged well in the three factors consistent with the three research constructs (perceived behavioral control, attitude, and subjective norm). We can see that the Cronbach alpha coefficients for all the constructs are well above the threshold value (0.7). The results verified that each question measuring the three constructs faithfully represents the corresponding concepts.

Similarly, as shown in Table 3, the factor analysis of all variables constituting attitudinal belief, control belief, and normative belief converged well into nine factors—perceived usefulness, trialability, result demonstrability, image, enjoyment, normative belief, fear of rapid change, cost, and ease of use. We can also see that the Cronbach alpha coefficients of the nine constructs were well above 0.7. Therefore, we may conclude that the questions used in the study are reliable and meet convergent validity.

Finally, we analyzed the AVE (Average Variance Extracted) to test the discriminant validity of the questions. After we conducted confirmative factor analysis and gained the values of the path coefficient and error variable, we measured the value of shared variables between the constructs and values. As shown in Table 4, it was verified that the questions have discriminant validity because the squared AVE, namely an element of the diagonal matrix, is greater than 0.5 and is also larger than the correlation between constructs.

5. Results

To test the causal model presented in Fig. 1, we conducted structured equation modeling using LISREL 8.0, because the model consists of multi-phases.

5.1. GFI analysis of LISREL model

First, the goodness of fit of the proposed model was analyzed in order to evaluate the reliability of the model. The value of GFI, as shown in Table 5, was 0.92, AGFI was 0.88, NFI was 0.94, and NNFI was 0.92. In addition, the value of SRMR was 0.059. [1] The results indicate that our research model is valid enough to proceed to further analysis of path coefficients.

[1] The high value of the χ^2 was inevitably caused by the large number of respondents.

Table 5
GFI for evaluating LISREL model

χ^2	DF	GFI	AGFI	NFI	NNFI	SRMR
2307.09	199	0.92	0.88	0.94	0.92	0.059

5.2. Relation analysis between observed variable and latent variable

In order to examine whether corresponding observed variables clearly reflect latent variables, we analyzed estimated coefficients among them. The average value of corresponding questions for each construct was used for the observed variables expected to constitute attitudinal belief, normative belief, and control belief.

The λ value of perceived usefulness was 0.87 ($p < 0.01$) and trialability was 0.78 ($p < 0.01$); result demonstrability was 0.56 ($p < 0.01$); image was 0.85 ($p < 0.01$); and enjoyment was 1.10 ($p < 0.01$). Because all the estimated coefficients of attitudinal belief and the corresponding observed variables were statistically significant, it can be concluded that perceived usefulness, trialability, result demonstrability, image, and enjoyment measured attitudinal belief well.

The two observed variables were expected to constitute normative belief and their λ values were all 1.41 ($p < 0.01$). Because all the estimated coefficients of normative belief and the corresponding observed variables were statistically significant, it is reasonable to conclude that they measured normative belief well.

With respect to the questions about rapid change in technology ($\lambda = 0.74$, $p < 0.01$), cost ($\lambda = 0.80$, $p < 0.01$), and ease of use ($\lambda = 1.09$, $p < 0.01$), which constituted control belief, the average value of each question was used. It can be regarded as reasonable that they measured control belief well because all the estimated coefficients were statistically significant.

The values of λ among the four observed variables expected to measure attitude itself were respectively 1.17, 1.21, 1.15, and 1.19. The values of λ between the two observed variables expected to measure subjective norm and subjective norm itself were 1.40 and 1.46. The values of λ among the four observed variables expected to measure perceived behavioral control were 1.06, 1.26, 1.30, and 1.23. The values of λ among the four measurement variables and behavioral intention were 1.21, 1.34, 1.30, and 1.06. As you can see in Fig. 3, it is reasonable to judge that each observed variable measured latent variables well because most path coefficients were statistically significant, except for four questions: the first question measuring attitude, the second one measuring subjective norm, the first one measuring perceived behavioral control, and the first one measuring behavioral intention.

5.3. Relation analysis within latent variables

Subsequently, we analyzed how much attitudinal belief, normative belief, and control belief affect attitude, subjective norm, and perceived behavioral control respectively, and how much these factors affect behavioral intention toward adopting interactive TV, as shown in Fig. 3.

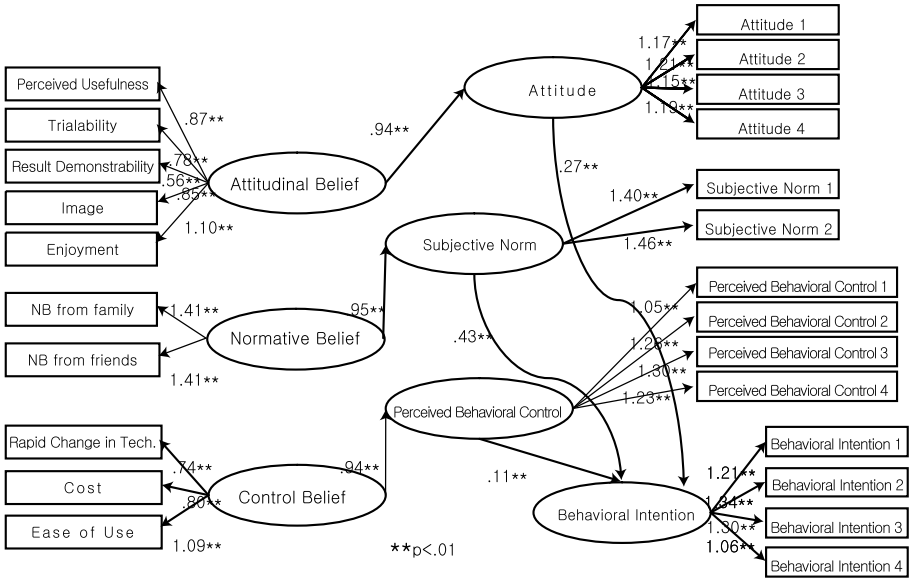

Fig. 3. The result of LISREL analysis ($^{**}p < 0.01$).

We examined the influence of each belief on attitude, subjective norm, and perceived behavioral control. For the estimated coefficient of effect of attitudinal belief

Table 6
The influence of attitude, subjective norm, and perceived behavioral control to behavioral intention for technologyadoption

Hypothesis		Estimated coefficient	T-value	Accept or reject
1	Attitude toward interactive TV will affect behavioral intention toward technology adoption of interactive TV	0.27	8.29 ($^{**}p < 0.01$)	Accept
2	Subjective norm regarding interactive TV will affect behavioral intention toward technology adoption of interactive TV	0.43	15.85 ($^{**}p < 0.01$)	Accept
3	Perceived behavioral control regarding interactive TV will affect behavioral intention toward technology adoption of interactive TV	0.11	4.34 ($^{**}p < 0.01$)	Accept
4	Attitudinal belief about interactive TV will affect attitude toward technology adoption of interactive TV	0.94	43.50 ($^{**}p < 0.01$)	Accept
5	Normative belief about interactive TV will affect subjective norm toward technology adoption of interactive TV	0.95	46.17 ($^{**}p < 0.01$)	Accept
6	Control belief regarding interactive TV will affect perceived behavioral control toward technology adoption of interactive TV	0.94	32.52 ($^{**}p < 0.01$)	Accept

on attitude, the value of λ was 0.94 ($p < 0.01$). For the estimated coefficient of effect of normative belief on subjective norm, it was 0.95 ($p < 0.01$); for control belief on perceived behavioral control, 0.94 ($p < 0.01$). The values of λ regarding behavioral intention were 0.27 ($p < 0.01$), 0.43 ($p < 0.01$), and 0.11 ($p < 0.01$) in reference to attitude, subjective norm, and perceived behavioral control. Because all estimated coefficients were statistically significant, it can be interpreted that attitudinal belief, normative belief, and control belief have an influence on attitude, subjective norm, and perceived behavioral control, respectively. It can also be understood that attitude, subjective norm, and perceived behavioral control affect behavioral intention to adopt this information appliance.

5.4. Hypothesis verification

By LISREL analysis, the hypotheses were verified as follows (referring to Tables 6 and 7):

Table 7
Constructs of attitudinal belief and control belief

Hypothesis		Estimated coefficient	*T*-value	Accept or reject
Attitudinal belief				
*h*4-1	Perceived usefulness of interactive TV will constitute attitudinal belief of the potential user	0.87	33.82 ($^{**}p < 0.01$)	Accept
*h*4-2	Trialability for interactive TV will constitute attitudinal belief of the potential user	0.78	30.36 ($^{**}p < 0.01$)	Accept
*h*4-3	Result demonstrability for interactive TV will constitute attitudinal belief of the potential user	0.56	26.72 ($^{**}p < 0.01$)	Accept
*h*4-4	Result demonstrability regarding interactive TV will constitute attitudinal belief of the potential user	0.85	29.31 ($^{**}p < 0.01$)	Accept
*h*4-5	Enjoyment of interactive TV will constitute attitudinal belief of the potential user	1.10	48.86 ($^{**}p < 0.01$)	Accept
Normative belief				
*h*5-1	Opinions of family will constitute normative belief of the potential user	1.41	48.24 ($^{**}p < 0.01$)	Accept
*h*5-2	Opinions of friends will constitute normative belief of the potential user	1.41	49.55 ($^{**}p < 0.01$)	Accept
Control belief				
*h*6-1	Rapid change in technology and/or fear of obsolescence will constitute control belief of the potential user	0.74	24.37 ($^{**}p < 0.01$)	Accept
*h*6-2	Cost of interactive TV will constitute control belief of the potential user	0.80	20.89 ($^{**}p < 0.01$)	Accept
*h*6-3	Ease of use of interactive TV will constitute control belief of the potential user	1.09	45.74 ($^{**}p < 0.01$)	Accept

6. Conclusion and discussion

In this study, we constructed a causal model of technology adoption for interactive TV and conducted a nationwide survey which was analyzed using LISREL. According to the results, we can come to conclusions as follows. First, attitude, subjective norm and perceived behavioral control were found to increase positive behavioral intention toward adopting interactive TV. Second, in order to have a positive attitude toward adopting interactive TV, the consumer needs to perceive usefulness, to have an opportunity for trial usage, and explicitly to perceive the result of using the appliance. He or she also needs to have a good image of the product and to perceive its adoption and use as pleasurable. Third, in order to impel the consumer to adopt interactive TV, it is necessary to increase normative belief appropriately by focusing on family and friends, as subjective norm affects behavioral intention. Finally, to increase control belief, we need to prevent fear of rapid change in technology and to reduce perceived cost. We also need to provide a usable system because the more a person perceives behavioral control, the more positive becomes behavioral intention.

Among the three factors that affect behavioral intention toward adopting technology, the subjective norm has the greatest impact. In other words, behavioral intention toward the information appliance is most affected by family and/or friends. We can conclude that, because a home appliance is not personal but shared by the family, the opinions of family members are very influential. We can also deduce that, concerning a previously unexperienced product, a potential user will regard a nearby significant person's attitude as a decisive influence in adopting the technology.

As one of the factors affecting attitudinal belief, enjoyment was found to be the most important factor previously missed in existing models based on the business environment. This result corresponds with existing studies showing that entertainment is relatively important regarding technology adoption in the home environment (Babin et al., 1994; Hirschman and Holbrook, 1982; Holbrook and Hirschman, 1982; Venkatesh, 2001). However, because TV is a tool for entertainment, our results may overestimate the importance of enjoyment in the adoption of the information appliance. Enjoyment could turn out to be irrelevant if the target of the study were an interactive refrigerator rather than interactive TV. Further studies are necessary to ascertain the importance of enjoyment in the adoption of a general information appliance.

Finally, ease of use was the most important factor among those concerning perceived behavioral control. This means that, regarding a new technology, worry about "Can I use it easily?" causes behavioral intention to decrease.

However, to adopt the results of this study, we must consider a few limitations as follows. First, the samples have a self-selection bias caused by the inherent limits of an online survey. In other words, because the survey was accomplished not by randomly selecting participants but by soliciting participants on the Internet, it is not assured that the respondents represent the whole population of potential users of interactive TV, For example, in this study, because a high percentage of respondents

was male and a high percentage also was between the ages of twenty and thirty, and, in addition, because this population represents the primary users of the Internet, it is possible that the result of the research was biased by their opinions. The statistical results in our paper might be true for young male Internet users but might not be true for other groups such as old females with no experience in the Internet. We attempted to complement the weakness of the online survey in order to collect representative samples. For example, we prevented multiple responses by the same person by checking social security numbers, and we filtered untruthful responses with thorough examination of data. Moreover, the large sizes of our sample size also relieve the possible risks from non-random sampling. However, follow-up research is needed to minimize such a sampling bias by using alternative data collection methods such as hierarchical random samples or quarter samples. Offline surveys may also be performed complementarily in conjunction with online surveys.

The second limitation is that among questions measuring latent variables, four did not attain statistical significance, which may have caused the marginal value of 0.88 for AGFI in the LISREL analysis. Moreover, questions for normative belief were only one for each observation variable, which might influence the path strength from subjective norm to behavioral intention. If a more accurate model can be presented or new variables can be found in following studies, this model can be improved upon.

In spite of these limitations, this study makes both theoretical and practical contributions. From a theoretical perspective, we proposed a causal model for technology adoption by potential users in the home environment which is suitable for information appliances. This model presents new constructs which have not previously appeared in existing technology adoption models. In addition, among the constructs regarding control belief, the relevance of rapid change in technology and/or fear of obsolescence and cost were empirically tested. The results of this study also provide practical implications for the marketing of interactive TV. For example, marketing efforts should be focused on increasing favorable opinions of friend and family members, because this was found to be the most influential factor for positive behavioral intention toward using interactive TV. Developmental efforts should also be focused on enhancing the usability of interactive TV, since ease of use was found to be one of the most influential factors for intention to use. Since this model makes practical contributions for designing marketing strategies focusing on subjective norms and for development strategy emphasizing enjoyment and ease of use, it provides one more significant step in developing the capacity to predict technology adoption behavior. It can also enable the capacity to apply appropriate strategies for effective product development and marketing for information appliances such as interactive TV.

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References

Adams, D.A., Nelson, R., Todd, P.A., 1992. Perceived usefulness, ease of use, and usage of information technology: A replication. MIS Quarterly, 227–247.

Ajzen, I., 1991. The theory of planned behavior. Organization Behavior and Human Decision Processes, 179–211.

Babin, B.J., Darden, W.R., Griffin, M., 1994. Work and/or fun: Measuring hedonic and utilitarian shopping value. Journal of Consumer Research 20 (4), 644–656.

Bergman, E., 2000. Information Appliances and Beyond. Morgan Kaufmann Publishers, NY.

Chang, M.K., Cheung, W., 2001. Determinants of the intention to use Internet/WWW at work: A confirmatory study. Information and Management 39, 1–14.

Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13 (3), 319–340.

Fazio, R.H., Chen, J., McDonel, E.C., Sherman, S.J., 1982. attitude accessibility, attitude behavior consistency, and the strength of the object-evaluation association. Journal of Experimental Social Psychology 18, 339–357.

Fishbein, M., Ajzen, I., 1975. Belief, attitude, intention, and behavior: An introduction to theory and research. Addison-Wesley, Reading, MA.

Hennessy, J., 1999. The future of systems research. Computer 32 (8), 27–33.

Hirschman, E.C., Holbrook, M.B., 1982. Hedonic consumption: Emerging concepts, methods and propositions. Journal of Marketing 46 (1), 92–101.

Holbrook, M.B., Hirschman, E.C., 1982. The experiential aspects of consumption: Consumer fantasies, feelings, and fun. Journal of Consumer Research 9 (2), 132–140.

Jeong, M., Lambert, C.U., 2001. Adaptation of an information quality framework to measure customers' behavioral intentions to use lodging web sites. International Journal of Hospitality Management 20, 129–146.

Karahanna, E., Straub, D.W., Chervany, M.L., 1999. Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. MIS Quarterly 23 (2), 183–213.

Kim, J., 2001a. Deficient Popularity of the Internet Appliances, Maeil Business, 5 September, 2001.

Kim, S., 2001b. Digital TV' Visible Range and Market Size, Korea Daily, 14 December, 2001.

Kim, Y., 2001c. Highlight on Digital TV (1): Prologue, The Digital Times, 25 October, 2001.

Kwon, H.S., Chidambaram, L., 2000. A test of the technology acceptance model: The case of cellular telephone adoption, Proceedings of the 33rd Hawaii International Conference on System Sciences, pp. 3–6.

Lau, A., Yen, J., Chau, P.Y.K., 2001. Adoption of on-line trading of investors in the Hong Kong financial market. Journal of Electronic Commerce Research 2 (2), 2–19.

Lewis, T., 1998. Information Appliances: Gadget Netopia. Computer, 59–68.

Limayem, M., Khalifa, M., Frini, A., 2000. What makes consumers buy from the Internet? A longitudinal study of online shopping. IEEE Transactions on Systems, Man, and Cybernetics—Part A: Systems and Humans 30 (4), 421–432.

Malhotra, Y., Dennis, F.G., 1999. Extending the technology acceptance model to account for social influence: Theoretical bases and empirical validation, Proceedings of the 32nd Hawaii International Conference on System Sciences, pp. 6–14.

Mohageg, M.F., Wagner, A., 2000. Design considerations for information appliances. Information Appliances and Beyond 2, 27–51.

Morris, M.G., Dillon, A., 1997. How user perceptions influence software use, IEEE Transactions, July/August, pp. 58–65.

Norman, D.A., 1998. The Invisible Computer. The MIT Press, Cambridge, MA.

O'Brien, J., 2001. Most Wanted by Users: VOD & Internet on TV, The Digitrends, 25 January, 2001. Available at http://www.digitrends.net/nwna/index_13862.html.

Randolph, C., 1999. Why do we Hate Microsoft and Still Use Word? Proceedings of the 10th Australasian Conference on Information Systems, pp. 736–748.

Segars, A.H., Grover, V., 1993. Re-examining perceived ease of use and usefulness: A confirmatory factor analysis. MIS Quarterly, 517–525.

Sheth, J.N., Newman, B.I., Gross, B.L., 1991. Why we buy what we buy: A theory of consumption values. Journal of Business Research 22, 159–170.

Sweeney, J.C., Soutar, G.N., 2001. Consumer perceived value: The development of a multiple item scale. Journal of Retailing 77, 203–220.

Taylor, S., Todd, P., 1995. Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. International Journal of Research in Marketing 12, 137–156.

Venkatesh, A., 1996. Computers and other interactive technologies for the home. Communications of the ACM 39 (12), 47–54.

Venkatesh, V.A., 2001. Longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. MIS Quarterly 25 (1), 71–102.

Vos, D.L., 2000. Searching for the Holy Grail: Images of Interactive Television, Proceedings of European Media Masters of Arts. Rotterdam: EMMA, pp. 1–138.

Wirtz, B.W., 1999. Convergence processes, value constellations and integration strategies in the multimedia business. The International Journal on Media Management 1 (1), 14–22.

Xia, W., Lee, G., 2000. The influence of persuasion, training and experience on user perceptions and acceptance of IT innovation, Proceedings of ICIS, 371–384.

Yang, H., Choi, I., 2001. The impact of social influence on information systems adoption: An extension to the technology acceptance model. KMIS 11 (3), 165–184.

Zanna, M.P., Rempel, J.K., 1988. Attitudes: A new look at an old concept. In: Bar-Tal, D., Kruglanski, A.W. (Eds.), The Social Psychology of Knowledge. Cambridge University Press, New York, pp. 315–334.