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User Adoption of IPTV: A Research Model

Sandra Weniger
University of Cologne, sandra.weniger@uni-koeln.de

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Sandra Weniger

Department of Business, Media and Technology Management
University of Cologne, Germany

sandra.weniger<at>uni-koeln.de

Abstract
The development of Internet Protocol Television (IPTV) is accelerating globally and provides significant revenue opportunities depending on user adoption. Hence, user adoption of IPTV constitutes a field of interest for IPTV providers. This paper extends prior research by proposing a research model for studying the driving forces of users' adoption of IPTV. Examining IPTV as a hedonic IT system, this paper stresses the importance of users' perception of IPTV-specific factors as well as enjoyment for the adoption process, and incorporates a direct link between buying related aspects preceding the intention to use.

Keywords: IPTV, adoption, user beliefs, intention to use, technology acceptance

1 Introduction

The convergence of communication, computing, and content has fueled increasing interest in the delivery of TV services via Internet Protocol (IP) networks (Wright, Jones & Lee 2008). Such TV services are also known as Internet Protocol Television (IPTV).

Understandings of the term IPTV differ (e.g., Jain 2005; Maisonneuve et al. 2009). In this paper, we define IPTV as the IP-based delivery of video programming (either broadcast or on-demand) over a carrier's managed broadband network to a customer's TV set or PC. The quality of service is guaranteed. By following Maisonneuve et al. (2009) and German TV Platform (www.tv-plattform.de), we thereby exclude streaming media over the Internet to a PC or TV screen, also called Internet TV.

In the last few years, IPTV has emerged as a major distribution and access technology for broadband services (Maisonneuve et al. 2009), destined to reach up to 70 million homes worldwide by 2014 (Informa Telecoms & Media 2010). IPTV is expected to provide new revenue opportunities depending on user adoption, i.e., acceptance (Casier et al. 2008). Hence, user adoption of IPTV constitutes a field of interest for IPTV providers.

Transferring the established information technology (IT) adoption research (e.g., Agarwal & Karahanna 2000; Davis, 1989; Davis, Bagozzi & Warshaw 1992; Venkatesh 2000) to IPTV, raises the question "Why do some persons adopt IPTV, whereas others reject them?". Whereas some studies investigate the drivers of user adoption of IPTV (e.g., Casier et al. 2008; Ha & Yook 2009; Shin 2007; Shin 2009a), respective studies regarding the formation of user beliefs and the intention to use – as decisive factors for user adoption – are rare and leave room for further theoretical grounding.

In order to gain a better understanding of the driving forces of user adoption of IPTV, in this paper, we offer a research model to study the formation of user beliefs and intention to use IPTV. We investigate IPTV as a hedonic system that provides self-fulfilling rather than instrumental value for the users and is strongly connected to home and leisure activities (van der Heijden 2004).

The remainder of the paper is structured as follows: Next we introduce the research model and the respective propositions for studying the formation of user beliefs and intention to use IPTV. Subsequently, we describe the conceptualization and operationalization of model variables and the proposed research design. We then discuss the overall complexity of our model, the development of measurement instrument, the selection of variables, and the choice of PLS as technique for model estimation. Finally, we conclude with a brief summary and an outlook to future research.

2 User Adoption of IPTV

2.1 Research Model

To investigate the driving forces of user adoption of IPTV, we look upon the formation of user beliefs and intention to use IPTV and propose a research model (Figure 1) that builds on prior technology adoption research (e.g., Agarwal & Karahanna 2000; Davis, 1989; Davis, Bagozzi & Warshaw 1992; Venkatesh 2000).

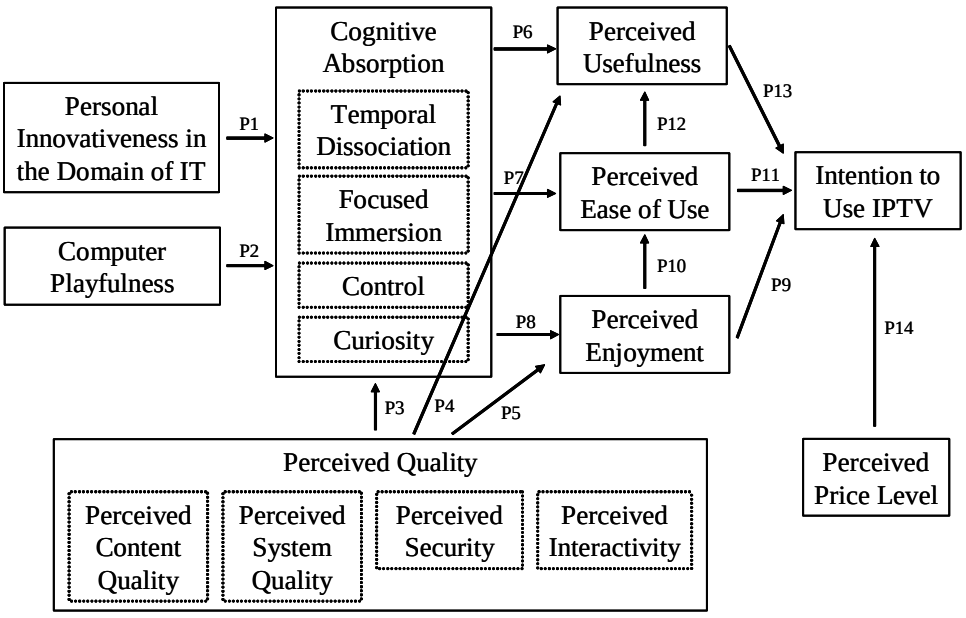

Figure 1: Proposed Research Model

The two personality traits of *personal innovativeness in the domain of IT and computer playfulness* are common to study technology adoption. Personal innovativeness in the domain of IT refers to "the willingness of an individual to try out a new IT independent of the communicated experiences of others" (Agarwal & Prasad 1996, p. 206). Computer playfulness is defined as "an individual's tendency to interact spontaneously, inventively, and imaginatively with new software" (Webster & Martocchio 1992, p. 202).

To include IPTV-specific factors (Lederer et al. 2000) with regard to IPTV, we incorporate *perceived quality* encompassing four dimensions:

(1) Perceived content quality – referring to the desired characteristics, such as accuracy, meaningfulness, and timeliness, of the information delivered via IPTV.
(2) Perceived system quality – referring to IPTV attributes such as response time, system accessibility, and reliability.
(3) Perceived security – referring to the users' security concerns that accompany IPTV usage.
(4) Perceived interactivity – referring to a person's perception of IPTV's "potential ability to let a user exert an influence on the content and/or the form of the mediated communication" (Jensen 1998, p. 201).

We include *cognitive absorption*, "a state of deep involvement with software" (Agarwal & Karahanna 2000, p. 673), with four dimensions:

(1) Temporal dissociation – referring to the inability to register the passage of time while being engaged in interaction.
(2) Focused immersion – referring to the experience of total engagement when other attentional demands are ignored.
(3) Control – referring to the user's perception of being in charge with the interaction.
(4) Curiosity – referring to the extent the experience arouses an individual's sensory and cognitive curiosity.

We incorporate three user beliefs, perceived enjoyment, perceived ease of use, and perceived usefulness, into the model:

(1) Perceived enjoyment – referring to "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis, Bagozzi & Warshaw 1992, p. 1113). Different from Agarwal and Karahanna (2000), we incorporate perceived enjoyment as separate variable as IPTV is mainly 'used for fun'.
(2) Perceived ease of use – referring to "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320).
(3) Perceived usefulness – defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). Although we understand IPTV as a hedonic system, we include perceived usefulness into our research model. Thereby, perceived usefulness rather refers to the degree to which a person believes that IPTV can be used advantageously and provides positive expected outcomes.

Based on our understanding of IPTV as a hedonic system, perceived enjoyment is supposed to play the most important role among the three user belief variables.

As a direct determinant of the intention to use IPTV, we incorporate *perceived price level*, referring to an individual's perception of the price level offered. We include it in our model as research in information systems (IS) and marketing (e.g., Kim, Chan & Gupta 2007; Lichtenstein, Ridgway & Netemeyer 1993; Mallat 2007) has shown it is a decisive determinant for the intention to use.

2.2 Propositions

In this section, we explain how we derive the propositions included in our research model from the literature:

Agarwal and Karahanna (2000) have shown that personal innovativeness in the domain of IT constitutes an important determinant of cognitive absorption while interacting with new IT. A person who is more likely to experiment with new IT, will tend to interact more spontaneously and curiously, and will tend to experience total engagement while her sense of time diminishes. Since IPTV represents relatively new IT (Xiao et al. 2007), we propose *'P1. Personal innovativeness in the domain of IT positively influences cognitive absorption'*.

We also suppose that the individual predisposition to interact spontaneously, inventively, and imaginatively with new software, labeled as computer playfulness, has a positive influence on cognitive absorption when using IPTV. Therefore, we propose *'P2. Computer playfulness positively influences cognitive absorption'*.

Perceived quality has been treated extensively in IT research and, e.g., Kettinger and Lee (1994) show that perceived quality influences affective and psychological states when interacting with IT. Modeling the states as cognitive absorption, we assume that the 'better' the perceived quality of IPTV, the more a person experiences cognitive absorption. This leads to *'P3. Perceived quality positively influences cognitive absorption'*.

Shin (2009a & b) and Lin and Lu (2000) have indicated that quality as technology-specific factor positively influences perceived usefulness. Hence, with regard to IPTV, we propose *'P4. Perceived quality positively influences perceived usefulness'*.

We capture perceived enjoyment as outcome of perceived quality, as we assume that the four quality dimensions are conducive to the user's perceived enjoyment when using IPTV. As a result, we propose *'P5. Perceived quality positively influences perceived enjoyment'*.

During the state of cognitive absorption a person is so engaged in the interaction (focused immersion) that she looses her ability to register the passage of time (temporal dissociation). Wondering why she uses the system, she rationalizes that it must be useful (or enjoyable, see P8), because she is spending time with it. As a result she attributes instrumental value to her behavior (Agarwal & Karahanna 2000). Hence, we propose *'P6. Cognitive absorption positively influences perceived usefulness'*.

Following Agarwal and Karahanna (2000), with all of its dimensions cognitive absorption is supposed to lower the perceived cognitive burden while using IPTV. Therefore, we propose *'P7. Cognitive absorption positively influences perceived ease of use'*.

The deeper a person's cognitive absorption while using IPTV, the more she rationalizes that it must be enjoyable (or useful, see P6), because she is spending time with it. Therefore, she attributes affective value to her behavior. Hence, we propose *'P8. Cognitive absorption positively influences perceived enjoyment'*.

Davis, Bagozzi, and Warshaw (1992) and van der Heijden (2004) indicate that perceived enjoyment serves as intrinsic motivator. Thereby it has a positive influence on the intention to use IT. This leads to *'P9. Perceived enjoyment positively influences the intention to use IPTV'*.

According to Agarwal and Karahanna (2000) and Venkatesh (2000), perceived enjoyment positively influences perceived ease of use, whereas Davis, Bagozzi, and Warshaw (1992) and van der Heijden (2004) indicate that the direction of influence may also be the other way around. Although both directions have been supported theoretically and empirically, we assume that enjoyment makes individuals 'underestimate' the difficulty associated with using IPTV since they simply enjoy the process itself and do not perceive it to be arduous (Sun & Zhang 2006). Thus, we propose *'P10. Perceived enjoyment positively influences perceived ease of use'*.

Although research about a direct influence of ease of use on the intention to use is inconclusive (Davis 1989; Venkatesh 2000), we assume that a person is more likely to use IPTV that she perceives as easy to use. Hence, we propose *'P11. Perceived ease of use positively influences the intention to use IPTV'*.

Davis (1989), Davis, Bagozzi, and Warshaw (1992), and Venkatesh (2000) indicate a positive relationship between perceived ease of use and perceived usefulness, meaning that the more a person believes that using a particular system is free of effort, the more she believes the system enhances her job performance. With regard to IPTV, we assume that the more a person perceives that relatively little cognitive effort will be expended while using IPTV, the more likely she perceives IPTV as useful. Thus, we propose *'P12. Perceived ease of use positively influences perceived usefulness'*.

In their technology acceptance research, Davis (1989); Davis, Bagozzi, and Warshaw (1992), and Venkatesh (2000) find that perceived usefulness influences the intention to use IT. Hence, we propose *'P13. Perceived usefulness positively influences the intention to use IPTV'*.

According to Pavlou and Fygenson (2006), the perceived price level is important to developing intention for service usage. Therefore, we capture the perceived price level as obstacle to the intention to use IPTV and propose *'P14. The perceived price level negatively influences the intention to use IPTV'*.

2.3 Conceptualization and Operationalization of Model Variables

Except for perceived quality all variables are modeled as reflective, i.e., their indicators (dimensions and items) reflect the underlying variable and thereby depend on it. As a result, the correlation among the indicators should be highly positive (Diamantopoulos & Winklhofer 2001). In contrast, perceived quality is modeled as formative. Its dimensions, perceived content quality, system quality, interactivity, and security, are not influenced by but influence perceived quality. Thus, as reflective indicators of perceived

quality, the dimensions can have a positive, negative, or no correlation (Diamantopoulos & Winklhofer 2001).

All variables in our research model are latent variables, i.e., none can be directly observed or measured (Diamantopoulos & Winklhofer 2001). Therefore, we operationalize them via item-based seven-point Likert scales ranging from '1 = strongly disagree' to '7 = strongly agree'. Reverse scaled items are included throughout the study, to prevent respondents from always choosing a particular response category without really attending to the item (Kline 2005).

To measure *personal innovativeness in the domain of IT (PIIT)*, we adapt the four-item scale presented by Agarwal and Prasad (1996).

PIIT-1. If I heard about a new IT, I would look for ways to experiment with IT.
PIIT-2. In general, I am hesitant to try out new IT (reverse-scaled).
PIIT-3. Among my peers, I am usually the first to try out new IT.
PIIT-4. I like to experiment with new IT.

To measure *computer playfulness (CPS)*, we use the scale developed and validated by Webster and Martocchio (1992).

CPS-1. When using IPTV services I am spontaneous.
CPS-2. When using IPTV services I am imaginative.
CPS-3. When using IPTV services I am flexible.
CPS-4. When using IPTV services I am creative.
CPS-5. When using IPTV services I am playful.
CPS-6. When using IPTV services I am original.
CPS-7. When using IPTV services I am inventive.

Perceived quality (PQ) consists of four dimensions. For the three dimensions perceived content quality (PCQ), perceived system quality (PSQ), and perceived security (PS), we adapt items developed and validated by Shin (2009a), applying three items to measure each single dimension. To measure perceived interactivity (PI), we combine three items proposed by McMillan and Hwang (2002) with three items used by Liu (2003).

PQ/PCQ-1. IPTV provides various information and services.
PQ/PCQ-2. The services and information I can get from IPTV is valuable.
PQ/PCQ-3. IPTV provides the information and services that I need.
PQ/PSQ-1. IPTV provides various information and services.
PQ/PSQ-2. The speed of IPTV is fast.
PQ/PSQ-3. IPTV is secure to use.
PQ/PS-1. In general, I feel secure in using IPTV systems.
PQ/PS-2. I feel safe in transaction, downloading contents, and accessing sites via IPTV.
PQ/PS-3. IPTV is well built against security-related concerns such as hacking, unauthorized uses, theft of data, interception of transmission, and virus.
PQ/PI-1. The IPTV service was very slow in responding to my requests. (reverse scaled)
PQ/PI-2. IPTV operates at high speed.
PQ/PI-3. While I was using IPTV service, I could choose freely what I wanted to see.
PQ/PI-4. It is easy to find my way through the IPTV service.
PQ/PI-5. IPTV enables two-way communication.
PQ/PI-6. It is difficult to offer feedback to the IPTV service. (reverse scaled)

To measure *cognitive absorption (CA)*, we use the scale developed and validated by Agarwal and Karahanna (2000). The scale consists of five items measuring temporal dissociation (TD), five items measuring focused immersion (FI), three items measuring control (CO), and three items measuring curiosity (CU).

CA/TD-1. Time appears to go by very quickly when I am using IPTV services.
CA/TD-2. Sometimes I lose track of time when I am using IPTV services.
CA/TD-3. Time flies when I am using IPTV services.
CA/TD-4. Usually when I get on to use IPTV services, I end up spending more time that I had planned.
CA/TD-5. I often spend more time using IPTV services than I had intended.
CA/FI-1. While using IPTV services, I am able to block out most other distractions.
CA/FI-2. While using IPTV services, I am absorbed in what I am doing.
CA/FI-3. While using IPTV services, I am immersed in the action I am performing.
CA/FI-4. While using IPTV services, I get distracted by other attentions very easily. (reverse scaled)
CA/FI-5. While using IPTV services, my attention does not get diverted very easily.
CA/CO-1. When using IPTV services I feel in control.
CA/CO-2. I feel that I have no control over my interaction with IPTV services. (reverse scaled)
CA/CO-3. IPTV services allow me to control my interaction with the IT.
CA/CU-1. Using IPTV services excites my curiosity.
CA/CU-2. Interacting with IPTV services makes me curious.
CA/CU-3. Using IPTV services arouses my imagination.

To measure *perceived usefulness (PU)*, we adapt the scale by Davis (1989), capturing the extent to which a person believes that IPTV can be used advantageously and provides positive expected outcomes (Shin 2009a).

PU-1. Using IPTV service is very useful to my life in general.
PU-2. Using IPTV is helpful to improve my performance in general.
PU-3. Using IPTV is helpful to enhance effectiveness of my life in general.
PU-4. Using IPTV provides very useful service and information to me.

To measure *perceived ease of use (PEU)*, we build on Davis' (1989).

PEU-1. Learning to operate IPTV services is easy for me.
PEU-2. I find it easy to get IPTV services to do what I want them to do.
PEU-3. It is easy for me to become skillful at using IPTV services.
PEU-4. I find IPTV services easy to use.

To measure *perceived enjoyment (PE)*, we employ the scale developed by Davis, Bagozzi, and Warshaw (1992).

PE-1. I have fun using IPTV services.
PE-2. Using IPTV services provides me with a lot of enjoyment.
PE-3. I enjoy using IPTV services.
PE-4. Using IPTV services bores me (reverse scaled).

To measure the *perceived price level (PPL)*, we draw on the three-item scale developed by Liao and Cheung (2001).

PPL-1. Overall, using IPTV is expensive.
PPL-2. The price level of using IPTV is a burden to me.
PPL-3. The price level of using special service or information through IPTV is expensive to use.

To measure the *intention to use IPTV (IU)*, we apply the scale from Ajzen and Fishbein (1980) which, in contrast to Shin (2009a), does not assume that the item 'I (strongly) recommend others to use IPTV' implicitly reflects a person's own intention to use IPTV.

IU-1. I plan to use IPTV services in the future.
IU-2. I intend to continue using IPTV services in the future.
IU-3. I expect my use of IPTV services to continue in the future.

2.4 Research Design

Sampling: We conduct a survey employing a web-based questionnaire. To survey only people with IPTV experience, we include a filter question in the questionnaire and post the survey link in various IPTV-related chats and discussion boards on the Internet. This approach, deploying a web-based questionnaire and locating it on the Internet, prevents random sampling. Hence we have to build our model estimation on non-random and probabilistic sampling. The required sample size follows the data analysis method. We apply Partial Least Squares (PLS), where the required minimal sample size is at least ten times the number of items in the most complex construct (Gefen, Straub & Boudreau 2000). Cognitive absorption represents the most complex construct with 16 items, which leads to a minimum sample size of 160.

Model Estimation: To estimate the research model, we apply Structural Equation Modeling (SEM), which enables us to examine our variables and to model multiple relationships among multiple constructs (Gefen, Straub & Boudreau 2000). As SEM technique, we choose PLS for four main reasons: (1) PLS is preferred over covariance-based SEM tools when the proposed relationships are causal, but the underlying theory has not been well developed (Gefen, Straub & Boudreau 2000). This is particularly appropriate as the theoretical grounding of our model stems from different application contexts, barely developed in the context of IPTV. (2) PLS does not require error free measurement (Fornell & Bookstein 1982), this suits the challenge to sample respondents with IPTV experience. (3) PLS enables modeling reflective and formative indicators (Fornell & Bookstein 1982) and hence allows us to have both kinds in the model. (4) PLS allows for minimized sample demands and is quite robust regarding model misspecification (Gefen, Straub & Boudreau 2000).

Using PLS, we first examine the psychometric properties of the applied measures distinguishing between reflective and formative indicators (Jarvis, Mackenzie & Podsakoff 2003). We assess the variables with reflective indicators based on validity and reliability, and the formative relationships between perceived quality and its dimensions based on weights and significance. To rule out multi-collinearity, we calculate the variance inflation factor (VIF) and the condition index (CI) (Coltman et al. 2008; Diamantopoulos & Winklhofer 2001). To assess the structural model, we analyze the local quality criteria for dependent variables with the coefficient of determination (R^2) for each dependent construct. To assess the proposed relationships, we test for the sign of the path and then evaluate the significance of path coefficients, which can be interpreted as standardized beta weights in a regression analysis.

3 Discussion

The discussion is organized around the overall model complexity, the development of measurement instrument, the selection of model variables, and the choice of PLS for model estimation.

The here presented research model turns out to be complex; it entails variables, propositions, and items derived from various research models applied in different research contexts. The complexity results from the integration of different research fields such as consumer marketing, psychology, and IS in our effort to take the theory of adoption in organizational contexts to business-to-consumer-like adoption scenarios relating to hedonic systems. Capturing psychology based items and technical systems qualities lead to model richness with advantages, but certainly also disadvantages. Empirical testing will show whether construct validity can be maintained for all variables.

In contrast to, e.g., Moore and Benbasat (1991), who develop a measurement instrument for studying the adoption and diffusion of IT innovations within organizations via a complex three-stage approach, we develop a research design for studying user adoption of a hedonic system in non-organizational contexts by relying on items and scales applied and validated in prior studies. The first step of PLS – the testing of measurement properties – will hopefully confirm the suitability of our measures.

Concerning the selection of variables incorporated in our model, we differ from Benbasat and Barki (2007), who question the general suitability of utilitarian technology acceptance variables in non-organizational contexts. Instead, we build upon those variables as they are the cornerstones of the dominant paradigm in IT adoption research. Thereby, we are in line with van der Heijden (2004) who keeps perceived usefulness, perceived ease of use, and perceived enjoyment together in the group of user beliefs when studying the adoption of IT in non-organizational contexts.

Finally, one may want to discuss the choice of PLS as SEM technique for estimating our model. We may need additional procedures to obtain estimates of standard errors of the parameter estimates. Moreover, we recognize the risk that PLS tends to underestimate the correlations between latent variables and to overestimate the correlations of the observed measures with their respective latent variables. However, whereas these shortcomings cannot be ignored, we still consider the PLS approach the most suitable and the most convenient data technique.

4 Summary and Outlook

In this paper, we extend prior IT adoption research to studying the driving forces of user adoption of IPTV as an example of hedonic IT. In our work, we emphasize the importance of enjoyment among the user beliefs, stress a user's perception of IPTV-specific factors, and incorporate a direct link between intention to use and buying related aspects. To that end, we stress the peculiarities regarding the formation of user beliefs and intention to use IPTV as a hedonic system. Stimulating a better understanding of the adoption of IPTV and of hedonic IT in general, should provide

guidance to IT vendors, designers, and managers who are interested in promoting system usage within their respective constituents (Lin & Bhattacherjee 2010).

Upon model estimation and validation for IPTV, hopefully showing a decent model fit, we suggest applying the model to the adoption of other hedonic IT applications such as playing games and listening to music. Such studies should then be integrated into larger research efforts; bridging the fields of IS, marketing, psychology, and communication studies in order to develop to a thorough understanding of technology adoption in non-organizational contexts.

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