Business Models and Programming Choice: Digital Video Recorders Shaping the TV Industry

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ABSTRACT

This paper focuses on the influence that Digital Video Recorders (DVRs) are expected to have on the business models and in particular the programming choice of TV stations and cable / satellite TV service providers. After presenting the theoretical underpinnings with respect to programming choice modeling for the TV industry, this work examines DVRs in detail covering their main product features, impacts on viewer behavior, and the current roll-out status. This paper then investigates how these DVR features impact earlier insights from programming choice modeling and how they lead to changed business models for TV stations. The paper concludes with a brief summary and a critical outlook for a TV industry business model.

Keywords

Business Model, Digital Video Recorder, Programming Choice, TV Industry.

INTRODUCTION

Digital Video Recorders (DVRs) are TV set-top boxes allowing people to record at least 15 to 200 hours of video. As personalized agents, these devices help users choose and organize the programs that they like to watch at the times they want to watch them. With DVRs, viewers can pause, rewind, and fast forward programs during recording. Advanced DVRs allow users to automatically skip commercials by offering 30-second jumps (ad-skipping). Finally, some DVRs provide the option to redistribute copied programs or video content among friends.

With these features, DVRs may fundamentally change the business models, in particular, the models of programming choice of TV stations and cable / satellite service providers.

The overriding decision for a TV station, aiming a financial success, is which programs to deliver to the end-consumer. Cable operators or digital satellite broadcasters need to decide which networks to carry, which content to show, and how to bundle their offerings to optimize profitability. These decisions, derived from programming choice questions, make up a good part of their so-called business model.

Of course, the extensive literature on business models (among many others, Afuah and Tucci 2001; Amitt and Zott 2001; Magretta 2002; Turban, E., King, D., Warkentin, M. and Chung, M. 2002) and on business model taxanomies (e.g., Timmers 1999; Rappa 2000; Tapscott, D., Ticoll, D. and Lowy, A. 2000) also covers many additional aspects in-depth.

Assuming that TV stations or cable / satellite service providers aim at highest possible profitability (see also Owen and Wildman 1992), in this paper we take the perspective of TV stations focusing on programming choice issues in the light of a DVR roll-out.

In the following, this paper briefly outlines the literature on programming choice models in the TV industry (section 2). It then describes the main DVRs features, the DVR-driven changes in viewer behavior, and the current DVR roll-out status (section 3). In section 4 it investigates how the existence of DVRs impacts earlier insights from programming choice modeling. The paper concludes in section 5 with an outlook on upcoming changes regarding business models of TV stations and cable / satellite service providers in case of an increasing DVR roll-out.

TV PROGRAMMING CHOICE: A LITERATURE OVERVIEW

The classic early models of programming choice related to television stem from Steiner (1952) who elaborates on earlier works by Hotelling (1929). Steiner constructs viewer preferences by splitting the audience into subgroups. He also divides programs into program types. His main assumptions are: (1) Viewer groups being highly unequal in size, (2) viewers

watching only their first choices, (3) limited channel capacity, (4) competitors sharing audience equally when duplicating programs, (5) all viewers being equal to broadcasters, and (6) ignoring program costs. Based on these assumptions, Steiner compares program offerings in monopolistic and in competitive settings. He comes to the overall conclusion that competition leads to program duplication and thus lower satisfaction. Hence he confirms Hotelling's term of 'excessive sameness'. In Steiner's model, a broadcaster's revenue is correlated with audience size as there is only advertising income and all viewers are assumed to be equal value to broadcasters; the business model hence was to maximize the number of viewers per channel.[1]

Jack Beebe (1977) models more complex programming choice scenarios while keeping the basic satisfaction criterion as being the number of viewers receiving the first, second, or even third choice. In line with Steiner, Beebe neglects potential differences in the intensities of such preferences. In several early scenarios, Beebe assumes (1) that all stations that simultaneously deliver the same content to the audience equally share viewers with a preference of that type of content and (2) that advertising revenues for specific content depend on a prevailing rate and the number of viewers (i.e., fixed value of viewer to broadcasters). When relaxing these two assumptions later, he shows that if large audiences are worth more per viewers than minority audiences, this drives more duplication and reduces diversity in the content offered. Beebe demonstrates that advertising-supported TV content not only has to fulfill the viewers' values of the programs, but also needs to reflect advertisers' values of exposures to viewers. Overall, Beebe identifies five factors that drive programming choice decisions: (1) the structure of viewer preferences among program types, (2) the channel capacity / number of channels, (3) the channel control - monopolistic versus competitive, (4) the financing of programs (advertising and / or pay TV), and (5) the program cost.

In the 1970s and 1980s, mainly Spence and Owen (1977) or Wildman and Owen (1985) stand for the next generation of TV related programming choice models. These authors introduce the willingness-to-pay (WTP) to measure preference intensity. The WTP construct allows them to apply a well-understood set of microeconomic concepts to optimize programming choice decisions under a variety of modeling assumptions. Going with their time, they build their various models on unlimited channel availability, and they respect that two programs can never be perfect substitutes (due to copy right and viewer attitudes). As common in the 1970s and 1980s, they integrate advertising-supported TV and pay TV. They model advertising as one of the TV costs for viewers and demonstrate the effects of various assumptions and their combinations. While they provide intriguing insights for a large variety of sub-models, they barely reach generally valid conclusions.

Among others, Noam (1987) and Waterman (1990) further detail several aspects of the WTP-based models. Noam (1987), in the tradition of public choice analytical models, introduces governmental influence to the models of programming choice. Waterman (1990) mainly investigates program quality as a driver for program selection. Wildman and Lee (1989) investigate the impact of program repetition as a dimension in program choice models.

In addition to the authors presented above and their numerous contributions that followed along those lines in journal papers, conference proceedings, and working papers, there is also a group of researchers providing a body of empirical literature on programming choice models in the TV industry. As common denominator and different from the groups around Steiner, Beebe, Spence, Wildman, and Owen (see all above), they researchers predict utilities for different viewing options and use these to predict channel shares. They publish in marketing, market research, and advertising outlets.

The majority of them uses observational data: Gensch and Shaman (1980) apply linear combinations of trigonometric functions. Henry and Rinne (1984) develop models using an aggregate logit analysis to accurately predict viewer preferences for given programs in different time slots. Horen (1980), Kelton and Schneider (1998), and also Reddy, Aronson, and Stam (1998) concentrate on regression models aiming to optimize TV scheduling, audience flows, or sometimes lead-ins. Rust and Alpert (1984) as well as Rust and Eechambadi (1989) construct audience flow models. Goettler and Shachar (2000) also use observational viewer data, but in addition model the unobserved program and viewer attributes.

Finally, Danaher and Mawhinney (2001) suggest experimental choice modeling. They ask viewers about their viewing preferences and then build appropriate schedules.

DIGITAL VIDEO RECORDERS: A PRODUCT INNOVATION

Major Features

Digital Video Recorders (DVRs) are set-top boxes that allow recording at least 15 to 200 hours of video to be accessed randomly. The software embedded in the device uses a menu system that permits users to program the specialized computer to record video content using criteria such as genre, program title, and actor (for a more detailed technical description see for instance Rizzuto and Wirth 2002). DVRs may act as personalized agents that automatically find programs of interest,

1 Similar constructs with slightly changed assumptions can be found in the works by Rothenberg (1962) and Wiles (1963).

possibly based on their previous selections. They do not require users to know the time or day when the program is broadcasted. Users may be able to connect their DVRs via the Internet and share programs and other types of content within and between homes. In short, DVRs help users choosing and organizing the programs that they like to watch at the times they want to watch them. (The analog VCR was initially marketed to do exactly this, but the lack of random access and the level of information required from the user made few willing to invest.)

While a live program is being recorded, viewers can pause, rewind, and fast-forward it. The fast forward capability on some device models can do 30-second jumps, thus making it easy to avoid commercials. Viewers of digital broadcasts may establish filtering mechanisms that block or suppress selected items in the broadcast stream. Suppression of commercials may take the simple form of automatic switching to alternate desired content for the duration of the commercial break. A more sophisticated approach toward commercial suppression would utilize automatic buffering, editing, and playback of the program material so as to permit uninterrupted near-real-time viewing. The only nuisance to the viewer would be a program start delay time equal to the length of the suppressed material.

Some DVRs make it possible to redistribute copied programs to other viewers (similar to peer-to-peer platforms known from the music industry). Other DVRs allow users to freeze the action on the screen while they surf for items of interest to them (clickable 'promercials').

DVR-Driven Viewer Behavior

Users with DVRs in their homes quickly change their viewing behavior and appreciate newly gained editorial and scheduling control (e.g., Decipher 2002; Myers 2002; Mogg 2004). Figure 1 introduces different options that users exploit when taking advantage of the DVR technology. Figure 2 depicts the results of a 2002 study among North-American DVR users, who were asked how much they appreciate the different available DVR features.

Buffering	Regularly moving favorite shows to more favorable time slot.
Bookmarking	Freeing consumers from schedule constraints due to ability to bookmark or 'series link' particular programs.
Grazing	Scanning complete day's or evening's viewing via on-screen program guide and recording selection for later viewing.
Stacking	Collecting number of episodes for big viewing session or 'appointment to view'.
Archiving	Storing content from DVRs to other storing devices, mainly to give copies to other people.
Compressing	Using DVRs to record events and use flexibility in fast forwarding to create 'highlights' version - watching 90-minute game in 20 minutes (primarily sports related concept).
Extending	Watching live game through DVRs, re-winding and re-playing key events repeatedly, and catching up with real time at half way break (corollary of 'compressing').
Pausing	Zapping in and out of recorded content of live TV (least used new function).
Ad Sampling	Halting fast forward process to watch ads one enjoys.

Figure 1. DVR-Driven Forms of Viewer Behavior (Source: Decipher 2002)

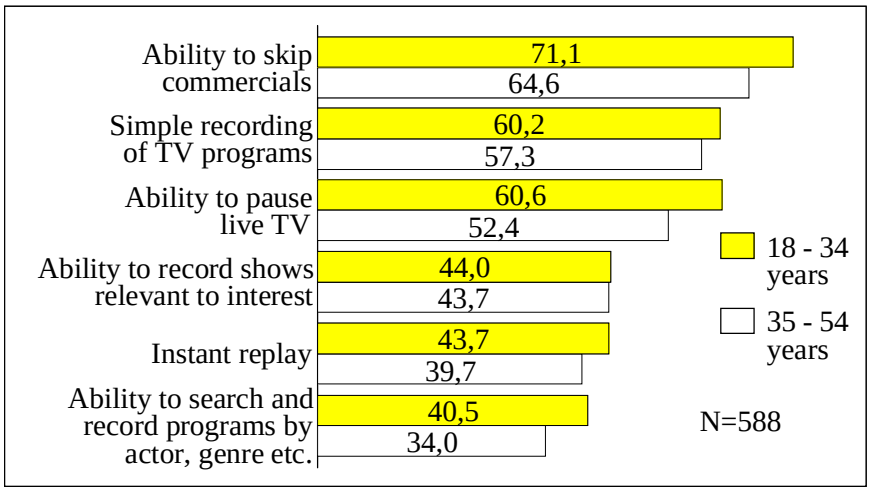

Figure 2. 'Very Interesting' DVR-Features in Percent of Age Group (after: Myers 2002; Mogg 2004)

Neither the purchase of a DVR nor the availability of the above mentioned DVR features necessarily leads to use. McClellan (2003) suggests that DVR households do 40 percent of their prime time viewing through the DVR. James (2005) claims that DVR watchers skip 70 percent of the commercials. Calculating with about two percent of US households being DVR users (National Cable Television Association 2004), such assumptions lead to slightly more than 0.5 percent of all commercials being 'lost' (2% of TV viewers times 40% viewing with DVRs times 70% skipping commercials).

Market Roll-Out

The current DVR roll-out mainly takes place in the United States of America (US)[2] where DVRs were introduced in the spring of 1999, when more than 90 percent of 108 million US TV households had an analogue VCR (Nielsen Media Research after FCC 2004). Such a seemingly saturated market limited the early success of DVRs. With a rather slow growth curve, it took about two years two reach the first million of devices in the field. Only by mid 2001, the FCC (2002) counted about one million DVRs in US homes.
From its beginning, the DVR market in the US has been divided into stand-alone DVRs and service provider DVRs. The latter ones nowadays represent about 80% of all DVRs shipped.

Service provider DVRs are integrated into digital satellite or cables receivers and can be obtained by subscribing to the respective satellite or cable services. By the end of 2004, digital satellite service providers shipped about 64% of all DVRs in the US (Bird, W., Gupta, N., Krutick, J., Gilardi, R., Post, I. and Ratcliffe, J. 2004).

By the end of 2003, according to Bilotti (2004), 1.9 million US households had DVR-equipped digital satellite broadcasting (DSB) receivers, up from 700,000 in 2002. Satellite suppliers have been active to integrate DVR technology into their products attempting to match cable's video-on-demand (VOD) services with their one-way technology: With a DVR the DSB operators could offer VOD functionality for hit titles by automatically storing them on a subscriber's DVR prior to receiving an order, speculating that the subscriber might later authorize viewing. While such an approach reduces the storage capacity available for discretionary recording by customers, this is less important with storage costs declining rapidly.
Cable service providers brought the first 900,000 DVR-equipped set-top converters into the US market in 2003. For such upgraded boxes, most cable service providers charge consumers between US$ 5 and US$ 10 per month, about twice the fee of a standard digital box. For 2005, the largest US cable service provider, Comcast, has announced plans to provide 10% of its customer base with DVRs (e.g., Hopkins 2004).

In addition to the 2.8 million households in 2003 who acquired DVRs through their satellite or cable service provider, 1.1 million households purchased stand-alone DVRs or recordable DVD players that incorporated hard drives with DVR functionality (Eisenmann 2004). Stand-alone DVRs are sold directly by their manufactures or through traditional retail channels. Today, TiVo dominates this market segment, followed by a small number of legacy units from ReplayTV and some

2 For the UK, British Sky Broadcasting (2005) publishes that 8% of their 7.6 million subscribers have a total of 642,000 DVRs.

self-made units based on PC hardware such as Microsoft's Windows Media PC or the open source software platform MythTV.
Up from those 3.9 million units in US households in 2003, several sources estimate five to six million DVRs in the US at the end of 2004 (e.g., Bird et al. 2004; Hopkins 2004). Further DVR rollout forecasts are also positive: The Yankee Group (2004, quoted after Bird et al. 2004) predicts 33.5 million US homes to be equipped with a DVR by 2008. Similarly, Forrester Group (2004, quoted after Bird et al. 2004) estimates 36.7 million homes in the US, and Smith Barney (Bird et al. 2004) even forecasts 40.00 million DVR households in the US by 2008.

PROGRAMMING CHOICE IMPLICATIONS OF DIGITAL VIDEO RECORDERS

In this section, we analyze some of the implications that DVRs cause in programming choice decisions. We briefly examine which impact DVR product features and specific DVR-driven user behavior have on the models and the decisions of programming choice. In particular, we look at the following four DVR-driven impacts:

- Shift away from linear TV watching
- Content copying and redistribution outside the scope of TV stations
- Skipping commercials and thus setting the cost of advertising to zero
- Ad customization

We will briefly investigate each of the above four items. The results are summarized in Table 1. Of course, many other model assumptions could be relaxed and any new assumptions could be combined. Hence, a complete analysis of optimal programming choice taking into account significant DVR roll-out is not feasible in the scope of this paper.

DVR-Driven Impact	Main Effect in Programming Choice Decisions	Programming Choice Literature / Model
Shift away from linear TV watching	Reducing importance of scheduling and program timing	Horen 1980; Kelton and Schneider 1998; Reddy, Aronson, and Stam 1998; Danaher and Mawhinney 2001
Content copying and redistribution outside the scope of TV stations	Neglecting broadcast repetitions and increasing cost of first copy	Wildman and Lee 1989; Spence and Owen 1977; Steiner 1952; Beebe 1977
Skipping commercials and thus setting the cost of advertising to zero	Shifting to pay TV and other non-advertising revenues	Spence and Owen 1977, Wildman and Owen 1985; Steiner 1952; Beebe 1977
Ad customization	Reevaluating and exchanging program modules (Assessing different viewers as being of different value to advertisers and same viewers as being of different value to different advertisers)	Beebe 1977; Spence and Owen 1977; Wildman and Owen 1985

Table 1: DVR-Driven Impacts on Programming Choice Decisions

Shift Away from Linear TV watching: Reduced Importance of Scheduling and Program Timing

While digitization and broadband connectivity have enabled TV distribution across traditional geographical and political barriers (e.g., Loebbecke and Falkenberg 2002), DVRs reduce the need for temporal coordination between programmers and viewers. They encourage consumers to shift away from linear TV watching and thus reduce the importance of scheduling focused programming choice decisions.

The time at which programs run during the day will not be as important as the specific program itself. The importance of 'prime time' or 'live shows' is likely to diminish. Further, with increasing time-shifting options for the audience, TV stations will need to change the way they do cross promotions[3] and program line-ups / lead-ins[4]. Similarly, programs that rely on viewers' calls will need to adjust because many people will no longer be watching at the time the program is being shown. Nevertheless, people will still prefer to watch certain programs such as sporting events live, because knowing the result prior to watching a game reduces its entertainment value.

Content Copying and Redistribution: Neglecting Broadcast Repetitions and Increasing Cost of First Copy

Programming choice models investigating the impact of program repetitions (e.g., Wildman and Lee 1989) need to be revisited. Once people have access to the content, they are expected to barely care where they get the content from (see experiences with peer-to-peer platforms)[5]. As soon as the content can be easily and conveniently copied and redistributed outside the scope of the TV stations or cable / satellite service providers, this could reduce subscriptions or VOD interest (e.g., Rao 2001).

As the convenience factor is provided by the DVR at no additional expense, neither additional pay TV costs nor additional advertising cost, the cost of the 'first' less frequently ordered copy will have to be increased. Thus, allowing customers to redistribute content with DVRs (not yet possible with all DVRs in the market) should have direct consequences for cable / satellite service providers' revenues generated by pay-per-view, VOD, or subscriptions for pay channels.

Skipping Commercials: Shifting to Pay TV and Other Non-Advertising Revenues

From the perspectives of TV stations and cable / satellite service providers, several models (e.g., Spence and Owen 1977; Wildman and Owen 1985) have translated 'watching commercials' into one of the costs of watching TV. Technically allowing end-consumers to reduce this cost to zero, implies that (1) the subscription or the 'on-demand' share of TV costs for viewers has to be increased and that (2) programming based on traditional advertising only would not be affordable for providers. Those viewers who take that options are of zero value to the advertisers and thus to the solely advertising-supported program providers.

Taking into account the possibility of skipping commercials, advertisers in conjunction with program developers will have to find alternative means to promote products and services. For instance, advertising could take place in the form of product placement or sponsoring within the programs themselves (e.g. Mandese 2004; Zeisser 2002).

Concerning the relationship between viewers, distributors, channels, and advertising industry, this has another interesting implication: The advertising industry would probably pay the content providers, but not the channels nor the distributors. Regarding the transfer prices along the TV industry value chain, one may speculate that providers may charge channels the same price as before although they already received advertising / PR money from brand manufacturers. In such a scenario a shift from TV commercials to product placement in actual shows (1) carries an additional revenue opportunity for content providers, (2) is of hardly any importance for the advertising industry, but (3) negatively impacts channels and distributors.

Ad Customization: Reevaluating and Exchanging Program Modules

Currently most commercials are targeted at rather broad segments such as adults between 18 and 49 or women between 25 and 54 years of age. Therefore, viewers see many commercials about products they will never purchase or are not ready to purchase soon. In programming choice terms this means that at least many viewers are valued equally by TV stations, cable and satellite service providers and the respective advertising industry in the back.

Increased deployment of DVRs allows better information about viewers and offers advertisers greater granularity and precision for more targeted advertisement.[6] Improved knowledge about viewer behavior should be modeled as a reduced

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3 In cross promotions, channels advertise in advance a program that will be shown at a later time.

4 Lead-ins describe that channels begin the next show immediately after the previous show, not showing the program credits until after the first scene, because many people leave channels during the commercials shown between programs (Gomery 2000). Without live audiences, this method of audience retention will no longer work.

5 While Digital Millennium Copyright Act (DMCA 1998) in the US stopped a significant amount of file exchanges, it does not specifically address DVRs and their legal implications.

6 According to TiVo's subscriber data (e.g., Allan 2003) regarding viewer patterns at the 2002 Super Bowl in the US, other than the winning field goal, the Britney Spears Pepsi commercial was replayed more often than any other part of the game. Such audience data provide an alternative to traditional Nielsen ratings. Channels and their respective customers from the advertising industry receive additional information about subscriber programming preferences (while at the same time raising some concerns about intrusions of viewer privacy). Hence the data source and metrics for advertisers and TV distributors may change.

number of commercials broadcast to smaller audience groups with higher prices per contact for better selected audiences. The potentially higher price per audience contact needs to be balanced against lower viewer figures, if viewers will be less exposed to commercials. As DVR users surf less through the channels (C-Cubed 2002), even without exploiting the ad-skipping feature, their behavior limits the likelihood of stumbling over programming (or advertising) that they did not directly target in the first place.

Also, when knowing the audience better, DVR technology also permits to send different ads to different households. Thus the improved customization or even personalization of commercials may also change content itself (see also Picker 2004).

A station needs to decide between showing a daily soap or a talk show. Viewer A prefers the daily soap, while viewers B and C prefer the talk show. Only one commercial can be shown in the time slot under the assumption that viewers find any more commercials infinitely painful. Three advertisers compete for the single slot. A candy seller company would pay US$ 6 to reach A and nothing to reach B or C. A shampoo seller would pay US$ 4 to reach B and nothing to reach A or C. A soft drink maker would pay US$ 4 to reach C and nothing to reach A or B.

Considering advertising-supported TV without customization, the daily soap with the candy commercial would be shown in such a situation. However, with DVR-enabled ad customization, the station would broadcast the talk show and target the shampoo commercial to B and the soft drink commercial to C. Total revenue from the commercial would increase from US$ 6 to US$ 8.

Obviously, higher advertising revenue allows for higher production cost. If the cost of producing the daily soap or the talk show was US$ 7, without ad customization neither show would be available; with ad customization, the game show is affordable.

SUMMARY AND OUTLOOK

DVRs will impact viewer behavior and thus ultimately the TV industry value chain and the business models. The increasing use of DVRs puts the current programming choice models and the implied business models of TV stations and of cable / satellite service providers at jeopardy.

While DVRs need TV stations and cable / satellite service providers to work, their very nature challenges the business model on which TV stations and service providers are based. Free, advertising-supported TV works only if one can distinguish advertising-supported viewers from fee-paying viewers. If viewers can choose to delete commercials, free TV - regardless of the programming choice model - becomes unaffordable, thus leading to subscription-based TV with some programming restructuring. Instead, one can imagine business models based on significantly increased product placements or other technological solutions such as pop-up ads. Business models focusing on product placements - taking national regulations into account - seem to shift advertising revenues from TV stations to content providers. Business models partially built on pop-up ads (e.g., TiVo) would shift the advertising revenue to DVR service providers, who may be equipment manufacturers, cable / satellite providers, or TV stations.

Further, DVRs put at risk recently developed revenue sources for cable / satellite service operators such as VOD, pay-per-view, or subscription-based approaches and DVD sales organized outside the classic TV industry.

Ultimately, in the light of a major DVR rollout, the revenue split in the TV industry among content providers, channels, distributors, and advertisers needs to be realigned. Subscription-oriented cable and satellite service providers will promote DVR features only if they find a viable business model in the light of decreasing advertising income and revenue losses in other initiatives. At the same time, however, even without actively promoting DVRs, TV stations and service providers will need to prepare for significant DVR diffusion, i.e., for the DVR-driven TV era.

One could, however, also question under which circumstances DVR producers may prefer to offer only DVRs without ad-skipping functionalities and thus secure the ad-based free TV business model. Finally research should investigate to which degree the economic analysis provided in the paper reflects the actual behavior of TV viewers and the different players along the value chain. In-depth empirical analyses are to be recommended as soon as a sufficient number of DVRs with ad-skipping functionality is in the market and in actual use.

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