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**Media fusion and future TV:
examining multi-screen TV convergence in Singapore**

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Abstract

This study examines Singapore's national media blueprint and industry stakeholders' coping strategies in response to multi-screen TV development. The findings show Singapore multi-screen TV development is still at a nascent stage after launching Media Fusion and FutureTV plans in mid 2009. The policymakers play a key role to follow national media blueprint to unify the inter-industry and cross-country collaboration. TV operators and telcos are found to remediate themselves by harnessing the power of internet and mobile technologies for content innovation and distribution. To tackle the complicated convergent issues in multi-screen TV industry, this study proposes to separately regulate the technology-neutral platforms and diverse audiovisual content. It also recommends a pro-innovative policy with the light-touch licensing scheme and loose content regulation to facilitate the development of the next TV.

Keywords: three-screen TV, multi-screen TV, convergence, media fusion, IPTV, mobile TV, cross-platform, TV technologies, TV market, TV policy

1. Introduction

The prevalence of Internet and mobile technologies has shaped TV industry dramatically in video consumption, content creation and distribution, and business models. The convergent video technologies allow viewers to watch audiovisual content with personalized experiences across three screens: TVs, computers, and mobile devices. Since 2009, "three-screen TV" has emerged as a trendy phrase which refers to the integrated solutions for multi-screen video consumption at anywhere, anytime (AT&T, 2010; Krazit, 2009). The Nielsen's Three Screen Report (2010a) shows video consumption across platforms keeps rising in US when the adoption of HDTVs, DVRs, broadband, and smartphones increases at double- and triple-digit rates and audiovisual content quality and timeshifting viewing experience have been

improved greatly. Another global video consumption survey on connected consumers in 55 countries (Nielsen, 2010b) finds that Internet users increasingly watch videos across screens with approximately 70% viewing Internet videos and 11% consuming mobile audiovisual content. This study also reveals that Asia-Pacific Internet users lead the adoption of online and mobile videos.

In 2011, Singapore was ranked second globally by the World Economic Forum as the most competitive countries in digital economy to use ICT to boost national growth (BBC News, 2011). According to IDA's annual survey (2010), Singapore's infocomm revenue reached \$50.9 billion in 2009 with a growth rate at 8%, and 14% of revenue comes from content services. Singapore, the 8th most globalized cities in 2010 (The Wall Street Journal, 2010), has a sophisticated content production, aggregation, and distribution ecology and becomes the base and springboard of many well-established global media companies, including 15 out of 17 major international cable and satellite broadcast networks in Asia. Due to geographic and cultural proximity, it has advantages and capabilities to be developed as a Hub to test, launch and reach other Asia's media markets. As a microcosm of Asia, multicultural Singapore with leading digital advancements is an ideal context to study how its advancement and convergence of media technologies affect the development of multi-screen TV industry and regulation.

To cope with the dynamic changes in media convergence, Singapore Media Fusion Plan (SMFP) was officially launched by Media Development Authority of Singapore (MDA) in mid 2009 to strengthen local media ecosystem, support the creation of innovative content with global appeal, and make Singapore the trusted global capital for new Asia media (IDM, 2009). Even though the phrase of three-screen TV is never used by IDA, MDA, or related stakeholders, FutureTV, the first of SMFP's five media futures and an industry initiative, encompasses projects and R&D in various innovations in TV and interactive digital media areas. This national media blueprint signifies Singapore's directions to develop its next TV or multi-screen video industry.

Prior studies show global regulatory bodies strived to make appropriate policies to regulate and facilitate the development of IPTV and mobile TV (Cheah, et. al., 2009; Curwen & Whalley, 2008; Lin, 2010a). Industry players also walked a long way to roll out these two convergent media. The emerging multi-screen TV industry is expected to bring even more challenges to develop pro-innovation regulatory frameworks and sustainable business models. What is the current status of Singapore's future TV development? How do Singapore's government and policymakers foster the growth of the multi-screen TV industry? How do the stakeholders in Singapore cope with these technological changes and convergent

issues? The Singaporean case is used to elaborate how the advancement and convergence of video technologies affect multi-screen TV policymaking and market development. This study examines the macro level of multi-screen TV phenomenon in Singapore and analyzes its national media blueprint, policymaking, and stakeholders' coping strategies. Finally, it makes regulatory recommendation for developing multi-screen TV business and policy.

2. Three screen TV: TV, PC, Mobile

Due to the advanced broadband network, wireless ubiquity, and digital convergence, TV has progressed to the third generation of individualized TV (Noam, 2008, P.3), which can be watched on various screens, including IPTV with its diverse content and mobile TV with its increasingly ubiquitous availability. Initiating the trend of media convergence, Internet provides a channel for content providers to re-distribute existing programming and empower users to create personal content. Debuted in 1999 in the UK, Internet Protocol Television (IPTV) poses as a form of interactive and personalized entertainment, communication and information source. IPTV can be categorized into a wall-garden pay TV model and a free web TV model (Good, 2008). The number of global IPTV subscribers increased 38% in 2010, reaching 45 million users among which Asia grew fastest (TeleGeography, 2011). According to MRG's report about IPTV Global Forecast (2009), the revenue of global IPTV is expected to grow from US\$12 billion in 2009 up to US\$38 billion in 2013 (compound annual growth rate of 33%). As for Asia-Pacific TV Market, Informa Telecoms and Media's report released in July 2010 expects it will have significant growth in Digital TV and IPTV usage for the next five years (APP Beta Market, 2010). It also forecasts by 2015 there will be over 400 million digital TV homes and 40 million taking IPTV with revenues of more than \$40 billion.

The advancement of mobile technologies adds additional video viewing option for users. Divided by modes of content delivery, mobile TV can be categorized into "mobile broadcasting TV" that transmits content with a scheduled timetable over broadcast networks, and "unicasting mobile video" that delivers user-selected audiovisual services by downloading or streaming over cellular networks (Kumar, 2007, p.5). The unicast mobile TV, such as 2.5G TV or 3G TV, started in early 2000 and took off slowly, while mobile broadcasting TV which emerged in 2005 has reached critical mass in South Korea, Japan, and Italy. Even though the growth rate of cellular mobile TV subscription is slower than mobile broadcasting TV, In-Stat estimated it would generate the lion's share of revenue with over \$15 billion in subscription by 2014 (Cellular-news, 2010).

Asia has been regarded as a hotbed for mobile TV development because of advanced mobile technology and the Asian commuting lifestyle (Gill, 2008; Pyramid Research, 2009). Connected consumers in Asia Pacific are 45 percent more likely to use mobile video than the global average and mobile Video penetration is highest in Asia Pacific and among consumers in their late 20s (Nielsen Wire, 2010b). The emerging tablet PCs is expected to expand the usage of mobile videos even more (Nielsen, 2010b). According to Pyramid Research's mobile video service: a five-year global market forecast (2009), by 2014, more than 500 million users worldwide will subscribe to mobile video services, equal to 8.5% of all mobile subscription services. Asia is forecast to drive the development of mobile TV (Cellular-news, 2010).

Watching TV with various screens shows a rising trend worldwide, especially in high-tech countries. Video viewing on the Internet and mobile platforms enhances interactivity, mobility, and control of synchronous or asynchronous consumption modes. According to Nielsen's 2010 survey about global Internet users' video consumption across screens, TV continues to be the universal significant platform and around 70% respondents watch online videos and 11% watch mobile videos (Nielsen Wire, 2010b). Respondents show increasing interests in HDTV (30%), 3DTV (12%), and Over-the-top TV with Internet connection (22%). Another 2010 three-screen TV study finds that Americans increasingly spend more time on TV viewing, watching videos via timeshifting modes (e.g. DVR), using TV and Internet simultaneously, and viewing mobile videos (Nielsen Wire, 2010a). Nielsen report (2010a) states that enhanced TV quality (e.g. HDTV, interactive TV, 3DTV) and novel mobile devices (e.g. smartphones, tablet computers) keep American staying tuned to the three screens.

Every screen adds a choice for users to control how they prefer to consume videos or even access to communications and entertainment anytime, anywhere. One key issue to develop three-screen TV industry is to make the switch between multi-screens become effortless and seamless to users. Stakeholders involving in the enhanced TV, IPTV, and mobile TV are striving to solve the convergent and integration issues. Technological neutral systems are important to accommodate the needs of different video services and business models. For example, AT&T recently announced to start three-screen integration to deliver content, applications and services across TV, computer, and mobile phones (AT&T, 2010). Apple appears to provide videos or applications easily transforming from one device to another (Krazit, 2009). Microsoft is making effort to ensure user's easy and seamless access to videos via Window on three screens, while Google is attempting to integrate ChromeOS and Android platforms to make one application run on all (Krazit, 2009). Both Apple TV and Google TV try to connect Internet and TV screens for video watching.

Besides, more cross-platform content and applications are introduced to demonstrate the potential of multi-screen convergence. For instance, AT&T is delivering three-screen content in various genres, like sports, movies, music, and reality shows. During Beijing Olympics Games, AT&T consumers could watch NBC Universal coverage on the TV, the PC and the wireless device (AT&T, 2010). Unbundling traditional TV channels and differentiating real-time and online videos can give consumers viewing options for timeshifting and personalized experiences.

As the delivery platforms increase, audiovisual content operators (e.g. broadcasters, cable TV, IPTV) that attempt to maintain their competitive edge in the industry are re-evaluating resources and expenses as well as dealing with policy issues. For the successful three-screen TV business as a whole, the key to multi-screen integration is to create ubiquitous “cloud” content working across multi-platforms (Davidovitz, 2010) and develop platform independent devices with interoperable capabilities (O’Neill, 2009). Operators must re-strategize and repackage previous separate services into one more-consumer-friendly, all-encompassing video package for users to consume video on three screens (TV, PC and mobile). However, for service providers, like IPTV and mobile TV operators, developing original audiovisual content customized for their screens is significant to catch viewers’ attention and cultivate their loyalty in the strong competition with varieties of videos across multi-platforms. After all, regardless of screens and platforms, TV is ultimately content-driven.

3.Global multi-screen TV regulatory challenges

The prevalence of the decentralized, borderless Internet stimulated the transformation of the traditional media laws. After mobile communication (e.g. voice, SMS, broadband, videos) has become affordable globally in recent years, its popularity also inevitably brings reassessment or revision to existing regulations. Like IPTV and mobile TV, the development of emerging multi-TV screens industry is also shaped by policymaking. Policy regulation and development usually trails behind the fast paced advancement of information communication technology (Lin, 2010). Since the Internet and mobile platforms become important channels for video consumption, the complexity in convergence and cross-overs causes controversies in regulatory issues and bring challenges to policymaking.

3.1 IPTV Policy

How to regulate IPTV’s license and content has been an unprecedented challenge to global policymakers. To settle the complex issues, South Korea even

delayed the introduction of IPTV for one year after its IPTV act was passed in late 2007. In December 2007, the European Union (EU)'s Commission amended "Television without Frontiers Directive," the cornerstone of its audiovisual policy, to better address TV-like services, like unbounded IPTV (InfoDev & ITU, 2010). The EU approved the Audiovisual Media Service Directive (AVMS) to apply some baseline rules to safeguard certain important public interest objectives to both broadcasters and on-demand services, like IPTV. Later, this directive aroused criticism that its over-regulation might disfavor the development of IPTV (Outlaw.com, 2006).

Regulators perceive IPTV providers differently affect their decisions in licensing and content regulation. The EU considers TV services provided over any platform as broadcasting services (InfoDev & ITU, 2010). In some jurisdictions, like UK, France and Sweden, IPTV providers are subject to pay TV content code with certain "must-carry" obligations (InfoDev & ITU, 2010). Other countries, such as South Korea and Singapore, develop new licenses to IPTV services. In Hong Kong and China, IPTV providers are regulated in the same manner as a subscription TV provider with the required program license. In U.S., the Federal Communications Commission (FCC) has not decided the regulatory status of IPTV.

IPTV has provided an important lesson for making regulation or policy for convergent media. Content providers' challenges are to find a content licensing scheme to distribute audiovisual content online without losing copyright. The difficulty that service providers face is to have right clearance for acquired content, including clearing rights in every territory where the IPTV transmission can be accessed (Cheah, et al., 2009). Digital rights management (DRM) tools and watermarking technologies have become significant means to manage access and track content distribution.

3.2 Mobile TV Policy

Across the globe, mobile TV policy is still in the process of taking shape and temporary regulations set in place cannot fully address the convergent issues (Shin, 2006). 3G TV and mobile broadcasting TV have their own developmental trajectories and regulatory considerations in different national contexts. Most countries apply loose content regulation to 3G TV as it is usually regarded to serve a niche market. However, the emergence of mobile broadcasting TV brings discrepancies in regulations due to its potential to reach mass audience (Lin, 2010).

The majority of regulatory bodies in the world apply original or amended digital broadcast TV rules to mobile TV (MDA, 2007). For example, the Korean Broadcasting Commission defines Digital Multimedia Broadcasting (DMB) as an extension of traditional broadcasting to be regulated under the broadcasting TV act

(Shin, 2006). Similarly, the Italian communications regulatory authority amended digital terrestrial TV regulation in 2006 to extend to MTS (Infodev & ITU, 2010). In contrast, some authorities, like the FCC and Ofcom, have decided to opt for a lighter, less stringent approach by classifying mobile TV as an information service. The Canadian Radio-Television and Telecommunications Commission also views the imposition of strict broadcasting regulations on MTS as potentially damaging to its development (Infodev & ITU, 2010). Moreover, most countries apply IPTV licensing approaches and impose TV content regulations to MTS (Infodev ITU, 2010).

3.3 Multi-screen TV Policy

As a result of the multi-screen, multi-platform trend, the challenges of TV-related regulatory framework is to decide whether to apply or amend existing policy system that regulates broadcasting or pay TV to multi-screen TV services. With diverse video consumption across screens, a primary concern that has been highlighted is to what degree different communication infrastructures and content can be regulated in the similar manner (Henten et al., n.d.). Because the TV-centric approach is politically relative easy to maintain existing interests and status quo, some regulators use extended TV regulations about licensing and content across all three screens (Noam, 2008). However, extending the traditional broadcast model to new TVs causes significant problems. It is difficult in controlling content of the huge volume of Internet and mobile videos across the borderlines.

Also, treating the audiovisual content widely differently, depending on which platform it is consumed, invites ongoing legal, regulatory, political, and business battles. As the layer approach suffers from technocratic complexity, Noam (2008) suggested adopt a two-tier model of TV regulation to separate the interwoven and convergent multi-screen TV regulatory issues between the content segment (i.e. message) and the conduit segment (i.e. medium). Currently, the global trend is to move towards a common infrastructure regulation encompassing formerly more separate infrastructures such as fixed telecom and mobile communications (Henten et al., n.d.). That is, the net neutrality conduit or the infrastructure will be operated similar to the common carrier with self-regulatory mechanism. As for the content, it should be regulated based on its natures. To fix the bottlenecks and assure a dynamic industry, Noam (2008, p.21) suggested harmonize the regulatory treatment for three-screen TV and, most importantly, apply the Internet regulatory rules to much of the next-generation media system as a whole. Moreover, the content copyright across multi-screens can be handled properly by local or regional coverage collecting societies with nondiscriminatory, fair, and reasonable principles to offer licenses and a central authority to facilitate cross-border clearance of rights (Summer, 2008).

4. Multi-screen TV ecology in Singapore

Singapore is one of the high-tech countries in Asia Pacific. Its household broadband penetration rate in February 2011 reached 195.3% (IDA, 2011). A comScore report on Internet usage shows that Singaporeans spend a huge amount of their time online – about 14% of their Internet time visiting entertainment sites (The Straits Times, 2009). In 2009, 81% household had Internet access at home, 12% used Internet-enabled mobile devices, 3% connected to the Internet via game machines (IDA, 2010). In IDA's 2009 annual survey, the primary online activity is for leisure activities (39%), but only a few downloaded movies and short films (8%) or watched web TV (1%). 15-24 year-old users watched Internet videos most. Singapore's mobile penetration rate in February 2011 reached 144.2%, with 4.3 million 3G mobile subscribers (around 85% of its total population) (IDA, 2011). Yet, only 2% Singapore's portable equipment owners used it to watch mobile TV and teenagers and young adult (year 15-24) enjoyed the new viewing mode most.

Singapore has a limited competitive media ecology with a monopoly broadcaster (MediaCorp), a cable TV operator (Starhub), a print media organization (Singapore Press Holding, SPH), and three major telecom operators (Singtel, Starhub, and M1). The major stakeholders in Singapore's multi-screen TV industry include MediaCorp terrestrial TV, Starhub cable TV, Singtel's mio TV (pay TV on Internet and mobile), SPH's Razor TV (On demand Internet videos), Mobile One's 1 Box (over the top TV, connecting internet and TV). IDA is the regulatory body supervising carrier and infrastructure in the infocomm industry, while MDA supervises media content and license. In Singapore, players in the changing TV industry are making effort to reinvent old business, strategize to make revenue from other platforms, and work on synergy effect across-screens.

4.1 Traditional TV Remediation

According to Nielsen Media Index, Singapore terrestrial TV viewership has declined from 98% to 86% from 2005 to 2010, while cable viewership grows moderately to 37%. Informa Telecoms & Media forecasts digital TV (DTV)'s household penetration in Singapore will rise from 69% in 2009 to 100% in 2015 (domain-b, 2010). To attract viewers' eyeballs, both Singapore's traditional TV operators, MediaCorp TV and Starhub Cable TV, are making effort to reinvent themselves to keep abreast of the fast-changing digital technologies and cope with rapid convergence with Internet and mobile-based networks.

4.1.1 MediaCorp TV

MediaCorp is Singapore's leading media company producing a wide range of local content distributing over multi-platforms, spanning television, radio, newspapers, magazines, movies, digital and out-of-home media. It has TV programming in four languages (English, Mandarin, Malay and Tamil) and adapts itself in the digital space by offering Internet TV-on-demand, High Definition TV (HDTV), and participating in mobile TV trials. In May 2006, Singapore officially began HDTV trials, involving MediaCorp and Starhub. MediaCorp was the first broadcaster in Southeast Asia to launch the HDTV commercial channel on the terrestrial platform in the last 2007. At present, MediaCorp, the only terrestrial TV broadcaster, runs 7 free-to-air TV channels and 1 HD TV channel.

Singapore plans to complete the transition to digital broadcasting in line with ASEAN goals for a digital switchover of terrestrial transmission between 2015 and 2020. As for digital transmission, MediaCorp has pioneered the rollout of digital transmission both in DAB (Digital Audio Broadcasting) and DVB-T (Digital Video Broadcasting over Terrestrial) platforms. After digital switchover in 2020, all of MediaCorp's free-to-Air TV channels will no longer broadcast in analog signals. There is the simulcast period to broadcast both analog and digital TV channels which facilitates audiences to smoothly migrate to digital terrestrial TV (DTT). Currently, MediaCorp's HD5, Singapore's main English TV channel, is simulcast in digital HD signals and analog transmission.

In 2007, MediaCorp TV news decided to adopt the integrated newsroom technology to solve the problems of obsolete analog equipment and improve workflow. After year-long training, the integrated newsroom was implemented in different news teams and fully utilized it after the 2008 Olympics (Lin, 2010b). MediaCorp TV News has successfully shifted to tapeless production which improves resource sharing, content repurposing, and cross-platform distribution. TV digitalization is still an ongoing reinvention mission in transforming other programming.

Newsroom convergence occurred in 2008 when MediaCorp TV News launched its Asia first NewHub (Rajaram, 2010). In this convergent newsroom, journalists across platforms are grouped to produce news content tailored for TV, radio, print and online media. Stories covered by NewsHub are pushed out as soon as possible for web and SMS and later re-purposed for different outlets. The benefits of implementing NewsHub include scale of economy and greater synergy across platforms. So far, the NewsHub has not fully implemented yet because the resistance of cross-media reporting is huge (Rajaram, 2010).

MediaCorp's Online Broadband TV (MOBTV) was Singapore's first subscription-based Internet TV service. Unfortunately, it failed because Singaporeans

dislike the idea to pay for online retransmission of terrestrial TV programming. Learning from the lesson, MediaCorp collaborated with Microsoft to launch a free VOD website, xinmsn.com. Since its debut in April 2010, xinmsn.com has become Singapore's No. 1 portal and entertainment site with 66% reach (MediaCorp, 2010a). With 310,000 video members, xinmsn.com's page views reached 40 million in April 2011, an increase of 392% from the same time last year (Comscore, 2010). Its key highlight is Catch-Up TV channel which allows users to watch MediaCorp's past episodes of dramas or variety shows at no charge. xinfirst channel plays exclusive internet videos before distributing to other screens. In December 2010, MDA's 360 TV scheme, part of SMFP, collaborated with MediaCorp to seek for experimental web episodes. xinmsn which attracts many 15-35 year-old users can serve as a "my TV" platform to cultivate MediaCorp's young viewership and make up its losing terrestrial TV audience.

In addition to refashion different TV technologies, MediaCorp uses the internet as another distribution channel for its diverse content. In Hitwise's top 10 Rankings for the first half of 2010, MediaCorp's Channel News Asia (CNA) website took the number one spot in the 'Entertainment-Television' category for the last five consecutive years (MediaCorp, 2010a). Since 2006, CNA provides news for three screens and thus Singapore's 3G mobile phone users can watch its news reports on the go. At present, smartphone users can access to MediaCorp TV's content online through mobile broadband. As for mobile TV, MediaCorp participated in the mobile broadcasting TV trial in 2008 and positioned itself as the major content provider (Lin, 2010a).

When MediaCorp showcased the strength of integrated media solutions for business partners in late November 2010, its CEO, Lucas Chow stated that MediaCorp would keep evolving and adapting itself to the fast-changing and converging environment, including venturing into 3D TV production, transferring content on iPad, and participating in FutureTV plan (MediaCorp, 2010b).

MediaCorp TV has positioned itself as a major multi-lingual content creator in Southeast Asia. Even though it takes a conservative attitude towards fast-changing TV ecology and video technological advancements, MediaCorp TV strategizes its coping plan and reinvents itself over the past three years by transforming to digital and high-definition production, implementing a tapeless integrated newsroom and convergent newshub, utilizing social media for marketing, and repurposing content for Internet and mobile platforms. Besides, MediaCorp's vision is to become Asia's top media company, delivering valued content to the world. Since 2007, MediaCorp's financial and strategic relationships in the southeast Asia region include a venture with Indonesia's most integrated media companies (i.e. PT Media Nusantara Citra and

Global Mediacom), and International Media Corporation in Vietnam to co-develop and co-produce TV content.

4.1.2 Starhub cable TV

Starhub, the only cable TV operators in Singapore, serves over half a million pay television households and over 1.9 million mobile subscribers. It faces competition in pay TV market from Singtel's IPTV, mio TV, after 2007. Starhub Cable Vision (SCV) ceased analog transmission in its cable networks from 30 June 2009 and go into full digital mode (Cassbaa, 2009). At present, Starhub cable TV subscribers can pay additional monthly payment to rent interactive set-top-boxes for watching 15 HD channels and enjoying VOD and/or DVR services. Although Starhub offers broadband services, it does not use the internet platform to extend the distribution of its TV programming, partly because of its rival mio TV.

However, Starhub is keen in using the mobile platform to extend its viewership. After Starhub participated in the 2008's DVB-H mobile broadcasting TV trial, the next year it started to offer TV on Mobile services. Its postpaid mobile users only pay \$0.8 per monthly for free watching 26 TV channels with various genres (e.g. BBC, CCTV, Disney), while the pre-paid mobile subscribers can pay \$0.4 per month for per channel (Starhub TV, 2010). Starhub's 3G mobile users can enjoy live Starhub TV programming on the go. The popular postpaid mobile TV package is meant to attract the huge number of foreign workers in Singapore who cannot afford to buy any TV set or computer and to subscribe cable TV.

2010 Youth Olympics was an important event for Singapore's TV and telecom operators to offer optimized live and on demand audiovisual content. International Olympic Committee (IOC) selected MediaCorp, SingTel and SCV as the official broadcasters for Youth Games within Singapore. While MediaCorp has been granted the exclusive rights for 2010 Youth Olympic on free-to-air TV and radio within Singapore, SCV was granted the exclusive broadcast rights for the live feeds on pay cable TV and mobile phone platforms in Singapore, as well as the exclusive broadcast rights for Youth Olympic News Channel on its free Preview Channel . Currently, From mid July 2010, Starhub is collaborating with Singtel and MediaCorp in the MDA-initiated \$4.06 million, year-long 3D TV trial, part of FutureTV plan. The trial aims to test transmission signals over different platforms and address possible technical challenges.

In this high-tech country with high Internet and mobile penetration rate, MediaCorp TV and Starhub TV in fact are encountering more and more pressure caused by the competition of Internet and mobile videos. Re-invention and innovation are necessary for the two traditional TV operators to survive and remain relevant to the audience.

4.2 Internet video

Currently, Singapore is ranked at No. 7 on Asia's IPTV market (Pyramid Research, 2009). Its IPTV services include Singtel's mio TV (online content aggregator) and SPH's RazorTV (made-for-Internet content creator). The two IPTV cases have re-distributed their IPTV content to the mobile platform after 2008. In November 2011, M1 offered 1Box, the first over-the-top TV service in Singapore, which uses a rental set-top-box to connect Internet with TV.

4.2.1 mio TV

After MDA awarded SingTel, the largest telco in Singapore, a national IPTV license, its mio TV entered the prior monopolized pay TV market in July 2007 to compete with Starhub cable TV. mio TV is a 24 hour online pay TV service, amongst the world's first to have free HD channels carried on an IPTV platform. It content not only aggregates 70 channels, including free-to-air channels by MediaCorp, HD channels, blockbuster movies and dialect movie channels, but also offers personalized content, like on demand videos, DVR, and EPG. Singtel's official website reported that it invested approximately SGD\$30 million in upgrading its broadband network to support the launch, and mio TV is now transmitted through Singtel's broadband network via an IPTV service by using Microsoft Mediaroom as its software platform. With greater control in searching for programming and recording the content, mio TV can be viewed from both PC or any regular TV set. In accordance with the hectic lifestyle of the consumers in Singapore, Singtel offer personalized content, such as the large amount of on demand videos, digital DVR functions, and EPG interface.

To expand mio TV's user base, in May 2008 SingTel started to offer mio TV on mobile which streams the programs via GPRS or 3G data connection without additional data charges (Koh, 2008). By the end of June 2010, SingTel has signed up some 220,000 mio TV customers, more than double the tally in 2009. However, the number of subscribers, after three years, is still less than half of SCV's 550,000 cable TV subscribers (Today, 2010). Its slow takeup rate could result from popular cable TV service, relatively expensive subscription fee, less compelling content lineup, and less compatibility to couch potato behavior.

Sports programming is the important genre to attract mobile TV viewers. With respect to 2010 Youth Olympics, Singtel won the exclusive broadcast rights for Youth Olympic New Channel on the mobile platform within Singapore and in the neighborhood countries (Singtel, 2009). To expose the Youth Olympics internationally, Singtel also worked with Olympic Broadcasting Services (OBS) to

develop an internet broadcasting solution. In December 2010, mio TV added four sports channels to its line-up to attract Sport fans' eye balls.

Moreover, the competition between SCV and mio TV has resulted in the widespread use of exclusive carriage agreements (ECAs) between channel providers and pay TV operators (Singapore Government News, 2010). MDA's study in 2009 revealed that the ECA-centric competition has negatively affected industry and consumers due to the significantly increasing exclusive pay TV content costs and a high degree of content fragmentation. SCV's content costs to revenue ratio has risen 30% and only 7 channels out of 179 channels are common to both SCV and mio TV. MDA later regulated SCV and SingTel to cross carry each other's content which was acquired exclusively on or after 12 March 2010. In future, consumers no longer require new STBs when they switch to new pay TV service.

4.2.2 Razor TV

The Straits Times RazorTV is Singapore's first and only webcast TV portal, which provides Internet free on-demand videos since August 2008 (Hou, 2008). Razor TV operates on a five-year "niche" IPTV license granted by the MDA (Lee, 2008). It targets at users between age 18 to 40 years old and strategically engages them with local content in a young, sensational and hyperlocal style (Kiat, 2008). Initially, it tied with STOMP, its sister user generated content website, to provide hyper local and sensational videos to appeal to the young viewers. Its videos include entertainment, news, sports lifestyle, specials, and current affairs.

RazorTV's features allow users to watch videos in their preferable way, including choosing videos as their "favorite" or add them to the "personal broadcast station" channel. In addition, popular videos are singled out, so users can notice the "hottest" local news, which are presented by fresh faces in an informal tone to make the news fun and personal. Besides, Razor TV users can have interactivity with content creators or other users by commenting on videos or participating in forum discussions. It also links to the social media, like Facebook, Twitter and Youtube, effectively making video sharing a part of the social networking experience. Moreover, RazorTV's short videos are offered to be downloaded freely as an iPhone application, which becomes one of most popular app in Singapore's Apple iTunes store, as it is the only news portal that offers local content specially tailored for the mobile device (Kok, 2009).

4.2.3 1Box

M1 launched 1Box, Singapore's first over-the-top TV service. By paying \$4 monthly rental fee for the Set-Top-Box (STB), M1's fiber, cable, and ADSL home broadband users can enjoy the value-added service to connect TV with internet (M1,

2010). On one hand, the subscribers can access internet on TV, including watching streaming videos on popular websites (eg. YouTube) and using social networking sites (eg. facebook, Twitter). On the other hand, they can listen to free music (eg. concerts, radio), pay monthly fee for educational content and video games, as well as pay per view for watching movies. Internet connection, free music and educational focus are unique selling points for this connected TV service which may be appeal to the niche audiences who do not use computers often, including children, senior people, or housewives.

4.3 Mobile video

Currently, there are two types of mobile TV available in Singapore – 3G mobile TV and mobile broadcasting TV – although the latter has yet to be commercialized. The 3G TV users in Singapore is slowly growing, when the 3G mobile subscription shows a steady rise (IDA Singapore, 2011). Despite vague business models, 3G TV content does not differ much from the broadcaster's programming and pay TV's content. M1 is the only mobile operator to collaborate with MediaCorp to experiment some made-for-mobile content. Even though the future of mobile TV in Singapore looks promising, it is still laden with developmental issues with regards to content, technology adoption, market, business models, price schemes and most importantly regulatory challenges.

4.3.1 3G TV

Singtel launched the commercial 3G services across the mobile, broadband and fixed line platforms in February 2005 and offered another 3G mobile phone service, "3G TV," in November at that same year (3GNewsroom.com, 2005). Singtel provided this free service for approximately one month, before they started charging on a per unlimited channel basis. Attempting to spur the 3G TV market demand, SingTel lowered the profit margins to accelerate the increase in usage and revenue. Mio TV on mobile was added as a new 3G TV service in 2008.

M1, like Singtel, also launched their commercial 3G services in February 2005. Other than encouraging 3G usage of their video calls and MP3 downloads, M1 offered innovative services, such as live feed of latest news, video clips of variety shows, streaming of music videos and trailers of newly-released films. It is the only mobile operator that is keen in developing original mobile TV content and integrating the social media and user generated content in its MeTV service.

In July 2009, Starhub TV developed Starhub TV on Mobile, a value-added service, which allows mobile postpaid customers to watch selected StarHub TV live channels via a handphone (Starhub, 2010). Currently, Starhub boasts features such as On-screen control, a unique TV browser, an integrated TV guide, automatic stream correction, and customized channel listing. Its Demand on Mobile TV channel launched a subway drama, *A Starry Night*, was well received on the various platforms (MDA, 2009). To target foreign worker customers, Starhub has added mobile TV channels in four languages – Mandarin, Bahasa Indonesia, Hindi and Tamil (Singapore Technologies Telemedia, 2009).

4.3.2 Mobile Broadcasting TV

Two major DVB-H trials took place during 2007 to 2008. The first mobile broadcasting TV market trial, TV2GO, started in June 2007 by Singapore Digital, a joint venture between Broadcast Australia and PGK media. The year-long trial allowed 100 trialists to watch 10 foreign TV channels and engage in real time interactive services, like voting, on the Nokia DVB-H broadcast platform (Lin, 2009). Although it offered premium foreign channels along with interactivity, TV2GO lacks of existing customer base, local content, and experience.

During July to September 2008, MediaCorp, Singtel, Starhub and M1 started another DVB-H consumer trial which involved 300 participants to watch live coverage of 2008 Olympics Games (Lin, 2009) and 14 other local and foreign channels, delivered by the DVB-H platform supported by Alcatel and Gemalto.

While the mobile TV service is regarded as a potential revenue generator, the lack of content, interactive services and technologically immature and costly mobile broadcasting TV service devices proved to be barriers for uptake (Lin, 2009). Bad reception indoor or on MRT and costly mobile devices are the inhibitors for the uptake of mobile broadcasting TV services (MTVS) (Lin, 2009).

After 2007's consultation paper, the MDA has not yet made any further announcement regarding MTVS. The trial reports were submitted to the MDA in December 2008. At present, Singapore's MTVS has not commercialized yet, as the MDA still puts mobile TV policy on hold due to its uncertain commercial viability.

5. Singapore's multi-screen TV policy

IDA and MDA supervise the conduit and content of infocomm and media industry respectively, which fits Noam's two-layer approach to regulate the three-screen TV development. Both clearly emphasize the significance to use Infocomm and media to foster economic growth and societal well-being. In the next session, Singapore's IPTV and mobile TV policymaking process will be examined to show how Singapore's government regulates video convergence on the computer and handphone

screens. Media Fusion and FutureTV plans will be elaborated to show the directions of Singapore's multi-screen TV development.

5.1 IPTV Policy

For Internet regulation in Singapore, the class license scheme, a light touch regulatory framework, was initially laid out for Internet services, as the MDA recognized the decentralized and borderless nature of the online platform. Singapore laid the regulatory foundations for the launch of IPTV at the beginning of 2007. Under the Broadcasting Act (Cap. 28), IPTV providers in or from Singapore must obtain a broadcasting license from the MDA (Cheah et al., 2009). The IPTV framework encompasses the Service Provider Licensing regime and the Content Regulation regime. For the Service Provider Licensing, a two-tier commercial license framework was announced by the MDA in 15 January 2007 to cater to mass market (Nationwide Subscription TV License) and specific market service providers (Niche Subscription TV license). It aims to encourage the growth of IPTV services in Singapore and garner tangible benefits for both the industry as well as consumers.

For the Nationwide Subscription TV license, industry players must provide services to reach over 100,000 subscribers. Singnet, a subsidiary of Singtel, is the first to be issued with a Nationwide Subscription TV license for its mio TV service, a host of IP based triple play service deployed via a network terminal. In comparison, the niche license is catered for IPTV service providers targeting not more than 100,000 subscribers. It is used to facilitate the entry of new niche IPTV players with a limited reach. RazorTV operates on a five-year niche license granted by MDA, which facilitates SPH's debut in the local IPTV market and limits them to less than 100,000 viewers (Lee, 2008).

According to the MDA, industry players will benefit from the greater flexibility as the licensing framework "promotes a more conducive and friendly business environments" and service providers can take advantage of the new technological trends and business models as they roll out IPTV service for different market segments in today's rapidly evolving media landscape. Industry players are able to provide more services and content, while consumers get to enjoy more rich and diversified content.

As for content regulation regime, Subscription TV Program Code applicable for scheduled TV programs and VOD Program Code applicable for on-demand programs. At present, Mio TV content is regulated by the Subscription TV programming code which is similar to the content regulation for Starhub Cable TV. Razor TV that obtains a niche license is subject to a "lighter" license framework

which is categorized as the on-demand content and is not required to carry local FTA channels.

5.2 Mobile TV Policy

Classified as niche information services, 3G TV or cellular video services were initially only required to obtain the class license from the MDA. Under this automatic licensing scheme, cellular mobile video services need not seek prior approval from the MDA. However, the 3G TV or mobile video operators must self regulate and exercise discretion to their content. So far, only the three mobile operators (Singtel, M1, Starhub) and two media organizations (MediaCorp and SPH) provide live streaming TV channels, downloadable mobile videos, or extend their primary platform to mobile.

In 2007 consultation paper, MDA proposed to adopt a more technology neutral and market driven approach for MTVS. With the platform neutrality principle, the government will not decide any compulsory standard but allow the industry to find their best technological match. The market trials show that DVB-H is a preferable choice for MTVS in Singapore.

Due to the mobile broadcasting technology which can reach myriad of users, the MDA proposed to re-regulate “all” kinds of mobile video services (3G TV, cellular videos, streaming live channels, downloadable clips) on a technologically neutral basis (Lin, 2009). If it is passed, 3G TV and mobile video operators must apply for new licenses and obey stricter TV programming codes (MDA, 2007; Lin, 2010). Instead of governing by the class license scheme, mobile TV operators must obtain a multiplex license and a broadcasting service license from the MDA under the Broadcasting act, as well as a Facilities Based Operator (FBO) license from the IDA under the Telecommunications Act (MDA, 2007). Singapore’s MDA 2007 consultation paper, so far, has been the only one country across the globe to propose to shift 3G video services from the light-touch Internet regulatory scheme to the broadcasting act (Lin, 2010).

Besides, the MDA proposed to adapt IPTV’s two-tier licensing framework: nationwide and Niche licenses. The MDA tend to have a beauty tender process to select the multiplexes and MTVS providers (Lin, 2010). Since the emerging mobile TV services still have a slow adoption rate, the MDA has proposed that the MTVS operators should apply for the niche license (MDA, 2007). The niche licensees do not have must-carry obligations or cap on advertising revenue.

At present, the stakeholders, especially the incumbent telcos and broadcasters, hold a conservative attitude toward this MTVS and wait for the government to finalize the policy and clarify its standpoint (Lin, 2010).

5.3 Future TV in Singapore

5.3.1 Singapore Media Fusion Plan (SMFP)

To showcase Singapore as a global media city and Asia's media hub, MDA's national media plan, Media Fusion, emphasizes the development of five future media and the enhancement of Singapore media image at an international level. It aims to catalyze growth in the interactive digital media (IDM) sector by clustering the local industry to create leading positions in targeted areas, namely FutureTV, FutureMobile, FutureGames, FutureWorlds and FutureBooks. Each of the five Futures will create a collective vision and leverage on one another's strengths to shape the media landscape (Interactive Digital Media, 2011).

Building on the previous Media 21 blueprint, the SMFP supports the country's transition to a creative economy and gears up the industry to thrive in a fast-changing global landscape shaped by fast technological advancements (Interactive Digital Media, 2009). "The media sector is in the midst of dynamic change, driven by convergence and the rise of Asia as a content powerhouse and one of the most influential markets in the world. The Singapore Media Fusion Plan is our response to the altered global landscape...by enabling the creation of New Asia Media," said Dr Christopher Chia, ex Chief Executive Officer of MDA (Interactive Digital Media, 2009). Its initiatives encompass to strengthen Singapore's media ecosystem, fuel the creation of innovative content and services with global appeal, and develop world-class talents. \$162.4 million have been allocated to drive the initiatives under the Plan with \$406 million committed to R&D in IDM (MDA, 2010a).

Under the SMFP, FutureTV, an industry initiative, was the first to be implemented in mid 2009 by a partner network of 13 MDA-supported founder companies, including MediaCorp, Starhub, Singtel, M1, PGK Media, Microsoft, Motorola, etc. FutureTV's key mission is to use Singapore as a test-bed for interactive and personalized innovative services that will shape a new generation of visual media experiences (MDA, 2010a). For the past almost two years, the FutureTV partner network, together with MDA, has launched several calls for interdisciplinary proposals to create, aggregate, manage, distribute and monetize visual media to anticipate and shape future patterns in the consumption of visual media. The recent R&D projects are related to how to remediate MediaCorp TV by studying the over-the-top TV and immersive TV content, interactive features and how to create new multi-screen interactive content for tourism and digital advertising. There are two important visions of the FutureTV Partner Network: first, they focus on developing multi-screens TV over the Internet, mobile devices, large format out-of-home displays, holograms, and other futuristic displays. Second, they aim to enable Singapore to become an "IDM Hub" to aggregate, manage, distribute multi-lingual audiovisual

content to for multiple devices across multiple geographies, and find new business strategies to monetize multi-screen content. Even though Singapore's government and industry sector do not use the phrase of "three-screen TV," their FutureTV and IDM visions and projects are indeed for developing next generation's multi-screen TV content creation, aggregation, and distribution.

The advantage of forming a FutureTV partner network is to leverage on each other's capabilities and resources to fuel TV innovations. With MDA's endorsement, the strong network support is beneficial to propel the TV media sector further by helping companies to build innovative offerings and access global markets. For example, PGK media was most active in the initial collaborations amongst the FutureTV Partner Network. It has a joint venture between Glocal Media Networks and the establishment of Out There Media to reach millions of users in EU and Asia Pacific (Interactive Digital Media, 2011). With the assistance from the founder members, like MediaCorp and StarHub, companies can reach and impact every Singaporean. StarHub provides a network of triple play on mobile, cable TV and broadband services in Singapore.

Besides, MDA and SingTel have established a strategic partnership to boost the distribution capabilities of Singapore by linking SingTel's Broadcast Innovation Centre (BIC), a Satellite Earth Station, seamlessly to the first digital media hub, Mediapolis@one-north (Interactive Digital Media, 2009). In Phase Ø, Mediapolis@one-north aims to stimulate and encourage media startups, incubates and R&D companies to test-bed, experiment and develop media concepts (eg. TV and interactive digital media) (MDA, 2011a). Until its completion by 2020, the hub will house state-of-the-art facilities, including digital and broadcast production studios, interactive digital media facilities, and R&D facilities.

Asia is the world's largest and most populous continent with approximately 4 billion people, 60% of the world's population. This vast market remains largely untouched as the total internet penetration in Asia is no more than 20% in Asia (Interactive Digital Media, 2011). Currently, all Singapore's major universities (i.e. NTU and NUS) and polytechnics have established cross-discipline centers for IDM R&D, which consist of some 20 laboratories involving hundreds of researchers in cross-discipline IDM research. Through an orchestration of East-West knowledge and talent flow, the SMFP which ensures local capacities to keep pace with global media breakthroughs and technical advances is prepared for the Internet's next wave of users in Asia as well as the multi-screen TV development. The SMFP facilitates to lay the foundations for futuristic technologies by helping local media companies and researchers to leapfrog innovations timeline and create new windows of opportunity for Singapore in the world.

5.3.2 Digital Switchover, spectrum relocation & next generation interactive multimedia (NIMS)

Nowadays, Singapore moves towards an all-digital environment by promoting IPTV and the adoption of HDTV nationwide. In addition to MDA, IDA also supervises and initiates some projects related to the future of TV. Preparing for the advent of digital audio and video broadcast, IDA has made the Radio Spectrum Master Plan which re-allocates frequencies and bandwidth for digital broadcasting TV and radio services in April 2008 (IDA, 2008). Singapore government, together with the ASEAN countries, plans to switch fully to digital broadcasting between 2015 and 2020. Singapore government will facilitate industry players to smoothly transform into digitization and prepare the public for the digital migration (MDA, 2011b). However, there are no public provisions to improve affordability by setting price restriction for digital TV services or there are no subsidies paid out to citizens who cannot afford STBs or digital TV sets yet. Currently, the government focuses on ensuring that supply will meet demands for those who can afford digital TV equipment. Moreover, digital broadcasting will release extra spectrum which provide new business opportunities for wireless, mobile, or new audiovisual services. According to Chia, the former CEO of MDA, MDA made efforts to build up local companies' capabilities in developing DTV middleware and value-added applications for STBs through funding schemes. In 2012, the IDA will hold a wireless spectrum right action for the fourth generation high-speed mobile data services (4G). Six lots of spectrum will go under the hammer (Chua, 2011).

Besides, in 2009, IDA and MDA launched Project NIMS (Next Generation Interactive Multimedia, Applications and Services) to develop a national strategy to establish the infrastructure and the industry ecosystem for interactive multimedia. TV viewing will transform to a two-way IPTV experiences riding on the Next Generation Broadband Network. In November 2010, the NIMS Connect Requirement document proposed all interactive multimedia content to be offered on one universal STB, NIMS Common Feature Set-Top-Box (NIMS CF STB) (MDA, 2010b). The Government will finance a selected NIMS operator to facilitate the rollout of the universal STB. Consumers no longer need to acquire separate STBs for switching services. Moreover, NIMS content will be managed by the MDA to ensure a wide variety of entertainment options for adults and meanwhile remove unsuitable content for the young. To engage the public and protect their interests, the MDA had regular dialogue sessions with citizen consultative bodies to invite feedback that ensures content contains the right mix of educational and entertaining programs.

6. Discussions and Recommendations

This study analyzes complex convergent and regulatory issues arising from TV services on Internet and mobile, which affects the development of three-screen TV. The concept of “clouding content/applications, multi-screens, and integrated multi-platform” is at the infancy stage in Singapore. The findings show even though the phrase of “three-screen TV” is seldom used in both government agents and industrial sectors, Singapore’s Media Fusion (SMFP) plans which involve many local and international media companies and interdisciplinary R&D research centers have started to develop a next generation, multi-screen media ecology since mid 2009. With the government endorsement and R&D, the FutureTV alliance can fully leverage each other’s capabilities and resources to make breakthroughs in creating interactive and personalized content for various screens and finding new business models to monetize the new TV. The stakeholders, telcos or media, are making efforts in reinventing their existing core business to adapt at the technological changes and strategizing how to successfully make revenue or obtain synergy effects from across-screens and across-platforms. Three telcos (Starhub, SPH, and M1) make use of the Internet and mobile platforms to step into the audiovisual content or TV industry, while MediaCorp strives to re-distribute, re-purpose, and promote its audiovisual content across-screens and across-platforms to make up the decreasing viewership for its free-to-air content.

The pro-innovation and ICT savvy Singapore with prosperous economy is an ideal context for the development of multi-screen TV industry. With the vision of Asia’s media hub, Singapore’s government emphasizes to develop media fusion and future TVs. If without the government push and moderation, the industry players who may pay more attention for survival and ROI have less innovative initiatives to think or develop ubiquitous content/application working across platforms or the integrated solutions to provide seamless customized viewer experiences. How to integrate multi-screens and create ubiquitous audiovisual content with more choices, continuity, and convenience requires firm support and push from the government because it involves large-scaled inter-industry, inter-disciplinary, and international collaboration. And these national strategies to develop fusion media and multi-screen TV ecology ahead of other countries will be likely to fulfill Singapore’s goals to become a global media city and the Asia media hub.

Besides, the multi-screen TV brings unprecedented challenges to policymaking. This study argues the TV-centric model is obsolete to regulate the individualized TV across multi-screens and multi-platforms. Noam (2008) also suggested adopt a two-tier model to separately regulate three-screen TV regulatory issues between the content segment (i.e. message) and the conduit segment (i.e. medium). Singapore’s dual regulatory system- IDA supervising the infocomm infrastructure and MDA managing

media licensing and content- fits Noam's proposed model. From aforementioned IPTV, mobile TV, and media fusion cases, the two regulatory bodies collaborate well to develop Singapore's future TV.

This study further recommends a technology neutral multi-screen TV policy. Prior studies suggest use similar approaches to regulate the platforms, regardless of TV, PC, or handphones (Henten, et al, n.d.; Noam, 2008). However, the content shown on multi-screen should be regulated differently based on its natures (eg. broadcasting to mass audiences, VODs, niche market, etc.). From Singapore mobile broadcasting TV case, although the MDA does not force a mandatory standard and allow industry players to choose their technologies, it does not hold a true platform-neutrality approach when it proposed to regulate all mobile videos, despite broadcasting or not, under the TV act.

As Noam (2008) proposed to apply the Internet regulatory rules to the next-generation media system to help with its early adoption, this study recommends a pro-innovative multi-screen TV policy with light-touch licensing scheme and loose content regulation to facilitate the development and rollout of the nascent multi-screen TV. For example, Singapore's IPTV two-tier licensing framework is appropriate to facilitate the development of mio TV (national license) and Razor TV (niche market license) as well as mobile TV. Such light-touched approach is likely to stimulate stakeholders to enter the risky and emerging markets and further facilitate nascent futuristic TV services' rollout. Meanwhile, it is also significant to make policies to give incentives for new entrants and starts to co-develop multi-screen TV and encourage incumbent stakeholders to remediate themselves and adapt to new video consumption patterns.

Guided by government's national media strategies, the FutureTV and other aforementioned projects in SMFP successfully form a supportive and pro-innovative next media ecology which is advantageous to propel Singapore to become future Asia media hub and a global media city. Regulations usually trail behind fast-changing technological advancements. Since there is no successful model to develop multi-screen, next generation TV, the government and policymakers should carefully make decisions and modify approaches in response to changes, feedback, and outcomes. Moreover, the cross-border content copyright across multi-screens is crucial matter to be dealt with in the multi-screen TV industry.

As for contributions, this study enhances the understanding of Singapore's multi-screen TV development guided by the government's media blueprint to unify the inter-industry and cross-country collaboration. It also elaborates the remediation and coping strategies used by Singapore's broadcaster, pay TV operators, and telcos.

Moreover, it analyzes global and Singapore's convergent TV policies and make regulatory recommendations about how to facilitate the next-generation, multi-screen TV development.

References

- 3GNewsroom.com. (2005, February 24). *Singtel unveils 3G plans*. Retrieved September 3, 2009 from, http://www.3gnewsroom.com/3g_news/feb_05/news_5582.shtml
- APP Beta Market. (2010). *Asia by 2015 - 400 Million Digital TV Homes With 40 Million On IPTV, Revenues Will Top \$40bn*. Retrieved from <http://www.appmarket.tv/news/458-asia-by-2015-400-million-digital-tv-homes-with-40-million-on-iptv-revenues-will-top-40bn.html>
- AT&T. (2010). *Media kit: three screen*. Retrieved April 10, 2010 from <http://www.att.com/gen/press-room?pid=2911>
- BBC News. (2011, April 12). *Nordic and Asian nations connected for growth, says WEF*. Retrieved April 13, 2011 from <http://www.bbc.co.uk/news/business-13053999>
- Casbaa. (February 17, 2009). *StarHub TV to go into full digital mode*. Retrieved from <http://www.casbaa.com/media-and-resources/news-center/members-news/1133-starhub-tv-to-go-into-full-digital-mode>
- Cellular-news. (2010, July 20). Broadcast mobile TV captures subscriber counts, while 3G mobile TV drives the revenue. Retrieved from <http://www.cellular-news.com/story/44373.php>
- Cheah, Y. K., Lim, R. J., Ong, W.C. and Teo, Y.L. (2009). *Enabling the IPTV experience – the Singapore legal perspective*. Paper presented at BroadcastAsia 2009, 17–20 June, Singapore.
- Choi, J. Y., Koh, D., and Lee, J. (2008). Ex-ante simulation of mobile TV market

based on consumers' preference data, *Technological Forecasting & Social Change*, 1043–1053.

Chua, H. H. (24 January, 2011). 4G wireless spectrum auction to take place in 2012. Retrieved from http://www.straitstimes.com/BreakingNews/Singapore/Story/STIStory_627738.html
Singapore

Curwen, P., & Whalley, J. (2008). Mobile television: technological and regulatory issues. *Info*, 10(1), 40–64.

Davidovitz, G. (2010). iPad Lesson: creating a new show across all devices, paper presented at 2011 Digital Media Asia conference, November 24–26, Singapore.

domain-b. (2010). *Research pegs IPTV, digital TV to continue upward trend in Asia Pacific*. Retrieved March 3, 2011 from <http://www.lexisnexis.com.ezlibproxy1.ntu.edu.sg/ap/academic/>

Gill, A. (2008). *The Business Model for Broadcast Mobile TV*. Paper presented at BroadcastAsia 2008, 17–20 June, Singapore.

Good, R. (2008, June 11). *IPTV vs. Internet Television: Key Differences*. Retrieved March 10, 2009 from http://www.masternewmedia.org/2005/06/04/iptv_vs_internet_television_key.htm#ixzz0odzD3FyM

Henten, A., Samarajiva, R. & Melody, W. (n.d.) *The Next Step for Telecom Regulation: ICT Convergence Regulation or Multisector Utilities Regulation*. Retrieved May 29, 2010 from <http://link.wits.ac.za/journal/j0301-anders-fin.pdf>

Hou, C. H. (2008, Feb 23). *New Web TV Service - With an Edge*. Retrieved Feb 20, 2010, from Asia Media Archives: <http://www.asiamedia.ucla.edu/article-southeastasia.asp?parentid=88009>

Interactive Digital Media (IDM). (2009, June 18). *Singapore Media Fusion Plan launched to propel media sector forward*. Retrieved March 12, 2010 from

<http://www.idm.sg/singapore-media-fusion-plan-launched-to-propel-media-sector-forward/>

Interactive Digital Media (IDM). (2011). *Future TV: future of TV partner network*. Retrieved April 12, 2011 from <http://www.idm.sg/future-of-media/futuretv/>

Infocomm Development Authority of Singapore (IDA). (2008, April). *Radio Spectrum Master Plan*.

Infocomm Development Authority of Singapore (IDA). (2010). *Annual survey on infocomm industry*. Retrieved from March 09, 2011 http://www.ida.gov.sg/doc/Publications/Publications_Level2/20061205092557/ASInfocommIndustry09.pdf

Infocomm Development Authority of Singapore (IDA). (2011, April 12). *Statistics on Telecom Services for 2011 (Jan-Jun)*. Retrieved April 13, 2011 from <http://www.ida.gov.sg/Publications/20110209152802.aspx>

InfoDev & ITU. (n.d.). *ICT regulation toolkit: applying content regulation to IPTV providers*. Retrieved from <http://www.ictregulationtoolkit.org/en/Section.3424.html>

Kiat, O. B. (2008, Feb 23). *SPH to launch free interactive Web TV*. Retrieved February 20, 2010, from SPH: <http://sph.listedcompany.com/news.html/id/148652>

Koh, D. (May 20, 2008). *SingTel mio TV on Mobile to launch May 24*. Retrieved March 10, 2010 from <http://asia.cnet.com/reviews/mobilephones/0,39050603,62041534,00.htm>

Kok, M. (2009, May 1). *RazorTV's iPhone app is tops*. Retrieved Feb 21, 2010, from The Straits Times: http://www.straitstimes.com/Breaking%2BNews/Singapore/Story/STIStory_371081.htm

Krazit, T. (2009, April 2). *Mobile just one leg of Microsoft's three-screen strategy*. Retrieved March 09, 2010 from http://reviews.cnet.com/8301-12261_7-10210473-51.html

Kumar, A. (2007). *Mobile TV: DVB-H, DMB, 3G systems and rich media applications*. Oxford: Focal Press.

- Lee, B. (2008, July 30). *SPH gets niche licence for web TV service*. Retrieved February 21, 2010, from Ufinity:
<http://www.ufinity.com/home/default.php?section=news&article=34>
- Lin, T. T. C. (2009). Emerging mobile TV industry in Singapore: A Six Forces Model analysis. *Proceedings of the 31st Pacific Telecommunications Council, Hawaii, Honolulu*. Hawaii: Pacific Telecommunications Council.
- Lin, T. T.C. (2010a). The Gordian Knot of Singapore's Mobile TV Policy, *Journal of International Commercial Law and Technology*, 5 (1), 11-21.
- Lin, T. T.C. (2010b). *Adoption Process and Implementation Strategies: Longitudinal Study of Integrated Newsroom Management*, paper presented at the European Media Management Association Conference, London, UK.
- M1. (2010). *TV meets Internet: introducing Ibox by M1*. Retrieved from
<http://www.m1.com.sg/ibox/index.html?ibox=01>
- MediaCorp. (2010a). *Channel NewsAsia and MediaCorp radio websites are netizens' favorite*. Retrieved from
<http://www.mediacorp.sg/en/media/EDC101020-0000296/channel%20newsasia%20and%20mediacorp%20radio%20websites%20are%20netizens%20favourite>
- MediaCorp. (2010b). *MediaCorp TV showcases the strength of integrated media solutions*. Retrieved from
<http://www.mediacorp.sg/en/media/EDC101126-0000127/MediaCorp%20showcases%20the%20strength%20of%20integrated%20media%20solutions>
- Media Development Authority of Singapore (MDA). (2007). *Policy and regulatory framework for mobile broadcasting services in Singapore*. Retrieved April 20, 2008, from
<http://www.mda.gov.sg/wms.www/devnpolicies.aspx?sid=152>
- Media Development Authority of Singapore (MDA). (2009, July 27). *A Starry Night Goes International and Multiplatform in Singapore and China*. Retrieved April 20, 2008, from
http://www.ecplaza.net/news/0/28080/a_starry_night_goes_international.html

Media Development Authority of Singapore. (MDA). (2010a). *Singapore media fusion: broadcasting technology*. Retrieved April 12, 2011 from http://www.smf.sg/MadebySingapore/Documents/7660_MDABroadcast_2010%20FA.pdf

Media Development Authority of Singapore. (MDA). (2010b). *Joint IDA-MDA Project NIMS Industry Dialogue*. Retrieved from <http://www.mda.gov.sg/REPORTS/CONSULTATIONREPORTS/Pages/NIMSIndustryDialogue.aspx>

Media Development Authority of Singapore. (MDA). (2011a). *Mediapolis@one-north*. Retrieved April 12, 2011 from <http://www.mda.gov.sg/ABOUTUS/OVERVIEW/Pages/MediapolisOne.aspx#state-of-the-art%2ofacilities>

Media Development Authority of Singapore (MDA). (2011b). *Introduction to digital TV*. Retrieved from <http://www.mda.gov.sg/Public/DigitalTV/Pages/IntroductionDigitalTV.aspx>

Multimedia Research Group. (2009, November). *IPTV global forecast-2009 to 2013*. Retrieved from <http://www.mrgco.com/iptv/gf1109.html>

Neilsen Wire. (2010a). *What Consumers Watch: Nielsen's Q1 2010 Three Screen Report*. Retrieved from http://blog.nielsen.com/nielsenwire/online_mobile/what-consumers-watch-nielsens-q1-2010-three-screen-report/

Neilsen Wire. (2010b). *Report: How People Watch – The Global State of Video Consumption*. Retrieved from http://en-us.nielsen.com/content/nielsen/en_us/report_forms/Global-Video-Consumption.html

Neuman, W. R., McKnight, L., and Solomon, R. J. (1997). *The Gordian knot: political gridlock on the information highway*. Cambridge: MIT.

Noam, E.M. (2008, 8 July). *TV or Not TV, Three Screens One Regulation?* Retrieved April 20, 2009 from, <http://www.crtc.gc.ca/eng/media/noam2008.htm>

Ofcom. (2006). *Review of the television production sector*. Retrieved April 20, 2009 from <http://www.ofcom.org.uk/consult/condocs/tps/tps.pdf>

O'Neill, N. (2009, December 29). *Three screen platforms and the app economy*. Retrieved from <http://www.socialtimes.com/2009/12/three-screen-economy/>
 Pyramid Research. (2009, June). *Mobile video services – a five-year global market forecast*. USA: Pyramid Research Inc.

Rajaram, C. (2010, February 26). *MediaCorp Newshub*, presented at Wan-Ifra's The Future of News Media & Journalism conference, Singapore.

Shin, D. H. (2006). Prospectus of mobile TV: Another bubble or killer application? *Telematics and Informatics*, 23(4), 253–270.

Singapore government news. (2010, March 12). *Acting Minister for Information, Communications and the Arts Lui Tuck Yew Speaks at Committee of Supply Debate on Driving Innovation, Productivity and Competition for a Vibrant Economy*.

Singapore Technologies Telemedia. (July 2009). *StarHub introduces mobile TV service with four ethnic language channels in Mandarin, Bahasa Indonesia, Hindi and Tamil to mobile pre-paid customers in Singapore*. Retrieved August 26, 2009, from <http://www.sttelemedia.com/content.asp?ContentId=1862>

Singtel. (2009, November 13). *SingTel awarded mobile and internet broadcast rights for the Youth Olympic Games*. Retrieved March 09, 2011 from <http://info.singtel.com/node/6598>

Starhub. (2010). *TV on Mobile*. Retrieved April 20, 2010 from, <http://www.starhub.com/support/tv/faq/tvonmobile.html>

TeleGeography. (2011, March 17). *IPTV subs reach 45 million as telcos achieve 10% penetration rate*. Retrieved from <http://www.telegeography.com/products/commsupdate/articles/2011/03/17/iptv-subs-r each-45-million-as-telcos-achieve-10-penetration-rate/>

The Straits Times. (2009, August 19). *RazorTV hits double*. Retrieved March 10, 2010 from http://www.straitstimes.com/Breaking+News/Singapore/Story/STISStory_418631.html

Today. (2010, March 26). *An eye on the regional pay-TV market; new competitive regime in Singapore will stand telco in good stead.*

The Wall Street Journal. (2010, September 9). *The top 10 most global cities.*

Retrieved March 10, 2011 from

<http://blogs.wsj.com/developments/2010/09/09/the-top-10-most-global-cities/>