

Understanding the Diffusion of HDTV through an Analysis of Risks and Uncertainties of Supply and Demand in The Netherlands

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ABSTRACT

This paper analyses the diffusion of HDTV in The Netherlands. The research provides an analysis of the supply side of the broadcast value chain as well as an analysis of consumer acceptance of HDTV in The Netherlands. The research is part of longitudinal research effort and uses both qualitative and quantitative measures. Using risks and uncertainties as a broad theoretical basis, we conclude that the consequence of the reluctant attitude on the supply side leads to a lack of knowledge on the demand side which is a necessary condition for the adoption of HDTV by consumers. This deadlock can be overcome when the supply side starts taking some calculated risks.

Categories and Subject Descriptors

K.4.0 Computers and Society; General

General Terms

Management, Economics, Human Factors, Theory

Keywords

Diffusion of innovations, Supply, Demand, HDTV

1. INTRODUCTION

HDTV research has, since its inception, been focused on issues regarding the technical feasibility and standardization. Another interesting question, however, is: how long it will take for HDTV to become accepted (and used) as the new broadcast standard. In order to understand the diffusion of HDTV in society it is important to research the dynamics behind the decision making processes of the various involved parties, as well as the effects that the decisions have on the rest of the broadcast chain. The results of that research will allow us to understand and improve the diffusion of HDTV (and other future new media technologies).

From different perspectives a rapid diffusion of the HD-technology would have advantages. On the supplier side, it would help to focus investments and to get agreement in the chain, thus avoiding years of wasted energy where different parts of the broadcast supply chain are not in sync. For producers a timely change to HD would allow

them to start experimenting with new crossmedia formats on HD-broadcasts (combinations of moving image, still image and text), thus gaining an early adopter position on the international formats-markets. Last but not least, on the consumer side it would shorten the time to availability of HD-content and as such help early adopters to cash on their investments and all other consumers to really enjoy their flat screen at its maximum capabilities.

In this paper we will present the results of our research into the factors influencing the diffusion of HDTV as a new media technology. We chose the diffusion of HDTV between 2006 and 2009 as the basis of our case study. The research uses two different perspectives. The first perspective consists of analyzing the supplier side of the broadcast value chain. It focuses on the established parties of that chain that create, facilitate and/or make content available. This analysis is mostly qualitative. The second perspective consists of research into the consumer acceptance of HDTV. This research is mostly quantitative and is part of an ongoing multiple year longitudinal research effort.

2. Analysing Risks and Uncertainties

The (rapid) diffusion of innovation depends on the decisions that institutions in the chain make. Since institutions have different stakes, they will try to develop and diffuse the technology in a way that fits their own strategy according to market expectations and existing power structures (Winston, 1998). In addition to these corporate strategies, the 'actor centered institutionalist' approach (Schmidt & Werle, 1998) states that human decision making in organizations is also an effect of 'soft' situational factors (social, cultural and political) that influence the actors within an organization. These factors combined can result in different technology rollout strategies. Especially when institutions depend on each other to deliver a final end product, such a product can emerge with only a part of its technical affordances, or not at all. In the same way, different institutional strategies determine the way the product is communicated to the public (Boddy, 2003). For example, Weber and Evans found that the different adoption speeds of digital television in several countries depended on the different meanings that were given to the concept of 'digital television' (Weber & Evans, 2002). Influenced by underlying situational factors, existing institutions have the power to create and sell this meaning. In short, institutional decision making depends on strategic economical but also on social, cultural and political factors.

In order to develop a strategy, or in the case of this paper understand the developments in the value chain, it is possible to look at risks and uncertainties in the HDTV value chain. Although there is extensive literature on uncertainty in the decision-making process (i.e. Fontana et al., 2004; Pomerol, 2001; Kobus et al., 2001; Yager,

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2004a,b), most studies focus mainly on decision-making in general. Conceptual frameworks are largely missing and analyses are mainly anecdotic and unsystematic (see for example Richardson, 2009). Based on Walker et al. (2003) and Meijer et al., (2006), Fijnvandraat & Bouwman (2010) developed a framework for analysis of Risk and Uncertainties. Table 1 provides an overview of different sources of uncertainties.

Table 1. Sources of uncertainties

Source
Technological: - uncertainty about the technology itself - uncertainty about the relationship between the technology and technological infrastructure - uncertainty about the availability of alternative technological solutions
Resource: - uncertainty about the amount and availability of financial resources - uncertainty about the amount and availability of human resources
Competitive: - Uncertainty about the actions of (potential or actual) competitors - Uncertainty about the effects of competitors' actions
Supplier: - uncertainty about the timing, quality and price of the delivery
Consumer: - uncertainty about consumer preferences - uncertainty about consumer characteristics - uncertainty about the development of consumer demand
Political: - unclear or inconsistent regulation - lack of regulation - future changes in regulation - overall government behaviour

As can be seen in Table 1 the sources of uncertainty are technological, resource related, competitive, supplier, consumer and political. Uncertainty is caused by imperfection of our knowledge (knowledge or epistemic uncertainty) or by the inherent variability of the uncertain variables (variability uncertainty). Risks are the likelihood of occurrence of a negative event, and the consequence of this negative event (Berdica, 2002). By reducing uncertainty it becomes clear what the real risks are. Based on that further strategic decisions can be made. In this paper we focus on knowledge or epistemic uncertainty in the domain of HDTV. We do that by first describing the supply side of the HDTV chain and after that we will provide insight into the consumers side of uncertainties.

3. Supply Side Uncertainties

Since the HDTV broadcast standards were established and published it was up to the parties involved in the traditional Dutch broadcast chain to take up the new standards and apply them to their processes. However, the policy decisions that were made by the parties at the supply side of the broadcast value chain depend on various institutional priorities and strategies. These priorities and strategies are in turn determined by a combination of technical, financial, political, cultural and historical circumstances in which organizations operate (Winston 1998, Fickers 2004, Boddy 2007). Our research focused on understanding and explaining policy decisions based on these factors. Therefore, the question that is central in this section is: Which factors influenced the relatively slow advent of HDTV between 2006 and 2009?

The analysis of institutional policy decisions is made by a content analysis of marketing and policy documentation as well as face-to-face interviews with some of the people involved. Contemporary

decisions of the organizations involved are evaluated in a broader context, such as past performance and decisions and the evolution of the media landscape.

In the first half of 2007 an exploratory study of the attitudes of the various parties in the television channel towards the transmission of HDTV signals has been done. The results mostly agree with the chicken-egg problem that was assumed by various sources (Hijink, 2006, Brill 2007, Immovator 2008): Manufacturers of broadcast equipment and consumer electronics have introduced HDTV on both ends of the chain. Producers however were waiting until broadcasters would start with HD and broadcasters would struggle with necessary investments in their technical infrastructure and a lack of content. The Dutch Public Broadcaster (NPO) was proving more motivated to remove these thresholds in the short term than the commercial broadcasters. However, the NPO was in no real hurry with the introduction of HDTV either. This was not only due to a lack of financial resources to prepare the technical infrastructure for HD and to create and promote HD-productions (Baaren, Van de Wijngaert & Huizer 2008a). The following two sections further explain these findings.

3.1 NPO: The Dutch Public Broadcaster¹

Despite the slow growth in Dutch HDTV productions, the NPO could have promoted the number of productions in HD and the awareness of HDTV, by using the HD test channel, which was created for the World Cup and European Championship in 2006 and 2008, as a permanent channel for testing HDTV productions. On this channel the limited national and wider range of international HD productions could have been broadcasted. The existence of such a channel would be an incentive for production companies to produce in HD (BBC (2007). The NPO however was very reluctant of such a HD channel and first wanted to make their entire internal infrastructure HD ready.

Regardless of whether the NPO has made the right choice, the cautious attitude of the broadcaster can be explained by the earlier experience they had with technological innovation for television. In the past 15 years the NPO played a pioneering role by investing time and money in various pilot projects around analog HDTV, widescreen digital television and interactive broadcasting. While all these projects have yielded much knowledge none of the projects, for various contextual reasons, led to an immediate deployment of the technology (Agterberg, 2006; Baaren, Baaren, Van de Wijngaert & Huizer 2008a). The fear to experiment, with a technology before its full deployment is achieved, has grown with these projects and provides an explanation for the caution with which the NPO operates today.

3.2 The Cable Operators

HDTV also had a difficult position in the policy of the larger Dutch cable TV companies UPC, Casema and @Home (the latter two have now merged to Ziggo). These companies benefit from the transmission of the HDTV signal, because it allowed them to distinguish their service quality from the competing telecom and satellite providers, who, with less bandwidth, were not yet technically capable of transmitting high quality HDTV. However, the priority given was to digital SDTV which can be explained by several factors. First of all investment costs in HDTV infrastructure for the cable companies would have to be passed on to consumers,

¹ For an extensive overview of the structure of the Dutch public broadcastind service see Dommering 1997

leading to an increase in subscription costs. The adoption of digital television by consumers therefore seemed more feasible than that of HDTV. Secondly the slow acceptance of digital television delayed the phasing out of the analog transmission signal. In order to speed the transition from analog to digital TV the cable company focussed on the “digital” aspect of subscriptions. HDTV was only one of the value added services to convince consumers to stop watching analog TV.

In conclusion it can be said that the speed of transition to HDTV has been influenced, not only by financial and technical investments, but also by policy decisions.

4. Consumer Side Uncertainties

At the end of the broadcast supply chain are the Dutch television households as future users of the new television technology. In the area of research on technology adoption by end users there is a tradition of social scientific theoretical models. These models focus mainly focus on (perceptions of) usefulness and ease of use and are frequently tested, verified and extended. The contribution that this study provides, does not focus on further optimization of these models, mainly because they are focused on predictions in the short term: It can only be predicted whether a technology will be rapidly accepted on the basis of whether people find the technology useful and easy to use. Instead, this study focuses on a deeper understanding of specific contextual factors that can help to explain the perceptions and adoption of media technologies (HDTV).

The premise of the perspective presented is that some of the factors that influence the adoption of HDTV are subject to change. To study the influence of these factors at a given time surveys are done yearly, in which the motives and backgrounds of some of the Dutch households are examined. Respondents, who participate in the investigation, represent television viewers distributed over various regions in the Netherlands with different connections (cable, terrestrial, satellite, IP) and subscriptions (analog, digital and HD). Two surveys are completed so far, where respectively 435 and 3100 people took part.

4.1 HD Added Value, Conditions and Content

One of the factors mentioned above is knowledge of HDTV. Knowledge of a new technology may be seen as a precondition for adoption. These are two distinct kinds of knowledge. The first is an awareness of the existence of the technology. This awareness can arise when a consumer has heard something about the technology or has seen it somewhere. The second kind of knowledge is knowledge about the purchase and use of new technology. In the case of HDTV it relates to the alleged value of HD (sharper picture, better sound) and knowledge of HD-capable displays, set top boxes, subscriptions and broadcasts. In 2007 the majority of respondents, 82%, had heard of HDTV one way or another. In 2008 that was 83% so the percentages in 2007 and 2008 for HDTV remained the same: this can be explained by the fact that between 2007 and 2008 there were hardly any changes in the provision of HDTV (screens, content, information).

Besides experience with HDTV images, the actual knowledge about HDTV purchase and use is also important for the adoption of this medium. In 2007 and 2008 participants in the study were presented with a list of propositions of which they could indicate whether they thought they were true or false, or that they did not know. The percentage of people with correct knowledge (41% in 2007 and 42% in 2008) was matched by an equal amount of people with lack

of knowledge (“don’t know”) (45% in both years). The number of incorrect responses decreased (18% in 2007 and 13% in 2008).

The differences in knowledge about the various aspects of HDTV can be explained by the attention HDTV has been given by the various players in the broadcast supply chain. Mainly electronics manufacturers and vendors have focused on the promotion of HDTV, while broadcasters and distributors have only done so slightly. The lack of sufficient bandwidth and focus on other services ensures that the telecom operators (KPN Mine, Digitenne, Tele2) did not promote HDTV. The cable industry only partly promoted HDTV: until the summer of 2008 the websites of the various cable distributors present HDTV only as an additional option of the top digital TV packages.

For broadcasters and producers there were, as explained in the previous chapter, few reasons to pay much attention to a fast introduction of HDTV. The commercial broadcasters postponed the introduction of HDTV, and the NPO had a desire announce the first steps towards the HDTV broadcasts only with caution (Baaren, Van de Wijngaert & Huizer, 2008a). To promote the knowledge about HDTV (and hence the likelihood of adoption of HDTV subscriptions) it is necessary that the information about HDTV from broadcasters, distributors or independent third parties increases.

4.2 Consumer Needs for HDTV

The adoption of a new technology is not only dependent on the knowledge distribution and content offering by the broadcast supply chain, but also on a need that ensures that the consumer sees the added value from the technology for his personal situation.

Figure 4 shows that both in 2007 and in 2008 the demand for the properties of HDTV (sharper picture and better audio) is relatively high compared to other developments in the television landscape. The desire for a sharper image takes the first place, the desire for better audio is third (right behind the desire to review a broadcast via Video-on-Demand (VOD)). The high valuation for a sharper picture and better audio means that HDTV could provide an added value compared to existing analogue and digital television subscriptions.

Noticeable is that the need for better picture and audio in 2008 has decreased. Because the amount of HDTV viewers in the study between 2007 and 2008 remained approximately equal, it is likely that the decline in demand for a sharper picture and better audio is caused by other factors, such as the continuing adoption of digital TV in standard resolution, which is also promoted as an improvement of image and sound. Furthermore watching audiovisual content via the Internet has led to a habituation to a low resolution image, perhaps making the need for a sharper picture less important.

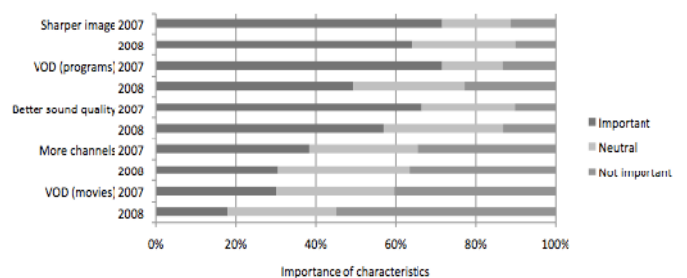


Figure 4. Demand for HDTV characteristics

Besides the high rating for the features that belong exclusively to the HD technology, the study shows consumers also attach a high value to flat television screens (not included in the graphs above). In 2007 consumers indicated that buying a flat screen TV came in third place on a list of ten possible expenditures. While the aesthetics of the display is not directly part of the HD technology, the popularity of flat screens means that the adoption process of HD-ready and / or Full-HD TVs, as a prerequisite of being able to watch HD content, does not pose much of a problem.

A question that since the advent of HDTV is often asked is whether there is a difference in valuation of various sorts of television content in HD. The research done in 2007, indicates that a relationship exists between the need for HDTV features and the frequency of certain television genres that people view. Sports, film and gaming enthusiasts attach more value to the features of HDTV. This can be explained by the fact that films, sports as well as games carry with them an idea of a 'total experience, involving the viewer as if he / she really participates. The same experience is also promised to consumers in the marketing of HDTV sets. The measurement of 2008 yielded a different result for the viewing habits: Two groups of viewers could be distinguished. The first consisted mainly of information seeking public broadcasting viewers, the second of commercial broadcasting viewers seeking entertainment. Where in 2007 there was no difference in needs for those groups, in 2008 the first group was found to have a greater intent to purchase subscriptions to HDTV than the viewers of commercial broadcasters.

Besides the differences in viewing behavior also the current type of television connection determines the need for HDTV features. Consumers who have a digital television subscription, have a greater need for a sharper image than those with an analog TV connection. Various explanations for this can be argued. First, the diffusion of digital television also only took flight in the past two years (thus similar to HDTV). Consumers with an analog connection may have little interest in new TV developments. It is also possible that the image quality of digital television did not live up to its expectations: like HDTV, SD digital television was (and is) also promoted as an opportunity for "superior image quality". Technical defects in the transmission or encoding of the digital television signal may have ensured that the image quality did not meet the expectations people had of digital television.

From the above results it can be concluded that the opportunities that HDTV technology offers are in theory desired by the viewers. This desire is bigger for consumers who frequently watch sports, games and movies and / or possess digital television. The need for HDTV in this sense does not form a threshold for adoption. The question remains however, whether HDTV subscriptions will indeed be purchased based on these needs. Furthermore subscriptions for e.g. VOD services are an attractive investment alternative for the consumer and the cost, content, price and meaning of HDTV changes over time.

4.3 Conclusion

In all, the description of the demand side sketches an image in which the uncertainties are limited. A lot of information can be gained from market and academic research. This section has for example shown that people do feel a need for higher quality television. The presented scenario's show that there are specific circumstances in which people are willing to switch to HDTV and that social influence is an important factor in this process. The research also shows that knowledge, an important factor in the adoption of new technologies is lacking. The knowledge level has hardly changed between 2007 and 2009. Although this is not a good sign in terms of diffusion, the amount of knowledge is something that can be influenced. So although the diffusion of HDTV is not a done deal from the perspective of the user, there are a lot of possibilities to reduce uncertainties and consequently the possibility to take calculated risks.

5. Conclusions

The results of our research confirm the theoretical conclusions: that decision making of institutions and end users both depend on many underlying factors. In addition, decisions made on one side become factors influencing decisions on the other side.

Institutional decisions are confusing to the outside world and as such influence the knowledge level, perceived usefulness and thus the adoption intention of the consumer. Although the majority of consumers is aware of the existence of HDTV and has a relatively large need for a sharper picture and better sound this is as yet not sufficiently expressed in adoption intentions to positively influence the institutional decision making. This results in a classical chicken and egg situation.

Established organizations within and outside the broadcast supply chain (such as government and independent consumer associations) can play an important educational role and help breaking through the chicken-egg situation. When broadcasters and distributors announce new developments in HDTV the knowledge level will naturally be increased by the increase of information that these parties, the media and ultimately the immediate social environment will be providing. Whether that will also help to decrease the confusion amongst consumers about the differences between digital television and HDTV remains to be seen. As long as these two systems coexist in the broadcast chain with different policies, active attention needs to be paid to informing consumers. Furthermore it is also important that price and content offering are well balanced. The adoption intention of consumers is probably higher if better image and audio (i.e. HDTV) can be combined with VOD. The amount of "favorite shows" available in HDTV does not need to be 100% immediately. It seems more important that at least a preliminary part of the content of Dutch origin is broadcasted in HD, and that the supply chain starts to communicate about that.

References

See www.xs4all.nl/~lidwien/Lidwien/EuroITV2010.