

**Exploring Mobile TV Trials in Singapore:
An Analysis of Stakeholders and Market Competitiveness**

Trisha Tsui-Chuan Lin

Assistant Professor
Division of Electronic Broadcast Media
Wee Kim Wee School of Communication and Information
Nanyang Technological University
Singapore

ABSTRACT

Using in-depth interview and document analysis, this exploratory paper elaborates the development of Singapore's mobile TV industry, analyzes stakeholders' business models, and uses the Six Forces model to examine industrial competitiveness. The findings reveal stakeholders tend to select DVB-H technology and adopt a consortium-led business model. The Six Forces analyses show that competition (rivalry, new entrant) and complementor/government are the forces that favor the rollout; however, insufficient mobile TV content and services, nebulous user demands, and strong substitutes are likely to inhibit its uptake. The study suggests the subscription model will be beneficial to push Singapore's initial mobile TV market.

Keywords: six forces model, mobile TV, mobile communication, DVB-H, 3G, business model, mobile policy

1. Introduction

Mobile TV is a promising but fledging industry, with multiple technological standards, several business models, emerging content, and nebulous customer needs. Although the nascent mobile TV market has only 37.3 million global users nowadays (Informa Telecoms & Media, 2007), ABI Research forecasts in 2010 there will be 250 million mobile TV users Worldwide (Oh & Jablon, 2008). Also, it is forecast that mobile TV and video will generate consumer revenues of US\$8 billion by 2012 and the Asia-Pacific region will lead the development of mobile TV market between 2007 and 2010 (Feuilherade, 2006; Informa Telecoms & Media, 2007). Many reports describes Asia as a hotbed for Mobile TV (BusinessWeek, 2006; Feuilherade, 2006; Gill,2008; Informa Telecoms & Media, 2007; Oh & Jablon, 2008) because of high penetration in cell phones, Asians' commuting lifestyles, and advanced broadcasting mobile TV technology. In July 2005, South Korea launched the first free-to-air mobile TV service across the globe, and Japan started its commercial mobile TV broadcast services early next year. Currently, market trials are undergoing in Asia Pacific region with various technological standards and business models, including China, India, China Taipei, Indonesia, Malaysia, Australia, and Singapore.

Singapore has more than 134.2% mobile phone penetration and 2.1 million 3G subscriptions in June 2008 (iDA Singapore, 2008). Its increasing high mobile penetration rate and digital savvy consumers make Singapore a promising mobile TV market. In 2005, M1 (a mobile operator) first launched 3G mobile video services in Singapore, followed by SingTel and StarHub. However, such services have not reached the critical mass. In 2007, Singapore's Media Development Authority (MDA) issued the DVB-H trial license to PGK Media to test broadcasting TV on mobile phones, and later proposed a market-driven, platform-neutral regulatory framework for mobile TV. In August 2008, MediaCorp, M1, SingTel, and StarHub, offered 300 users a three-month trial of Mobile TV on DVB-H enabled cell phones to investigate customer demands.

Mobile TV is regarded as a significant part of interactive digital media industry in MDA's Media 21 plan which envisions Singapore as a global media city. At present, Singapore's mobile

TV is in its infancy. It strikes to develop appropriate policies to regulate and foster the industry, and undertake market trials for exploring viable business models and obscure consumer demands. Because Singapore's mobile TV industry is situated in obscure market trial stage, this exploratory paper uses document analysis primarily, interviews several industrial players (Singapore Digital's general manager, MediaCorp's business development vice president and manager) involved in trials, and test the usability of their mobile TV devices. By analyzing the qualitative data, this paper aims to elaborate the development of Singapore's mobile TV industry, analyze the existing stakeholders, and use the Six Forces model to evaluate the competitive forces and market opportunities within Singapore's mobile TV industry.

2. Literature Review

Mobile TV is "the transmission of TV programs or video for a range of wireless device ranging from mobile TV-capable phones to PDAs and wireless multimedia devices (Kumar, 2007, p.5)." Based on the content delivery, a mobile TV has two kinds: mobile broadcasting TV and unicasting mobile videos (Informa Telecoms & Media, 2007; Kumar, 2007). The former follows a scheduled timetable, emulates traditional TV services, and transmits over cellular networks (streamed TV services) or the broadcast networks (i.e. DVB-H or DMB-T), while the latter delivers user-selected video or other audio/video services to handsets by downloading or streaming over the cellular network. The global value of mobile videos is forecast to triple to US\$3.3 billion in 2012 and Japan is the market leader for mobile video at present (Informa Telecoms & Media, 2007). However, in 2009, it is projected the global mobile entertainment revenues in broadcasting mobile TV will exceed mobile videos (Informa Telecoms & Media, 2007).

A 2008 consumer-behavior study conducted by Ericsson and CNN showed more than a third (34%) of respondents ranked mobile TV as the number one desirable application on their phones and almost half (44%) of the respondents would adopt mobile TV in the next two years (Ericsson, 2008; Gill, 2008). Choi, et al. (2008) found that "subscription cost" and "media

quality” as the two most important core attributes for successful adoption of mobile TV in South Korea. Wei and Huang’s study (2008) about mobile TV diffusion in China found that young professional males who spent a great deal of time commuting and had used the Internet via the mobile phone would be most likely to become the critical mass. Moreover, from i-mode’s experiences in European and US, contextual differences between societies affected adoption rate and user behaviors significantly. There will be no exception to the adoption of mobile TV.

2.1 Mobile TV Technology

According to Gill (2008), one main inhibitor of widespread mobile adoption is the multitude of technologies. Mobile network operators used 3G technology to provide video services to boost the sales of cell phones, and shift phone use from communicating to proactively searching for information or entertainment (Carlsson & Walden, 2007). However, bandwidth limitation caused unsatisfied viewing experiences of 3G videos. Later, broadcasting mobile technologies emerged. The broadcasting mobile TV technologies in trials or in use include three main open standards—Europe's digital video broadcasting-handheld (DVB-H), South Korea's digital multimedia broadcasting (DMB), Japan's integrated services digital broadcasting-terrestrial (ISDB-T)--and one proprietary standard, the United States' (Qualcomm) forward link only (MediaFLO) (Choi, et al., 2008; Gill, 2008; Kumar, 2007).

DVB-H, the recommended technology by the EU, is selected by most European operators and vendors, from T-Mobile to Vodafone and Nokia. Also, it is being trialed in several European countries and Asia markets. After successful field trials in Berlin and Helsinki, the mobile network operator 3 Italia launched a commercial mobile TV service based on DVB-H in Italy in June 2006. And this technology has been trialed in the UK by BSkyB. DMB/SDMB is an Asian developed standard and the most mature mobile TV technology available today. Mobile broadcast TV services started in 2005 in Korea via the terrestrial-based T-DMB system. As of November 2006, more than 2.7 million South Koreans had been using mobile TV via either T-DMB or S-DMB (satellite DMB) (Choi, et al., 2008). In April 2006, ISBD-T was developed by Japan and launched as a free mobile TV service. Finally, Qualcomm’s MediaFLO is the

dominant technology in the USA and Verizon launched VCast Mobile TV service in 20 US markets in March 2007.

In comparison, broadcast based Mobile TV has several advantages over cellular Mobile TV (Gill, 2008). First, it can transmit content to large areas simultaneously and carry high quality pictures with little additional cost. Second, broadcast mobile TV can allow many players to join in, not just broadcasters and telcos. Third, broadcasting mobile TV transmits content robustly that does not require telco infrastructure or spectrum availability. However, whether there is a reliable transmission of services in tunnels or indoor and unified frequency allocation for mobile TV are two critical technological issues to decide the feasibility of broadcasting mobile TV. In future, if the software challenge to integrate DVB-H and 3G technologies is overcome, the hybrid technological infrastructure will keep costs down (Carlsson & Walden, 2007).

2.2 Mobile TV Business Model

Most agree mobile TV is technologically ready; however, successful business models are still ambiguous. Currently, there are two dominant business models: the subscription model and free-to-air model (Gill, 2008; Kumar; 2007). First, the subscription model is the mobile operator-led model where the carrier manages the end-to-end relationship with customers and provides the full service, including distribution, billing and CRM. Second, the free-to-air model is led by the broadcasters or a consortium comprising distributors, technology providers and other third parties to provide services and support and largely by-passes the mobile operators. TU Media Corp in South Korea that adopted a hybrid model attracts one million subscribers in early 2007, the biggest positive uptake of Mobile TV worldwide (Shin, 2007).

In Asia, the low willingness to pay for mobile TV services is attributed to unfamiliarity and confusion about charging models (Oh& Jablon, 2008). The broadcasters and satellite operators claim the FTA model that transmits TV channels to large-scaled viewers with less cost will migrate viewers easily. However, in the emerging mobile TV market with uncertain user demand, the FTA model that offers free, conventional content, and relies fully on advertising is risky and hard to sustain in the initial years(Gill, 2008). Comparatively, Qualcomm's research supports the subscription model is suitable in the Asia-Pacific region, because mobile TV service providers

can gain revenue in return immediately and offer diverse content and services for Asia's heterogeneous peoples and cultures (Oh & Jablon, 2008). Even if the FTA model succeeds in several Asian countries, Oh and Jablon (2008) believed the subscription model that provided incentives of revenue generation to all stakeholders would become the mainstream.

Besides, there are different business models for broadcasting mobile TV, based on who assumes the mobile broadcast service provider roles: mobile operator-led business model, broadcaster-led business model, independent DVB-H service operator-led model, and consortium-led model (Cheng, 2007). And the emerging model of mobile TV in a particular market will be heavily shaped by the regulatory and licensing regime, as well as the societal and media context.

2.3 Mobile TV Content

Content is a key driver of mobile TV adoption. Groebel, et al. (2006) identified the two key characteristics of the mobile devices: anytime, anywhere and location-based services. News, drama, sports are found by many studies as the most popular genres for mobile TV customers (Carlsson & Walden, 2007; Gill, 2008; Shin, 2007; Wei & Huang, 2008). In Asia, consumers prefer local content (Gill, 2008). As mobile attention span is short, mobile TV, an attention-expensive medium, should create content and services with shorter, quick interaction. In Carlsson & Walden's (2007) pilot experiment about Finland's mobile TV, they found that the mobile TV potential users prefer non-stop looping programs of 30-45 minutes; programs which can be stored on the device and activated when time and opportunity to watch; specially designed programs where the core/key information can be absorbed in less than 10 minutes; news, sports, cartoon, documentaries.

Besides, TV channels have been pioneers in successfully exploiting the mobile channel as means of increasing the interactivity (initially SMS services, like voting) with viewers. In addition to a new distribution platform, mobile TV acts as a secondary channel to add interactivity, mobility, and personalization into traditional TV content (Andersson et al, 2006). Usually, mobile TV can act as an interactive tool used in conjunction with home TV and keeps user in touch with programming anywhere, anytime. Results from pilots and successful rollouts reflect the 'surrogate TV effect' and show mobile TV to be popular in prime time (Gill, 2008;

Radne, 2007). International content providers are developing mobile TV-specific channels, like Discovery mobile, HBO's mobile TV film, CNBC's mobile news, and ESPN, etc.

Jenson (2005) criticized the mobile industry's "default thinking" caused the failure of MMS. Carlsson & Walden (2007) were concerned a similar "default thinking" with mobile TV. That is, mobile operators believe multi-media phones can be naturally turned into platforms for TV content, without making lots of effort to build a user-friendly interface with compelling content and services. In order to fuel subscriber uptake, operators must realize that the mobile phone is a communication tool in nature and mobile TV needs complement this to achieve smooth user experience (Oh& Jablon, 2008). Oh and Jablon suggested operators make mobile TV a ubiquitous feature on a handset and create a seamless user experience to incorporate interactive features, like chatting and voting, with mobile TV viewing. Ease of use in interface design is another critical in successful diffusion of mobile TV. Past studies showed that consumers felt frustrated to discover videos on mobile services and wanted a personalized Electronic Program Guide (EPG) tailored to personal tastes and interests to find content (Oh& Jablon, 2008).

2.4 Six Forces Model

Porter's five forces model (1980) is a useful framework to analyze the development of the industry and assess its competitive intensity and market attractiveness. This model looks at the strength of five distinct competitive forces: the threat of substitute products, the threat of established rivals, the threat of new entrants, the bargaining power of suppliers, and the bargaining power of customers. Porter argues that five forces determine the profitability and competition of an industry.



Figure. 1. Porter's five forces analysis

However, this well-cited model has been criticized by other scholars and strategists for the dubious underlying assumptions, such as the unrelated buyers, competitors, and suppliers and the low uncertainty. Although Porter stated a key role for complements, he has not emphasized it as a force. Later, Brandeburger and Nalebuff (1995) added the concept of complementors as the sixth force to explain reasons behind strategic alliances. Many credited the idea, complementors, to Andrew Grove, the former CEO of Intel Corporation. In other studies, the sixth force also refers to the government or the public.

3. Analysis

3.1 Singapore's Mobile TV industry

In April 2001, Infocomm Development Authority of Singapore (IDA) sold the 3G licenses to Singapore's mobile communication providers, M1, SingTel and StarHub, with \$100 million each. StarHub launched Singapore's first 3G network service in late 2004, including wireless voice telephony, video calls, and broadband wireless data. Soon after, M1 and SingTel launched their 3G services in early 2005. StarHub further collaborated with NTT DOCOMO to start the exclusive i-mode mobile internet services in November, 2005. After M1 provided commercialized 3G video services to let users watch streamed TV via a web portal, its *MeTV*,

Singapore's first video sharing service on mobile phones, was inaugurated in January 2007 to display and exchange user-generated audiovisual content. On a whole, 3G video services have not been successfully diffused in Singapore, as many are deterred by the hefty 3G data charges in downloading content.

After a few commercialized broadcasting mobile TV services succeeded in South Korea and Japan, mobile TV re-grab the attention of Singapore's telcos, the broadcaster, and policymakers in 2007. In June, 2007, PGK Media launched the first Singapore's nationwide trial for its mobile broadcasting TV service, TV2GO. It was characterized by its on-the-move live programming and real-time interactive content using the DVB-H technology.

Viewing mobile TV's potential to herald the next milestone in Singapore's broadcasting landscape, MDA, Singapore's policymaker for digital media, conducted a public consultation from late November 2007 to seek public feedback for mobile TV services. First, MDA announced a "platform-neutral" approach to mobile TV services (MTVS) to "regulate mobile TV services equally regardless of the technology platform (Fierce Mobile Content, 2007)." The rationales behind were to provide operators flexibility to choose a best standard for their businesses. DVB-H, MediaFlo, and UHS platforms are MDA's three suggested technologies for broadcasting mobile TV. Second, MDA is prepared to issue up to four multiplex licenses for mobile TV service (MTVS) operators: two 8 MHz UHF channels and two VHF 1.5 MHz channels. There will be a comparative tender to select multiplex licensees that meet consumer interests and show commercially viable. To foster the growth of MTVS, MDA proposed a two-tier IPTV framework: an niche subscription TV license and a nationwide subscription TV license. Lastly, MDA encouraged innovation in mobile TV interactive services. As the mobile TV is likely to be adopted by many young users, to prevent them from being exposed to harmful content, MDA suggested that MTVS should be subjected to the TV Program Code.

In May 2008, SingTel made its IPTV, mio TV, available on mobile phones. Viewers can watch mio TV's live channels and video-on-demand with an electronic program guide (EPG). One month later, Broadcast Australia teamed with PGK Media to form Singapore mobile TV services joint-venture, Singapore Digital. Later, TV2GO was granted a license extension to November 2008. This mobile platform was integrated with the Nokia DVB-H broadcast platform to support interactive functionalities.

Using the Beijing Olympics 2008 as an incentive to attract mobile TV viewers, three telcos (SingTel, M1, StarHub) and the broadcaster (MediaCorp) rolled out their first joint DVB-H mobile TV consumer trial in August 2008. Users can watch broadcasting channels and a variety of foreign and local television programs. The DVB-H platform was supported by Alcatel – Lucent’s DVB-H technological solution. To understand potential consumer preferences and behaviors, 300 trialists were given the Samsung p-960 handsets to experience mobile TV. Whether to launch mobile TV commercially and how to collaborate next is remain uncertain for these telcos and broadcaster. Both the local players and Singapore Digital that submitted the trial results to MDA in late 2008 and wait for a finalized regulatory framework for licensing so that they can launch commercial MTS soon.

Table 1. The Development of Mobile TV in Singapore

Time period	Event(s)
April, 2001	3G licenses awarded to MobileOne, SingTel and StarHub
December, 2004	StarHub launched 3G network
February, 2005	M1 started commercialized 3G video services
November 18, 2005	StarHub launched i-mode
January, 2007	M1 launched MeTV
June, 2007	PGK Media launched TV2GO Trial
November, 2007~ January, 2008	MDA sought public feedback on its proposed regulatory framework for mobile TV services in Singapore
May, 2008	SingTel had mio TV on Mobile
June, 2008	Joint venture between PGK Media and Broadcast Australia to set up Singapore Digital
August, 2008~ November, 2008	Joint DVB-H mobile TV consumer trial by SingTel, StarHub, M1, and Mediacorp
Late 2008	Local DVB-H trial and TV2GO submitted results to MDA

3.2 Key Players in Singapore’s Mobile TV Market

Singapore has a limited competitive telecommunication market and a monopoly broadcasting industry. Currently, all three telcos (SingTel, M1 and StarHub) are actively involved in the development of Singapore's mobile TV, while MediaCorp is the primary local content provider. Singapore Digital, a potential competitor for MTVS, is a full service mobile TV provider that not only aggregates content but also provides transmission of DVB-H mobile TV signals.

1. SingTel

Set up in 1879, SingTel is Asia's leading communications group with operations and investments around the world. SingTel Mobile is a subsidiary of SingTel and a leading mobile operator in Singapore with more than 1.9 million customers. As of 31 March 2006, SingTel has 43% market share for mobile services. As the largest telco in Singapore, SingTel has not been keen in developing mobile TV until recently. In addition to provide some 3G video services, SingTel offered mio TV on Mobile in mid 2008. It is supported by Nokia Siemens Networks' Mobile TV streaming service on its MDS 3.5 platform, while the phone application is based on Adobe's Flash Lite technology. mio TV on Mobile allows viewers to watch six mio TV channels, on-demand programs, and pay per view with an easy-to-use EPG for the viewing schedule. mio TV on Mobile is available to SingTel's 3G users at S\$6 flat monthly fee, plus the fee for watching pay per view. Besides, in 2008, SingTel also offered Apple's latest 3G iPhone exclusively in Singapore.

In July 2008, SingTel and StarHub, announced to join in the consumer DVB-H mobile TV trial planned by M1 and MediaCorp. Involvement of four of the territory's most powerful media and telecoms firms could spell troubles for a rival DVB-H trial, TV2Go (Mayer, 2008). The 300 trialists could view varieties of broadcasting mobile TV content encompassed sports, news (Channel News Asia for international news, CNBC for their financial updates, Taiwanese cable news channel), Cantonese movie channel, local broadcasting channels, kids' programs, entertainment, and documentaries. Participants used the Samsung P-960 handsets to get access to the DVB-H platform that was supported by technology partners, Alcatel-Lucent and Gemalto.

2. StarHub

Launched in 2000, StarHub is the second largest mobile operator and the sole cable television operator in Singapore. Its substantial shareholders are ST Telemedia and Qatar Telecom (Qtel) Q.S.C ("Qtel"). StarHub was the pioneer of "hubbing;" that is, it delivered

integrated package services, like cable, mobile and Internet all-in-one, to customers with bundled prices. StarHub operates Singapore's fastest 3.5G mobile network to complement its nation-wide GSM network, and an island-wide HFC network to deliver digital cable TV and broadband services.

In February 2003, StarHub experimented with interactivity via Hub TV, Singapore's first MMS/SMS TV. Its viewers could interact with other viewers and participate in contests and games by sending SMS or MMS shown on the live broadcasting TV programs. StarHub's 3G system was implemented in 2005 and its 3G subscribers could view multimedia data on mobile phones. After NTT DOCOMO provided know-how, technologies, and patents for StarHub to operate i-mode exclusively for Singapore's mobile users, this mobile Internet service was launched in November, 2005 (Hardware Zone, 2005). i-mode users could use one button access to the 100 English and Chinese sites, download files, play games, and do emails and online shopping and banking. Until this August, StarHub took part in the DVB-H consumer mobile TV trial.

3. M1

Established in April 1997, M1 is one of the leading mobile communications providers. With more than one million customers, it is the third largest mobile operator. It provides a full range of mobile voice and data communications services over its 2G/3G/3.5G network. Its shareholders include Keppel Telecoms and SPH Multimedia, together with Telekom Malaysia (MobileOne, n.d.). M1 is active in experimenting with mobile TV and video services. After launching a 3G network, in 2005 M1 partnered MediaCorp to test mobile TV's consumer market. In January 2007, M1 launched MeTV, which made use of its mobile portal and MMS for sharing user-generated videos among mobile social networks. M1 users were encouraged to upload videos to the MeTV site for sharing and monetary rewards. After MeTV attracted more than 50,000 users after half a year, M1 and StarHub signed a deal to open MeTV for StarHub customers (TeleGeography, 2007). Moreover, M1 partnered MediaCorp to launch Asia's first mandarin mobi-drama, "P.S I Luv U" on 3G technology (MobileOne, 2008). The series contained 30 episodes of 3-minute videos, and featured local and Taiwanese celebrities. Moving forward, M1 and MediaCorp initiated in 2008's DVB-H mobile TV trial.

4. MediaCorp

MediaCorp is Singapore's leading media company and content provider, spanning television, radio, newspapers, magazines, movies and digital media. It broadcast the first TV pictures in 1963. It held its monopoly status till 2001 when Singapore Press Holdings (SPH) was given the broadcasting license. After SPH made losses, in 2004, MediaCorp took over its two channels and regained monopoly. Nowadays, MediaCorp has 8 television channels and 14 radio channels. Besides, MediaCorp is the first to use DVB technology for outdoor digital TV worldwide. MediaCorp has been the primary local content provider for mobile TV trials so far. A Memorandum of Understanding (MoU) signed between M1 and MediaCorp in October 2007 to develop made-for-mobile TV content. Working with MediaCorp Studios, M1 had offered its customers Asia's first 3G mobile drama series and celebrity and entertainment programs in 2008. The 2008 DVB-H mobile TV trial was planned by MediaCorp and M1 and MediaCorp's several channels were included in the content offered.

5. Singapore Digital

Founded in 2001, PGK Media is a Singapore-based firm specializing in the development of innovative technologies for the broadcasting, advertising and media industries. Singapore TV2GO, a mobile TV market trial run by Singapore Digital, a joint venture between PGK Media and Broadcast Australia, commenced in June 2007, and was recently extended to end November 2008. The purposes for trial extension were to provide viewers interactive content and services, like chat-room services, teletext-to-mobile and real-time financial services. The trial is in alliance with Broadcast Australia Zentek Technology, NCS Communications Engineering, CNBC Asia Pacific, ESPN STAR Sports, Kamera to test technical capabilities and obtain feedback from viewers. Using an EPG, 100 trialists can watch diverse content, covering news, sports, entertainment, and premium programs from 10 channels, like CNBC, ESPN, WOW!TV, and engage real-time interactive services on the move, including voting and access to dedicated micro-sites. TV2GO may use Singapore as the test bed for to expand to other countries by using standardized technology, business model, content, and device. Additionally, PGK and MDA have collaborated many R&D projects and initiatives successfully.

3.3. The Six Forces model Analysis

The Six Forces model (Porter 1980; McAfee, 2002) is a useful framework to analyze the competitive intensity and market attractiveness of Singapore's mobile TV industry. This study finds out how this industry is shaped by below forces:

1. Competitive rivalries

In Singapore's mobile TV, currently, there are two broadcasting mobile TV trials: telco-broadcaster camp (SingTel, StarHub, M1, MediaCorp) and TV2GO (Table 2). Both of them are testing broadcasting content on DVB-H platform. Their targeted early adopters focus on young adults and PMEBs (professionals, Managements, Executives, Businessmen). They have two major technological problems, indoor coverage and bad reception in tunnels, to conquer, because Singaporeans spend lots of time indoor and commuting. The signals of both mobile TV trials can be received only by a few expensive Nokia and Samsung cell phones and their designs and interfaces are still immature for commercialization. In terms of content, the strength of the telco-broadcaster camp is the MediaCorp's local programming and several Chinese channels; however, TV2GO adds interactivity to the broadcasting content and provides some premium foreign channels. From the interview with TV2GO's general manager, after commercial launch, TV2GO will ask affordable monthly flat rate for subscribing 8-10 channels. The payment will be charged into users' mobile phone bill.

At present, the business models of these established rivals are unclear. The telco-broadcaster formed a consortium in this trial. The three mobile operators (SingTel, StarHub, M1) are likely to collaborate to launch the commercial MTVS during the economic downturn because the investment of the infrastructure and R&D in content and services are costly. The three mobile operators all obtained experiences of 3G mobile videos and mobile Internet services, like SingTel's mio TV on Mobile, StarHub's i-mode and StarHub TV on Mobile, and M1's MeTV. StarHub can easily serve as the content aggregator based on its cable TV business. From the operation of mio TV, SingTel is no foreign to content aggregation. As for M1, it has allied with MediaCorp for the experiments of made-for mobile TV content. Based on the interviews, MediaCorp will take a neutral position and offer local content to MTVS operators.

Table 2. DVB-H Broadcasting Mobile TV Trials in Singapore

	Joint DVB-H Mobile TV trial	TV2GO
Trial Time	August 2008- November 2008	June 2007-November 2008
Technology	DVB-H	DVB-H
Content	15 channels (English and Chinese) News (Channel NewsAsia, CNBC, Cti, TVBS News); Sports (tvmobile's Olympics 2008, Football Channel); Entertainment (UKTV, Channel 8, Channel U, ETTV Asia); Kids & LifeStyle (MTV, Kids Central, Nickelodeon, World Fashion, The History Channel)	10 foreign channels CNBC, ESPN, WOW!TV, ESPN, Bloomberg, Disney Channel and TV2GO's own channels
Interactive services	None	EPG, Interactive radio shows, digital text applications, interactive ads, voting on programs, content purchase, and access to micro-sites, weather applications
Trial partners	M1, StarHub, SingTel, MediaCorp Alcatel-Lucent and Gemalto (Technology partners)	PGK Media, Broadcast Australia Zentek Technology, NCS Communications Engineering, CNBC Asia Pacific, ESPN STAR Sports, Kamera
Cell Phones	Samsung P-960	Nokia N77, N92, Samsung SGH-P930
Usability of Interface/Artifact	Version 1.1 handset: simple navigation and channel switch functions, minimalistic design	User friendly, easy to navigate, long waiting for channel switch

2. Threat of new entrants

MDA is prepared to issue four multiplex licenses for mobile TV service (MTVS) operators through a beauty contest tender process. In the nascent stage, the mobile TV industry has high entry barriers in technology, content, business models, and even artefact and interface design. To date, Singapore Digital is the only possible new entrants for MTVS. Its strength lies in its innovation in interactive content and services. However, as a new brand lacking of mobile customer bases and local experiences, Singapore Digital should expect a tough battle ahead, especially if it cannot take the first mover advantage to differentiate its brand.

3. Threat of substitute products

Without mobile TV services, mobile consumers still can use mobile internet services to download videos from Tudou.com or YouTube.com to their phones and watch them on the go. Other portable artifacts with information and entertainment functions are strong substitutes of mobile TV, including iPods, blackberry, and portable video games. The large number of iPod users, young adults mostly, can store and watch their favorite videos downloaded freely from the Internet, without worrying about unstable signals or connectivity problems. Portable video games are popular among Singapore's public transportation passengers. Besides, Singapore's working professionals often use the blackberry. As the blackberry and mobile TV handsets are unlikely to be merged in future and users are unlikely to buy two, it will inhibit to reach this targeted group.

4. Bargaining power of customers

In a position paper available for public comment in January 2007, MDA reveals only 11% Singaporeans are willing to pay between S\$5 and S\$15 per month for mobile TV. It appears Singaporeans are not very keen to have this new mobile service. Due to several possible MTVS operators and various substitute portable artifacts, the bargaining power of customers is indeed quite high. If the initial launch of mobile TV fails to provide original and differentiated content and interactive services at affordable prices available on many cell phones, it will be hard to switch users to the new platform from competing media. Also, the improvement of mobile TV devices and their price reduction are critical for the early adoption.

5. Bargaining power of suppliers

Content and service providers are keys to the success of mobile TV services. As a result of product innovativeness and scarcity, the providers for made-for-mobile programming and interactive mobile services will have great bargaining power to decide where to place their content. MediaCorp, the only broadcaster, becomes the powerful local content provider for mobile TV. Its collaboration with M1 to produce mobile TV customized dramas increases its strength even more. Foreign TV channels and radio channels play a role to differentiate mobile TV content. With respect to the mobile TV devices, Nokia and Samsung are two manufacturers who are keen in producing mobile TV compatible cell phones and participating in Singapore's mobile TV trials.

6. Complementors/ government/ public

As aforementioned, TV2GO and the local telcos have formed their alliances to various levels. TV2GO has a complete list of complementors, ranging from content providers, infrastructure builders, cell phone manufacturers, and interactive service developers. When TV2GO launches its commercial MTVS, it is likely to coordinate with cell phone manufacturers or local telcos to boost the take-up and facilitate its sustenance. The three mobile operators also collaborate with various partners for developing mobile TV content and technology.

Although the global financial crisis may hold back the growth rate of Singapore's mobile TV industry, MDA takes a market-driven and technology-neutral approach to encourage advancing such interactive digital media to move one step closer to the vision of Asia Media Hub. Tech-savvy and gadget loving, Singaporeans have great potential to accept the launch of commercialized mobile TV as long as it demonstrates its must-to-have uniqueness. However, mobile TV now is not aware by the majority in Singapore's society and people often mistake it for TVMobile, a digital TV service shown on SBS buses. When the launch of commercialized mobile TV services, the operators must make lots of efforts to educate customers and create awareness.

In sum, rivalry, new entrant and complementors/government are positive forces to foster mobile TV in Singapore. On the contrary, high bargaining power of customers and suppliers as well as various competitive substitute products might dwarf its diffusion.

4. Discussion and Conclusion

Mobile TV offers new business and investment opportunities to both telcos and media companies, whilst it presents a new platform for TV and content producers to showcase products and generate sales. Its success will not only advance Singapore's vision of Asia's media hub, but also benefits consumer to enjoy varied content and interactive services on the move. The diffusion of mobile TV is contextualized in different societies. Singapore has several advantaged conditions to develop mobile TV successfully, including high mobile penetration, digital savvy customers, pro-innovation government, sophisticated media companies, and well-established

telecommunication infrastructure. If the key issues, like business models, content creation, technology, and policy making, are settled, Singapore's mobile TV industry has great potential to blossom.

Market experiences show multiple technological standards hold back the development of mobile TV in different countries and standard harmonization is critical to ensure scalability and cost-effectiveness. Based on the findings of the market trials and interviews, Singapore's industrial players tend to select DVB-H over other technologies. Regardless of the number of users, the DVB-H platform can support up to 20 channels, as with the same quality and speed of transmission, whilst 3G technology only support a few. Besides, the DVB-H users need not pay extra data charges for watching broadcasting shows or using interactive services, which helps the affordability of DVB-H mobile TV services/content. However, as Singaporeans spend most of their time indoor or commuting, if DVB-H is the chosen technology, there is an urgent need for upgrading the infrastructure to improve the indoor and tunnel reception of mobile TV signals. Besides, TV2GO market trial's results showed that users wanted to have "the latest gadget" in town and "impress" others. The design of the mobile TV device/interface must be improved so that its sleek look and user-friendly interface will appeal to the target audience.

Singapore's mobile TV trials show that the future business models are likely to be the consortium-led model. And MediaCorp will position itself to be the primary local content provider for mobile TV. Nokia's 2007 study forecasts that by 2012, 25% of all entertainment will be created, remixed, and shared within one's peer circle (Zeman, 2007). Consumers will be increasingly demanding their entertainment to be truly immersive, localized, customized and home-grown. These all clearly point out that simply broadcasting TV content on the mobile phones will not satisfy customers. Instead, only innovative genres to instantly engaging users on the move will attract the critical mass. However, developing customized mobile TV content and interactive applications require huge investment in content creation and R&D. It is necessary to use the subscription model to ensure a clear revenue stream to stakeholders in the mobile TV value chain (Oh& Jablon, 2008) and thus keep ongoing development in specialized mobile TV content and interactive services. Singapore digital that has devoted to create original MTVS content and interactive services revealed its decision to charge future subscribers with an affordable monthly fee. This study also thinks the subscription model as the viable pricing model

for Singapore's MTVS.

Although Singaporeans are unfamiliar with mobile TV services at present, they have experienced pay TV's tiered packages, video on demand, pay per view, mobile IPTV, and video downloads from Internet or mobile. As long as viewing mobile TV content meets consumers' needs to be entertained on the move, they will be willing to take money out of their pockets. This study suggests in future Singapore's MTVS operators can charge their basic tier with a flat subscription fee for users to watch live terrestrial TV programming and some made-for-mobile content, listen to radio channels, use mobile Internet and basic interactive services (i.e. EPG). In terms to the add-on mobile TV services, users can select a la carte pay TV channels, use pay-per-view for live events, films, and niche content, and use pay-per-use for advanced location-based information services (i.e. map). What should be worried about the mobile TV content creation is that Singapore MTVS that lacking of economy of scale will face a huge challenge to produce content to satisfy multi-culture and multi-language Singapore mobile customers. Moreover, Singapore's mobile TV policy has a questionable licensing issue: can Singapore's small market let four MTVS multiplexes sustain and thrive in the media-saturated milieu?

In sum, this paper that clearly illustrates the status quo of Singapore's mobile TV industry and identifies the key stakeholders provides empirical data and insightful analysis. It can shed light for the future development of mobile TV in Singapore or other countries in Asia Pacific. The future research will follow Singapore's commercialized mobile TV services and tackle their business models, marketing and content strategies.

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新加坡行動電視產業發展初探

林翠絹

新加坡南洋理工大學黃金輝傳播學院

電子與廣播媒介系助理教授

<摘要>

本研究採用深度訪談及次級資料分析法，專訪星國無線電視與新媒體業者，不僅詳述新加坡行動電視從 3G 影像服務迄今發展，並分析業者商業模式，以六力分析檢視其產業競爭力。研究結果顯示星國行動電視未來傾向採用 DVB-H 科技，商業模式將以聯盟方式為主，此外六力分析發現：競爭者、潛在進入者、政府支持為有利產業推展因素，而內容服務不足、消費者需求不明、和多元替代品可能阻礙其普及。本研究建議收費模式較適合初期推廣星國行動電視。

關鍵詞：六力分析模式,行動電視, 行動通訊, DVB-H, 3G, 營運模式