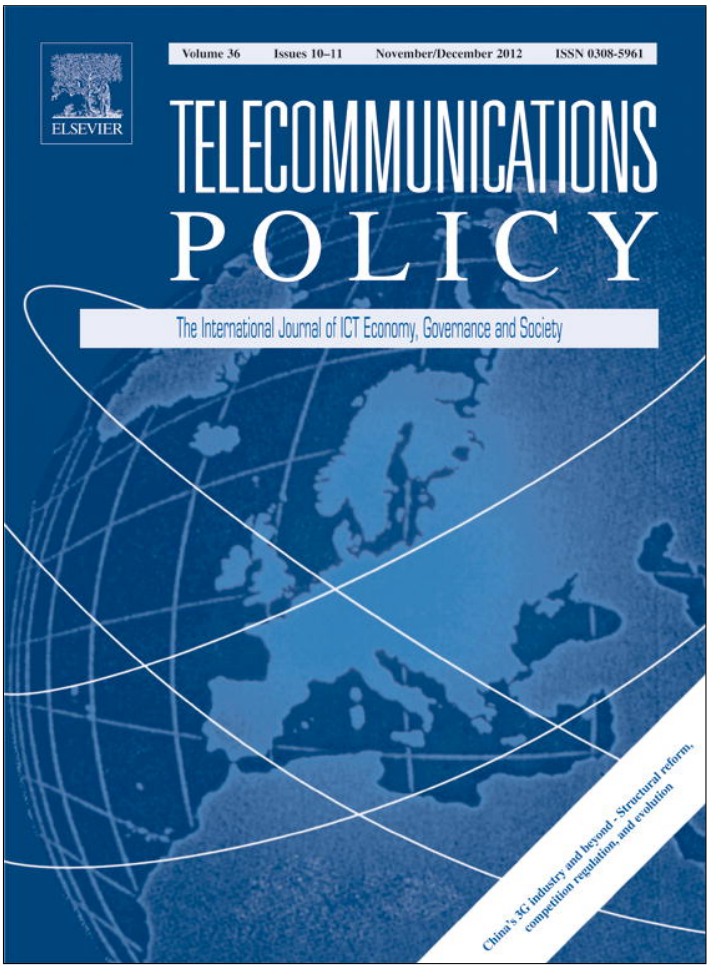

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# Market competitiveness of mobile TV industry in China

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ABSTRACT

Mobile TV is listed as China's national priority to develop the triple play system. Fast-growing China Mobile Multimedia Broadcasting services (CMMB) leads China's mobile TV industry and forms the largest network globally. As mobile TV regulation and technology became stable after the initial stage, this study focuses on CMMB's competitiveness in market/industry subsystem. Using document analysis and expert interviews, it analyzes CMMB's institution-driven and market-driven forces in the Chinese 3G/4G telecommunication market. The socio-technical framework is incorporated with seven forces model to examine commercialized CMMB and investigates its market and technoculture in Shanghai. Institutionally, CMMB business structure was collapsed into three levels which managed extensive and diverse Chinese markets strategically through a unified platform. After the business model switched to a subscription model, CMMB's rollout slowed down but turned it into a sustainable business. Besides, analysis of market forces shows CMMB's good market competiveness due to strong support from suppliers, complementors, and distribution channels and little threat from rivals, new entrants, and substitutes. CMMB users have increasing switching cost because of improved content/services and devices and no data charge fee. In contrast, CMMB faces stronger threat from competitors and substitutes and less loyal consumers in Shanghai than on a national level. CMMB's rapid developmental path provides meaningful implications for other countries in establishing mobile multimedia networks. This study recommends a pro-innovative and technology-neutral regulatory approach to develop mobile TV. Finally, the socio-technical model is found useful for analyzing technological development at different stages and contexts.



## 1. Introduction

Market convergence of the triple play system and the regulatory reform in telecommunication in recent years brought about the growth of 3G users in China (Xia, 2011). In the 12th Five Year Plan, China's government invested more than USD$158 billion in developing 3G and 4G to serve as locomotives to drive the rising telecommunication industry (Hou & Liang, 2011). However, China, the world's largest mobile phone market, only reached of around 15% penetration rate in 3G mobile phone in May 2012 (Forbes, 2012), which shows the huge growth opportunities for smartphone manufacturers and incumbent telecom operators. China Mobile, China Telecom, and China Unicom tag their enormous 2G subscriber base to drive the demand for the lucrative 3G/4G data services (Forbes, 2012).

On the one hand, the growth of 3G/4G and the triple play integration in China are beneficial to the development of the emerging mobile TV industry. On the other hand, mobile broadband and multimedia services are motivating factors in

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stimulating the adoption of 3G services (Liao, 2011). According to Ministry of Industry and Information Technology (MIIT), as of February 2012, 3G mobile TV users exceeded 35 million (3.18% of 3G mobile phone users) which became triple play's main battleground (Yu, 2012). Compared with the slow rollout of cellular mobile TV, homegrown mobile broadcasting TV, China Mobile Multimedia Broadcasting (CMMB) deployed its infrastructure rapidly after 2008 Beijing Olympics and become the first commercialized mobile TV service (MTVS) in China (Lin, 2012).

CMMB, with the strong support from the regulator, the State Administration of Radio, Film and TV (SARFT), and audiovisual content providers (i.e., broadcasters and cable network operators), managed to win the mobile broadcasting TV competition over the national standard Terrestrial Mobile Multimedia Technology (TMMB). Its cooperation with China Mobile expanded CMMB's user base tremendously in early 2010 (Jiang, 2011). Due to the fact that it levies no data charge, CMMB attracted 37 million users in late 2011, including 19 million paid subscribers 3 years after commercialization (Communications Weekly, 2012). Its transmission covers more than 336 cities and 850 counties in China.

Mobile TV is listed as part of China's national priority for developing the triple play system. The fast-growing commercialized CMMB MTVS leads mobile TV in China and in the world. As China's mobile TV regulatory and technological subsystems became stable after the initial stage (Kshetri, Palvia, & Dai, 2011; Lin, 2012), this study focuses on CMMB's market competitiveness in relation to the stakeholders in this industry. It uses Xia's (2012) framework to analyze CMMB's institution-driven and market-driven forces to understand the competitive market behaviors of the 3G/4G Chinese telecommunication market. It incorporates the seven forces model to examine market-driven forces of commercialized CMMB MTVS and investigates its market and technoculture in Shanghai.

This study not only contributes to the understanding of the rising Chinese mobile TV model but also integrates socio-technical perspectives with the seven forces model to further the market competitiveness analysis of mobile TV technologies. Moreover, this study provides policy recommendations and implications to apply the CMMB experience to other contexts.

## 2. Industry overview and analytical framework

### 2.1. Mobile TV industry structure

Mobile TV is the new battleground for mobile operators, broadcasters, and cable TV operators as well as IPTV and Internet video operators. Based on transmission differences, mobile TV can be divided into cellular mobile TV and mobile broadcasting TV (Kumar, 2010). Mobile TV services in China can be categorized into (1) the broadcasting model (using a broadcasting network for transmitting live or on-demand mobile videos such as CMMB), (2) the telecommunication model (using a cellular network to dispatch streaming videos or downloadable audiovisual content like 3G TV), and (3) the Internet model (using mobile Internet to watch online videos, e.g., Tudou) (Jiang, 2011).

Standard setting for new technologies is a turf war that is full of politics, interests, and conflicts. Multiple technological standards inhibit widespread technological adoption, which happens in China's mobile TV industry (Lin & Liu, 2011). MIIT, the telecommunication regulator, and SARFT, the broadcasting regulator, both support their industries and technological standards and fight to govern this new industry (Lin, 2012). After China launched its 2.5G cellular mobile TV in 2005, the pre-3G mobile TV services did not attract a substantial amount of users. Some Digital Multimedia Broadcasting (DMB) mobile TV trials were held in Beijing, Shanghai, and Guandong around 2005, but this South Korean mobile broadcasting TV standard was not zealously promoted in China. Instead, SARFT endorsed homegrown CMMB as the core standard for developing mobile broadcasting TV.

In China's mobile TV industry, CMMB faces market competition from 3G TV and TMMB. 3G TV services have been offered by China Mobile, China Unicom and China Telecom after they obtained 3G licenses from MIIT in January 2009 (Li, 2009). Among them, China Mobile benefited from exclusive cooperation with the China Broadcasting Corporation (CBC) in diffusing CMMB-enabled devices (Lin, 2012). Besides, TMMB was selected by the Standardization Administration of China (SAC) as the national standard for mobile TV in June 2008. With MIIT's support, NUFRONT operated TMMB mobile broadcasting TV but struggled in forming a sustainable value chain (Xinhuanet.com, 2009). After its launch in 2009, commercial CMMB MTVS has emerged as the first successful mobile TV model, not only outpacing its competitors in infrastructure establishment and commercial operation but also becoming the largest mobile TV network worldwide (Fig. 1).

### 2.2. CMMB development

Since 2002, SARFT has collaborated with enterprises and scientists to develop mobile multimedia broadcasting technologies. When homegrown STiMi transmission standard became mature, SARFT officially announced CMMB as its endorsed standard in October 2006. CMMB – which uses 2.6 GHz frequency and 25 MHZ bandwidth – can provide 25 TV channels and 30 radio channels via a satellite-terrestrial unified infrastructure. This transmission network utilizes the S-band satellite to cover the whole country, the U-band terrestrial network to serve dense populated urban areas, and the two-way network to provide interactive services (CCTV.com, 2008). Hence, CMMB's broadcasting technology is able to reach remote and rural areas in the geographically extensive country at little cost.

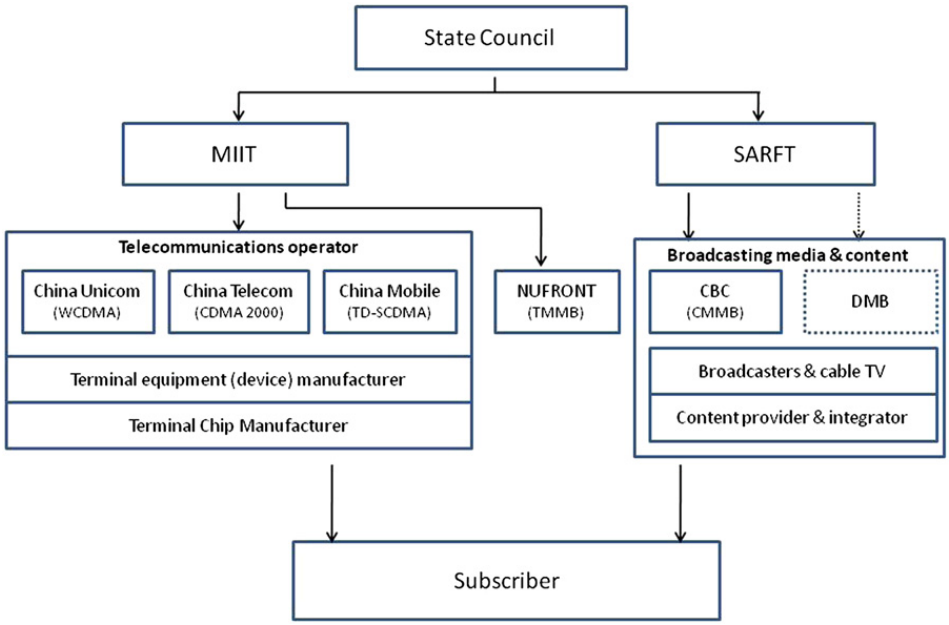


**Fig. 1.** Stakeholders in China's mobile TV industry.

CMMB's infrastructure developed rapidly after the 2008 Beijing Olympics. The China Broadcasting Corporation (CBC) was appointed by SARFT as the CMMB national operator in October 2008. Three months later, the first commercial CMMB MTVS started in Shanghai. In March 2009, CBC and China Mobile, the leading Chinese mobile operator, signed a 3-year memorandum of understanding (MOU) as exclusive partners to co-develop mobile TV services (Chen, 2010). After the CBC-China Mobile CMMB services were officially launched in February 2010, their collaboration accelerated the diffusion of mobile TV in China (HC360.com, 2010). Currently, CMMB MTVS can be watched on thousands of devices including mobile phones, MP4 players, PDAs, and even on car information platforms. In June, 2011, CBC announced CMMB's integrated platform which could simplify the manufacturing of CMMB-enabled devices (Communications Weekly, 2012).

Collaborating with 16 content/service alliances, CBC launched its branding, Jingcai in January 2010. Half a year later, it switched from a free model to a paid model. To enrich CMMB MTVS, CBC continued to collaborate with content providers such as CCTV to develop innovative services. CMMB-II currently uses Wii-Max to provide interactivity in the lab (Table 1).

**Table 1**
Key events of development in China's mobile TV industry.

| | |
|---|---|
| **Pre-3G stage** | |
| 2002 | SARFT Academy of Broadcasting Science began to develop mobile multimedia broadcasting technology |
| 2005 | China Mobile launched cellular mobile TV service |
| March 2005 | SARFT determined CMMB's satellite-terrestrial unified infrastructure |
| November 2005 | The first DMB mobile TV started in Shanghai |
| October 2006 | SARFT announced CMMB as the core standard for MTVS |
| October 2007 | CMMB trials setting up terrestrial mobile multimedia broadcasting signals in six trial cities (Beijing, Shanghai, Tianjin, Shenyang, Qingdao, Qinhuangdao) |
| June 2008 | TMMB was selected as the national standard by SAC |
| August 2008 | CMMB officially broadcast 2008 Beijing Olympics |
| October 2008 | SARFT appointed CBC to establish CMMB infrastructure and managing commercialization |
| December 2008 | CMMB signals covered 118 cities |
| **3G stage** | |
| January 2009 | MIIT granted 3G licenses to China Mobile, China Telecom, and China Unicom |
| February 2009 | CMMB commercialization launched in Shanghai |
| March 2009 | CBC and China Mobile signed MOU as three-year exclusive mobile TV partners |
| March 2009 | China Unicom and China Telecom launched 3G mobile TV services |
| January 2010 | CBC started Jingcai MTVS |
| February 2010 | CBC-China Mobile CMMB services officially launched in 24 provinces |
| May 2010–October 2010 | CMMB broadcast events in Shanghai Expo and developed interactive services |
| 30 June, 2010 | Jingcai MTVS switched to the subscription model |
| November, 2010 | CMMB broadcast Guangzhou Asian Games |

**Table 1** (*continued*)

| | |
|---|---|
| **4G trial stage** | |
| November, 2010 | China Mobile launched trial 4G services (TD-LTE) in 6 cities |
| August 2011 | Automotive Information Systems, Shanghai CBC and Beijing CBC Jingcai signed the MOU to co-develop TSP-CMMB |
| June 2011 | CBC announced CMMB's integrated platform |
| December 2011 | CMMB MTVS available 336 cities and 850 counties in China |

### 2.3. Analytical framework

#### 2.3.1. Socio-technical analysis

Technological development is neither politically or ethically neutral nor a mysterious black box. In a similar vein of social shaping of technology theory, the socio-technical approach which analyzes how actors and action shaping key subsystems (e.g., policy, economy, technology) provides a useful analytical framework to investigate the socially constructed trajectory of emerging technologies, including mobile TV (Lin, 2012; Lin & Liu, 2011).

Prior studies proved the appropriateness of the socio-technical framework for predicting technological development by analyzing driving forces of developing new technologies and complex interrelationships holistically. Sawyer, Allen, and Lee (2003) used the socio-technical framework to predict the development of emerging broadband mobile technologies. Examining the adoption of broadband technologies socio-technically, Han (2003) found that the policy system propelled consumer demand and speeded up rollout.

Several studies applied a socio-technical framework to predict the development of mobile TV in different countries. Bauer, Ha, and Saugstrup (2007) treated technology, economics, and policy as three coevolving ensembles shaping mobile broadcasting TV in South Korea. Shin (2006) used a socio-technical triangle model to explore relationships between DMB policy, technology, and market dimensions. It attributed DMB as a technology push to market and found different business models of broadcasters and telcos.

Besides, when Lin and Liu (2011) compared the development of mobile broadcasting TV in Singapore and Taiwan, they suggested culture as an underlying layer shaping interrelated socio-technical subsystems (i.e., market/industry, technology, and policy). According to Flew (2007, p. 37), such technoculture should be understood by examining artefacts, use of content/services, and knowledge systems and social meaning. Investigating emerging mobile broadcasting TV in China, Lin (2012) found CMMB at its early adoption stage was technologically ready and driven by government/policy forces. She claimed the unbiased socio-technical lens was suitable to investigate subsystems of emerging mobile TV and predict its evolution in specific contexts.

#### 2.3.2. Seven forces model

Porter's (1991) five forces model is widely used to examine the strengths of an industry's market competitiveness by analyzing the threat of substitute products, established rivals, new entrants, and the bargaining power of suppliers and customers. To extend the model's analytical power, Brandeburger and Nalebuff (1995) first introduced the complementor as the sixth force to explain reasons behind strategic alliances. Based on the Porter's work, Intel's former president, Andy Grove, also identified six forces affecting the survival of a business in a drastic changing environment. He removed substitutes and added two forces: the complementor and what the business is doing differently. Grove regarded the complementors as "fellow travelers" (1996, p. 29) who share aligned business interests and provide products to support each other. As the six forces cannot operate in a completely unregulated free market, he further emphasized the significance of regulation which affects the competitive well-being of a business. Applying Chinese famous militarist Sun-Wu's war strategies to business competition, Lee and Yu (2010) further proposed the seventh force of distribution channel/retailers. It is appropriate for analyzing the resource allocation for optimal use.

Although the socio-technical framework is useful to predict the technological directions of emerging technologies, the organic relationships of subsystems show different strengths of shaping power at developmental stages. To emphasize the market/industry subsystem, the seven forces model is useful when incorporated into the socio-technical framework to enhance the analytical power.

## 3. Method

When technological and regulatory development slowed down after the initial stage, CMMB, the leading mobile TV in China, started facing more challenges in expanding its market/industry subsystem. Viewing mobile TV as socio-technical ensembles, this study incorporated the seven forces model to analyze evolving commercialized CMMB's market/industry in seven aspects: threat of established rivals, threat of new entrants, threat of substitute products, bargaining power of suppliers, bargaining power of customers, complementors (strategic alliances and regulation), and distribution channel/retailers. This study also investigated the adoption and technoculture of CMMB in Shanghai, the Chinese international economic and media hub and the major city for diffusing this new media.

In-depth interviews with key stakeholders and document analysis were used to examine China's mobile TV industry. From April 2008 to October 2010, the researcher identified China's mobile TV experts and CMMB's national and Shanghai operators/distributors (i.e., CBC's public relation manager in Beijing, Shanghai SMEG Handy TV marketing and channel managers, and CMMB Experience Shop in Shanghai) and conducted semi-constructed interviews to obtain first-hand insights. Interview questions concentrated on CMMB's commercial deployment, content/service and device development, competition, alliances, and consumer needs. Interviews were recorded and transcribed for thematic analysis. Document analysis of abundant archives provided supporting information to delineate complex realities in the mobile TV's socio-technical ensembles.

## 4. Competitiveness of CMMB's market/industry subsystem

According to Xia (2012), competitive market behaviors in the 3G/4G era should be analyzed by institution-driven forces and market-driven forces. This section first analyzes the institution forces that shape CMMB's market/industry subsystem, and then uses the seven forces model to examine its market-driven competitiveness.

### 4.1. Institution-driven market behaviors

After the CBC set 2010 as the CMMB's overall development year, it made effort to improve its content/services, brand exposure, and alliance cooperation. In that year, it launched Jingcai MTVS and CBC-China Mobile CMMB services, switched to a paid subscription model, and broadcast events of the Shanghai Expo and Guangzhou Asian Games to promote brand awareness.

According to J. Zhang from CBC's Public Relation Department (personal communication, April 13, 2010), CBC deployed three layers of strategies (i.e., brand awareness, local market development, and value chain collaboration) to diffuse CMMB MTVS to Chinese potential users:

> The first layer is related to brand awareness … "We hope to make the public aware that CMMB, an excellent value-added product, does not involve data charges for viewing mobile videos. It is a broadcasting technology that differs from mobile operators' unicasting media services. As for the second layer, every provincial team in CMMB marketing and promotion will roughly know CMMB's local markets, characteristics, and viewing habits by this year. The third layer is to develop mutual understanding and collaboration among stakeholders in the value chain."

The three layers are related to improving the market subsystem. The first two focus on educating the market in CMMB technology, promoting its brand name nationwide, and understanding local market variations. The last layer is to strengthen cooperation with strategic alliances in the value chain. SARFT set the goal to improve CMMB content, networks, and services and expand its user base to over one billion in 2015.

#### 4.1.1. Commercial operation structure

In September 2008, SARFT officially assigned CBC to lead business operations CMMB MTVS under unified standards, planning, and rules throughout the country. To strategically manage the geographically extensive and culturally diverse Chinese markets, CBC set the separating the central and the subsidiaries management structure. While CBC takes charge of CMMB's national business strategies, provincial or municipal operators have some autonomy in developing customized marketing plans and local content packages (Lin, 2012).

To adapt to technological advancements and increase efficiency, CBC's new operation structure was collapsed into three vertical levels in 2012, including a conglomerate corporation, 31 provincial corporations, and 100 municipal/county corporations (Communications Weekly, 2012). This structural change is regarded as the first successful verticalization in China's broadcasting industry that builds a solid foundation to the triple play system (Cao, 2012). To cope with vertical operation structure, CBC is developing a unified business management platform to deal with CMMB's various operations and sales, which allows cross-province collaboration and localized development (Cao, 2012).

#### 4.1.2. Business model

CBC offered free CMMB channels initially to cultivate viewing habits but switched to a paid model in 2010. Although a free-to-air model with advertising support expanded CMMB user base in the beginning, J. Zhang from CBC's Public Relation Department (personal communication, April 13, 2010) stressed the significance to charge CMMB because the ROI was necessary to support costly infrastructure establishment, customer service, and content creation. Even if some worried that paid CMMB MTVS would delay its diffusion (Jiang, 2011), the subscription model is the only way to sustain the upgrade of interactive CMMB network and content/service innovation.

As for the paying scheme, Tencent Tech's survey (2009) showed 98.96% of potential CMMB users preferred to pay a monthly flat fee. At present, most CMMB subscribers pay less than USD $1 monthly to watch six to seven mobile broadcasting TV channels and free content. Besides a monthly/yearly flat rate for this basic package, CMMB subscribers can pay a la carte for premium or information services.

#### 4.1.3. Content/services

CMMB MTVS can offer more than 20 TV channels and 30 radio channels. Its diverse programming derives from national programs, provincial productions, and hundreds of local shows. CMMB MTVS is made up of three types of content/services: (1) public service which provides community radio and TV programs, government information, and emergency broadcast information; (2) monthly paid service for encrypted audiovisual content; and (3) value-added premium content/services.

Enriching and innovating content is the core mission for developing CMMB MTVS. When CMMB's *Jingcai* MTVS was first introduced to the market, it included seven free broadcasting channels: five national channels (*CTTV 1, CTTV 5, CTTV news, Jiangcai Film, Jiangcai Sports*) and two local channels (one provincial channel and one municipal channel). Later, made-for-CMMB information services, like *Jingcai Navigation*, *Jingcai Finance*, and weather forecast were added.

The local CMMB operators urged CBC to improve quality, diversity, and innovativeness of content/services when considering market differentiation and customized local packages. According to SMEG Handy TV marketing manager (T. Dong, personal communication, October 18, 2010), market investigations revealed the majority preferred news and sports in CMMB content. Another manager R. Shen (personal communication, October 18, 2010) suggested CMMB should make use of broadcasting characteristics to provide timely news and sports and existing TV programming.

Live broadcast of international events like the Shanghai Expo and the Guangzhou Asian Games provide incentives for adopting CMMB. To celebrate the 2010 Shanghai Expo, a multimedia portable device called *Chang e Xing* was launched to broadcast CMMB signals and Expo content. In July 2010, CBC released *Jingcai World Cup*, the first interactive mobile TV channel that allows fans to participate in football quizzes and voting (CMMB.org.cn, 2010).

To cater to individual needs, CBC is testing on-demand content/services based on time slots and genres. In May 2011, CMMB signed cooperative agreements with noted national newspapers to provide *Jingcai Newspaper*. It also added new content from IPTV and user-generated websites like Sohu Video and Tudou.com. In August 2011, Jingcai offered the first interactive mobile TV shopping service in Hunan.

#### 4.1.4. CMMB-enabled devices

Experts considered insufficient models of CMMB-enabled handsets initially as the bottlenecks of CMMB's development. After 3 years' effort, thousands of CMMB terminals could receive CMMB signals via mobile phones, tablets, PCs, GPS devices, PMPs, and TSP-CMMB car automobile systems. However, market sales of and revenue from CMMB devices did not perform well. Upgrading CMMB devices is crucial to facilitate the rollout. In 2012, CBC started to develop an integrated terminal platform that can interoperate on different manufacturers' systems so as to reduce R&D difficulties and improve device development.

### 4.2. Market-driven behavior: Seven forces analysis

#### 4.2.1. Threat of competitive rivals

CMMB's main competitive rivals are the 3G TV services offered by China Mobile (TD-SCDMA standard), China Unicom (WCDMA standard), and China Telecom (CDMA standard) as well as TMMB mobile broadcasting services. In 2012, CMMB's users tripled to 37 million, two million more than the total users of the other three operators (Communications Weekly, 2012).

Compared with CMMB, 3G TV packages offered by mobile operators tend to provide similar and less compelling content lineups that only contains several media companies' production approved by SARFT. In China, local TV production follows strict regulation and foreign audiovisual content find it difficult to enter the Chinese market. To appeal to price-conscious users, 3G TV operators face challenges to set a reasonable fee based on bandwidth use for mobile video viewing (CNBN, 2012). In contrast, free data access and low subscription fee are strengths of CMMB MTVS.

China Mobile, the strongest competitor, has a 3-year exclusive co-petition relation with CBC from 2009 to 2012. According to CBC's general manager Sun, the collaboration with China Mobile involved cooperation in both terminals and business operations, which integrated telecommunications networks, TV networks, and the Internet (CMMB Information Weekly, 2010). China Mobile's 3G TV content was strengthened after adding Jingcai MTVS. Besides, experts indicated that CMMB was superior to 3G TV as it has enough bandwidth for high quality signals (Z. Zhao, personal communication, April 3, 2010). T. Dong (personal communication, October 18, 2010) indicated CMMB's strengths complemented the weaknesses of China Mobile's unicasting service. Most importantly, the increasing sales of TD+CMMB devices and their price reduction facilitated the diffusion of CMMB MTVS. This collaboration has increased both sides' revenues, enhanced content, increased interactivity, and expanded user bases. The exclusive TD+CMMB model causes relative high switching cost to the users of China Mobile and CBC.

Comparatively, TMMB's development encountered many obstacles. Before the Beijing Olympics, it implemented several pilot trials in four cities. However, the investors withdrew investment during the financial crisis. Only a few manufacturers develop limited models of TMMB-enabled devices. This national standard faces a tough situation in that most content providers, chip manufacturers, and terminal makers in the value chain support the fast-growing CMMB MTVS (Fu & Zhang, 2010).

Because CMMB has distinctive strategies and differentiated content/services with a larger size of users, its competitive rivals are relatively weak.

#### 4.2.2. Threat of new entrants

The Chinese mobile TV industry has high entry barriers due to R&D challenges in transmission technologies, content and devices, competition between SARFT and MIIT, and huge investment needed for infrastructure and commercial operation. The incumbents, which are either supported by SARFT or MIIT still try to foster customer loyalty to achieve economy of scale. SARFT has been strict in supervising mobile TV content/services and issuing licenses. Under such circumstances, it is hard for new entrants to enter this nascent industry.

SARFT's protectionism reduces the threat of new entrants for CMMB. However, the National Generation Broadcasting (NGB) network, a broadcasting version of the triple play system will be established in late 2012 (Lang, 2011). Integrating digital cable TV and mobile broadcasting technology, this network is based on next-generation interactive High Definition (HD) technology for television broadcast with value-added information services. The NGB will turn cable operators into the fourth telecom vendor in China (Zhao, 2009). Since cable TV operators also have SARFT's support to access upstream content sources, they will provide similar mobile TV services and bring competition and threat to CMMB MTVS in near future.

#### 4.2.3. Threat of substitutes

Mobile video services are new value-added telecommunication businesses. Due to increasing use of smartphones, tablets, and mobile broadband, viewing online videos on mobile devices is increasing in popularity. With a large number of users and audiovisual content, web TV operators in China entered the mobile video battleground. According to the 2011 iMediaResearch report on China's mobile video market (Yu, 2012), Joy.cn, a professionally made video website, led the market, and several user-generated web video sites (e.g., Uodoo, Tudou, and Youku) were listed as the top 10 popular sites.

In addition, mobile operators run websites to provide diverse multimedia content. MediaResearch's report ranked China Mobile's MobileVideo as No. 3 site which contains downloadable or streaming free videos, paid premium content, and user generated mobile videos. China Telecom's 3G cellular video service, TV189.com, also offers live web programs, on-demand videos, and downloadable content. Regionally, Guangdong Unicom and the Nanfang Media Group launched U.3G TV.net in June 2011, which provides mobile TV, user-generated video (UGV) sharing, and video microblogs. Besides, user-generated videos filmed by smartphones and instantly uploaded to Sina Weibo accounted for more than half of video traffic and has become the most popular function (Yu, 2012).

The aforementioned substitutes' business models include advertising-supported free content/services, initial free service followed by paid subscription, and a hybrid model of free and paid premium content/services. As their payments are similar to CMMB's pricing, the quality and quantity of audiovisual content and value-added services are the determinants for user adoption. Although CMMB which appeals to the largest number of users involves more switching cost, the threat of substitutes is expected to increase due to new audiovisual services from mobile and Internet service providers.

#### 4.2.4. Bargaining power of consumers

Consumers have huge bargaining power in adopting CMMB because of the varieties of mobile TV services and substitutes available in China's market. Nda Consulting (2008) revealed above 70% of respondents held high expectations of CMMB MTVS. CMMB Media Data Research Center (2010) found users in nine major Chinese cities used this service at least once daily. However, their viewing time varies greatly and Shanghai users watched the longest (71.5 minutes), while Chengdu users watched as little as 16 min. Males and 15–44 year-old users used more CMMB MTVS. 76.2% of CMMB users watched it at home and the peak hours appear in the morning (6.00 a.m. to 8.00 a.m.) and evening (7.00 p.m. to 8.00 p.m.).

After switching to the subscription model, CMMB's adoption rate has slowed down, as fewer consumers are willing to pay for it. To attract subscribers, CMMB operators made effort in creating content, services, and devices. For example, during 2011 Guangzhou Asian Games, China Mobile and CBC Guangdong provided a customized mobile TV package.

Developing innovative content/services and strong branding can differentiate CMMB MTVS from rivals and substitutes so as to decrease users' bargaining power. To increase competitiveness, CBC and China Mobile are testing on-demand content/services to be charged based on viewing time and program types (CNBN, 2012). Z. Zhao (personal communication, April 3, 2010) stressed "CMMB should have a clear position and a promotional channel to introduce it to the public." If CMMB's branding becomes stronger, potential users who see its unique value are likely to select it.

Comparatively, CMMB MTVS is still cheaper and offers better content and viewing quality than 3G TV services and substitutes. In late March 2012, the number of CMMB paid subscribers reached 19 million, 51.3% of the total number of users (Communications Weekly, 2012). As CMMB keeps enriching its content/services and improving branding, consumers' switching cost is likely to increase and their bargaining power will be reduced.

#### 4.2.5. Bargaining power of suppliers

With support from SARFT and China Mobile, CMMB has strong suppliers for hardware and software. Currently, CMMB-enabled devices comprise thousands of models made by 36 device manufacturers (e.g., Samsung, LG, and Motorola) and many chip makers (e.g., Intel). However, CMMB mobile phones are more expensive than other mobile devices. In August 2011, Shanghai and Beijing CBC and JingCai Navigation signed an MOU to set up the TSP-CMMB platform in several automobiles for providing navigation and mobile video services.

In June, 2011, CBC signed strategic cooperation agreements not only with enterprises in developing mobile technology and devices but also with various content providers including online media (e.g., Sohu videos, Youku, Tudou and People Video), traditional media (e.g., CCTV, Beijing TV station, Hunan Satellite TV station, newspapers), and information services (ITsohu.com, 2011). These further strengthen CMMB's value chain.

Cooperating with many hardware and software suppliers and China Mobile, CBC lowers the switching cost among suppliers, owing to their weak bargaining power. As CBC forms a strong value chain, CMMB can maintain its leading role and market competitiveness in China's mobile TV industry.

#### 4.2.6. Complementors

Emphasizing the triple play reform, the State Council of China announced the first batch of experimental cities in June 2010 and some metropolises like Beijing, Shanghai and Nanjing, have formally integrated the three networks (News.xinhuanet.com, 2010).

Triple play is the motivating factor to expedite the alliance between CMMB and mobile operators. After cross-over restrictions were lifted between broadcasting and telecommunication industries, content regulation and licensing of IPTV and mobile TV are still controlled by SARFT (Tech.Sina.com.cn., 2010). SARFT-endorsed CMMB MTVS has the advantage of access to rich upstream content resources from broadcasting and cable TV networks. CMMB's strengths in content and broadcasting technology attracted the exclusive cooperation of China Mobile. This alliance strengthens both parties by combining resources and both groups complement each other (Lin, 2012).

Moreover, content/service providers and mobile device manufacturers are motivated to ally themselves with CBC as co-developing SARFT-supported and commercially viable CMMB business reduces risks, lowers R&D costs, and improves system interoperability. Overall, CMMB's complementors (alliances and regulation) strongly support CMMB development.

#### 4.2.7. Distribution channels/retailers

To increase efficiency, CBC's new operation structure is collapsed into three levels: national, provincial, and municipal levels (Cao, 2012). The cooperation with China Mobile propelled CMMB to build distribution channels and service networks even faster. CMMB Experience Shops were established in major cities like Beijing, Shanghai, and Guangzhou to promote this innovative service. In addition to CBC's website, a lot of retail shops sell CMMB MTVS and CMMB-enabled devices.

Besides, CBC expands CMMB's business operation internationally. More than 10 nations tested the CMMB standard in 2011, which is likely to be adopted internationally like DMB (Ni, 2011). Hong Kong's CMMB was available in June 2012 (Communications Weekly, 2012). Bangkok and Africa have formed trial networks. Many countries like Singapore and the Philippines are negotiating with the CBC for possible cooperation with the rapid-growing mobile TV.

Overall, both CMMB's institution-driven and market driven behaviors favor CMMB's leading place in the evolving China's mobile TV industry. The seven forces analysis shows that CMMB MTVS has good market competitiveness and industry profitability because it faces little threat from rivals, new entrants, and substitutes and obtains support from complementors and distribution channels/retailers. Although consumers have strong bargaining power, improving CMMB content/services and devices will increase switching power, especially when rivals and substitutes fail to catch up with this first mover.

## 5. CMMB's Shanghai technoculture

Due to geographical extensiveness, technological adoption in different Chinese markets can vary greatly. As culture is context-specific, this study selected Shanghai, the first city that launched commercialized CMMB MTVS, for investigation.

### 5.1. Shanghai media and culture

With more than 20 million residents, Shanghai is the economic, financial, and trade center of China. According to the 2010 China City Competitiveness Report, Shanghai ranks the first in innovation environment competitiveness (eChinacities.com, 2010). Shanghai has the largest population of IPTV users among Chinese cities. With 4500 Wi-Fi hot spots, its Fiber to the Home (FTTH) is developed most rapidly to form a high-speed 3G+Wi-Fi network (Wang, 2011). As the Shanghai population is open to adopting new media and gadgets, CBC selected this city to launch the first commercial CMMB MTVS.

Shanghai's competitive broadcasting and TV industry includes three major groups (i.e., Shanghai Media Group (SMG), Oriental Cable Network (OCN), and Shanghai Oriental Pearl (SOP)) and many production companies. SOP aggressively develops new media which includes Eastoday.Com news and Shanghai Oriental Pearl Mobile TV Corporation.

In Shanghai's busy and fast-paced life, many people use public transportation and live a commuting lifestyle that benefits the diffusion of mobile TV. In late 2005 SMG obtained the first mobile TV license in China. Shanghai people have experienced various mobile TV services. Oriental Dragon Cultural Works Co. and China Unicom set up Oriental 2.5G mobile TV in 2005 and switched to a subscription model in March 2006. China Mobile and SMG started their 3G mobile TV service here in 2009. As for mobile broadcasting TV, DMB service – which was launched by SMG and SOP in May 2006 – failed to

take off. When CMMB MTVS was introduced to Shanghai in 2009, technological superiority and the lack of data charge appealed to the locals.

In this media-saturated context, new media like CMMB must struggle to establish their positions by finding unexploited interests and under-served needs. The exclusive cooperation with China Mobile let CMMB jumpstart its MTVS in Shanghai as the No. 2 service in the market. As of May 2009, cellular mobile TV in Shanghai had 52.19% of market share, while CMMB had 20.9% (Chang & Wang, 2010).

### 5.2. Shanghai CMMB MTVS

In March 2009, the CBC partnered with SOP to begin the first commercial CMMB MTVS in China. SMEG Handy TV (SHT), SOP's subsidiary company, manages its business operation, content/services, and distribution. Currently, CMMB signals have 95% coverage in Shanghai. SHT built transmission towers to improve reception in the metro system. In May 2010, Shanghai Mobile started the TD+CMMB mobile multimedia service.

Free trials of CMMB during 2008 Beijing Olympic Games attracted 1.4 million users, including about 100,000 in Shanghai (Hong, 2009). With positive trial feedback, CBC switched to a hybrid model to keep some free channels but encrypted premium content and value-added services. Discrepancies existed within CBC with respect to timing for subscription: some preferred to wait for a sustainable size of users; others supported early change to use subscription revenues for future investment.

Insufficient CMMB content/service is one of the key inhibitors to attract paid subscribers (ChinaYes Magazine, 2009). In March 2010, Shanghai CMMB first encrypted and charged for CMMB MTVS use in China. Its payment schemes include a monthly rate (USD $3) and a yearly fee (USD $30), similar to IPTV but more costly than cable TV. Users who purchase bundled packages could enjoy free content/services for one year. Information services, like *Jingcai Finance* and *Stock/Navigation*, are charged separately. Although SHT held many campaigns to stimulate the takeup rate, Shanghai CMMB only had 150,000 subscribers in September 2010 (Ding, 2009).

China's first CMMB Experience Shop opened in Shanghai's central business district, Xujiahui, in September 2009. Even though the area is usually crowded, this shop was quite empty. The shopkeeper of the CMMB Experience Shop (personal communication, 23 September 2010) attributed the sluggish takeup to people's low awareness of CMMB MTVS. He said many customers were dissatisfied with its insufficient content/services and less user-friendly devices. CMMB's characteristics and pricing packages were most frequent queries in the CMMB Experience Shop.

Besides, SMEG Handy TV's marketing manager admitted only 20 to 30% of Shanghai residents heard about CMMB in late 2010 due to insufficient promotion, when CBC emphasized infrastructure and signal reception at the initial stage (R. Shen, personal communication, October 18, 2010). However, among the 150,000 CMMB users, 80% users frequently enjoyed this service (R. Shen, personal communication, October 18, 2010).

### 5.3. Shanghai CMMB content/services

Shanghai's CMMB MTVS includes four national channels (CCTV-1, CCTV-3, CCTV-5, and CCTV-News) and seven value-added channels (Shanghai First Financial Channel, Jingcai Film, Five Star Sports, and Traffic Navigation). It also offers mobile data services, including weather forecast, stock market information, and real-time traffic reports.

To celebrate the 2010 Shanghai Expo, a domestic GPS manufacturer launched *Chang e Xing*, a multimedia portable device. With live broadcasting headline news, it could show CMMB MTVS, Expo's customized content (e.g., Expo navigation, map, ticketing, and schedule), and Shanghai information (CMMB.org.cn, 2010).

### 5.4. Shanghai CMMB users

Shanghai users increased their use of CMMB MTVS drastically. According to CMMB viewing behaviors report (2010), Shanghai people spent more time (74.3 min) using CMMB than other cities. Compared with the same survey in 2009, CMMB's monthly usage in Shanghai was ranked at second last.

SMEG Handy TV marketing manager identified the 30–35 year-old age group as CMMB's early adopters who preferred business, news, and sports content (T. Dong, personal communication, October 18, 2010). It was also crucial for CMMB to appeal to young students without TV in dormitories and the elder watching many TV programs.

Diffusing CMMB in Shanghai requires stronger marketing promotion (T. Dong; R. Shen, personal communication, October 18, 2010). Big events, like Expo and the World Cup, provided incentives for people to watch real-time mobile videos and obtain location-based information. CMMB MTVS should strategically integrate and customize its content/services for such campaigns and attract more users for trials.

Expert interviews forecast a promising future for CMMB MTVS in China. For its future development in Shanghai, there are four aspects to improve: (1) completing CMMB network construction; (2) cooperating with suppliers; (3) collecting user feedback and understanding their needs; and (4) modifying organizational structure to attract talents (R. Shen, personal communication, October 18, 2010). Holding optimistic views, SHT believed CMMB MTVS would become a standardized feature in most mobile devices and attract a huge number of users.

### 5.5. Shanghai technoculture

Shanghai is one of the cities with the latest innovation in CMMB content/services, devices, and platforms. Technoculture involves three levels: physical artifacts, use of content/services, and systems of knowledge and social meanings (Flew, 2007). CMMB's artifacts has evolved and expanded from limited models and devices to thousands of models cross platforms (e.g., mobile phones, MP4 players, PDAs, GPS devices, laptop computers, TSP-CMMB). User experiences of various artifacts differ from one another with increasing satisfaction to advanced functionalities.

As for software, CBC and its alliances that realized their insufficient content/services devoted to creating original programming, value-added information services, and live broadcast events, in addition to VODs and interactive services. Shanghai's broadcasting and cable media that view mobile devices as an additional distribution platform are keen to collaborate with CBC. The advancement of CMMB MTVS is likely to fulfill users' needs and even outshine substitutes like IPTV and cable TV networks.

With respect to social meanings, CBC kept promoting its brand even if most people could not differentiate various mobile TV services (e.g., DMB, 3G TV, CMMB). Compared to its development on a national level, CMMB MTVS in Shanghai's media-saturated and innovative environment faces a stronger threat from competitive rivals and substitutes and Shanghai consumers enjoy a lower switching cost and bigger bargaining power. However, this new media has been gaining in popularity among users in Shanghai (CMMB Media Data Research Center, 2009, 2010), indicating its rising market competiveness and commercial viability.

## 6. Discussion and conclusion

At the early adoption stage, homegrown CMMB broadcasting technology was an enabling factor in obtaining SARFT's endorsement and the Chinese government's triple play policy propels the diffusion of CMMB MTVS (Lin, 2012). However, after commercialization and allying with China Mobile, CMMB's fast-changing and uncertain market/industry subsystem deserves a closer examination than the technological and regulatory and subsystems. This socio-technical study – which emphasizes CMMB's market competitiveness in relation to the stakeholders in China's mobile TV industry – examines CMMB's institution-driven and market-driven forces (Xia, 2012) with the seven forces model, and also investigates CMMB in Shanghai's market and technoculture.

The institution-driven forces of CMMB business show its collapsed organizational structure can unify national strategies with some provincial and municipal-level autonomy and customization. The decision to switch to a subscription model is beneficial to CMMB's sustainability and innovation but is likely to delay its diffusion. The market-driven seven forces analysis reveals that CMMB MTVS has strong market competiveness and viability in China with the support from three forces (i.e., complementors, suppliers, and distribution channels/retailers) and low threat from rivals, new entrants, and substitutes. Although Chinese consumers have great bargaining power, their switching cost is increasing as CMMB MTVS, after initial commercialization, has improved its market competitiveness by upgrading content/services, devices, branding, and interactivity. Superior viewing quality and a low rate (no data charge) are still CMMB MTVS' greatest success factors. Meanwhile, CBC has implemented vertical institutional changes to an efficient, three-level structure. It also establishes an integrated platform to carry out national goals, cross-provincial collaboration, and localized business development.

In Fig. 2, the triangle part delineates the complex interrelationship between CMMB's socio-technical subsystems. The competition between SARFT and MIIT and multiple standards are still ongoing between technology and government/policy subsystems. When examining the relation between technology and market/industry subsystems, the CMMB, the first commercialized mobile TV in China, has first-mover advantages in expanding its market share. In recent years, CBC has made efforts to strengthen the alliances in the value chain and ramp up R&D so as to create innovative content/services and increase the number of CMMB-enabled devices and platforms. These positive interrelationships explain why CMMB MTVS' users tripled in size. Additionally, the interaction between government/policy and market/industry subsystems creates a favorable situation for CMMB MTVS. As part of the national triple play system, CMMB development has been strongly supported by the broadcasting regulator, SARFT, and upstream content creators and providers (e.g., broadcasters and cable networks). Although multiple technological standards bring competition to CMMB, its superior mobile broadcasting technology helped secure an exclusive cooperation with China Mobile. Their alliance propelled CMMB's fast development in devices, user base, and innovation. However, without interviewing key persons in China Mobile, this study is unable to provide insights into their co-petition relations. The seven forces analysis of CMMB's market/industry subsystem would be more in-depth if interviews with suppliers and substitutes could be obtained.

Culture, like air, is invisible, but omnipresent and fundamental for technological adoption and sustainability. It affects how key actors (i.e., policy makers, industry players, users) to perceive, interpret, and make decisions to adopt or develop any emerging technologies. This study finds that technoculture subsystem is the crucial shaping force that affects CMMB MTVS' diffusion at both the national and city levels. It is interesting to note that in Shanghai CMMB MTVS development faces more competition than on a national level. Contexts bring different meanings of technoculture to users in a geographically extensive country like China. As a cultural artifact, CMMB means distinctively different things to urban users in prosperous, technologically savvy cities, and poor digital have-nots in the rural areas. It explains why similar

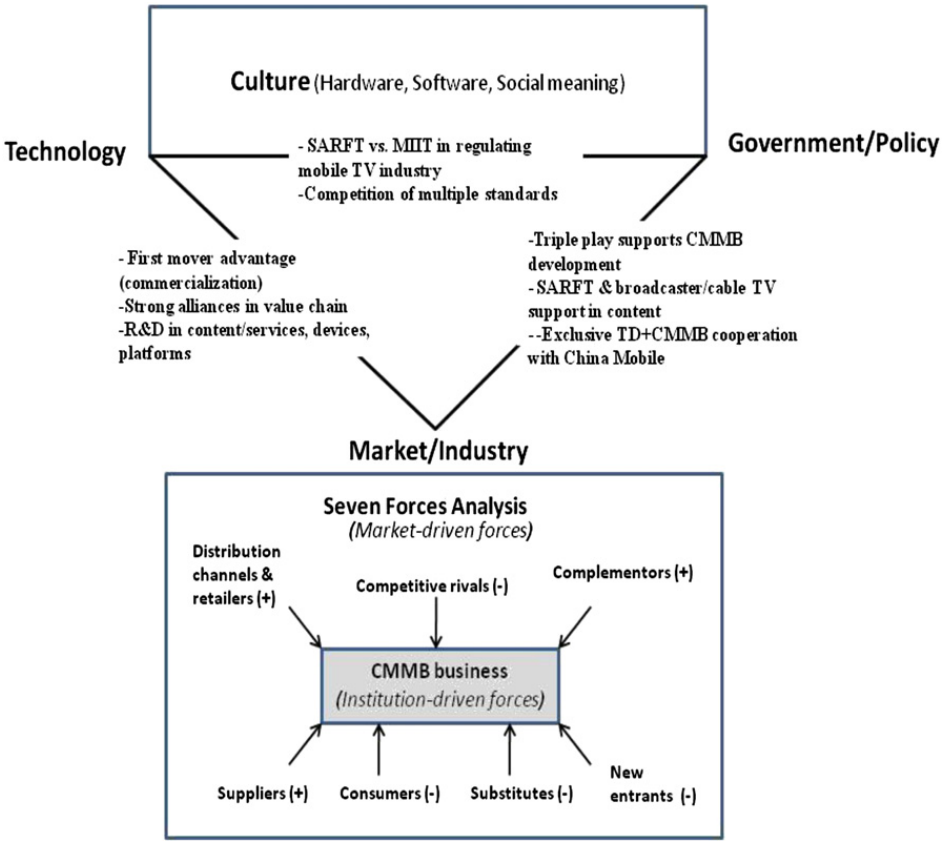


**Fig. 2.** Socio-technical model for analyzing CMMB mobile TV market competitiveness.

technologies have distinct trajectories in various contexts. Moreover, developing attractive mobile video content is related to the understanding of cultures.

Using a socio-technical approach to examine and predict the technological trajectory of emerging technologies is unbiased and organic. The model is not a static equilateral triangle as the shaping power of the technology, government/policy, and market/industry subsystems may change at different developmental stages. For theoretical contributions, this study finds the socio-technical model's open structure can incorporate a pertinent model to further investigate any selected subsystem. The added seven forces model shows its strong analytical power to provide insights of competitiveness in the market/industry subsystems.

As for policy implications, to foster the development of the mobile TV industry, the government should take a pro-innovative and technology-neutral regulatory framework that can encourage and subsidize focal technological innovation and creative content creation. This study shows how SARFT's content control favors CMMB but inhibits 3G TV and TMMB. MIIT also postponed the license for CMMB MTVS to connect to the Internet. After the exclusive cooperation between CBC and China Mobile ends, China's mobile TV market will experience the next wave of co-petition between CBC, 3G TV operators, and substitutes. For fair competition, the regulators should supervise the nascent market with no discrimination and less content control.

CMMB MTVS, the largest mobile TV network in the world, shows a successful example of triple play integration. Its fast-growing developmental path provides meaningful implications for other countries that are still planning to establish mobile multimedia networks. In this case, government support and strategic alliances are the key to develop such a R&D- and finance-intensive industry. Besides, CMMB broadcasting technology is superior in transmitting high quality videos in large countries at little cost. This is why Thailand and Africa held trials in late 2011. Diffusing CMMB technology and services is likely to help less Information Communication Technology advanced areas to catch up with mobile multimedia development in infrastructure, commercial operation, and content/service innovation. As CMMB MTVS offers subscription at a cheaper rate without data charge, it may be adopted by users in some Asian and Africa countries and become a key mobile broadcasting TV standard worldwide.

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