

# The Adoption and Management of Interactive Digital TV Commerce in Taiwan

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*The introduction of interactive digital television (IDTV) has a major impact on the existing TV operators. It has resulted in fierce market competition and decreased profit margins for the TV industry as a whole. Accordingly, the TV industry needs to look for new ways to manage and utilize the technology to be competitive. Since very few studies have examined and evaluated how the TV industry manages its business using IDTV (i.e. IDTV commerce), this paper sets out to establish a decision analysis mechanism that can assist the TV operators in adopting and managing IDTV as their commerce platform. Literature review, semi-structured interviews and survey were employed to investigate and identify the key issues for adopting IDTV commerce by TV operators. The AHP (Analytic Hierarchy Process) methodology was used to the data collected. Our results indicate that the three most important adoption and management drivers for implementing IDTV as a commerce platform are: (1) the operational capability for the IDTV services; (2) the innovation and strategy execution capabilities of the TV operators; and (3) the level of maturity in technological development within the TV industry. In addition, most respondents indicate that the IDTV commerce should be fully operated and managed in-house, rather than outsourced.*

## 1 Introduction

The proliferation of interactive digital television (IDTV) has brought many benefits to the quality and the transmission of the TV channels for the customers (Buhalis and Licata, 2002; Ha, 2002). This includes giving customers easier access to products and services. It has been predicted by many analysts and researchers that IDTV will be the growth star of the future (Jennings, 2004; Pagani, 2003). For example, according to Forrester Research, more than 10% of Europeans are now using interactive digital television (IDTV) services (Jennings, 2004). However, this has a major impact on the market outlook for the existing TV operators (Pagani, 2003). It has resulted in fierce market competition and decreased profit margins for the TV industry as a whole. Therefore, the industry needs to look for new ways to utilize the technology to be competitive.

However, organizations often encounter challenges and problems when implementing new information technology (IT) (Lin et al., 2005; Love et al., 2005). For instance, organizations are likely to face uncertainties when assessing the new adopted IT (Lin and Pervan, 2003; Standing et al., 2006; Standing and Lin, 2007) such as IDTV (Gallen and Reeve, 2006). Moreover, very few studies have examined and evaluated how the TV industry as a whole conducts its business using IDTV (i.e. IDTV commerce) (Pagani, 2003). Thus, the objective of this paper is to establish a decision analysis mechanism that can assist the TV operators in adopting and

managing IDTV as their commerce platform. Literature review, semi-structured interviews and survey were employed to investigate and identify the key issues for adopting IDTV commerce by TV operators. The AHP (Analytic Hierarchy Process) methodology was then used to analyze the IDTV adoption and management decision processes of these TV operators. The AHP methodology was developed by Saaty (1980) to reflect the way people actually think and it continues to be the most highly regarded and widely used decision-making theory (Lin et al., 2005). Our results indicate that the three most important adoption and management drivers for implementing IDTV as a commerce platform are: (1) the operational capability for the IDTV services; (2) the innovation and strategy execution capabilities of the TV operators; and (3) the level of maturity in technological development within the TV industry. In addition, most respondents indicate that the IDTV commerce should be fully operated and managed in-house, rather than outsourced.

## **2 Literature Review**

### **2.1 Digital Television**

DTV (digital television) is based on the transmission of a digitalized signal and is a brand new technology for receiving and sending digital TV signals, which is different from the traditional analog TV signals (DigiTAG, 2001; Pagani, 2003). These television signals were sent digitally (in 1s and 0s, like computer data) via compression of the signal by reducing in the use of electromagnetic spectrum. Analog TV is usually available in only one quality whereas DTV digitalizes the processes of program production, image processing, encoding, signal emitting, and transmission and comes in several levels of picture quality: High Definition Television (HDTV), Enhanced Definition Television (EDTV) and Standard Definition Television (SDTV) (FCC, 2001). HDTV is DTV at its finest and you can enjoy a true home theater experience. EDTV is a step up from basic television while SDTV is the basic display. In terms of DTV screen types, the primary options are: (a) cathode ray tube (CRT) screens – traditional color television screens updated for digital; (b) rear projection TVs – rear projection TVs can create brilliant, wide angle pictures on ever-larger screens; (c) LCD screens - are very thin and produce extremely clear pictures, but are currently expensive and limited in size; and (d) plasma screens - create a bright, clear picture up to enormous sizes while remaining very thin.

DTV is available via three main delivery methods: (1) cable – this offers subscriptions to multiple channels of DTV and/or HDTV programming which varies depending on the provider; (2) satellite – this offers subscriptions to multiple channels of DTV and/or HDTV programming which varies depending on the provider; (3) over air – this allows you to view DTV signals sent by local broadcasters only, and there are no subscription fees. In addition, there are two basic components of DTV: a television monitor and a tuner. A tuner (also called a receiver or set-top box (STB)) takes the television signal and communicates it to the television monitor. Tuners need to be connected to a TV monitor in order to view the programs contained in the signals they receive. The successful application of DTV was due to two main factors: (1) the development of compression techniques (e.g. MPEG2 and MPEG4 standards); and (2) the agreement of universally accepted standards (Rangone and Turconi, 2003). There are three global DTV standards - ATSC used in America, DVB used in Europe, and ISDB used in Japan. There are four categories of digital TV: CATV via Cable modem, MOD via ADSL, mobile TV via smart phones, and IPTV via any IP-based network environments (Liu, 2005; Liu, 2006).

### **2.2 Interactive Digital Television**

In recent years, the deployment of interactive services on DTV is gaining moment and it has the potential to reach the similar level of access to the Internet (McGrail and Roberts, 2005; Thompson et al., 2002). Interactive TV is a DTV extended technology (usually abbreviated to IDTV). Interactivity implies the presence of a return channel in the communication systems between the user and the source of the information and can be defined as the “convergence

between television and the new interactive digital technologies” (Pagani, 2003). IDTV focuses on the interactive functions and services, including user-friendly interfaces, VOD (video on demand), EPG (electronic program guide), PVR (personal video recorder), and so on (Chang, 2001). It refers to television displayed using a digital signal delivered by a range of media – cable, satellite and terrestrial (by aerial). Consumer interactions are provided by a remote control which enables viewers to select different viewing options through signals sent to a set top box (STB) (Chaffey, 2002). STB is a critical component for users to receive digital television signals on traditional TV sets. STB provides the users with capabilities for implementing interactive television applications (Rangone and Turconi, 2003). Using STB, IDTV commerce is no longer an one-way transmission media but a two-way virtual transaction channel (Lin and Liu, 2006; Lin et al., 2006; Sheng, et al., 2004). IDTV can be used in areas such as health information (e.g. by allowing consumers to access health information at home 24 hours a day, seven days a week) (Thompson et al., 2002) and tourism (e.g. by allowing consumers to directly access their reservation systems) (Buhalis and Licata, 2002).

According to a survey by Gallup Research, 42% of respondents over the age of 50 would be interested in purchasing items via IDTV although they may be uncomfortable using Internet (Digisoft.tv, 2004). The advantages offered by IDTV include: an increase in the number of channels transmitted, better transmission of image and sound quality, integration of web technologies with digital TV (e.g. travel shopping), greater confidence by the buyers regarding the IDTV transactions than the Internet, allowing video on demand, and easy integration among broadcasting networks (Buhalis and Licata, 2002; Ha, 2002; Licata et al., 2001; Pagani, 2003). It is also attractive to viewers as they do not need to purchase any additional equipment (most households already possess a TV set) besides STB or to learn a new technology (Ha, 2002).

### **2.3 Management of IDTV Commerce**

In general, all the transactional behaviors via TV can be called TV commerce. The traditional TV shopping is the most popular form of TV commerce. TV commerce allows viewers to access to a variety of goods and services through their TV. TV has been perceived as a more trusted medium than the Internet because viewers are familiar with it and feel that TV is still subject to government regulation (Digisoft.tv, 2004). TV commerce comprises the following sub-markets: (1) TV shopping; (2) direct response TV; (3) travel shopping; and (4) interactive TV (IDTV) applications (Goldmedia, 2004).

Like other electronic commerce mediums, IDTV providers can also offer ways to exchange money electronically which facilitates TV commerce. IDTV commerce is a specific kind of TV commerce using TV sets and other related equipments with interactive services (e.g. banking, shopping, betting and gambling, auctions). According to Gallen and Reeve (2006), traditional TV commerce has been geared towards large volumes of small viewers and a highly redundant network. In contrast, the management of digital TV commerce involves with a relatively small number of stations with very large population and the impact of any fault can be much larger than in traditional TV commerce (Gallen and Reeve, 2006). As such, the problem of managing and adopting a digital TV business will be more complex in the technological, operational, and strategic levels (Gallen and Reeve, 2006) and the success of IDTV commerce will be determined by the TV operators’ abilities in identifying and managing the drivers in these levels (Lin and Liu, 2006; Pagani, 2003). The identification and the subsequent management of these drivers and their criteria are likely to assist TV operators in avoiding early problems and in reducing the risks before major purchasing decisions are made (Gallen and Reeve, 2006; Pagani, 2003). Therefore, the objective of this paper is to establish a decision analysis mechanism that can assist the TV operators in adopting and managing IDTV as their commerce platform.

### 3 Research Methodology and Design

This research uses a combination of semi-structured interviews and survey research approaches (a pluralist approach) (Figure 1). It follows the two phase approach of sequential triangulation to add scope and breadth to the study (Yin, 2002). Sequential triangulation allows for inductive insights from the qualitative approach to inform the more deductive outcomes from the quantitative approach. According to Mingers (2001), the results will be richer and more reliable if different research approaches are combined together. The use of multiple approaches such as semi-structured interviews and survey increases the reliability of the data as well as the process of gathering it and serving to corroborate the data gathered from other sources (Gable, 1994).

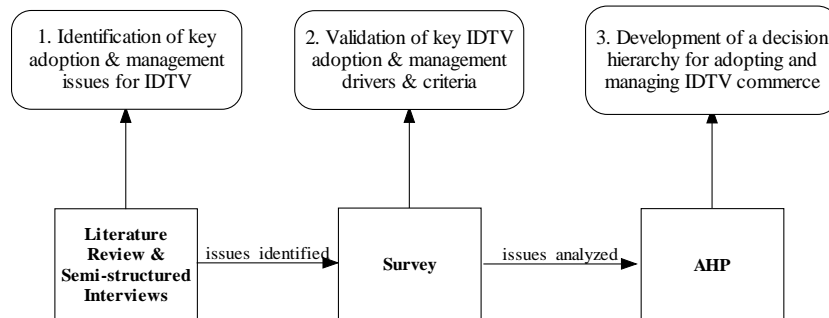


Figure 1: Research design

#### 3.1 Semi-structured Interviews

After having reviewed the relevant literature on the adoption and management of digital television, eleven semi-structured interviews were conducted in Taiwan with five local digital TV experts, analysts, and researchers as well as with six senior executives from five TV operators in order to gain an overview of the key and critical issues with the adoption and management of interactive digital TV. Each interview lasted around one hour. The questions asked during the interview were related to the current and future trends of IDTV, key management and adoption drivers of IDTV, the criteria for supporting the key management and adoption of drivers of IDTV, and how do they evaluate IDTV. The targets were deliberately chosen in order to focus efforts on useful interviewees (following the theoretical, non-random sampling strategy by Eisenhardt (1989)). This was done to solicit different opinions about the adoption and management of interactive digital television. The data collection continued until a point of theoretical saturation, which is when the value of an additional interview was considered to be negligible (Eisenhardt, 1989).

The interviews were recorded and transcribed in order to acquire a full description of the interviewee's comments, yielding 100 pages of transcripts. In addition to the semi-structured interviews, the researcher examined more than 200 pages of relevant documents (e.g. annual reports and news releases) that were collected from the participating TV operators. These documents provided some useful means of corroborating data from the other sources. The qualitative content analysis was then used to analyze the qualitative data (Miles and Huberman, 1994). Where there were discrepancies in the interpretation of responses to the questions these were resolved by consultation between the researchers and in some cases further explanation from the interviewees.

#### 3.2 Survey

The survey approach was employed to statistically test the major IDTV adoption and management drivers and criteria identified via literature review and semi-structured interviews. Prior to sending out the main survey, a pilot survey of 15 executives from TV industry was conducted. The comments were quite positive and the questionnaire was not significantly

modified. For the main survey, the respondents were chosen from those senior managers who were involved in the decision-making processes in relation to the adoption and management of IDTV. The 51 questionnaires were sent out and a total of 37 questionnaires were returned, giving a response rate of 72.55%. The use of both semi-structured interviews and survey approaches provides stronger substantiation of the identified issues, strengthening convergence of results (Eisenhardt, 1989).

### 3.3 AHP (Analytic Hierarchy Process)

Following the completion of the survey, AHP was used to analyze the data. AHP is a process that transforms a complicated problem into a hierarchical structure (Lin and Liu, 2006). Developed by Saaty (1980), AHP is used to reflect the way people actually think and it continues to be the most highly regarded and widely used decision-making theory. By reducing complex decisions to a series of one-on-one comparisons and then synthesizing the results, AHP not only assists decision makers in arriving at the best decision, but also provides a clear rationale that it is the best (Saaty, 1980). AHP has three main steps: problem decomposition, comparative analysis, and synthesis of priorities (Timor and Tuzuner, 2006). This can be used to assist organizations in analyzing the IDTV adoption and management options in the process of developing an integrated assessment of the entire organizational structure. It can also help to assess the inter-organizational issues among different divisions within an organization. Moreover, AHP can help to predict possible risks and challenges when adopting IDTV commerce so that the organizations are able to formulate appropriate strategies in order to minimize them (Saaty, 1980).

In the hierarchical design, AHP identifies important factors involved in a particular decision and this provides the overall decision-making process and the relationship between various factors involved in a decision making problem. The pair-wise judgments phase is based on the assumption that the judgment will be effective and meaningful when a pair of elements alone is compared on a single criterion without concern for the other criteria. In general notation, at each level of hierarchy the decision-maker establishes scores among elements by constructing a matrix of pair-wise comparison judgments regarding relative importance or preference between any two elements. The  $a_{ij}$  value of the matrix represents the relative importance of the  $i$ th element over the  $j$ th element. After making the pair-wise comparisons, the consistency is determined by using the eigenvalue  $\lambda_{max}$  to calculate the CI (consistency index) value. The calculation for  $CI = (\lambda_{max} - n)/(n-1)$ , where  $n$  is the matrix size. CI is only acceptable if it's less than 0.10, otherwise, the judgment matrix is considered as inconsistent (Al-Harbi, 2001).

According to Hair et al. (1998), the following steps and considerations need to be taken into account when analyzing IDTV adoption and management using AHP:

- Issues may arise at the divisional level within a TV operator when adopting and managing IDTV commerce;
- The hierarchical structure for the TV operators studied needs to be built using the collected data;
- The questionnaire needs to be designed appropriately in order to identify and assess these issues;
- Suggestions for improvement and/or alternatives need to be put forward in order to minimize the IDTV adoption and management risks for the participating TV operators; and
- Suggestions for improvement and/or alternatives also need to be communicated to all divisions within a TV operator and alternatives need to be adjusted and revised accordingly.

## 4 Research Analysis and Findings

The responses were analyzed using the AHP software, Expert Choice. The main characteristics of AHP were that they were based on pair-wise comparison judgments and they allowed different IDTV adoption and management issues or problems (which were identified via the survey earlier) to be integrated into a single overall score for ranking decision options before actual adoption and management. All criteria within the three major adoption and management drivers have consistent responses as their CI (coefficient index) value is less than 0.1 (Satty, 1980). Then the weighting and ranking of the three major adoption and management drivers were computed using the software. The results indicated that the operational capability is the most critical adoption and management driver for conducting IDTV commerce by TV operators (weighting = 0.405), followed by innovation and strategy execution capabilities (weighting = 0.342). According to the survey respondents, the capability to manage the IDTV adoption has a significant positive impact on the operations of IDTV commerce. On the other hand, the level of maturity in technological development (weighting = 0.253) was considered as the least important driver. This had showed that TV digitalization and interactive technologies were not considered as the significant barriers for conducting IDTV commerce.

<b>Adoption and Management Drivers</b>	<b>Criteria</b>	<b>Weighting within each driver</b>	<b>Ranking within each driver</b>	<b>Overall Weighting</b>	<b>Overall Ranking</b>
<i>Operational capability (0.405)</i>	Level of market penetration for interactive STBs	0.257	1	0.09243	1
	Security in financial transactions	0.192	2	0.08492	2
	Control on operational costs	0.145	3	0.06311	11
	Speed & flow of logistics coordination	0.140	4	0.05158	13
	Capability in production of digital program contents	0.134	5	0.06430	9
	Flow and coordination of commerce platform	0.133	6	0.04901	14
<i>Innovation and strategy execution capabilities (0.342)</i>	Level of strategic alliance with other industries	0.249	1	0.08414	3
	Level of utilization in customization	0.212	2	0.06568	8
	Abilities in setting up comprehensive CRM databases	0.186	3	0.06339	10
	Level of program contents & products innovation	0.185	4	0.07309	5
	Personalization & design capabilities	0.169	5	0.05565	12
<i>Level of maturity in technological development (0.253)</i>	The level of maturity in relay technology	0.334	1	0.07928	4
	Wireless digital TV signals broadcasting coverage or cable TV lines penetration	0.290	2	0.07306	6
	Setup of multimedia middleware platform	0.277	3	0.06686	7
	Installation of image automation publication systems	0.100	4	0.02517	15

Table 1: Weighting/ranking for all adoption and management criteria

Table 1 shows weighting and ranking for the individual criteria of the three major adoption and management drivers. The most critical criteria from each of the three major adoption and management drivers are as follows:

1. Operational capability – The level of market penetration for interactive STBs by TV industry players was considered as the most important criterion for operational capability. The respondents indicated that the interactive effect of IDTV commerce would be limited if the market penetration for STBs was not widespread enough. In addition, the security in financial transactions was still considered as an important criterion even though the commercial platform has now changed from the PC to IDTV. Moreover, the control on operational costs was also another important criterion.
2. Innovation and strategy execution capabilities – The level of strategic alliance with other industries by IDTV operators was ranked as the most critical criterion for determining the innovation and strategy execution capabilities. The next two critical criteria are the level of utilization in customization and abilities in setting up comprehensive CRM databases. It is obvious that the success of IDTV commerce

depend not only on the industry itself but also on the formation of strategic alliance with other industries in order to obtain other necessary expertise and skills.

3. Level of maturity in technological development – the most decisive adoption and management criteria for this driver are: (a) the level of maturity in relay technology; (b) wireless digital TV signals broadcasting coverage or cable TV lines penetration; and (c) setup of multimedia middleware platform.

The respondents were also asked to give scores to the three identified alternatives for adopting and managing IDTV commerce. The results indicated that the IDTV commerce was most suited to be fully operated and managed in-house (140.63). The next preferred alternative was the partial outsourcing of IDTV commerce operation and management (135.35) while the total outsourcing of IDTV commerce operation and management was the least preferred option for IDTV operators (123.22).

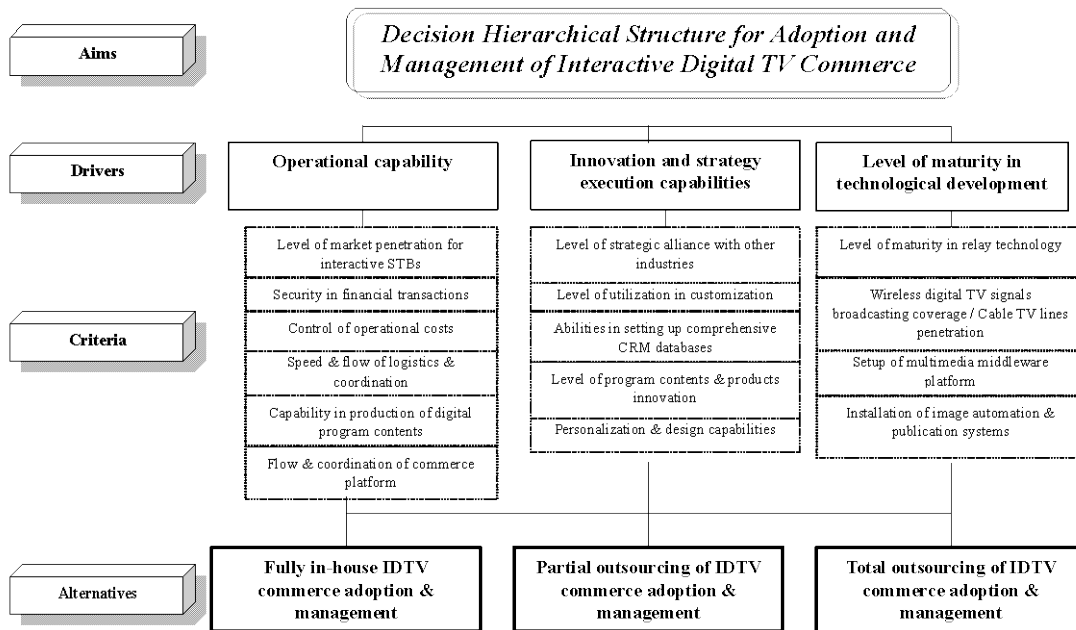


Figure 2: The decision hierarchy for the adoption and management of IDTV commerce

As stated earlier, this research first integrates the literature and the data collected (via semi-structured interviews and survey), and then establishes a decision hierarchical structure for adopting and managing IDTV commerce. This structure represents the three major drivers and their related criteria which influence the adoption and management of IDTV commerce. The three major adoption and management drivers identified are related to TV operator's: (1) level of maturity in technological development; (2) operational capability; and (3) innovation and strategy execution capabilities. The decision hierarchical structure for evaluating the adoption and management of IDTV commerce is shown in Figure 2:

1. Aims - The aims for this level were to conduct the feasibility study of IDTV commerce within the TV industry as well as to identify and evaluate the importance of all major adoption and management drivers.
2. Drivers - After confirming the scope of the feasibility study for IDTV commerce adoption and management within the TV industry, three major drivers were identified: the level of maturity in technological development, the operational capability, and innovation and strategy execution capabilities.

3. **Criteria** - The three major drivers identified in the second level were then decomposed into several criteria (in the third level) which were evaluated according to their relative importance. For example, a TV operator's innovation and strategy execution capabilities were measured by its level of strategic alliance with other industries, abilities in setting up comprehensive CRM databases, level of utilization in customization, level of program contents and products innovation, and level of personalization and design capabilities. As mentioned earlier, these criteria were identified via literature review and semi-structured interviews with the respondents, and were confirmed statistically by the survey.
4. **Alternatives** - Three options were proposed for the adoption and management of IDTV commerce. Shown at the bottom of Figure 2 are the three alternatives that the TV industry players may employ: (1) Fully in-house IDTV commerce operation and management; (2) Partial outsourcing of IDTV commerce operation and management; and (3) Total outsourcing of IDTV commerce operation and management.

## **5 Managerial Implications and Conclusion**

This research aims to establish a decision analysis mechanism that can assist TV operators in identifying and understanding the adoption and management drivers and their criteria. A hierarchical decision structure for the adoption and management of IDTV commerce by the TV industry players was presented in Figure 2. The AHP methodology was employed to analyze these adoption and management drivers. Operational capability for the TV services was found to be the most significant driver for adopting and managing IDTV. The level of market penetration for interactive STBs was established to be the most important criterion for influencing the TV operator's operational capability. This has implied that TV operators need to spend more time and efforts in improving their operational capability in running the IDTV services. This can be done by: (1) increasing the level of market penetration of STBs; (2) improving security in financial transactions; (3) controlling operational costs; (4) optimizing the speed and flow of logistics and coordination of IDTV; (5) increasing the capability in producing digital program contents; and (6) optimizing the flow and coordination of the IDTV commerce platform. In addition, three alternatives for conducting a successful IDTV commerce were also identified. It was found that the operation and adoption of IDTV commerce should be managed fully in-house.

The TV industry is now at a new crossroads facing the problems of allocating personnel with suitable expertise and skills as well as dealing with fierce competition from other new entrants. It is likely that other players such as Internet broadband providers might also enter the digital TV business. For instance, it is vital for the existing TV industry operators to increase security in financial transactions via IDTV commerce (as part of operational capability) and at the same time lower their distribution costs. In order to achieve these goals, they need to form strategic alliance (as part of innovation and strategic execution capabilities) with other industries. Strategic alliance not only can assist in improving reciprocal strengths of alliance partners but also can provide them with means to achieving their goals and this will ultimately lead to the success by all parties involved (Chung et al., 2000).

As mentioned earlier, it has been anticipated that in the future that IDTV will be accessible to a greater portion of the population than the Internet and it will allow a greater penetration to the home market as most households already possess a TV set. Its technology will become more advanced, incorporating an increasing number of e-commerce features. This convergence will enable companies to realize the interconnectivity between IDTV, Internet, and mobile devices (Licata et al., 2001). Furthermore, in light of the recent interest in IDTV investments, it is critical for senior executives within the TV industry to carefully assess their IDTV investments and ensure that the required operational, innovation, and strategy execution capabilities, as well



as its level of technological development maturity are appropriate in the process of realizing the full potentials from the IDTV commerce. Finally, future work can be conducted to analyze and examine other key management issues related to IDTV technologies and their adoption such as:

- The market share of broadband technologies: The diversity and market share of various broadband technologies (e.g., cable modem, ADSL, satellite, WiFi, 3G, etc.) will influence the diffusion and usage model of IDTV commerce;
- Interactive digital TV channels: The number of IDTV channels available will influence the willingness of the viewers to watch IDTV;
- Costs of entry: the high costs might prove to be a barrier for smaller companies wishing to enter the IDTV market;
- Digital contents: The quality of IDTV programs is the most significant factor influencing the willingness of the viewers to shop over IDTV;
- Payment methods: “Pay once for all view” is not suitable for all types of the audience. Therefore, the IDTV operators should provide the PPV payment (pay per view) as it gives the viewers the option to select and watch their prefer channels or programs. This is a tradeoff between operators’ profits and audience’s choices;
- The price of STB: Currently, the price of STB seems to be too high. This is one of the major barriers for diffusion of IDTV;
- More possibilities for IDTV commerce may emerge in the future and it is also very likely that other models will be proposed to analyze decision processes for adopting IDTV commerce.

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