Chapter on Broadcasting

1. Introduction

The Broadcasting Sector consists of Television (including analog and digital cable TV services, Direct-To-Home (DTH) satellite TV services, Internet Protocol Television (IPTV) services, Head-end In The Sky (HITS) and Over-The-Air (OTA) terrestrial TV services) and Radio services. The following table gives timelines of various events in this sector (Sridhar, 2012; Prasad & Sridhar, 2014):

Table 1. Sequence of Events in the Broadcasting Sector

Year	Event
1982	First Indian National Satellite (INSAT) launched
1983	Doordarshan started cable TV service
1991	International satellite TV launched
1992	Cable TV programs launched by Zee and Star
1995	Cable TV Networks Regulation Act announced
1997	Prasar Bharati was formed; All India Radio and Doordarshan were brought under it
2000	First phase FM (Frequency Modulation) broadcasting; licenses given by auction
2001	Direct-To-Home (DTH) guidelines announced by the Government of India
2003	First notification of Conditional Access System (CAS) in Chennai
Jan 2004	Broadcasting regulation brought under Telecom Regulatory Authority of India (TRAI)
July 2005	Phase II of FM broadcasting guidelines announced; auction held
Nov 2009	DoT released Head-end In The Sky (HITS) guidelines
June 2012	Phase I Cable digitization: Digitization and implementation of CAS in metros
12 Mar 2013	Government allows leasing of foreign transponder capacity by Indian DTH providers
31 Mar 2013	Phase II of Cable TV digitization in 38 million plus cities
Aug/Sep 2015	Phase III of FM broadcasting guidelines announced; auction being held
Dec 2015	Phase III of nation-wide cable TV digitization in urban areas
Dec 2016	Phase IV of nation-wide cable TV digitization in all areas
Mar 2015	TRAI issued consultation paper on Over-The-Top (OTT) services

In the following sections, we discuss the market structure, competition, and regulatory issues in each of these sectors in detail.

1.1. Television Broadcasting

Cable Television came in to existence in India in 1983 when Doordarshan (the broadcast arm of the government) started its services on cable networks in the rural villages of Rajasthan. In 1989 few entrepreneurs setup small Cable TV networks and started local video channels showing movies and music videos. The International satellite television was introduced in India during 1991 with the coverage of the Gulf War by CNN. The spread of Cable TV received a boost during 1992 with the launch of Cable TV program networks from Zee Telefilms and STAR group by beaming India specific content.

The DTH guidelines were released in 2001. The Cable TV digitization progressed in parallel with nation-wide completion expected to be completed by end of 2015. Though guidelines were issued for HITS way back in 2007, though it has not grown until now.

1.2. Radio Broadcasting

In India, radio coverage is available in Amplitude Modulation (AM) (both Short Wave and Medium Wave), and Frequency Modulation (FM) modes. In terms of coverage, AM broadcast covers almost 99% of Indian population and 100% of the area, while the FM coverage is about 37% of the territory of India. (TRAI, 2012).

As an initial step towards consolidating efforts in public service broadcasting, the Government of India created "Prasar Bharati", a statutory autonomous body established under the Prasar Bharati Act. The Board of Prasar Bharati came into existence in November 1997. Prasar Bharati is the Public Service broadcaster of the country. The objective of public service broadcasting is to be achieved through All India Radio (for public radio) and Doordarshan (for public television) which earlier were working as independent media units under the Ministry of Information & Broadcasting.

Following Table gives the market sizes of the various media industry segments (KPMG, 2015). As is clear TV continues to contribute about 50 percent of the industry revenue.

Table 2. Revenue of Indian Media and Entertainment Industry

Overall Industry Size (INR Bn)	2008	2009	2010	2011	2012	2013	2014	Growth in 2014 over 2013
TV	241.0	257.0	297.0	329.0	370.1	417.2	474.9	13.8%
Print	172.0	175.2	192.9	208.8	224.1	243.1	263.4	8.3%
Films	104.4	89.3	83.3	92.9	112.4	125.3	126.4	0.9%
Radio	8.4	8.3	10.0	11.5	12.7	14.6	17.2	17.6%
Music	7.4	7.8	8.6	9.0	10.6	9.6	9.8	2.3%
0utdoor	16.1	13.7	16.5	17.8	18.2	19.3	22.0	14.0%
Animation and VFX	17.5	20.1	23.7	31.0	35.3	39.7	44.9	13.1%
Gaming	7.0	8.0	10.0	13.0	15.3	19.2	23.5	22.4%
Digital Advertising	6.0	8.0	10.0	15.4	21.7	30.1	43.5	44.5%
Total	580	587	652	728	821	918	1,026	11.7%

2. Two-Sided Market Theory as applicable to Broadcasting

Two Sided Markets (2SM) and associated Platforms (P) form the basis of operation of broadcast networks. In a typical 2SMP, there are two sets of users who complement each other's usage thereby increasing the network effect for enhanced value for both (Rochet & Tirole, 2003). The theory of 2SMP and associated platforms is not new. It has been in existence since the time Visa and MasterCard were discovered and even prior to that. The platform enables these two heterogeneous sets of users to come together to conduct commercial transactions.

2.1. Cross-side Network Effects

Success of 2SMP depends on the number of users on each side and the usage across them which is often referred to as *cross-side network effect* (Sridhar, 2014). Hence in a 2SMP, the cross-side network effects typically complement the same side network effects – direct or indirect or both. These effects are captured in the case of a typical e-commerce market place as follows. Following figure illustrates a typical 2SMP and its associated characteristics.

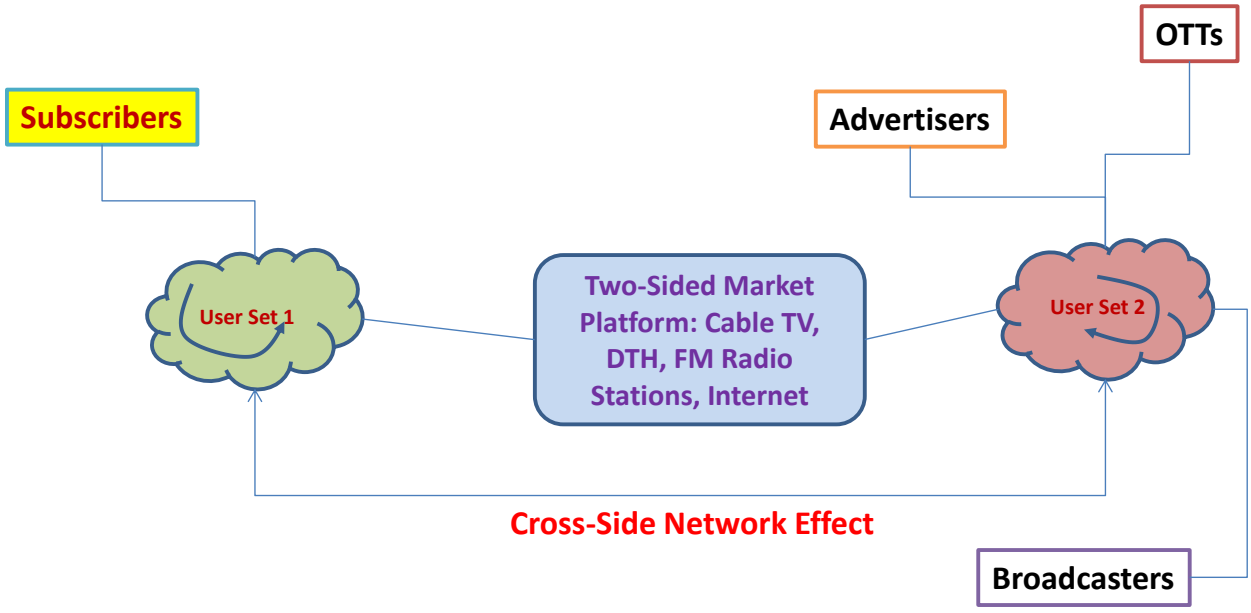

Figure 1. Overview of a Two-Sided Market Platform (2-SMP)

In a typical broadcasting network (both TV and Radio), the platform (i.e. Cable TV, DTH, FM Radio) provides the required glue between broadcasters and listeners/ viewers. The cross-side network effect complements the same side networks in a 2SMP as shown.

2.2. Pricing in 2SMP

Pricing is one of the important strategies in a 2SMP. Typically, one set of users are subsidized while the other set pays premium depending on the price elasticity of the demand. In a two sided market with positive cross-side network effects, the platform provider, even if it is a monopolist, has an incentive to reduce platform profit. This is because in order to compete effectively on one side of the market, a platform needs to compete well on the other side. This creates a downward pressure on the prices offered to both sides compared to the case where no cross-side effects exist (Prasad & Sridhar, 2014).

In TV broadcasting, subscribers belong to the subsidy side while broadcasters are on the money side. Broadcasters in turn embed advertisements in their channels and associated programs to earn revenue. On the other hand, FM Radio broadcasting platforms are much similar to Internet search engines (viz. Google) where listeners do not pay due to the inherent impossibilities of monetization of broadcast content while advertisers on the money side pay to FM broadcaster.

The following able illustrates how advertising revenue contributes to the different sectors (KPMG, 2015). Though Print (i.e. newspapers and magazines) ad revenue is slightly ahead of TV, TV ad revenue is expected to overcome Print ad revenue in the years to come. It is to be noted that digital advertising has grown and will continue to grow in the years to come.

Table 3. Advertising Revenue in India's Media and Entertainment Industry

Ad revenues (in INR billions)	2008	2009	2010	2011	2012	2013	2014
TV	82	88	103	116	124.8	135.9	154.9
Print	108	110.4	126	139.4	149.6	162.6	176.4
Radio	8.4	8.3	10	11.5	12.7	14.6	17.2
DTH	16.1	13.7	16.5	17.8	18.2	19.3	22
Digital Advertising	6	8	10	15.4	21.7	30.1	43.5

2.3. Waterbed Effect

A significant feature of the two sided market is that one group of users, choose to use only one platform, i.e. they 'single-home.' The other group, may 'multi-home.TV broadcasting involves the "last mile" delivery of content either over Cable or DTH and this enjoys the natural monopoly status much like erstwhile fixed line services, Hence the subscribers often single-home. However, availability of Internet video allows multi-homing to some extent. Broadcasters multi-home with many cable TV operators and

DTH providers. Thus platforms have monopoly power over providing access to their single-homing users for the multi-homing side. This leads to the possibility of high prices being charged to the multi-homing side. By contrast, platforms have to compete for single-homing users and their high profits from the multi-homing side are to a large extent passed on to the single-homing side in the form of low prices or even zero prices. This is known as the waterbed effect and has been demonstrated in analytical models like Economides and Tag (2012).

Hence the reason for subscribers on the subsidy side of the 2SMP in broadcasting. However, in FM Radio, both listeners as well as advertisers multi-home with different FM stations, though only advertisers are priced by the platform provider.

2.4. Competition

The prospect of increasing returns to scale in network industries especially in 2SMP, can lead to winner-take-all battles, and hence, if not monopoly, but a relatively less number of platform providers. This is the case with cable TV much like in fixed telephone services. Normally it is found that only one or two cable operators provide service in a mutually agreed service region. In DTH and FM Radio, there is an added constraint of spectrum that limits the number of operators. Hence in both Television and Radio, there is an inherent oligopoly market in existence. Hence there is a need for regulatory oversight in to cartels and collusions. If Broadcasters have a stake in the platform (viz. DTH), then regulatory oversight is needed on bundling of channels and predatory pricing of bundles channels to prevent abuses of vertical integration.

3. Cable Television

In India, with 168 million TV households is the world's second largest Television market after China with a TV penetration of 61 percent. Out of this 40 million households have DTH, while the rest are Cable TV subscribers. Though initiated by the government in June 2012 for mandatory digitization of Cable TV, there are about 70 million analog subscribers in the country with the rest of 50 million connected to digital cable TV (KPMG, 2015).

3.1. Market Structure

In India, Cable TV has adopted a franchisee model with Local Cable Operator (LCO) being the main contact for subscribers. The LCO lays down the last mile connection, thus connecting each household to

the Cable TV network. The LCOs receive the programmes broadcast through the Geo Stationary Satellites by installing dish antennas at the cable head-end. With increasing number of broadcasters, number of such antennas also increased and most of the LCOs were not able to install the required number of antennas to provide comprehensive content to subscribers. Hence a set of aggregators referred to as Multi Service Operators (MSOs) emerged. The MSOs aggregate the content obtained from the broadcasters and sometimes multiplex the local video channels including movie and songs, and then feed the signal to the LCOs. MSOs are often owned by relatively large business houses which had interest in broadcasting business. Examples include Sun Cable, and Hinduja's InCable. The distribution chain of cable TV industry is shown in the following Figure.

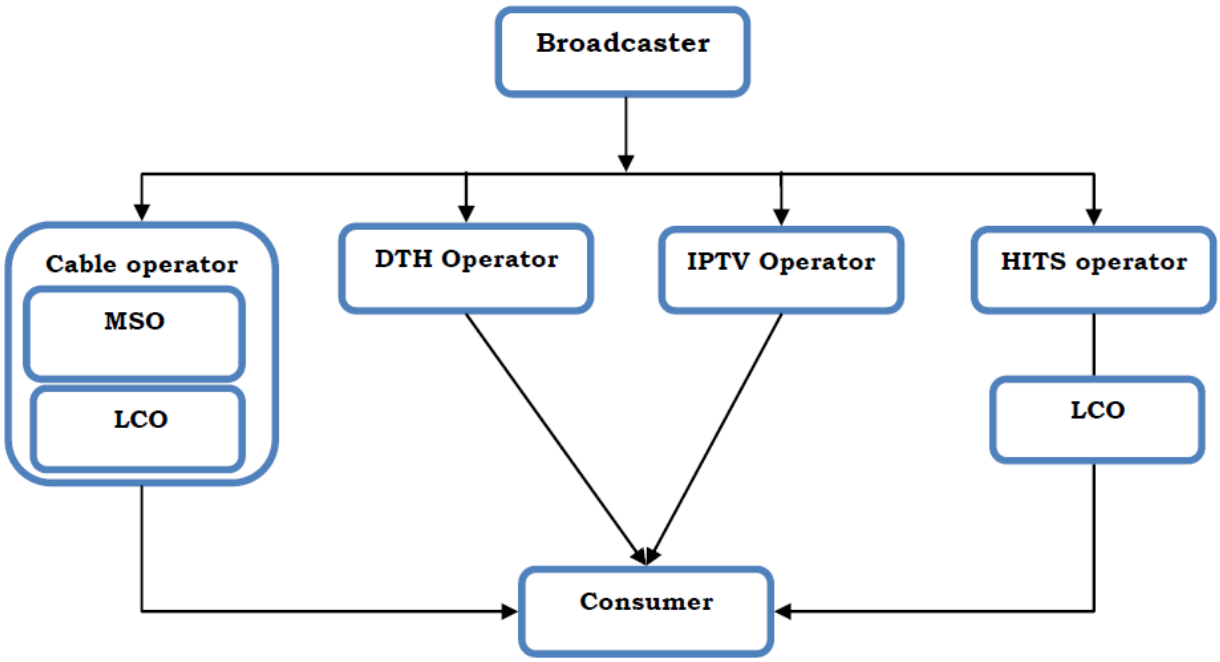

Figure 2. Distribution chain of TV broadcasting (TRAI, 2014)

The number of Cable TV subscribers is more than number of landline subscribers in the country, indicating a phenomenal growth, thanks mainly due to lesser regulation and the franchise model of the LCOs. As per the Ministry of Information & Broadcasting, there are 30,000 registered cable and satellite operators in the country, broadcasting over 339 cable and satellite TV channels in national and regional languages (Sridhar, 2012). Taking in to account the number of unregistered Cable TV operators, an LCO in India connects about 1,200 subscribers.

The Cable TV market has been traditionally considered as a "natural monopoly" market much the same way as the fixed wire line telephony market. Since the coaxial cable laid by the LCO provides the last mile access to the subscriber, the characteristics of the network in terms of sunk cost, and substitutability are much alike the wire line network. Though there are no restrictions on the cable TV licenses in any geographical area, there is only one LCO in operation in most geographical regions of the country.

The LCO installs and maintains the local cable network and gives connectivity to subscriber homes. Since the average number of households connected to the Cable TV network is much larger in India, compared to rest of the world, there are often devices such as "one-way amplifiers" installed, especially in the later legs of the Cable TV to boost the signal strengths to the desired levels.

The distribution chain as discussed in Figure 1 has inherent weaknesses. Since the broadcasters and MSOs do not come in to direct contact with the subscribers, there is information asymmetry between them and the LCOs who is direct contact with the subscribers. This information asymmetry was exploited to certain extent and the LCO could potentially hide the exact number of households connected, thus saving the revenue to be shared with the broadcasters and MSOs. The MSOs in turn might disconnect signals to the LCO without any prior notice and seek undue enhanced commitment for subscriber base and higher payments. Moreover, LCOs are required to pay entrainment tax and service tax which are linked to the number of subscribers. Without the implementation of proper billing systems, LCOs may evade taxes by under declaring their subscriber base (TRAI, 2008).

Realizing these problems, Conditional Access System (CAS) was proposed to be implemented in 2003. The CAS introduced addressability in the Cable TV network along with providing signals in digital format. The CAS ensures that only duly authorized subscribers are able to view a particular programming package. A CAS system consists of an integrated receiver decoder also called as the Set Top Box (STB) at subscriber premise. This is an electronic device which contains the necessary hardware, software, and interfaces to select, receive, unscramble and video programmes. Since signals are scrambled in CAS, only the viewers with a valid signed contract with CAS service providers are authorized to unscramble and view the chosen programmes. Moreover, when the viewer chooses a pay channel or a programme, the information related to subscriber details, method of payment, and services purchased is stored and updated in the database. Apart from selecting pay channels, a CAS may be used for provisioning of other services such as Video on Demand.

In India, the LCOs are unorganized with little financial strength to implement CAS and the associated digitization. Hence the MSOs changed their role from B2B service provider to B2C, implementing CAS in

the notified areas. The STB, the associated authorization and billing for channels shifted from LCO to MSO, thus creating transparency down the distribution chain. However, the problem of revenue sharing between LCO to other entities shifted to revenue share from the MSOs. Hence there is inherent conflict between LCOs and MSOs. The ownership of subscribers shifted from the hands of LCO to MSOs.

The Ministry of Information & Broadcasting (MIB) extended CAS to cover the whole country in phases as given below. Though digital CAS was largely complete in Phase I and II cities, roll-outs in phase III and IV in smaller towns proved to be challenging due to the following:

i. The conflict between the relatively more powerful LCOs in these regions and MSOs;
ii. The expected low Average Revenue Per User (ARPU) due to lower disposable income levels; the lower ARPU levels not only reduce profits of the MSOs but also results in MSOs not able to subsidize STBs. This results in cyclical effect reducing adoption of CAS.

The subscriber base of TV broadcasting industry is given below (KPMG, 2015).

Table 4. Subscriber base of Television Broadcasting Industry

	2010	2011	2012	2013	2014
Analog Cable	65	74	69	68	70
Digital Cable	5	6	19	25	29
DTH	28	31	34	37	40
Other digital	8	8	9	9	10

3.2. Pricing

Pricing in Cable TV platforms consists of two parts: (i) User subscription fee and (ii) content carriage fee. It is to be noted that typically subscribers single-home while broadcasters who provide content multi-home. Hence as per the water bed effect, the platform providers should consider broadcasters as the money side and subsidize the subscribers. While the conversion from analog to digital saw an increase in subscriber Average Revenue Per User (ARPU) by about 50-60 percent, it will continue to be very low in the range of Rs. 120-160 in Phase III and Phase IV areas. However this subscription revenue needs to be passed on by MSO to LCO and broadcasters. While the LCOs continue to be last mile haul for the MSOs operationally, the revenue collection shift from LCO to MCO puts them at loggerhead in terms of revenue sharing. On the other hand, the content carriage revenue is less controversial and is expected to increase by 10-15 percent in the years to come to more channels being carried.

As is well known, the broadcasters' major share of revenue comes from advertisements and not from subscription. The broadcaster industry size currently at Rs. 230 Billion is expected to grow up to Rs. 500 Billion by 2019 as per KPMG (2015). The break-up of advertisement and subscription revenue for the industry from all Distribution Platform Providers (viz. Cable TV and DTH) is given below (KPMG, 2015). As digitalization continues in to phase III and IV areas, the subscription revenue is expected to continue to slide and need to be compensated by the advertisement revenue.

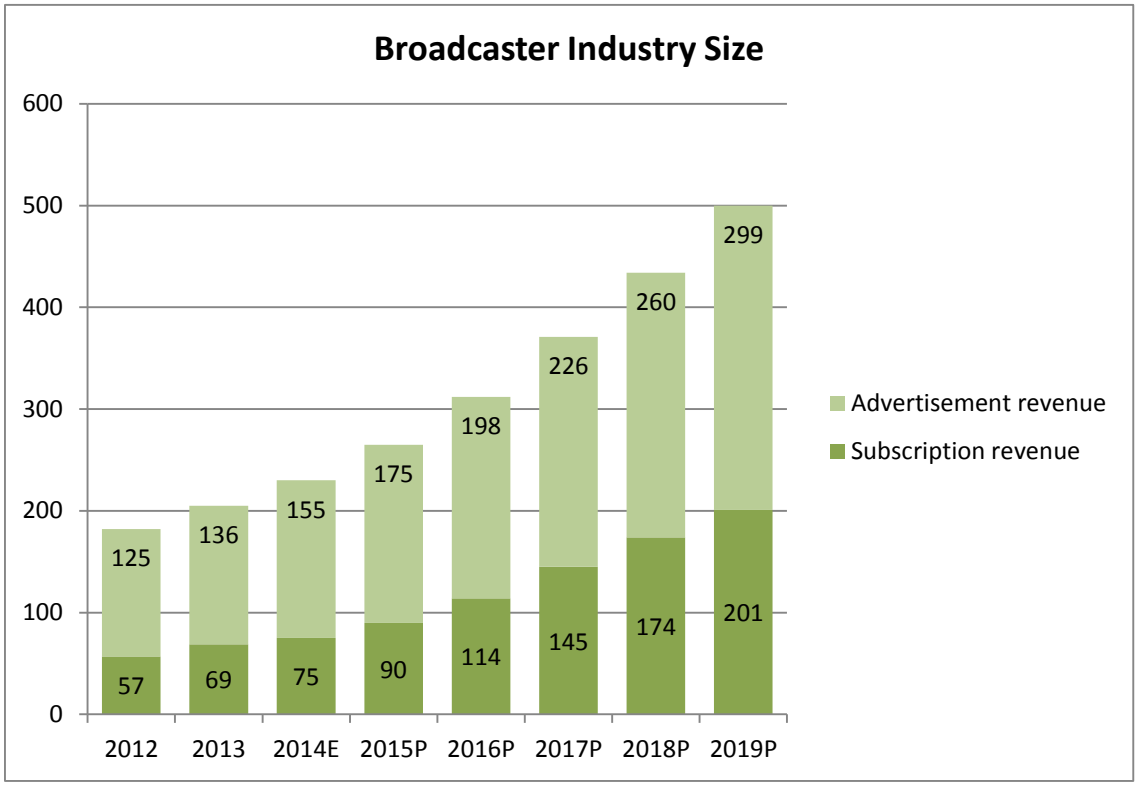

Figure 3. Revenue split of the TV broadcasting industry

3.3. Bundling

In both Cable TV and DTH, the "channel aggregators" aggregate content from one or more broadcasters and feed to the Distribution Platform Operators (DPOs, viz. Cable TV / DTH operators). Since the channel aggregators are mostly joint ventures between large broadcasters, they combine their might and bundle channels from select broadcasters to sell as packages to distribution platform owners. Since these channel aggregators can multi-home, they are at the bargaining end on bundling and fees against the MSOs and DTH operators. To avoid possible monopolies and their resultant abuse, TRAI notified

changes to the regulatory framework restricting the power of channel aggregators. As per the notification, only broadcasters can now enter into contracts and interconnection agreements with DPOs. Further, "in case a broadcaster, in discharge of its regulatory obligations, is using the services of an agent, such authorized agent can only act in the name of and on behalf of the broadcaster." The notification added that the "broadcaster shall ensure that its authorized agent, while providing channels/bouquets to the DPOs, does not alter the bouquets as offered in the RIO (reference interconnect offers, or contracts) of the broadcaster." This basically reduces the role of channel aggregators and disable them from bundling channels from multiple broadcasters. Bundling is one of the characteristics of an oligopoly market such as broadcasting and channel aggregation. Hence the notification is trying to prevent possible monopolization. This is a good news form DPOs as they can now bargain more carriage fee as per the interconnect order and use it subsidize subscribers.

However, this has an unexpected effect on smaller broadcasters who tie-in their channels with that of merger broadcasters through channel aggregators. In the absence of bundling, smaller broadcasters will have difficulty in getting DPOs to carry their channels. They will also likely to be hurt by possible increase in carriage fees for their channels.

4. Direct-To-Home Satellite Television

Direct to Home (DTH) Television services refer to direct transmission of TV programs from satellites to consumer-installed dish antennas. The DTH services commonly use very high frequencies in the Ku band (viz. 12-14 GHz) for transmission. Signals in this high frequency band are very focused and hence requires smaller dishes of about 18-24 inches, that can be easily deployed on roof tops. Transmitting in the Ku band and receiving programs directly by users using dish antennas were prohibited in India until 2000. DTH is a substitute for Cable TV as it bypasses the local cable network to deliver TV programmes directly to subscribers.

The Government of India announced the guidelines for DTH in 2001.

4.1. Market Structure

The initial adoption rate both by the service providers and subscribers was very low, with only a couple of DTH operators providing service. It was only with the entry of new DTH operators in 2006 that subscriber growth started happening. The current 40 million DTH subscribers distributed amongst the government owned Doordarshan Prasar Bharati, and 6 private operators, is expected to more than double and reach 76 million by 2019 (KPMG, 2015). Most of the DTH operators are using the new MPEG4 standard. DVD quality picture and crystal clear sound quality make DTH services an option preferred to

cable TV. Due to increased adoption, cost of digital Set-Top-Box (STB) and roof top antenna's for DTH services have appreciably come down. The operators normally bundle the STB and antenna with their services and hence provide them at a subsidized upfront fee.

4.2. Spectrum and Transponder Capacity

As in mobile cellular service, adequacy and availability of Ku band spectrum is very much essential for the growth of DTH market. One of the major hurdles that the DTH service providers face is the inadequacy of Ku band transponder space in the INSAT satellites. The following table illustrates the major INSAT satellites that carry Ku band transponders for DTH services.

Table 5. INSAT Satellites for DTH Services

INSAT Satellite	Transponders	Year of Launch
3A	18-C; 6-Ku	2003
4A	12-C; 12-Ku	Dec 2005
4B	12-C; 12-Ku	Mar 2007
4CR	12-Ku	Sep 2007
4G (GSAT 8)	18 –Ku	May 2011
GSAT 10	18-C; 12 Ku	Sep 2012
GSAT 11	32 Ka × Ku; 6 Ku × Ka	2016

INSAT 4A satellites that host many of the DTH channels are nearing the end of their lives and hence the corresponding channels need to be shifted to other satellite transponders. A shortage of Ku-band transponder capacity is looming large on the horizon for DTH service providers. With an increasing number of TV channels and many standard definition channels getting converted into high definition ones, DTH players have to juggle with capacity allocations for their regional and national channels to retain their subscriber base.

As of now, there are over 800 satellite channels registered with the Government of India. At present, DTH players have anywhere between 12 and 15 transponders each. While the best of compression technology can squeeze in 25 channels to a transponder, service providers who use MPEG 2 (compression format) can get far less. Hence, DTH operators have a capacity to transmit hardly 350 channels. This prevents DTH players from carrying many regional channels, although these channels are important for their subscriber base, particularly in rural markets.

As of now, DTH players need at least an additional 10 transponders each to accommodate the demand for new channels. The DoT policy document states that while operations from Indian soil may be allowed to use both Indian and foreign satellites, proposals envisaging use of Indian satellites will be accorded preferential treatment (Sridhar, 2012).

The need for satellite space will only increase in the future as the number of TV channels is expected to double in 3 to 4 years. It is estimated that the DTH industry will need more than 220 transponders in 2017 to address the growth of DTH subscribers, the proliferation of television channels and the provisioning of High Density (HD) content. Under the government's Satellite Communication (SATCOM) policy, the DTH operators are not permitted to directly buy or lease foreign transponders. These can only be procured by the Indian Space Research Organization (ISRO) on demand projection and sublet to India-based users. Over 75 per cent of the 820-odd private channels are beaming into Indian homes through leases on foreign satellites. While ISRO tightly regulates this lease, it provides only 25 per cent of industry requirements on its own INSAT/GSAT communication satellites. It is also expected that more of INSAT and GSAT satellites with Ku band transponders will be put in to orbit to meet the growing demand. The 12th Plan working group on Space noted that the space agency needs to "pursue rigorously to secure spectrum" for another 100 Ku-band and 50 C-band / extended C-band transponders. ISRO reckons that its 2017 tally should touch 400 transponders, including 102 in the C and 158 in Ku bands. But that would still fall below the last Plan target of 500 transponders, as well as the broadcasters' projected needs.

4.3. Channel provisioning

It is to be noted that both CAS and DTH are addressable systems and the users pay for channels they subscribe. However, it is to be noted that in CAS notified areas, the LCO has to offer "basic service" that consists of about 30 Free-to-Air channels and the subscribers should be able to access these basic service offerings without the need for set-top boxes. However, in case of DTH, all programmes are viewable only by authorized subscribers through the set-top box. Even the free-to-air programmes of the national broadcaster Doordarshan can be viewed by DTH subscribers only through set-top box. While it is mandatory for CAS operators to provide channels to subscribers on a-la-carte basis, it is not so in case of DTH services (TRAI, May 2009).

DTH guidelines stipulate that: "the Licensee shall provide access to various content providers/ channels on a non-discriminatory basis." The non-discriminatory clause does not include "must carry" conditions. Over the last few years, the number of channels broadcast has increased tremendously. Apart from

ground based channels, there are more than 270 satellite channels registered under uplinking/ downlinking guidelines of the Ministry of Information & Broadcasting and close to hundred channels are awaiting permission. Since the transponder space for carrying channels is limited, it is not possible to include "must carry" clause on the DTH operators to include all available channels in their offerings. Hence it is clarified in TRAI's recommendations included "non-discriminatory" conditions that refer to transparent, predictable, fair, equal and unbiased treatment (TRAI, Jan 30, 2008). This essentially means that the DTH operator should select the channels for carriage on its platform in a fair and equitable manner, which would enable various content providers to constructively negotiate. The factors that would have a bearing are price and the broad terms offered by the broadcasters. Any decision based on the above mentioned considerations are further subject to the technical limitation on the number of channels that a DTH platform can carry. Wherever the broadcasters and DTH providers are vertically integrated, then regulatory intervention is required to prevent "tying" of channels. TRAI in its recommendations on new DTH license has clarified that it shall not reserve more than 15% of this capacity for its vertically integrated broadcaster(s). The rest of the capacity is to be offered to the other broadcasters on a non-discriminatory basis (TRAI, June 2015).

4.4. Interoperability

DTH license agreement stipulates that: "The Open Architecture (non-proprietary) Set Top Box, which will ensure technical compatibility and effective interoperability among different DTH service providers, shall have such specifications as laid down by the Government from time to time." The requirement of technical interoperability essentially protects the interest of the subscribers by enabling them to shift from one DTH service provider to another without having to buy new hardware. The regulation also requires the DTH service providers to give an option to their subscribers for obtaining the DTH hardware on hire purchase or rent basis. Thus the DTH subscribers have an option to change their service provider through commercial interoperability as provided by the quality of service regulation.

However, provisioning of interoperable set-top boxes has not been successful in India. The main reason for this is unavailability of Conditional Access Modules (CAM) of different DTH service providers. The BIS specifications for DTH set top boxes require each set top box to have a Common Interface (CI) slot for the purposes of technical interoperability. Technical interoperability is achieved by plugging in the CAM of new DTH operator in the CI slot of set top box provided by the existing DTH operator. For example, a subscriber of DTH operator 'A' who wishes to switch over to DTH operator 'B' has to procure a CAM from 'B' and plug the CAM into the CI slot of the set top box supplied by 'A'. This enables the subscriber to start receiving the services of 'B' using the existing set top box and dish antenna (although the dish

antenna has to be re-aligned towards the satellite being used by 'B'). The CAMs presently cost almost as much as a new set top box. Therefore, technical interoperability has not been very successful. However, the new entrants are expected to make available the CAM and with the increasing DTH subscriber base, the demand for CAM is expected to increase resulting in a price decline. These two factors should promote interoperability of STB amongst DTH operators. It is also ideal that the STBs be interoperable not only amongst DTH operators but also across CAS and IPTV providers.

The other issue is regarding MPEG 2 and MPEG 4 digital compression formats used by the DTH operators. The newer MPEG 4 format delivers DCD-quality video at lower data rates and smaller file sizes. While the older operators still use MPEG-2 format, the new entrants have migrated their transmission to MPEG-4 format, thus using superior compression technology to save as much as 25% of transponder bandwidth. This change in formats implies that the subscribers who currently subscribe to MPEG-2 cannot migrate to DTH operators who use MPEG-4 though the converse is possible. The solution to this problem as outlined in TRAI (Jan 30, 2008) is that the DTH operators should migrate within the stipulated time of notification of the adoption of any new standard by the Bureau of Indian Standards (BIS). Hence the existing MPEG-2 STBs shall be changed to MPEG-4 by the DTH operators within the time frame. However, they can continue to broadcast their content in MPEG-2 until such time they shift over to the new standard.

The non-interoperability of STBs can act as "subscriber lock-in" and prevent subscribers from switching and multi-homing. Hence the need for DPO to subsidizing the single homing side of subscribers using the multi homing money side of broadcasters as per water bed effects.

4.5. Regulatory and policy Issues

The future of satellite communication, especially for DTH operators, is to provide television channels bundled with broadband using high frequency spot beams in the Ka band (18-27 GHz). Ka band based Satellite Broadband is being provided at Gigabits/ sec speed in the Americas, Europe and Russia (Hughes, 2015). In India, this frequency has not yet been allocated and not even mentioned in NFAP 2011 with regard to DTH services. It is time that the satellite communication policy is revised to open up this band, which is extremely useful for the provisioning of HD TV as well as broadband connectivity, especially in remote parts of the country.

5. Radio Broadcasting

In emerging economies such as India, radio is still the most popular and affordable means for mass communication, entertainment, and education. The terminal devices are affordable and portable. Even low end mobile phones have FM tuners. Though the radio dipped in popularity after the diffusion of television, it has regained much lost ground due to the government's initiatives in allowing private parties to enter this segment.

In India, radio coverage is available in Amplitude Modulation (AM) (both Short Wave and Medium Wave), and Frequency Modulation (FM) modes. In terms of coverage, AM broadcast covers almost 99% of Indian population and 100% of the area, and FM covers about 40% of the population and 25% of the geographical area of the country (TRAI, 2008).

As an initial step towards consolidating efforts in public service broadcasting, the Government of India created "Prasar Bharati", a statutory autonomous body established under the Prasar Bharati Act. The Board of Prasar Bharati came into existence in November 1997. Prasar Bharati is the Public Service broadcaster of the country. The objective of public service broadcasting is to be achieved through All India Radio (for public radio) and Doordarshan (for public television) which earlier were working as independent media units under the Ministry of Information & Broadcasting.

It is to be noted that in case of FM radio, the geographical jurisdiction of operators is relatively small such as cities. One reason for city based licensing and allocation of spectrum is the localized nature of radio content. Another important factor is that radio stations, much like Television broadcasting is a two-sided market platform. On one side are listeners who don't pay due to the broadcast nature. The content is owned and managed by the platform provider unlike DFTH and Cable TV operators. However, the advertisers on the other side of the platform consist of the money side. Advertisement is the only monetization model for radio services. Both listeners and advertisers can multi home on various radio stations in a chosen geography. Hence the water bed effect is not present due to less stickiness of both sides of users.

5.1. Market structure

The policy objective of the Government for Radio in the 9th Five year plan was to improve the variety of content and technical quality of radio. On the technology front the focus shifted from amplitude modulated (AM) transmissions to frequency modulated (FM) transmission as the latter has a much better

performance in the presence of noise. In line with the policy of liberalization and reforms followed by the Government since 1991, the Government during the 9th Five year plan allowed Indian companies to setup private FM Radio stations. Until then government entity All India Radio was the sole radio broadcaster in the country. In May 2000, the Government started the first phase and identified 108 frequencies in the FM spectrum (87-108 MHz) for auction across 40 cities of the country.

In Feb 2004, TRAI was asked by the Ministry of Information and Broadcasting to give guidelines for phase II of private FM radio licensing. In Aug 2004, TRAI submitted its recommendations. Based on these recommendations and the Radio Policy Committee report, the phase II policy was announced in July 2005, placing for bid 337 channels encompassing 91 cities. After scrutiny, 245 channels spanning 87 cities were given licenses for FM broadcasting. The licenses were valid for 10 years.

The grounds for further expansion of private FM radio broadcasting by bringing in the Phase-III Policy was to meet the huge unmet demand that exists for FM radio in many cities which still remain uncovered by private FM radio broadcasting. Only state capitals and a limited number of cities with a population of three lakh and above were taken up for bidding during the first two phases of FM radio broadcasting. Border areas, particularly in J&K, North East States and Island territories, are largely missing from the FM map. Even those places that were put up for auction could not find takers due to poor viability.

In the first stage of Phase III auction that was held in September 2015, about 91 FM channels were picked up in 51 cities, including 2 in Jammu. Only one additional channel were made available in Delhi and Bangalore and were picked up at high prices. With additional channels, these cities are expected to face more competition.

5.2. FM Radio Spectrum Allocation

Radio and television broadcasting and mobile services have one thing common –the use of spectrum for transfer of information. However, there are significant differences in the manner in which they use spectrum for information transfer. Radio and TV are traditionally one-way broadcasts with one transmitter transmitting over a large area – often the entire city; while mobile services are two-way communications with transceivers in each micro cell site as explained earlier. The management of interference in radio and TV transmissions is less complex because of its one-way broadcast nature, as opposed to mobile services where two way transmission between handsets and base stations often involves tricky interference management. Cell reuse is non-existent in terrestrial radio and TV

broadcasting as they operate at lower frequencies which have better propagation characteristics to cover entire cities with just one transmitter. However, both these services require allocation of spectrum and its effective management. In relation to the pricing of spectrum for broadcasting and mobile services, it is relevant that the use of community radio and TV has often been thought of as a public good and hence subjected to lower taxation compared to commercial mobile services which are even treated as a 'premium' service in some developing countries.

Spectrum for FM Radio in India always used a market based auction mechanism. The robust Simultaneous Ascending Auction (SAA) method that is used for spectrum auctioning for mobile services is being used for FM Radio since Phase II. The service area was restricted to cities defined in the following categories.

Table 6. Categorization of Cities for FM Broadcasting Service Source: TRAI, 2008

Category of Cities	Population criteria for classification of Cities
A+	Metros
A	Population > 20 lakhs
B	Population > 10 lakhs and up to 20 lakhs
C	Population > 3 lakhs and up to 10 lakhs
D	Population > 1 lakhs and up to 3 lakhs

The spectrum auction for Phase III First batch was initiated in August 2015. As the curtain fell over the spectrum auction for FM Radio Phase III, Stage I, after 33 days of intense bidding, Government raked in about Rs 1,157 Crore against the aggregate reserve price of about Rs 460 Crore as the Non-refundable One Time Entry Fee (NOTEF). About 91 channels were picked up in 51 cities in the first batch of Phase III FM Radio auction. This will likely result in coverage of most cities with a population of one lakh and above with private FM radio channels.

5.3. Regulatory and Policy Issues

As in mobile services, higher spectrum price in Phase II was cited as one of the reasons for loss of profitability of FM Radio stations, especially in regions in category 3 and 4. Hence the objective of Phase III FM Radio augmentation is to increase coverage in smaller towns and rural areas of the country. There is also a need for promoting private FM radio in border areas to draw people to listen to Indian radio channels and to check cross border propaganda. Similar initiatives are required for island territories. Even in the phase III auction, only two channels were awarded in Jammu.

The high prices paid by the bidders in the first stage of Phase III auction, will force them to be operational first only in large cities to earn much needed ad revenue. The annual license fee is set to be 4 percent of the revenue in all areas except some selected North Eastern states, which will pose additional burden to the FM operators. Given the public good nature of FM Radio, but provided by private firms, the government shall look in to revising the annual fee to 1 percent (as applicable in case of 4G mobile spectrum) just to cover administrative cost and not actually milking the FM operators (Sridhar, Sep 2015).

6. Head-end in the Sky (HITS)

Head-end In The Sky (HITS) is one of the delivery platforms to distribute the digital TV content through a head-end in the Geo Stationary Satellites directly to LCO. The TRAI, after the consultation process allowed the third hybrid model whereby the HITS operator can work both as a conventional MSO (except that the head-end is in the sky) as well as passive infrastructure provider to other MSOs/ cable operators who wish to use the facility for uplinking/ downlinking their own aggregated content.

While the HITS is similar to DTH in the delivery of channels through the satellite, it is meant to supplement the cable TV network and not act as a substitute as in the case of DTH. It is clearly stated in the recommendations and later in DoT guidelines that the HITS operator should provide signals directly from the satellite only to the registered MSOs/ cable operators (Sridhar, 2012). However, the operator will not be barred from providing signals, through their own cable network, if any, to consumers also after first downlinking the signals to the terrestrial station. The HITS operator under no circumstances should provide signals directly from his satellite to the consumer much like DTH providers. The function of HITS is very similar to MSOs except that the head-end is terrestrial in case of MSOs while it is in the sky in HITS. Both carry and distribute broadcast television signals by first uplinking from an earth station to a satellite in the sky for downlinking later. One of the important advantages of HITS model is that the encrypted signals can be delivered through the HITS platform over C or extended C-bands as the LCO can receive them using a larger antenna. This also avoids rain fading and poor quality signals during monsoon which is typically experienced with high frequency signals used in DTH.

There is no "must carry" provision for the HITS operator, except for the carriage of some channels of national importance of the public service provider Doordarshan as in the case of DTH operations. However, broadcasters "must provide" their channels for any distribution platform such as DTH, HITS

or cable network. TRAI in its recommendations (TRAI, July 2008) noted that in the absence of such a provision, it would be difficult for the distribution platform to source content, and as a result, that platform operator will not take off in the absence of such popular content.

6.1. Regulatory and Policy Issues

Though allowed long time back, the HITS never became a serious option. However, it is noted in KPMG (2015) that HITS could play a major role in the last phase of digitization across Phase III and IV areas. In these regions, LCOs are often very small and do not have finances to set up their own head-ends for multiplexing channels which is solved by HITS. The encryption, notifications and billing are taken care of by the HITS operator and hence the LCOs can concentrate only on customer acquisition and services. Unlike DTH, HITS allows LCOs to introduce local language channels to suit their customer needs and provides more monetization opportunities, both from subscription as well as advertisement. Hence HITS need to be promoted as a viable option for covering Phase III and IV areas in the cable digitization roadmap.

7. Over-The-Top Broadcasting

Entertainment is a big part of daily lives of many people in India, especially in suburban and rural areas. FM Radio, cable TV, and DTH provide services in this domain. Due to convergence, it is possible for all operators to provide advanced communication services including Internet access.

The traditional broadcasting industry value chain is very long. On one hand, we have cable TV broadcasting systems that have Broadcasters -> Multi System Operators (MSOs) -> Local Cable Operators -> Subscribers. On the other hand, there is Broadcasters -> DTH providers -> Subscribers. There is also one more model that was attempted by the telcos: Broadcasters -> Internet Protocol Television (IP TV) providers -> Consumers. However, the technology of IP TV was so complex and available on only select devices such as PCs, Laptops or Smart TVs connected to the Internet based on subscription that it failed miserably, especially in India. As is true with any closed walled-garden system, the intermediaries - the MSOs, DTH providers and IP TV providers, in the above cases control the subscriptions and hence the revenue share of the broadcasters (Kishore & Sridhar, April 2014).

With the availability of pluggable devices such as *Google's Chromecast* there is a disruptive opportunity for the broadcasters to embrace online OTT service. By providing broadcast content as free OTT service

much like messaging applications, and enabling easy viewing on large dumb TV through a Cast application, subscribers can look forward to days when they *don't have to subscribe* for any TV broadcasting service! There are already signs of this phenomenon. The UK based broadcaster *Mediaset* garnered about 100,000 subscribers within the first week of launching its OTT service in Italy. In India, there are online streaming services such as *BoxTV* and *NexGTV* that have been started offering shows, movies and TV programmes. These firms are expected to build apps for Google's Chromecast that enable much easy viewing of the content on Television sets. Since advertising contributes to bulk of the broadcasting services revenue, the OTT service can be made absolutely free, with broadcasters and OTT providers cross-subsidizing through innovative advertisement based monetization models.

7.1. Market Structure

As per Tracxn, the firm that tracks start-ups, the entertainment distribution industry is about $735 million wherein OTTs have started evolving (Tracxn, 2015). Start-ups such as Apalya, Dhingana, Lukup Media, TVFPlay, MultimediaBus, and ErosNow have not only attracted venture capital funding; but have been expanding in providing services.

Following Table indicates the new age start-ups in India in the Entertainment OTT space and their service offerings:

Table 7. Select list of Indian start-ups in providing Entertainment OTT Services (Tracxn, 2015).

Name	Services Provided
Apalya Technologies	Mobile video distribution platform
TVFPlay .	Digital OTT content distribution platform
Eros Now	OTT content distribution platform operated by Eros International Media
FilmiFilmy	Digital platform that aggregates video songs from YouTube and distributes over-the-top (OTT) to the end consumers
ZingReel	Online movie streaming platform
Zenga Media	Platform for live streaming of TV channels and also OTT distribution of entertainment content
Hotstar	Digital entertainment content streaming platform by Star India
Ditto TV	Launched by ZEE New Media, delivers live TV channels and video-on-demand content as OTT service

As can be seen, some of the OTT firms are owned or funded by the broadcasters such as Zee or Star so that they can reach the end users without intermediation by the cable or satellite networks. These developments are in tune with happenings elsewhere as well.

7.2. Internet Radio

Typically the FM radio stations participate in government held auctions for spectrum for radio waves and pay huge sums to get the required quantity of spectrum for providing radio services. Since FM is city/town specific, the radio stations have to get frequencies in each city/ town they want to operate. However Internet radio stations such as TuneIn Radio, onlineradios.in and gaana.com, offer streaming of a wide array of radio stations worldwide to subscribers as OTT services. They also provide flexibility to listen to the channels of choice without any geographical constraints such as region specific language channels. Though advertisement models in Internet Radios is still evolving, it is a low cost service to roll out compared to the complex spectrum/ antenna set up required for running FM radio stations. There are platform providers such as TuneIn that manage subscriptions and advertisements while individual radio stations can be set up easily using widely available streaming servers such as VirtualDJ and plugged in to the platforms. Realizing this trend, radio firms such as Radio Mirchi have started offering their program over Internet radio as well.

What is unique about Internet radio is that while it offers access to stations available globally, it can also cater to specific requirements of local communities including organizations. Even firms can set up their own Internet radio stations and nurture Tech and Entertainment DJs! This is almost akin to the amateur radio, also called as Ham radio, that became so popular in US and other countries in early 20th century, thanks to local enthusiasts. While the amateurs had to grapple with interference and license restrictions on spectrum use, Internet radio surmounts all these with ease. Internet radio is amateur radio reborn (Sridhar & Kishore, May 2014)

7.3. Net Neutrality and Internet Broadcasting

The rivalry and associated debate on Telcos versus Over-The-Top (OTT) firms has been simmering in different parts of the world for quite some time now. The Telcos who controlled the "last mile access" and were powerful until the beginning of this decade have been relegated to the background by the hyper ambitious, innovative, exponentially growing, less regulated OTT firms, thanks to the "hour glass" Internet. With applications and content being provided over the ubiquitous Internet Protocol (IP), the role of the Telcos has been tuned down to mere bandwidth provisioning and hence the turf war. Presently, the Telcos face threat from OTTs (Sridhar & Srikanth, July 2015).

In its simplest form, **Net neutrality** means that a Service Provider (SP) (viz. telco or ISP), has to treat **all** data bits in the same manner irrespective of their source, destination and the application that generated it. There are three parties on the Net: SPs, content providers/ OTTs and users. The SPs connect the OTTs to users. Hence they can potentially charge either the OTTs or the users for content transported through

their network/ platform. Since most of the users single-home (though multi-SIM handsets allow users to multi-home), they are in the subsidy side and the multi-homing content providers/ OTTs are on the money side.

The OTTs , can potentially charge their subscribers or subsidize them through advertisement revenues.

The Internet broadcasting services provided by the OTTs are often bandwidth hungry which can cause undue delay to other services such as messaging and Internet Telephony. Hence the bottleneck access provider (viz. Telco or ISP) can potentially throttle or differentially price these services compared to other services. This goes against the tenets of Net Neutrality.

In India after the release of consultation paper by TRAI, there have been overwhelming response to treat all Internet traffic to be the same. On the other hands, the opponents of pure Net Neutrality indicate that Indian ISP and broadband market is very different from that of the other countries. India is "mobile only Internet" market where most of the content is consumed through the wireless mobile networks. The mobile network is severely constrained in terms of spectrum and associated capacities (Prasad & Sridhar, 2014). Hence the need for toning down Net Neutrality policy and rules to suit the Indian context. While the results are awaited, innovations in the OTT space continue.

8. Conclusions and Policy Recommendations

The cable digitization, entry of DTH as a competing and substitutable platform for Cable TV, launch of Phase III auctioning of spectrum for FM Radio and the entry of OTT broadcasting have revolutionized Indian broadcasting sector. In this chapter we provided a two-sided market analysis of this important industry. As is indicated, the broadcasting industry is embracing digitization in various forms, at production, distribution and consumption. Internet is going to be an important channel of broadcasting and poses to threats to conventional methods of distribution through cable TV, DTH and FM Radio.
It remains to be seen whether the two will coexist or either one will dominate. However, competition in the broadcasting industry is set to intensify in the years to come.

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