

Understanding Technology Adoption Through Individual and Context Characteristics: The Case of HDTV

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Technology adoption research has a tradition of using and improving Davis' (1989) "Technology Acceptance Model" (TAM) and extended versions of it. This article suggests a break with this tradition by showing that the TAM is limited in its understanding of technology adoption. Two alternative approaches are proposed that focus on the role of knowledge and user-technology match, and on the role of temporary dynamical contexts in the process of adoption decision-making. Together with the TAM, both approaches were empirically tested and compared to the TAM by incorporating them in a questionnaire regarding the adoption intention of HDTV in the Netherlands. Results show that the constructs of both approaches show significant relations with the respondents' adoption intentions of HDTV and, together, offer a good alternative to the TAM. This result can be seen as a basis for more future research that uses technological and contextual factors as a starting point for adoption research. Using this starting point will contribute to a better understanding of future technology adoption processes.

Whenever a new media technology is developed, scholars from various social science disciplines attempt to understand the factors that influence its possible success or failure. In the last 10 years, the digitization of television has been subject to studies of standardization (Dupagne & Seel, 1998; Grimme, 2002; Hart, 2004), changing power relations (Galperin, 2004) the development of digital (interactive) services (Choi, Choi, Kim, & Yu, 2003; Jensen, 2005; Kim & Sawhney, 2002) and

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adoption of digital television in households (Atkin, Neuendorf, Jeffres, & Skalski, 2003; Chan-Olmstead & Chang, 2006; Lin, 2003).

One emergent technology that is closely connected to the introduction of digital television, and currently at the beginning of its diffusion process but has hardly been studied, is the household adoption of digital High Definition Television (HDTV). Studies conducted in order to understand household adoption of HDTV in the last decade of the previous century, concentrated on the effect of demographic and behavioral characteristics on the adoption intention of (analogue) HDTV (Bouwman, Hammersma, & Peeters, 1991; Dupagne, 1999; Dupagne & Agostino, 1991). Little is still known about the adoption dynamics behind the introduction of *digital* HDTV. HDTV is a new television broadcast standard, containing a digital image resolution that displays a sharper image (1080 interlaced, or 720 progressive scan lines and higher) compared to existing PAL (576 interlaced) and NTSC (525 interlaced) standards. The transition to HDTV is not a straightforward process, since this new standard needs to be adopted by every party within the television chain before it can be used. At the end of this chain, the end-users of HDTV (households) need to invest in new HD-ready television sets, set-top boxes and HD subscriptions to successfully receive and view high definition images. While the penetration of suitable television sets is rising steadily, the adoption of HDTV subscriptions is still very low.

This article aims to understand factors that influence end users' adoption intentions of the new digital HD standard. While many studies use existing models like the Technology Acceptance Model (TAM) and its variants, the present study argues that insight into the adoption of HDTV cannot be discovered by these models. Instead, the adoption speed of HDTV, as well as of any other new (media) technologies depends on temporary underlying user-technology matches and situational factors.

In the remaining sections of this paper, the argument is developed further. The next section presents two alternative approaches to TAM-based models, and research design section explores how these models may be operationalized. These alternative approaches were empirically tested in a representative sample of 3100 Dutch households, and present the effects of this test in the results sections. By combining the two alternative approaches, a clearer picture of the underlying factors that influence the differences in adoption between users, technologies, and times emerged. With such analytical tools, the diffusion process of emerging digital television technologies can be better understood, predicted or actively steered by institutions that control at least some of these underlying factors.

Beyond the Technology Acceptance Model

Much of the research on the adoption of new information technologies (ITs) in organizations and homes focuses on perceptions of usefulness and ease of use. These concepts were first used in Davis' Technology Acceptance Model (1989). The TAM builds on theories of reasoned action and planned behavior, both of

which argue that execution of a behavior is determined by an individual's attitude toward that behavior and perceptions of the individual's own performance (Ajzen, 1985; Fishbein & Ajzen, 1975). The TAM was successfully validated by scholars who tested the model empirically and established that it explained much of the variance between perceived usefulness (PU), perceived ease of use (PEOU) and adoption intentions (e.g., Adams, Nelson, & Todd, 1992, Szajna, 1996, Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003). Because of this, the TAM is regarded as a trustworthy tool for predicting adoption intentions.

However, for researchers who seek to understand the full process of technology diffusion, the Technology Acceptance Model is limited in scope. First, the model treats perceptions of usefulness and ease of use as independent factors, leaving the dynamics that determine these perceptions as a "black box." This "black box" is illustrated by the way that TAM-based questionnaires are operationalized. Questions that measure technology perceptions, or technology belief constructs (Bensabat & Barki, 2007), are designed with scale-based items such as I find <the technology or service> useful, or I find <the technology or service> easy to use. The results of TAM-based research can therefore only show whether respondents find a technology useful or easy to use, but they cannot tell us why. In other words, the characteristics of the technology and contextual factors that determine perceived usefulness and ease of use remain unclear. But since the adoption process differs by technology, timeframe, and society (Rogers, 1995), research in this domain should concentrate on exactly these differences and their underlying factors. This implies that a shift of focus from whether to why, and thus a move away from a model that treats perceptions of a technology as independent factors is necessary.

Extended Versions of the TAM

Several authors acknowledged the need for deeper insights into factors that influence adoption process. Some of these models, for example TAM2 (Venkatesh & Davis, 2000) and the UTAUT model (Venkatesh et al., 2003), extended the existing TAM with several other constructs to explain adoption intention and adoption. These constructs refer to personal circumstances (age, gender, experience) as well as contextual factors like social influence and voluntariness of use. While some of these factors may contribute to a better understanding of technology adoption, they are still only studied alongside the TAM constructs of performance expectancy and effort expectancy (Venkatesh & Davis, 2000, Venkatesh et al., 2003). Because the core variables of TAM are still in place in these extended models, they do not really provide anything new with regard to the question of why people adopt a new technology. However, new constructs added to the TAM are useful to this study's proposed models, but these will be discussed among other theories that focus on the influence of personality traits, knowledge, experience, user-technology matches and/or contextual factors.

Personality Traits

Personality traits are seen as important indicators for technology adoption. These traits are intrinsic characteristics of individual end-users and include concepts like venturesomeness (Ostlund, 1974), novelty-seeking (Hirschman, 1980), self-efficacy (Bandura, 1994), and personal innovativeness (Rogers, 1995). But while the effects of these factors on perceptions of usefulness and actual adoption were proven viable (e.g., Lin, 1998; Lu, Yao, & Yu, 2005; Manning, Bearden & Madden, 1995), they are still generally measured as belief constructs instead of as actual psychological characteristics (Bensabat & Barki, 2007). Furthermore, the share of personality traits in a society remains roughly constant over time. Differences in the speed with which different technologies diffuse can therefore hardly be seen as a result of swings in the population's personality characteristics. To understand the differences in adoption, the focus should be on factors beyond personality traits that are more technology-based and context specific. This means that broad theories of technology adoption must be combined with the identification of possible factors that may influence the diffusion of a specific technology; in this case, HDTV.

HDTV Knowledge and Visual Experience

According to Rogers (1995), adoption decisions depend on the end users' perceptions of how compatible the technology is with personal values, experiences and needs. These values, experiences and needs can only influence an adoption decision when there is some degree of knowledge regarding the existence, uses and meaning of the technology. This knowledge can be actively sought by end-users, but also depends on external factors that surround the specific technology, such as its trialability and visibility in society (Rogers, 1995). For HDTV, both trialability and visibility can be translated into visual experience with its main characteristic: the high resolution image. Visual experience was seen as an important factor influencing adoption intentions; earlier research on HDTV adoption in the Netherlands has demonstrated that HDTV was more positively valued by respondents that claimed to have seen HDTV images (Baaren, van de Wijngaert, & Huizer, 2008; Joor, Beekhuizen, van de Wijngaert, & Baaren, 2009).

Next to visual experience, knowledge about HDTV devices and subscriptions may also have several consequences for adoption intention. A study on the adoption process of digital television in the United States found that knowledge regarding DTV had a significant influence on adoption intention. The study also argued that a lack of knowledge was likely to lead to a delay in making any adoption decision, since potential adopters were insecure about the possible benefits of the technology (Chan-Olmstead & Chang, 2006). However, as stated earlier, knowledge about the functions of a technology and conditions for use serve only as a precondition for making a decision whether to adopt a technology. The remainder of the decision-making process depends on additional factors that are discussed in the next two sections.

End-user and Technology Matches

The TAM treats the role of technological characteristics in the technology adoption process as a "black box." But the possibilities and limitations for its use due to the inherent characteristics of the technology, or the product in which the technology is delivered, can be seen as the boundaries within which the end-user does or does not find a proper use for the technology. These boundaries manifest themselves in several ways.

First, according to the Media Richness theory, end-user communication becomes effective when the characteristics inherent to a medium match the communication task(s) a user has to perform (Trevino, Lengel, & Daft, 1987). Although the media richness theory was heavily criticized and was difficult to validate empirically, there was much support for the notion that task-technology fit influenced the adoption of a new technology. The technology-fit concept also was influenced by media choice theories. These theories were developed to understand choices in two-way end-user communication media such as face-to-face conversations, telephone and e-mail. The use of television, which is mainly a one-way broadcast communication, calls for tasks that differ from those between end-users. The Uses and Gratifications approach provides a good alternative here. As this approach is based on the notion that viewers make active choices about the genres, channels, and amount of content they watch based on the gratification they expect to receive from their viewing behavior (Palmgreen & Rayburn, 1985; Palmgreen, Wenner, & Rayburn, 1980). These viewing choices may affect adoption intention, since image and sound quality can enhance the feeling of "being there" that is often sought in watching sports, movies, and games (Baaren et al., 2008). Similarly, there may be little desire for high quality images when the end-user watches other genres, or when s/he places little value on television-watching.

Second, variations in desires regarding television exist outside of specific television genre viewing behavior. The relative advantage (Rogers, 1995) that end-users do or do not see for HDTV is also related to the way that this technology is valued among other existing technologies. The extra value that end-users see for HDTV is questionable since HDTV is, technically speaking, no more than an upgrade of the existing television image resolution and sound quality. This raises the question of whether a better image and higher sound quality are desirable to the end-user. This question becomes even more relevant when taking into account the fact that diffusion of HDTV goes hand in hand with that of standard digital television (DTV), which also promises image quality improvement, and contains other use options such as video-on-demand (VOD) and interactivity. The relative value of HDTV among existing and emerging television features can be measured by analyzing desire for image and sound quality improvement and comparing this to the desires for other new television uses made possible by digitalization. The strength of the desire for HDTV may also be related to the television signal (analog or digital) that end-users receive; for consumers who switched to DTV, the desire for better image quality may have been fulfilled.

Third, the characteristics of the HDTV reception devices (determined by the supply side of the television chain) make adoption of the technology rather complex. HDTV adoption currently requires purchasing HD-compatible sets, set-top boxes and subscriptions, all of which require understanding the remote controls that come with the devices. Complexity of HDTV adoption and use should therefore be measured as a possible factor influencing adoption intentions. But instead of measuring general beliefs of HDTV complexity and falling back into the use of TAM-based constructs (e.g., I find the use of HDTV very difficult), questions should ask for attitudes towards adoption of specific HDTV characteristics (e.g., arranging a new subscription) and HDTV uses (e.g., handling the remote controls and the decoder).

In sum, alongside visual experience and knowledge, the match between the needs, uses and gratifications of the end-user on one hand, and the characteristics of technology on the other, should be incorporated into adoption research. In the case of HDTV, this can be achieved by looking closely at the context in which HDTV adoption choices take place. This context has, so far, included the characteristics and use behaviors associated with existing technologies (analog and digital SDTV) and devices. In the next section, contextual factors beyond end-user and technology matches are discussed.

Contextual Factors

The preceding sections explained the limitations of TAM and provided an alternative list of factors influencing adoption intentions based on theories that take technology-specific characteristics and use as a focal point. What was omitted were the contextual system factors (Lin, 2002, 2003) that surround the emergence of a technology in a society. Whereas the TAM lacks explanations for perceptions of usefulness and ease of use, the personality and person-technology match approaches still lack recognition of the social and economic contexts in which the adoption intention is formed. These larger contextual factors are discussed in this section.

First, adoption intention may be socially influenced by opinion leaders or salient others (Rogers, 1995). These groups of actors may impose a positive or negative attitude toward the technology on the end-user. There are two forms of social influence. First, social influence may come from partners, friends, peers and relatives (Quiring, 2006; Venkatesh et al., 2003). Second, on a macro level, organizations influence public opinion through advertising in an attempt to sell technology. News media also may influence the public discourse with regard to a technology. A comparative study between Britain, the United States and Australia demonstrated that different national discourses (measured by the extent of media coverage and language structures) regarding digital television caused differences in the rate of adoption (Weber & Evans, 2002). All these influences should be taken into account in adoption research.

Apart from influence by communication, the supply side of the television chain also presents the technology as a product, accompanied by certain prices and conditions for use. For HDTV adoption in the Netherlands, prices and conditions are highly variable and depend on the choices of broadcasters and distribution parties. During the time of this research, the amount of content offered in high definition was low, with only four foreign channels, and no national content other than major international sporting events presented in HD. Limited HD content was a recurring topic in HDTV news articles, and seen as a major barrier to adoption (van Ammelrooy, 2006; Briel, 2008; Hijink, 2008). Second, the emergence of HDTV was only one of the events surrounding digital television. As a result, distribution parties offered television subscriptions with VOD or set top-boxes with hard disc recorders next to, or instead of, HDTV. This situation could change in the future when more content becomes available and separate HDTV and VOD subscriptions are combined. These changes, in turn, may lead to a more positive attitude toward HDTV, and more positive news coverage regarding the introduction of HDTV.

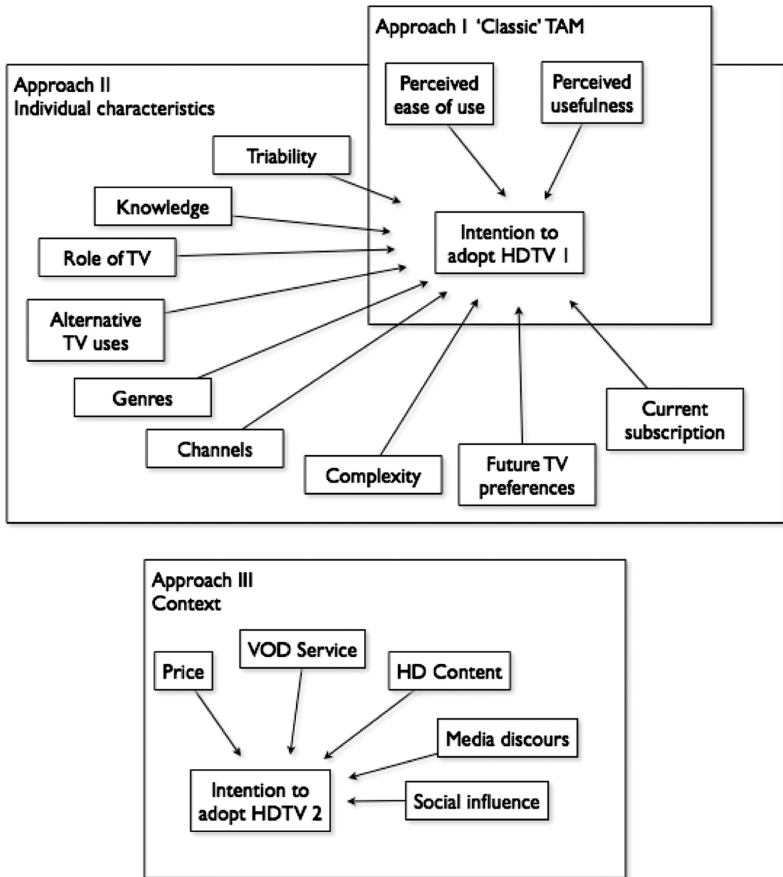
In short, an adoption intention cannot be understood without accounting for the dynamics of contextual system factors as well as end-user and technology matches. Researching these contexts requires a specific method for two reasons. First, adoption decisions are not based on the consideration of one contextual factor at a time, but on the whole context: Prices, services and surrounding opinions are bundled by end-users, and then turned into an adoption decision. Second, the contextual factors mentioned above tend to change quickly, making it difficult to research their influence at a fixed point in time. The effects of contextual changes should therefore be measured using scenarios. Compared to studies that take a "policy capturing," "factorial survey," or "conjoint measurement" approach (Bouwman & Van de Wijngaert, 2005), scenarios in which context factors change systematically can be used to test the influence of context factors on adoption intention. A detailed description of these scenarios follows in the next section.

Research Design

A Framework With Three Approaches

The factors described in the previous section, and the differences in methodology that are needed to research these factors, requires a framework that has three approaches to empirical quantitative testing. The first approach examines TAM-factors, the second studies individual underlying factors and the third investigates the influence of contextual factors on HDTV adoption intention. This framework is displayed in Figure 1. The central hypothesis of this paper is not so much to test the individual hypotheses of the different models. Rather, the goal is to test the hypothesis that a contextual approach provides a good alternative to the conceptually TAM like models.

Figure 1
A Research Framework for Adoption Intentions of HDTV



The first approach tested the influences of the “classic” TAM-based variables (PU and PEOU) on HDTV adoption intention. All questions were based on a 5-point Likert-scale, and focused on beliefs of usefulness and ease of use of HDTV (see section 1 for examples). Adoption intention was measured by behavior (e.g., I plan to switch to HDTV in the future; I’m keeping a close eye on HDTV developments).

The second approach focused on the relation of the construct of adoption intention with knowledge, trialability (visual experience with HDTV), subscription ownership, future TV preferences (including the need for better image and sound quality), viewing behavior of channels and genres, alternative TV uses, and the general importance of television in daily life. When possible, the independent variables measure behavior towards specific (HD)TV characteristics, instead of beliefs.

These variables were drawn from earlier studies on the adoption of HDTV such as Bouwman et al., (1991), Dupagne (1999), Dupagne & Agostino (1991), and Lin (2002; 2003). The dependent variable adoption intention was the same as the adoption intention measured in the TAM approach.

The third approach tested the influence of contextual factors on adoption intention. As noted in the previous section, scenarios were used to test these factors by systematically varying the values of each of these variables. Four factors were incorporated that varied the amount of HD content provided (30, 60 or 100% of the respondent's favorite content), HD subscriptions (with or without VOD), opinions on the media (positive or negative), and the social influence of an acquaintance (positive or negative), leading to a set of 72 hypothetical scenarios. An example of a scenario:

Imagine a television subscription that offers 30% of your favorite programs and movies in HDTV quality (high image sharpness' and sound quality). It also contains extra on-demand services for reviewing missed programs. In newspapers and on television, you read and hear positive messages about HDTV. A trustworthy acquaintance, however, already has this subscription and tells you the subscription is definitely worth having. The subscription costs will be five euro extra on top of your current subscription costs. Furthermore, a decoder is needed with a price of 300 euro. Based on these scenarios, what is the probability of you getting such a subscription within a year?

When respondents are randomly presented with one of these scenarios, they are asked to estimate the chance they will adopt HDTV subscriptions based on the scenario.

Figure 1 graphically outlines the hypotheses that will be empirically tested in the next section. In addition to these hypotheses the study considered another, higher-level expectation related to a comparison of the three approaches. It was expected that the TAM-based factors would explain more of the variance than individual factors and contextual scenarios. The reason for this expectation was that TAM measured general beliefs of usefulness and ease of use, therefore containing many unexplained underlying factors. Because the other two approaches focused on specific underlying factors, these individual factors were expected to explain less of the variance than these more inclusive variables. Although a lower level of explained variance may appear to be a disadvantage of this approach, these factors could better explain the intention to use a technology. The more detailed understanding provided by this analysis makes it possible for institutions to actively influence the diffusion of an innovation, in this case, HDTV. In sum, although statistical significance may decrease in the second and third approach, the conceptual strength of this research is much higher.

Data Gathering

A survey was conducted in the early summer of 2008 on 3100 Dutch households. Because the decision to adopt new television subscriptions and sets were house-

hold matters rather than individual decisions, only respondents that considered themselves to be in charge of the adoption decision were asked to complete the questionnaire. An online survey was conducted using a select sample of 435 Dutch households in different geographical regions. Respondents were gathered through announcements via mail invitation, electronic newsletters, and on Web sites of the largest Dutch cable companies. In addition to the online survey, respondents could request a pen-and-paper version of the questionnaire. Ten percent of the final responses were gathered this way. These respondents generally were over 60 years of age.

Of the total set of respondents, 60% were male and 40% were female. Most of the respondents (41%) were between 31 and 60 years of age and had been educated at the college (56%) or academic level (13%). Survey responses were sorted by type of subscription, use of infrastructure (cable, satellite, terrestrial, IP) and type of signal received (analog or digital). Based on this procedure, the researchers can confidently generalize results to the Dutch population.

Also, the scale-questions for perceived usefulness, perceived ease of use, role of TV in daily life, frequency of alternative TV uses, complexity of adoption and use, future TV preferences, and adoption intention. The Cronbach's Alpha for these newly created variables ranged between 0.73 and 0.99. For viewing behavior of genres and channels, an exploratory factor analysis was conducted resulting in a division between two groups of viewers: Commercial channel viewers, mostly interested in entertainment, and public channel viewers, mostly interested in news and documentaries.

The amount of knowledge regarding HDTV was measured using a quiz-like approach. Respondents were presented items such as: "In order to watch HDTV, it is sufficient to have a flat panel TV screen," and offered the responses "correct," "incorrect" or "don't know." The answers were recoded to new variables expressing a lack of knowledge (the amount of don't knows), false knowledge, and correct knowledge.

Results

Influence of TAM-based and Individual Constructs

Results for the constructs that were tested within the TAM-model show similarities to those of other TAM research: The construct of PU has the highest coefficient (0.64) followed by PEOU (0.12) in Table 1.

As was the case in many other projects, the TAM model showed strong statistical validity. When it came to individual underlying factors, the results in Table 2 show that six out of nine constructs show significant relationships with the HDTV adoption intention.

The constructs "wish for HDTV characteristics," "knowledge," "alternative television uses," "preferences in genres and channels," "visual experiences" and "own-

Table 1
Approach I: Classic TAM

Independent Variables (TAM)	<i>Mean</i>	<i>R</i> ²	<i>F</i> -value	<i>t</i> -value	St. Beta
Model Summary	—	0.48	493.42**	—	—
-Perceived usefulness	3.4	—	—	27.10	0.64**
-Perceived ease of use	3.3	—	—	4.96	0.12**
-Constant	—	—	—	-0.51	—

* $p < 0.05$; ** $p < 0.01$ (two tailed).

ership of digital television subscriptions" all partly determine the HDTV adoption intention. The mean of the adoption intention variable was relatively low, at 2.8 on a 5-point scale. For most respondents, adoption of HDTV subscriptions was rather unlikely. But a change in some of the significantly influential factors mentioned above may change HDTV adoption intention.

Desire for HDTV Characteristics

As Table 2 shows, the wish for HDTV-related characteristics had the strongest influence on the adoption intention. This wish included a desire for sharper image quality, better sound quality and a bigger flat screen TV in the future. Not only was

Table 2
Approach II: Individual Characteristics

Independent Variables	<i>Mean</i>	<i>R</i> ²	<i>F</i> -value	<i>t</i> -value	St. Beta
Model Summary	—	0.34	86.23**	—	—
-Knowledge	—	—	—	8.97	0.27**
-HDTV characteristics	3.5	—	—	11.27	0.30**
-Alternative TV uses	4.3	—	—	4.79	0.13**
-Public channel viewers	—	—	—	3.51	0.09**
-Visual experience with HDTV	—	—	—	3.12	0.09*
-Current subscription	—	—	—	2.96	0.08*
-Role TV	2.9	—	—	-1.13	-0.04
-Commercial channel viewers	—	—	—	-1.85	-0.06
-Complexity of adoption & use	4.0	—	—	0.85	0.03
-Constant	—	—	—	0.92	—

* $p < 0.05$; ** $p < 0.01$ (two tailed).

an influence demonstrated, but the wish for an improvement of image sharpness and sound was also relatively high in the population; sharper image quality ($Mean = 3.7$) and better sound ($Mean = 3.6$) were found to be the most desired characteristics compared to other television developments such as a growth of channels, VOD and interactive services. Despite the threat of other digital developments and services, the characteristics that HDTV offers was be seen as an incentive for adoption.

Knowledge and Visual Experiences

In the regression analysis, knowledge had the second largest positive influence on the adoption intention. This can be explained by the argument that an increase in knowledge decreases insecurity, making it possible to actually form an attitude towards adoption (Rogers, 1995). However, the results also show that most end-users still lack knowledge about HDTV. Out of 17 multiple choice questions, "don't know" was the response with the highest mean, at 7.5, compared to means of 5.6 for correct answers, and 3.5 for incorrect answers. In particular, topics about the amount and character of broadcast HD content, as well as the status of current HDTV subscriptions, showed a big gap in knowledge. Further down in Table 2, the construct of visual experience (for which 64% of the respondents claimed to have seen HDTV in practice) showed a positive influence on the adoption intention.

Viewing Behavior and Television Uses

Next to needs for HDTV characteristics, knowledge and experience, differences in adoption intentions can be explained by current television uses in two ways. The first is the frequency with which the television set is used for alternative purposes such as watching DVDs, watching recorded or downloaded content, and gaming. These uses highly correlated with each other (Cronbach's $\alpha = 0.99$), and together explained 13% of the adoption intention. Second, viewing habits of channels and genres also partially influenced the adoption intention. Public channel viewers that frequently view serious content such as news and documentaries had a higher adoption intention than less frequent viewers in this group, whereas viewing frequencies of commercial channels and the entertainment genres did not show significant differences.

Television Subscriptions, Complexity and the Importance of Television

The last significant individual variable was that of television subscriptions. After differences in wishes, knowledge, and viewing frequencies were filtered out, respondents with a digital subscription still had a more positive HDTV adoption intention than respondents that still used an analog signal. An explanation may lie in the perception of lack of choice. Respondents that belong to this group may have adopted digital television out of an idea of inevitability, and may now also prepare themselves for HDTV as the next step for the same reason. A second explanation can be found in possible dissatisfaction with the existing digital signal, which also

promises the user an improvement in image quality. End-users that still have an analog signal may still be satisfied with the quality of their signal.

Finally, the role of television in daily life and the complexity of specific HDTV uses did not play significant roles in HDTV adoption intention.

Summary

The results based in the individual factors model show that wishes for HDTV characteristics were high and have the biggest influence on adoption intention among other individual factors. Furthermore, frequent viewing behavior of news and sports programs, frequent alternative uses of the TV set, and the use of digital TV also positively correlate to HDTV adoption intention. In addition, knowledge was seen as an important factor in the diffusion of HDTV. A low level of knowledge leads to a low chance of HDTV adoption.

When comparing the results from the three approaches to each other, expectations regarding the amount of explained variance were confirmed. The explained variance was the highest for the TAM approach ($R^2 = 0.48$), followed by the accumulated effect of individual constructs ($R^2 = 0.34$) and the analysis of contextual factors ($R^2 = 0.05$). When influences from both contextual factors and individual factors were counted together and compared with the "classic" TAM, the reduction in the explained variance was relatively small. However, as argued earlier, conceptually the two new approaches form a much stronger conceptual framework. Thus, it can be concluded that a combination of approaches that test individual and contextual factors provide a good alternative to the TAM approach, especially since this alternative approach likely explained constructs that were underlying factors of the TAM.

Influences of Situational Factors

The results of the third approach are displayed in Table 3. First, the dependent variable of this model (adoption intention 2) shows a lower mean (2.2) than the adoption intention based on the former approaches ($Mean = 2.8$).

When respondents become conscious of certain situational conditions, adoption intentions can change. Furthermore, all tested factors showed significant results, except for the factor related to the amount of content that was broadcasted in high definition. Opinions from acquaintances had the strongest influence, followed by the price of the subscription, media opinions and, finally, the presence of VOD services in the HDTV-subscriptions. The amount of HD content had no significant influence on the adoption intention.

These results have several implications. First, the significance of social influence shows that communication or persuasion between end-users has a greater effect on adoption intention than institutional communication by the news media. However,

Table 3
Approach III: Situational Characteristics

Independent Variables (Conjoint)	<i>Mean</i>	<i>R</i> ²	<i>F</i> -value	<i>t</i> -value	St. Beta
Model Summary	—	0.05	15.80**	—	—
-Social influence	—	—	—	4.98	0.14**
-Price of subscriptions	—	—	—	-4.65	-0.13**
-Media discourse	—	—	—	3.35	0.10**
-VOD service	—	—	—	2.04	0.06*
-HD Content	—	—	—	1.11	0.32
-Constant	—	—	—	25.95	—

* $p < 0.05$; ** $p < 0.01$ (two tailed).

opinions of end-users are also partly based on the knowledge and opinions of others, including those of institutions. Institutional communication towards end-users therefore remains an important factor. Second, institutions also play a role in the determination of prices and conditions of subscriptions; despite a general need for sharper image quality, VOD-services appear to be of greater importance than the availability of a large amount of HD content. This does not mean that the amount of high definition content does not matter at all. First, the scenarios in this research set the minimum amount of HDTV content to 30%, which means that differences in adoption intention may appear when the amount of HD content rises from 0% to 30%. Second, an increase of HD content can also have an indirect effect on adoption intention through an increase in positive media attention and in the positive opinions of salient others.

Conclusion

The purpose of this article was to show the additional value of researching individual underlying factors and changing contexts in order to better understand and predict adoption intentions of new media technology. Three approaches were empirically tested in a survey that contained questions aimed at general attitudes toward the concept of HDTV (PU, PEOU, adoption intention), specific attitudes toward aspects of the technology (complexity, wish for HDTV characteristics), specific behaviors (knowledge, television use, viewing habits, importance in daily life), and hypothetical scenarios (social influence, amount of HD content, presence of VOD and media discourse). While the explained variances for individual and contextual factors were lower than that of the TAM approach, both alternative approaches show significant results for most factors. Together, they offer a better alternative to

the TAM-approach, since they not only describe contemporary attitudes towards adoption of a technology, but also explain them and offer possibilities for the active stimulation of adoption. Research regarding adoption decisions of new (media) technology should therefore concentrate on individual and contextual-based factors and, given the explained variances, preferably in combination with each other. The TAM model can still be used as an indicator of future adoption, but the perceptions of usefulness and ease of use constructs will only be symptomatic of the presence of underlying factors that vary from one technology and one context to the next.

From the results of the multi-theory, multi-method approach conducted in this research, several conclusions can be drawn regarding the near future of HDTV adoption. First, very few households intend to adopt HDTV subscriptions in the Netherlands. Intentions that are present, come from respondents who have seen HDTV work, have a strong wish for sharper image quality and better sound quality, respondents who frequently watch public channels with news and documentaries, respondents with digital television subscriptions, and/or respondents who frequently use the television device for alternative purposes (including internet movie downloads, which are often seen as a threat to HDTV rather than an incentive for adoption). What is still lacking in the surveyed population is sufficient knowledge surrounding the use and adoption of HDTV subscriptions. The strong relation between knowledge and adoption intention indicates that an increase in knowledge can have a profound positive influence on HDTV adoption intention. The direct social environment of the end-user and institutional campaigns can change the amount of knowledge. These actors can also change attitudes towards HDTV through persuasion or by altering conditions for HDTV subscriptions. If costs drop and combinations with VOD become available, not only will the potential adopters themselves become more positive regarding adoption of HDTV, but the opinions of neighbors, friends, and media that these potential adopters value, might do the same.

In a broader context, this research is an indication of how households will deal with the adoption of HDTV in other countries that experience one or more of the same contextual factors. It also shows how contextual factors may play a role in future digital television developments such as the adoption of 3DTV; the speed of adoption of 3DTV subscriptions will depend not only on personal preferences, but on the way 3DTV is presented by institutions and the social environment of households.

Limitations, Further Research and Future HDTV Developments

Based on the results of this research, further investigation regarding HDTV adoption is needed. First, the way contextual factors were varied within the scenarios for this research was rather extreme. For example, opinions of acquaintances were either positive or negative, and the amount of HD content in a scenario could be 30%, 60%, or 100%. This leaves the question open of what happens between

these extreme situations. Second, since scenarios were hypothetical, answering the question required extra imagination from respondents. Next to hypothetical situations, changes in contextual factors should therefore, if possible, also be studied by longitudinal research. For example, content factors may play a role in the adoption of HDTV. For instance, HDTV is a natural for sports, but it offers little intrinsic benefit to viewers of comedies and soap operas. In future studies this type of factors may be studied in more detail. Such a study would allow changing contextual factors to show their effects on the adoption decision. Also, factors such as social influence could be included into the vignettes in a more subtle way. In sum, the research represents a small slice in time and represents a unique competitive environment. The HDTV offer will go through considerable changes as far as offerings and pricing are concerned. These changes and the effect on adoption should be a subject of further study.

Third, the results of this study call for future research that combines the two alternative approaches by not only counting up their outcomes, but also measuring the influence of individual factors such as prior experience and exposure on the adoption decision via the awareness of contextual factors. Such a combination will contribute to an even more in-depth explanation of adoption decisions of a specific technology at a specific moment in time. Fourth, this research focused on finding factors that influence the adoption intention for HDTV specifically. But the approaches used in this study also indicate the potential for further research on other media technologies. It is important to look to contemporary situations to define influential factors, rather than to examine only those factors that have been tested before. In addition to statistical research, methods of a qualitative nature, such as face-to-face interviews with end-users can help define such factors and further explain their nature.

In conclusion, exciting times await the HDTV adoption process, as public broadcasters have started broadcasting HDTV programs on a regular basis since July 2009. This may cause a shift in adoption intentions due to an increase in the first 30% of HD content. Further, a major cable distributor in the Netherlands called Ziggo launched a new set-top box that can be used for HDTV, as well as on-demand services and hard disc recording. This may be a small indication that VOD services and HDTV subscription packages will, in time, likely be combined. While prices of subscription are likely to rise when more content becomes available, this combination may well be needed by distribution parties that are eager to speed up the adoption rates of HDTV subscriptions.

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