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Evaluation of Interactive Digital TV Commerce Using the AHP Approach

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INTRODUCTION

The popularity of interactive digital television (IDTV) has been increasing rapidly over the last few years and is likely to be the growth star of the future. According to Forrester Research, more than 10% of Europeans are now using interactive digital television (IDTV) services (Jennings, 2004). Indeed, the introduction of IDTV in the diffusion of television has brought about many benefits to the customers (e.g., more TV channels) (Buhalis & Licata, 2002). The proliferation of IDTV has also given customers easier access to products and services. Nevertheless, according to Pagani (2003), this has a profound effect on the market outlook for the existing TV operators. Although IDTV contributes many benefits to the quality and the transmission of the TV channels for the customers, it has also 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, Pervan, & McDermid, 2005). For instance, organizations are likely to face uncertainties when assessing the new adopted IT (Lin & Pervan, 2003) such as IDTV. Moreover, very few studies have carried out proper examination and evaluation of how the TV industry as a whole conducts its business using IDTV (i.e., IDTV commerce). Thus, the objective of this short article is to establish a decision analysis mechanism that can assist the TV operators in adopt-ing IDTV as their commerce platform. A survey was employed to investigate and identify the key issues for adopting IDTV commerce by TV operators. The analytic hierarchy process (AHP) methodology was used to analyze the IDTV adoption 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). One contribution of the short article is that our results indicate that the three most important adoption drivers for implementation IDTV as a commerce platform are: (1) the operational capability for the IDTV services; (2) the innovation and strategy execution capabilities; and (3) the level of maturity in technological development. Finally, most respondents indicate that the adoption of IDTV commerce should be fully operated and managed in-house, rather than outsourced (partial or total outsourcing).

BACKGROUND

Digital Television

Digital television (DTV) is a brand new technology for receiving and sending digital TV signals, which is different from the traditional analog TV signals (Pagani, 2003). DTV is television signals sent digitally rather than in the analog form used when TV was introduced. Analog TV is available in only one quality whereas DTV digitalizes the processes of program produc-

tion, image processing, encoding, signal emitting, and transmission (FCC, 2001). DTV comes in several levels of picture quality: high definition television (HDTV), enhanced definition television (EDTV), and standard definition television (SDTV). 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 or HDTV programming, which varies depending on the provider; (2) satellite—this offers subscriptions to multiple channels of DTV 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 & 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, 2006).

In recent years, the deployment of interactive services on DTV has gaining momentum, and it has the potential to reach a similar level of access as the Internet (McGrail & Roberts, 2005; Thompson, Williams, Nicholas, & Huntington, 2002). Interactive TV is a DTV extended technology (usually abbreviated to IDTV). IDTV focuses on the interactive functions and services, including user-friendly interfaces, video on demand (VOD), electronic program guide (EPG), personal video recorder (PVR), and so forth (Chang, 2001). It refers to television displayed using a digital signal delivered by a range of media, including 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). 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, 7 days a week) (Thompson et al., 2002) and tourism (e.g., by allowing consumers to directly access their reservation systems) (Buhalis & Licata, 2002).

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 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 submarkets: (1) TV shopping; (2) direct response TV; (3) travel shopping; and (4) interactive TV (IDTV) applications.

Like other electronic commerce mediums, IDTV providers can 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 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). It is also attractive to viewers, as they do not need to purchase any additional equipment (besides the costs of STB) or learn a new technology. 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 & Turconi, 2003). Using STB, IDTV commerce is no longer a one-way transmission media but a two-way virtual transaction channel (Lin & Liu, 2006; Lin, Kaun, & Chiu, 2006).

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RESEARCH METHODOLOGY AND DESIGN

Analytic Hierarchy Process (AHP)

AHP is a process that transforms a complicated problem into a hierarchical structure (Lin & 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 & Tuzuner, 2006). This can be used to assist organizations in the analysis and evaluation of the IDTV adoption options in the process of developing an integrated assessment of the entire organizational structure. It can also help to assess the interorganizational issues among different divisions within an organization. Moreover, AHP can help 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 aij value of the matrix represents the relative importance of the ith element over the jth element. After making the pair-wise comparisons, the consistency is determined by using the eigenvalue λmax to calculate the CI (consistency index) value (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 inconsistent (Al-Harbi & Kamal, 2001).

The Decision Hierarchy for Adopting IDTV Commerce

This research first integrates the literature data and the expertise opinions, and then establishes a hierarchical structure. This structure represents the three major constructs and their related factors which influence the adoption of IDTV commerce. The research framework for evaluating the adoption of IDTV commerce is shown in Figure 1:

- **Level 0:** The objectives 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 drivers.
- **Level 1:** After confirming the scope of the feasibility study for IDTV commerce adoption within the TV industry, three major factors were identified: the level of maturity in technological development, the operational capability, and innovation and strategy execution capabilities.
- **Level 2:** The three major factors identified in Level 1 were then decomposed into several criteria (in Level 2) which were evaluated according to their relative importance. These criteria were identified via interviews with the respondents, literature review, and surveys of industry characteristics.
- **Level 3:** Three options were proposed for the adoption of IDTV commerce. Shown at the bottom of Figure 1 are the 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.

Data Analysis and Results

Prior to sending out the main survey, a pilot survey of 15 executives from the 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 three major IDTV adoption drivers (i.e., technological development, operational capability, and innovation and strategy) from the TV industry in Taiwan. Fifty-one main surveys were sent out in 2005

Figure 1. The decision hierarchy for the adoption of IDTV commerce
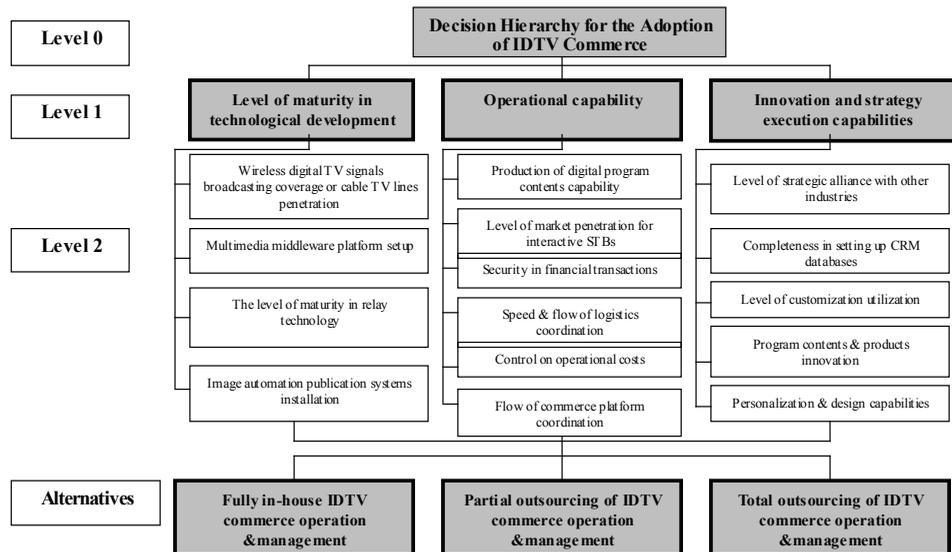
and a total of 37 questionnaires were returned, giving a response rate of 72.55%.

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 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. All criteria within the three major adoption 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 drivers were computed using the software, and the results are shown in Table 1. The results indicated that the operational capability is the most critical adoption driver for IDTV.

Table 2 shows weighting and ranking for the individual criteria of the three major adoption drivers.

The most critical criteria from each of the three major adoption drivers are as follows:

1. **Level of maturity in technological development:** The most decisive adoption 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) multimedia middleware platform setup.
2. **Operational capability:** The level of market penetration for interactive STBs by TV industry players was considered the most important criterion for operational capability. The respondents indicated that the interactive effect of TV commerce would be limited if the market penetration for STBs was not widespread enough.
3. **Innovation and strategy execution capabilities:** The level of strategic alliance with other industries by IDTV operators was ranked as the

Table 1. Weighting and ranking of the three identified adoption drivers for IDTV

Major IDTV Adoption Drivers	Weighting	Ranking
Level of maturity in technological development	0.253	3
Operational capability	0.405	1
Innovation and strategy execution capabilities	0.342	2

Table 2. Weighting/ranking for all adoption criteria

Adoption Drivers	Adoption Criteria	Overall Weighting	Overall Ranking
Level of maturity in technological development (0.253)	Wireless digital TV signals broadcasting coverage or cable TV lines penetration	0.07306	6
	Multimedia middleware platform setup	0.06686	7
	The level of maturity in relay technology	0.07928	4
	Image automation publication systems setup	0.02517	15
Operational capability (0.405)	Production of digital program contents capability	0.06430	9
	Level of market penetration for interactive STBs	0.09243	1
	Security in financial transactions	0.08492	2
	Speed & flow of logistics coordination	0.05158	13
	Control on operational costs	0.06311	11
	Flow of commerce platform coordination	0.04901	14
Innovation and strategy execution capabilities (0.342)	Level of strategic alliance with other industries	0.08414	3
	Completeness in setting up CRM databases	0.06339	10
	Level of customization utilization	0.06568	8
	Program contents & products innovation	0.07309	5
	Personalization & design capabilities	0.05565	12

most critical criterion for determining the innovation and strategy execution capabilities. The next two critical criteria are the level of customization utilization and completeness in setting up CRM databases.

Finally, the last section of the questionnaire asked the respondents to give scores to all three alternatives for adopting IDTV commerce. The results show that the respondents preferred to operate and manage their IDTV commerce fully 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 (123.22) was the least preferred alternative for IDTV operators.

FUTURE TRENDS

It has been anticipated that in the future 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. The AHP methodology can be utilized to analyze the key issues and future trends for the IDTV commerce development:

- **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.
- **The price of STB:** Currently, the price or cost of STB seems to be too high for the benefits it brings. This is one of the major barriers for diffusion of IDTV.
- **The diffusion of IDTV sets:** The other barrier is that it will take some time for the viewers to convert their analog TV sets to digital TV sets.
- 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.

DISCUSSION AND CONCLUSION

This research aims to establish a decision analysis mechanism that can assist IDTV operators in identifying and understanding the evaluation of critical

success adoption drivers, criteria, and alternatives for conducting a successful IDTV commerce. The AHP methodology was employed to analyze the adoption drivers for IDTV commerce by the TV industry. This research has presented a hierarchical decision structure for the adoption of IDTV commerce by the TV industry players. By using the AHP approach, we have obtained the weightings and rankings of the three key adoption drivers, criteria for the key adoption drivers, and the three adoption alternatives. This research process and pattern can be applied to various other industries to explore their possible adoption problems and issues when implementing new technologies.

Furthermore, the respondents indicated that the operational capability is the most critical adoption driver for IDTV. The innovation and strategy execution capabilities of the IDTV operators were the second most critical adoption driver, whereas the level of maturity in technological development was considered the least important adoption driver for IDTV commerce. Looking from another perspective, the TV industry is now at a new crossroads in facing the problem of finding personnel with suitable expertise and skills. As a result, forming strategic alliances with other industries is of critical importance. Finally, it is likely that other players such as Internet broadband providers might also enter the digital TV business. Therefore, it is vital for the existing TV industry operators to explore new business models and lower their distribution costs.

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KEY TERMS

Analytic Hierarchy Process (AHP): A process that transforms a complicated problem into a hierarchical structure.

Digital Television (DTV): A new technology for receiving and sending digital TV signals. DTV digitalizes the processes of program production, image processing, encoding, signal emitting, and transmission.

IDTV: Interactive TV is a DTV extended technology. IDTV focuses on the interactive functions and services, including user-friendly interfaces, VOD, EPG, PVR, and so forth.

IDTV Commerce: A specific kind of TV commerce using TV sets and other related equipments with interactive services.

Set Top Box (STB): A critical component for users to receive digital television signals on traditional TV sets. STBs provide the users with capabilities for implementing interactive television applications.

TV Commerce: In general, all the transactional behaviors via TV can be called TV commerce. This occurs over the medium of the television. TV commerce allows you to purchase goods and services that you view through your TV.

TV Shopping: The most popular form of TV commerce.