Can Cable TV Network Boost Broadband Competition in Turkey?

Developing Policy Implications for Turkey

by

Serdar Ozcan

B.S. Electrical and Electronics Engineering, Middle East Technical University, 2007

Submitted to the Engineering Systems Division in partial fulfillment of the requirements for the degree of

Master of Science in Technology and Policy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2015

Author: Signature redacted

May 8, 2015
Engineering Systems Division

Certified by: Signature redacted

David Clark
Senior Research Scientist
Computer Science and Artificial Intelligence Laboratory
Thesis Supervisor

Accepted by: Signature redacted

Dava Newman
Professor of Aeronautics and Astronautics and Engineering Systems
Director, Technology and Policy Program

Can Cable TV Network Boost Broadband Competition in Turkey? Developing Policy Implications for Turkey

by

Serdar Ozcan

Submitted to the Engineering Systems Division in partial fulfillment of the requirements for the degree of
Master of Science in Technology and Policy

Abstract

Turkey is one of the most important emerging markets in the world. Considering its young educated population prone to use computer technologies, Turkey can make more benefit from broadband services. Compared with OECD countries, however, current broadband access penetration in Turkey, particularly for fixed broadband service, is quite low. Furthermore, there is a limited competition in Turkish fixed broadband market, which is highly dominated by a single incumbent network.

Different than many developed countries, cable TV infrastructure, which is an important part of facility based competition in fixed broadband market, has not been developed much and it is still owned and governed by the state company called Türksat which is established primarily responsible for national satellite operations. In October 2014, Finance Minister Mehmet Şimsek has announced Turkish government's new privatization agenda covering cable TV operations of Turksat. In this thesis, it is focused on possible effects of the privatization of cable TV network on the competition dynamics of Turkish fixed broadband market and developing policy implications for Turkey to enhance sustainable broadband ecosystem.

The research findings, based on the interviews conducted with experts from Turkish telecommunication and media sector, affirms the government's privatization decision that privatization of cable TV platform is needed because of uncompetitive company behavior and lack of private sector motivations in management under the ownership of state. Moreover, privatization is high likely to enhance consumer welfare.

Although, the service coverage area of the cable platform is low, it has a potential, to make a significant impact on competition with follow up coverage investments. There are economic incentives, complementarily, to invest in network roll out in Turkey. However, there are challenges mainly rising from municipals' attitude toward new infrastructure deployment. Therefore, developing policies triggering investment incentives for network roll out and eliminating the reluctance of municipals toward telecommunication infrastructure development would be the key policy implications to increase the attractiveness of the cable platform auction and to sustain competitive environment after the privatization

Thesis Supervisor: David Clark,

Title: Senior Research Scientist

Computer Science and Artificial Intelligence Laboratory

Acknowledgement

First of all, I would like to express my very great appreciation to my thesis supervisor PhD. David Clark for his support, guidance and valuable suggestions while selecting the research topic and developing the research work.

I would like to extend my thanks all of the TPP family for their support and encouragement during my studies at MIT.

I am particularly grateful for the experts accepted to participate in my research study for their valuable views and suggestions.

I would like to offer my special thanks to my wife Şefika and my son Mahir and my parents Esat and Nurşen Ozcan for their great support, encouragement, patience and indulgence during my studies.

Table of Contents

List of Figures

List of Tables

1 Introduction

In an increasingly globalized world, the Internet has emerged as a crucial technology for communication, commerce, and development (Jensen, 2009). The internet economy brings an enormous opportunity for the governments struggling to find new sources of growth, creating jobs and enhancing the well being of their citizens (OECD, 2013). As it contributes to enhance skills, productivity and innovation, broadband internet access is regarding as a driver of economic growth. From this perspective, development of the national internet infrastructures and attaining higher levels of Internet penetration rates are high in the agenda of most of the countries. Turkey, one of the most important emerging countries in the world, has the opportunity to get more benefit from the internet because of its emerging economic position and youthful demographic profile (McKinsey, 2012), however the current broadband access, particularly fixed broadband, penetration level of Turkey is still quite low compared with the OECD countries.

Telecommunication industry is one of the well known examples of oligopolistic market structure and the lack of competition. High sunk investment costs, scope and scale economies and the network externalities are the main features and the competition barriers of the telecommunication industry. Particularly, Turkish fixed broadband market faces the same lack of competition. It is highly dominated by a single incumbent network operator. Moreover, currently most of the alternative operators' competitive strategy in Turkish fixed broadband market is a form of service based competition in which competitors of the incumbent network operator provide their service over the facilities of the incumbent network operator.

Cable TV infrastructure, which is an important part of facility based competition in fixed broadband market, different than many developed countries, in Turkey, is still owned and governed by a state company called Türksat. In October 2014, Turkish government announced to privatize its cable TV network facility which also provides high speed broadband access to its customer within some cities of the country. In this study, it is focused on whether the privatization of the cable TV network could boost the competition in fixed broadband in Turkey significantly and to develop policy implications for Turkey to enhance sustainable broadband ecosystem.

In the second chapter of this thesis general concepts of broadband, including broadband networks and broadband competition methodologies, have been examined. Afterwards, in the third chapter Turkish telecommunication market, including market figures, description of regulatory regime and the development of the cable platform, has been studied.

In the fourth chapter, in order to deepen the knowledge about the development of cable TV networks and the understanding of investment and the competition dynamics of cable platforms, brief cable TV network development histories and the market figures relevant with the cable TV business of the selected three countries have been examined in this study too. These countries are United Kingdom, Germany and France. The reasons to select these country cases can be listed as, first, in these countries cable platforms are in the challenging position to the incumbent fixed network operator, secondly, similar with the Turkey, the early stages of the cable platforms have been developed through regional operators, and third, these countries, across Europe, are the comparable countries with Turkey in terms of population.

Research design and research findings are located in the fifth chapter. The research methodology anticipated in this study is expert interviews. Experts are selected from the professionals of the Turkish telecommunication industry, who have extensive experience in regulation, public policy and government relations, as the aim of this study is to develop policy implications. Moreover, to ensure multi-stakeholder approach and to minimize biases, it is intended to reach different parties of the telecommunication industry as much as possible. These stakeholders can be listed as incumbent network operator, alternative network operators, mobile network operators, digital satellite operators and telecommunication associations. The research results mainly based on the answers of the experts during the interview to the predefined questions.

In the sixth and last chapter, based on the research findings, conclusion remarks and policy implications regarding how to boost sustainable broadband competition in Turkey via the privatization of cable TV network have been stated.

2 Broadband concepts

2.1 What is broadband?

The early marketing of residential internet access was started with the narrowband dial-up internet access which serves limited internet access speed over the Public Switched Telephony Network (PSTN). With the advance of new internet access technologies using higher frequency data bands, higher internet access speeds have been reached. Most of the broadband definitions explains this transition from narrowband dial up internet to higher speed internet access. On the other hand, some organizations define broadband as a specific internet access speed level for the practical usage of comparisons and evaluations. Some of the broadband definitions are stated as follows:

According to Federal Communications Commission (FCC):

> "Broadband or high-speed Internet access allows users to access the Internet and Internet-related services at significantly higher speeds than those available through "dial-up" services"

According to national regulatory authority of UK, OFCOM (2013), broadband is:

> "A service or connection generally defined as being 'always on', providing a bandwidth greater than narrowband."

According to International Telecommunication Union (ITU, 2010), broadband Internet refers to,

> "high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s."

Similar with the ITU, Organisation for Economic Co-operation and Development (OECD, 2009) considers,

> "broadband as a service providing Internet access at speeds higher than 256 Kbps,"

Thanks to the rapid development of broadband internet access technologies, contemporary broadband internet access speed standards have become much higher

than the speed level defined as 256 Kbps. Today, many countries set higher minimum broadband access speed targets in line of their policy targets and generates new definitions to monitor the developments. For instance, OFCOM addition to broadband figures monitors high speed broadband access services under a generic name of Superfast broadband. OFCOM (2014) defines superfast broadband as follows:

> "Sometimes known as next-generation broadband, super-fast broadband delivers headline download speeds of at least 30Mbit/s"

FCC, a different example, in January 2015 has updated broadband speed benchmark to 25 Mbps for download and 3 Mbits for upload. Additionally, Germany, in its national broadband plan, sets an ambitious target of minimum 50 Mbps broadband access speed. Likewise, many other countries putting broadband access speed targets where a change in the understanding of broadband definition arises.

2.2 Broadband as an economic driver

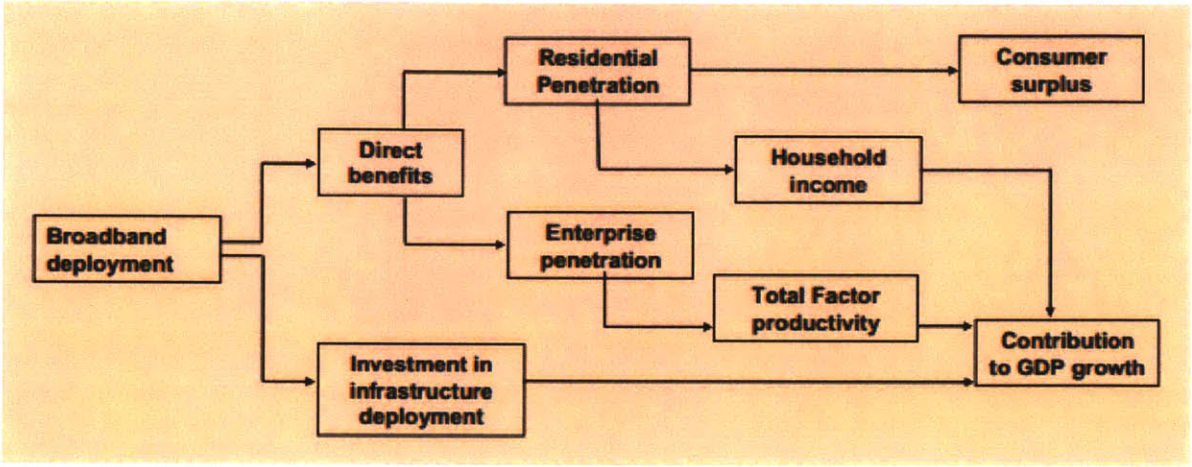
Broadband services, particularly internet, have become an integral part of human life. It has many aspects and positive impacts on daily life, some of them are studied and some of the others are waiting to be studied. From all of the aspects, the foremost positive impact of broadband is on the economy, which also the main factor stimulating the interest of policy makers.

From an economical point of view, broadband can be classified like with other infrastructure services such as electricity, roads and railways, which lead an important transformative impact on nations as they are facilitating new activities (Qiang et al, 2009). These kind of infrastructures leading a substantial change in economic activities are called general purpose technologies (GPT). Information and communication technologies, specifically broadband internet access, are the most remarkable GPT of the twenty first century enabling spill overs all over the economy (OECD, 2008).

According to ITU, (2012) economic impact of the broadband networks emerges more than one way. The first impact arises from the direct investment in infrastructure deployment. The second positive impact of broadband networks emerges from the external benefits of broadband usage through consumers and enterprises. The multiplier effect of broadband on the productivity of enterprises and the positive effect of broadband service usage on real income of the residents are the two external factors

contributing to economic growth. Although it is not demonstrated in GDP studies, the the consumer surplus arises from the difference between actual broadband service price and the highest price willing to pay by consumer can be regarded as another economic benefit of broadband services (Figure 2-1).

Figure 2-1. Broadband economic impact



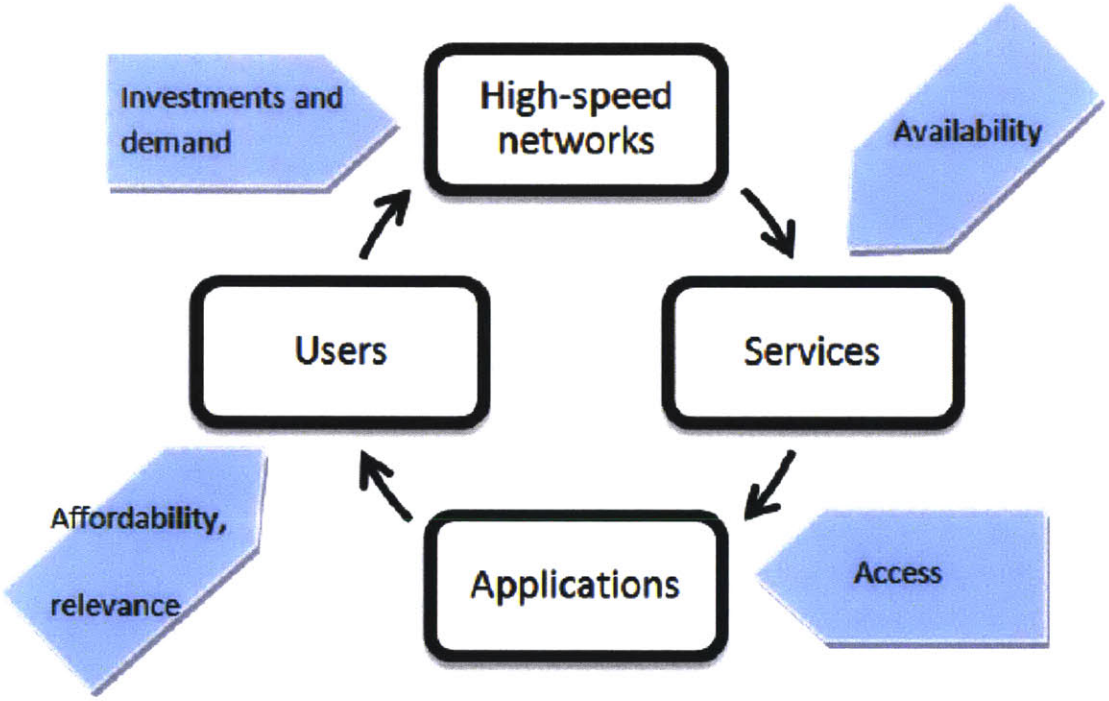
Source: ITU, 2012

There are many researches show correlation between broadband deployment and the economic growth from different sub-economic aspects such as employment, business productivity and organizational developments. In a US level econometric study covering the years between 1998 and 2002, researchers have found that the areas having mass broadband access shows higher performance in economical growth in employment, information technology concentrated businesses, and the overall number of business (Lehr et al, 2006). In another US oriented study regarding the economic impact of broadband adoption on the rural areas between the years 2001 and 2010, it is pointed out that broadband adoption in rural areas has positive effects on economic growth on household income and employment levels (Whitacre et al, 2014). In a different macroeconomic level study conducted by Koutroumpis (2009) about the effect of broadband penetration on economic growth regarding 22 OECD countries for the period between 2002 and 2007, it is found out that "*there are increasing returns to broadband telecommunications investments, which are consistent with the persistence of network effects*".

2.3 Broadband as an ecosystem

Rather than the accustomed static definitions based on minimum internet connection speed and network connectivity type, a different concept regarding broadband has put forward as an evolving ecosystem which is formed by four sub-components namely networks, services, applications, and users (Kim et al, 2010).

Figure 2-2. Broadband ecosystem

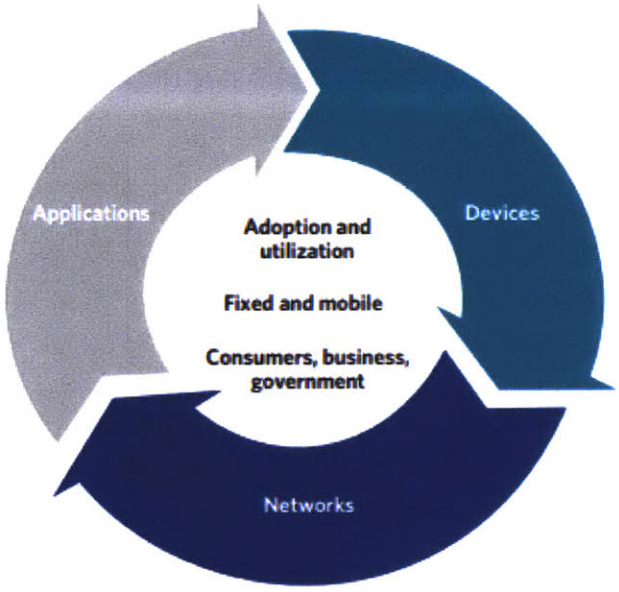


Source: (Kim et al, 2010)

As illustrated in the above figure, the broadband ecosystem is a circular convention of the networks, services, applications and users. Networks are the the main supply of the broadband ecosystem, and the network reach outs are driven by the investments of investors, which can be either by public or private, and the demand of the users. Developments in the high speed networks increase the availability of better-quality services for the users and the accessibility of applications to the users. Such an improvement in the service part makes broadband services more affordable and enable the application providers to provide more relevant services from the perspective of users. These advancements on the side of user lead a growth in demand and boost again the investments in networks (Kim et al, 2010).

Ecosystem approach to broadband is also anticipated by FCC in its national broadband plan. Different than above structure, FCC defines acting forces on the broadband ecosystem of United States under three parts, namely networks, devices and applications (Figure 2-3).

Figure 2-3. Forces shaping the broadband ecosystem in the United States



Similar to the previous figure, FCC's broadband ecosystem approach is illustrated as a reinforcing cycle. However, it is distinct from the former by including devices as an important driver of ecosystem and not specifying the services separately. The logic behind the FCC's (2010) broadband ecosystem can be described as follows: when the networks are become speedier, reliable and broadly accessible, firms strive to develop and produce more capable network devices compatible with the networks. These high capable new devices embolden innovators and application providers to develop and innovate attractive applications and the content which is expected to retain current broadband users and stimulate the non-users to subscribe in broadband services. Such an increase in subscription increases the incentives for the internet service providers to upgrade and enlarge their networks.

Broadband ecosystem approach is embraced by policy makers and the scholars for national policy evaluations. That is mainly because that is both covering demand and the supply side of the market for broadband adaptation (Kim et al, 2010). Moreover, its

systematic approach and divided structure enables it to develop tailored policy implications for the needs of each sub-part of the broadband ecosystem. The table given prepared by Torres and Beltran (2011) for a comparative national broadband policy evaluation, can be an example of how the national broadband policies could be classified with broadband ecosystem approach.

Table 2.1. Policy actions of three selected countries to enhance broadband ecosystem

Country	Networks	Services	Applications	Users
Korea	• Public–private partnerships to support the broadband network rollout (backbone and rural connectivity) and low interest for network rollout in rural areas • Cyber building certification • Standards for interconnectivity and interoperability • Broadband convergence network	• Broadband as a value added service and a facilities-based service • Regulation and competition policies (price regulation, facilitating access to spectrum, universal service, VoIP regulation, network access regulation, QoS) • Subsidized services to access broadband networks	• e-Government, e-commerce, e-learning, e-working policies • Industrial ICT policies (R&D, tax and rent reductions; to promote ICT in traditional industries such as agriculture) • Security systems in networks • Content promotion and applications for people with disabilities	• Internet education programs • IT training programs • Free access internet and access in schools
Netherlands	• Interoperability and standards • Support ICT research networks • Municipalities support the develop fiber networks, • Market players are expected to invest in broadband infrastructure • Market intervention is through private-public partnerships.	• ICT as a solution to solve energy and environment problems • Promote infrastructure competition	• e-Government policies • safety/security to exchange information and protecting people • develop applications to SMEs • Stimulate research in broadband technology innovation	• e-Skills to particular groups (minorities, unskilled workers, civil servants, etc.) • Consumer protection
New Zealand	• Public–private partnerships to support the broadband network rollout in the country: the ultrafast broadband network (UFB) and the rural broadband initiative (RBI) • Allocate spectrum for wireless broadband access • Consultations on NGN include interconnection, interoperability and services	• Promote the reduction of carbon emissions and sustainable resource use • Subsidies for computers and Internet access	•Awareness of online safety, security and privacy issues •Support new digital businesses and business models • Promote research • e-government policies	• Promote digital literacy • Promote digital careers and ICT skills to strengthen the workforce in ICT industry

2.4 Broadband networks

Broadband networks are classified according to their access technology to the premises or end-users. Generally, broadband networks are divided under two main categories namely fixed and mobile broadband networks. The usage of the term "fixed" expresses the meaning of physical wired connection between the network provider and the end user premises or location, on the other hand the term "wireless" express that network provider access to the end user through air interface via electromagnetic waves (Corning, 2005).

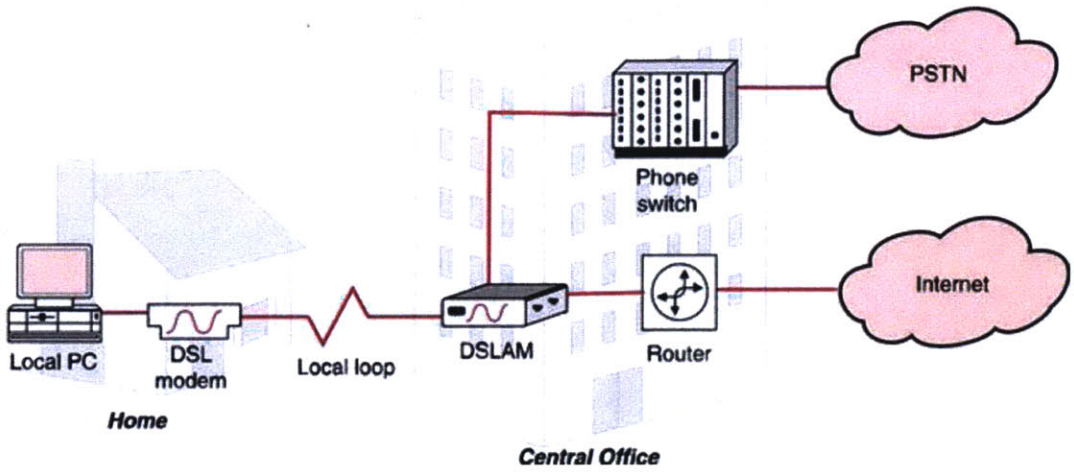
2.4.1 Fixed broadband networks:

Among the fixed broadband access technologies the most widely used are can be listed as DSL, cable and fiber networks. As follows, these three broadband network platforms will be described.

2.4.1.1 DSL networks

DSL is the most widely used internet access technology in the world; at the end of 2012 more than 57% of the world's fixed broadband subscribers were connecting to internet via DSL connection (Johnson, 2013). Digital subscriber line (DSL), developed by Bellcore in 1989, is the broadband access technology developed on the top of the existing twisted copper lines of PSTN. DSL technologies work over the twisted copper line between the premises and the local exchange point, known as central office, where this operation length is also called as local loop or last mile (Figure 2-4). The length of the loop and other characteristics such as line type and line quality have crucial importance on the quality, speed and availability of the DSL broadband service (Littman, 2002).

Figure 2-4. Basic DSL architecture



Source: MSJC Computer Information Systems.

Local loop, also known as last mile, has another importance from the point of economics. As it is the last mile of the telecommunication network, implying the deployment of twisted lines to each premises in the country, it is the most capital and labor intensive part of the network. Therefore, local loop is not easy to be replicated and regarded as the bottle neck of the telecommunications network. The company holding the ownership of the local loop of the telecommunication infrastructure, called the incumbent operator, has an important and deterrent competitive advantage over its competitors. According to this rationale, many governments have regulated this part of the network to enforce incumbent operator to open its competitors with reasonable conditions. This is also know as Local Loop Unbundling (LLU) or Unbundling of Local Loop (ULL)

DSL is also a generic name of a standard family of xDSL. Some of them can be listed as ADSL (Asymmetric DSL), SHDSL (Symmetric High-Bit Rate DSL or G.shdsl), VDSL (Very High-Speed DSL) (Littman, 2002). Asymmetrical digital subscriber line (ADSL) technology is designed for typical residential users who are mostly downloading data such as internet surfing but uploading lesser. The term "asymmetric" refers to the differentiation of access speeds between downstream and upstream which is higher for downstream. Symmetrical digital subscriber line (SDSL) provides higher broadband rates both for upload and download, which is appropriate for two way high speed demanding activities such as video conferencing (FCC, n.d.). VDSL is developed to fulfill the increasing demand in higher broadband connection speeds of the online

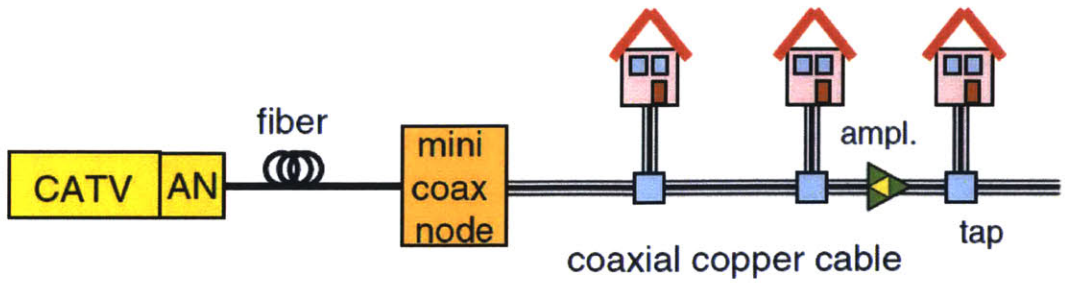
users. VDSL provides a maximum data download rates between 51 and 55 Mbps for the premises having short length of actual twisted copper lines (Cisco, 2012). VDSL broadband service provision is primarily available for the premises close to the central office, nevertheless, for the premises far from the central office, a new investment is needed to bring network device closer to the street cabinet which will be evaluated in fiber access section in more detail.

2.4.1.2 Cable broadband networks

According to Point Topic (2013) world broadband statistics, as of first quarter of 2013, cable broadband market share is 19%, coming after from copper and fiber broadband subscribers. Cable is not the prevailing platform for broadband services in most of the countries, however, across the OECD countries, United States is the largest exception where cable broadband has the highest market share (OECD, 2014).

First cable TV installation started in United States for backing up the Community Antenna TV. Mainly, it was deployed to re-transmit the broadcast television signals over coaxial cable to the premises having difficulty receiving the air signals. Later on, in 1950s, the first television programing, in 1970s, satellite broadcasts and pay per view content was introduced over cable platforms. One of the important technological upgrade of the cable TV network started from the beginning of 1980s. This is mainly the development of coaxial cable with fiber infrastructure called Hybrid Optical Fiber Coaxial Cable (HFC) which helps to increase the total program carriage capacity of the platform and the signal quality (Littman, 2002).Today, Hybrid fiber Coaxial Cable network architecture is the most common technology used in cable platforms. (OECD, 2014).

Figure 2-5. A basic HFC (Hybrid Optical Fiber Coaxial Cable) network architecture.



Source: Shami et al, 2009

In HFC architecture fiber network is connected to a mini-coax node, where the transformation between optic signals of fiber and electronic signals of cable conduit occurs. After this node, users are served over a shared coaxial network. Since, in coaxial network users have to share the feeder cable, a closer fiber deployment is needed to reduce the number of users fed from the same coaxial cable, so to increase available data capacity per user. Similar with the logic of Asymmetric DSL, the available data band for downstream is allocated significantly higher than the upstream. (Shami et al, 2009). For the standardization and interoperability purposes, a protocol called DOCSIS (Data-Over-Cable Service Interface Specification) is develop by CableLabs, which is an organization founded by various cable network operators. Specifically, DOCSIS standardizes the physical and MAC layer of the network protocol for service provisioning and management practices (Gorshe et al, 2014). DOCSIS protocols evolved with the versions namely DOCSIS 1.0, DOCSIS 2.0 and DOCSIS 3.0. With DOCSIS 3.0 compatible cable modems, it has been reached to more than 160 Mbps downstream data speed (Cisco, 2010).

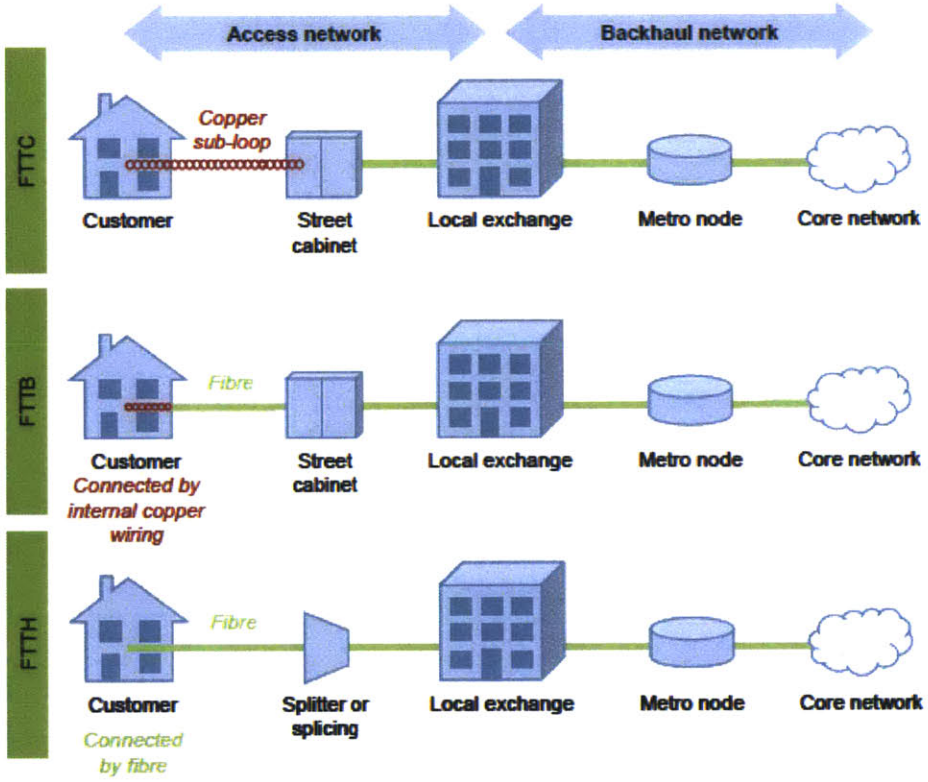
Upgrading the one-way cable network, cable TV operator to user, to two way digital communication networking, including the broadband internet access service, needs higher investment than enabling basic DSL service over the twisted copper. Nevertheless, cable networks have higher capacity to provide higher broadband speeds than the twisted copper networks. This is mainly because of the superiority of cable, which is thicker bundles of copper wires enabling higher capacity, over twisted pairs (OECD, 2014)

2.4.1.3 Fiber networks

Fiber optic technology enables the conversion of the electrical data signals to light and the conveyance of the light in a very thin transparent glass fibers (FCC, n.d.). Fiber-optic technology has very high capacity. Even in some sources, it is pointed out that fiber has no bandwidth limit. However, mainly the electro-optical equipment, which has practical limits under the given budget, designate the data speeds of the network (Shami et al, 2009). In laboratory conditions, researches proved that fiber optic medium allows data transmission up to 255 Tbps (Gold, 2014). With the new modulation technics and advances in electronic technology, it is expected to continue in fiber speed record news in the near future.

Even though, fiber optic technology is far advance than the other available broadband technologies, from the perspective of network operators, there is a big challenge to deploy fiber network, which is its cost. Despite the decrease in electronic equipment cost of fiber networks, reaching every premise with fiber edge still composes the important portion of total deployment costs (OECD, 2014). As an alternative to direct reaching to the home, network operators developed other fiber access types to minimize the deployment costs. There are three fiber access types called FTTC, FTTB and FTTH, which are also known under the generic name of FTTX (Figure 2-6).

Figure 2-6. FTTX architectures



Source: Analysys mason

FTTH council (2011) defines Fiber to the Home (FTTH) as "*an access network architecture in which the final connection to the subscriber's premises is Optical Fiber*" and Fiber-to-the-Building (FTTB) as "*an access network architecture in which the final connection to the subscriber's premises is a physical medium other than Optical Fiber*". In Fiber to the curb (FTTC) architecture fiber network reaches to the street cabinet, as a last point. FTTC is mostly associated with VDSL2 internet access services, which is

known one of the most recent DSL technologies, and it can fulfill 100 Mbps connection rate in short distances and 50-75 Mbps for the distances 1-2 kilometer to the curb (Baker, 2007).

Today most fixed broadband operators use fiber in their backhaul, core and distribution parts of network. The hybrid solutions of broadband networks, up to last mile with fiber and the rest with residual platform; namely HFC for cable and VDSL2 for twisted copper, are capable of transmission of the data rates of FTTH's early data throughputs (OECD, 2013). Besides the maximum data throughput levels and the architectural advantages, many other factors affect the the fiber access deployment level of the network operator. These are can be listed as profitability, ability to generate higher average revenue per unit (ARPU) and the competition between the platforms (Elixmann et al, 2008).

2.4.2 Wireless broadband networks

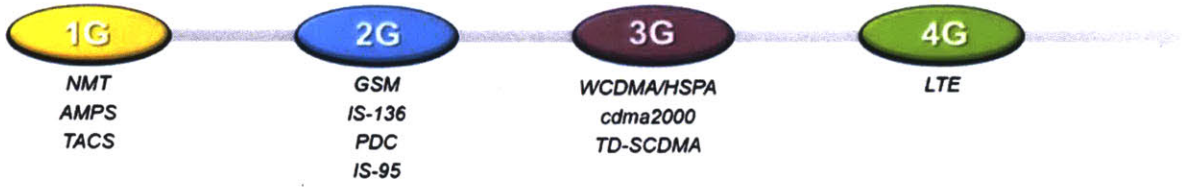
In wireless broadband connection, broadband internet access is provided between customer's location and internet service provider's network point through a radio link (FCC, n.d.). Depending on the range and the usage purpose, there are many wireless network types. For instance; wireless local area networks (WLANs) and wireless fidelity (WiFi) are having better performance for isolated and short range wireless connectivity; on the other hand, WiMAX and 4G/LTE are appropriate for wider coverage. Moreover, WiMAX and 4G/LTE are accepted as an alternative to last mile in fixed broadband networks to provide broadband access to customer premises (Bidgoli, 2008). Due to this superiority aspects, these two wireless networks will be covered as follow.

2.4.2.1 Long term evolution (LTE)

Generally, mobile communication systems are classified as generations; first generation, abbreviated as 1G, represents the analog mobile radio technologies of the 1980s, 2G represents the family of the first digital mobile technologies, 3G is known as the first mobile communication technologies providing mobile broadband access (Dahlman et al, 2014). Some important improvements within generations are stated with decimals. For example, General packet radio service (GPRS), which is one of the first provisions of data services in mobile communication systems, is known as 2.5G; in addition High-Speed Packet Access (HSPA) technology, which enhances the initial

3G UMTS performance remarkably, is also known as 3.5G. 4G is the general name of the next generation mobile broadband standards and LTE is one of the members of this family.

Figure 2-7 Generations of mobile communication systems



Source: Dahlman et al, 2014

From the beginning of the mobile communication standards, there has been a competition among these. LTE is the continuation of the GSM/HSPA standard family which has a pervasive and overwhelming position globally (4G Americas, 2012). As of December 2014, there are approximately 2 billion HSPA subscribers and more than 300 million LTE subscribers around the world (Statista, n.d.).

Compared with the earlier mobile broadband services, LTE offers three distinctive features. First one is full mobile broadband experience with the network performance providing instantaneous download maximum data rate of 100 Mb/s within a 20 MHz downlink frequency band allocation. Second one is enhanced network coverage thanks to operating frequency of 700 MHz spectrum band having penetration superiority. Third and the last one is improved data connectivity through enabling the mobile broadband network for the connection of different types of devices (AT&T, 2015).

2.4.2.2 WIMAX

WiMAX (worldwide interoperability for microwave access) is a point to multipoint network solution for wireless metropolitan area broadband access, based on the IEEE 802.16 standard. The WiMAX network provides high speed broadband connection within a wide service coverage area up to several tens of kilometers (Shami et al, 2009). With this outstanding feature, WiMAX technology offers a cost effective solution high speed broadband access solution where it is costly to deploy a fixed network, particularly for rural areas (Poole, n.d.).

Certification and promotion of compatibility and interoperability of WiMAX network products have been governed by WiMAX Forum which is an industry led, non profit organization. WiMAX has a maximum theoretical data throughputs of 75 Mbps for downlink and 30 Mbps UL (Middleton, 2009). As of 2014, there are 33.4 million worldwide WiMAX subscribers (Statista, n.d.)

2.4.3 Other broadband technologies

Although the aforementioned broadband technologies are widespread, there are other broadband access services depending on other technologies. Broadband over Power line, which is known as BPL, is another broadband technology providing high speed internet access over power lines. Communication satellites also provide broadband access service, known as satellite broadband. However, it is a rather expensive service and practically serves to locations where there is no coverage with common broadband technologies. There are other broadband internet access technologies in experimental level, one of the popular example is Google's project loon which enables internet access through the balloons floating in the stratosphere.

2.5 Broadband competition

Like other infrastructure industries, telecommunication industry regarded as natural monopoly because of high sunk costs, scale and scope economies. Opening this industry to competition is high in the agenda of many policy makers and governments caring the strategic importance of ICT, particularly broadband services. To promote competition in telecommunication industry, regulators and policy makers have come up with the question which method do they need to follow; either service competition, which is based on a single infrastructure with regulated access or facility based competition, which is boosting parallel infrastructures competing each other (Höffler, 2007). It is observed that, in most of the sources, facility based competition is regarded as inter-platform competition and service competition as intra-platform competition, however there are also different notations and categorizations of these terms. There is a significant number of researches and literature about the relation between broadband competition and the broadband adoption. The tendency about these researches is pro inter-platform competition; describing inter-platform competition as an important driver for broadband penetration. However, there are some country case researches where

there is no significant contribution found about a relation between facility based competition and broadband adoption (Fageda et al, 2014).

2.5.1 Facility based competition

Bourreau and Doğan (2004) claim that, controlling supply chain of its operations with the highest extension is necessary for an operator to attain long term efficiency through harnessing the benefits of flexibility and innovation, where it is much likely achievable in facility based competition. The main drawback in this competition policy is the inefficient duplication of existing broadband network, nevertheless, according to Höffler (2004) this inefficiency might be recouped from the deadweight loss due to imperfect competition. There are many studies showing the positive impact of facility based competition on the adoption of broadband. The results of the empirical study conducted by Aron and Burnstein (2003), indicate that facility based broadband competition between DSL and cable modem has an important positive impact on broadband adoption. Similarly, in another research based on the data for 14 European countries, it is emphasized that the higher competition between broadband technologies is "the *main driver to stimulate broadband adoption*" (Distaso et al, 2006). In a different study based on the across 20 OECD countries for the period between December 2003 and March 2008, research results put forth that inter-platform competition has a positive significant impact on broadband adoption, reversely, service based intra-platform competition has a remarkable negative impact on the broadband adoption (Bouckaert et al, 2010).

2.5.2 Service based competition

According to Pindyck, for the network industries having quasi-monopolistic market structure, service based competition is regarded as crucial for stimulating market entry and having the prices lower in short term (Briglauer et al, 2013). Particularly for telecommunication industry and broadband service, mandating incumbent telecom operators to unbundle their local loop and enforcing them to provide interconnection to their competitor ISPs under regulated prices are the common methods to induce competition. As it does not need to build up a parallel network, in other words as it relies on the existing DSL infrastructure, it is also the easiest and the fastest way to boost market entry via DSL broadband service (Distaso et al, 2006). After making market entry easier with service based competition, it is expected from competitors to

build their own network and ultimately to reach a facility based competition. However, from the point of sustainability and effectiveness about service based competition there are many critics arises. Bourreau and Doğan (2004) figure out that service based competition has deterrent effect on facility based competition, where incumbent can strategically delay the development of competitor's facility through setting attractive prices for its access service.

Determination of the access prices is another important issue to be handled by regulators in service based approach. It is expected from the price level to be a balance state between enabling market entry easier but no to deter the investment incentives of the incumbent operator. Long run incremental cost (LRIC) approach is the common method anticipated by many national regulatory authorities to determine the access service prices. Nevertheless, Hausman criticizes the TELRIC (a specific type of LRIC) approach based regulated prices that are neglecting the high sunk costs of telecommunication industry and too low to encourage investments (Cambini and Jiang, 2009).Lastly, there are not many studies indicating the positive impact of service based on broadband adoption. In one recent research regarding broadband adoption in Spanish market, it is found that intra-platform is the main factor to increase broadband adoption, while inter-platform competition has no effect on the expansion of broadband services (Fageda et al, 2014)

3 Turkish telecommunication market

3.1 Introduction

Turkey is one of the most important emerging markets in the world with its population more than 77 million and the size of around 780.000 km^2 located between Europe and the Asia. According to the World Bank data, Turkey is the 18th largest economy in the world with a gross domestic product (GDP) of $822 billion. In addition, across European countries, Turkey has the largest young population with 16.6 percent (Anadolu Agency, 2014).

Turkey is the member of the many important international organizations such as Organisation for Economic Co-operation and Development (OECD), G-20 major economies, North Atlantic Treaty Organization (NATO) and Organisation of Islamic Cooperation. Moreover, Turkey has started full membership negotiations with European Union in October 2005, and continuing alignment of its national legislation particularly for telecommunication sector under the scope of EU enlargement chapter 10 called information society and media.

Turkish telecommunication sector is one of the important economic drivers of the country with the annual economic size around 35 billion Turkish Lira[1]. However, it deserves much better figures particularly for fixed broadband penetration which is relatively low compared with the developed countries. Considering its emerging economy and young population, Turkey has a significant potential to unleash economical growth from broadband internet (McKinsey, 2012)

3.2 Brief Turkish telecommunication history

Posts, Telegraph and Telephone (PTT) was the state monopoly of Turkey regarding telecommunication services starting from the early dates of Republic of Turkey. During the years between 1980 and 1984, an important telecommunication infrastructure build up movement carried out by PTT, resulted a significant increase in the number access lines (Telli, 2011). In 1994, as a part of state policy regarding the privatization of the

[1] According to the data provided by Information and Communication Technologies Authority, 2014 Q3

telecommunication services, telecommunication services were split from postal services and Türk Telekom A.S. (TTAS) was established as a state company (Atiyas and Doğan, 2007). Although it was established in 1994, the privatization of Türk Telekom could be made in 2005. In 2005, 55 percent of Türk Telekom's share has been sold to a private company called Oger Telecom for 6.55 billion US dollars. This was the end of direct state control over Türk Telekom and one of the most important liberalization event of the Turkish telecommunication market (Bagdadioglu and Cetinkaya, 2010).

Before the liberalization of Türk Telekom, in 1994, the first important step in liberalization was the signing of the revenue sharing agreements between Türk Telekom and the private companies namely Turkcell and Telsim to provide GSM services over 900 MHz frequency band. Later on, these revenue sharing agreements were licensed by Ministry of Transport in 1998 (Atiyas and Doğan, 2007). In 2000, Turkish independent telecommunication authority has been established. As seen in the licensing regime of the Turkcell and Telsim, up to 2000, regulatory issues regarding telecommunication were handled by Ministry of Transport. The same law establishing Turkish independent telecommunication authority also abolished the monopoly rights of Türk Telekom over fixed telephony services that would be effective as of 1 January 2004 (Burnham, 2007).

The third GSM license owner Iş-TİM which was operating under the brand name of Aria and the fourth license owner Aycell, Türk Telekom's GSM Operator, were started mobile service operations in 2001. However, in 2004 Aria and Aycell, later on, have merged under the name of Avea where majority shares of it belongs to Türk Telekom. Lastly, Telsim purchased by Vodafone group in 2005 and then Turkish mobile communication sector has settled with present three mobile network operators state; Turkcell, Vodafone and Avea. In 2009, all three mobile operators have attended to the 3G spectrum auction and have been providing 3G services since July 2009. As of March 4, 2015, Ministry of Transportation Maritime and Communication has announced to start tender process of 4G services.

3.3 Turkish telecommunication market figures

Information and Communication Technologies Authority (ICTA) of Turkey is the main responsible body to collect and publish the official data of telecommunication market. As a practice of ICTA, it publishes communication reports quarterly. In this part of the chapter, it will be passed over the some of the main figures of these market reports.

3.3.1 Market overview

According Information and Communication Technologies Authority's data about the term 2014 Q3, there are total 654 operators with 1094 authorizations operating in Turkish telecommunication market. Of all these authorizations seven of them refers to the concession agreements between ICTA and Turkcell, Vodafone, Avea and Türk Telekom. As Türksat is government owned satellite and cable TV company, it is operating according to the authorization agreement between Türksat and ICTA. The rest of the authorizations are general authorization practices of the authority called either authorized by notification or authorized by the right of use depending on whether the scarce resources are used or not.

When it is looked to the net sales tables of the Turkish telecommunication market below (Table 3.1 and Table 3.2) the total annual net sales is around 35 billion Turkish Lira[2]. Three mobile operators and the fixed incumbent operator Türk Telekom generate 80% of the total net sales, other operators including cable TV correspond to the rest 20 percent. Among the mobile network operators, Turkcell has the highest annual net sales around 9 billion Turkish Lira where the total of its mobile competitors Avea and Vodafone is around 10.5 billion Turkish Lira.

Table 3.1. Net sales of Türk Telekom and mobile operators, (Turkish Lira)

	2013-3	2013-4	2014-1	2014-2	2014-3
Türk Telekom	1.810.509.445	1.817.517.743	1.841.304.824	1.864.910.968	1.968.569.071
Turkcell	2.365.114.942	2.239.520.050	2.204.904.252	2.295.798.874	2.477.025.035
Vodafone	1.468.827.698	1.496.734.109	1.584.537.273	1.617.740.772	1.726.949.041
Avea	972.605.176	943.458.183	957.083.201	1.055.891.809	1.143.942.329
TOTAL	6.617.057.261	6.497.230.085	6.587.829.551	6.834.342.423	7.316.485.475

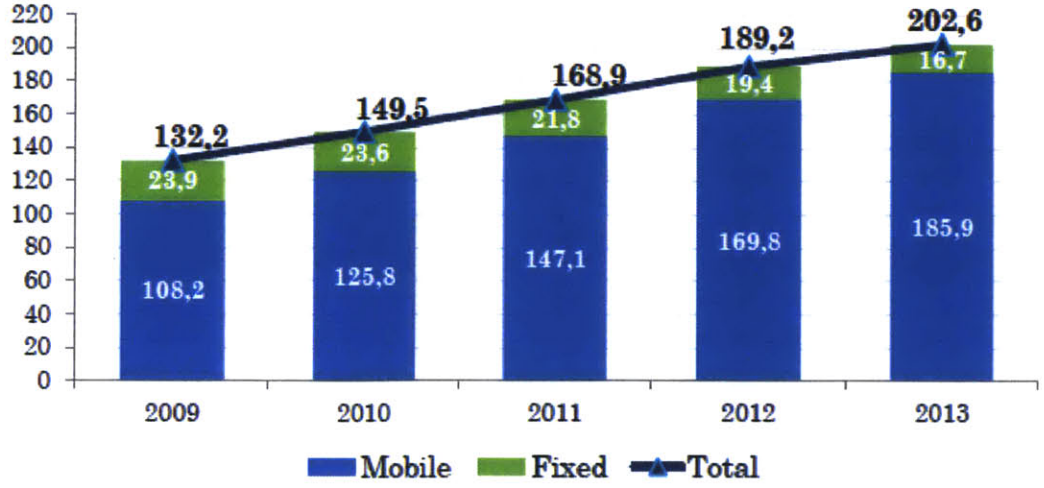
[2] According to the Central Bank of the Republic of Turkey, 1 US dollar is 2.34 Turkish Lira as of January 2nd 2015

Table 3.2. Net sales of other operators, (Turkish Lira)

Operator Type	2013-3	2013-4	2014-1	2014-2	2014-3
Internet Service Providers	1.035.472.403	1.186.313.849	1.151.274.415	1.178.104.243	1.184.990.337
Fixed Telephony	278.027.268	266.149.367	269.898.385	292.080.183	297.090.202
Infrastructure	134.931.694	141.024.831	156.914.030	167.370.274	170.349.056
Satellite Telecommunication	61.849.689	75.567.418	64.058.866	67.719.903	60.220.838
Directory Information	21.358.769	18.785.663	15.459.780	16.803.773	22.892.570
Cable TV	89.827.987	100.501.499	110.534.588	105.148.267	109.019.212
GMPCS	3.882.222	3.508.254	2.143.905	3.755.230	2.227.269
PMR/PMAR	3.458.719	3.332.752	4.400.977	5.099.146	4.221.024
TOTAL	1.628.808.751	1.795.183.633	1.774.684.947	1.836.081.019	1.851.010.508

Between 2009 and 2013, the annual voice traffic volume of the Turkish telecommunication market has increased from 132.2 to 202.6 billion minutes (Figure 3-1). However, during these years the traffic originated from fixed networks has decreased from 23.9 to 16.7 billion minutes. As of 2013, fixed networks were generating only 8.2 percent of the total voice traffic while this ratio was 18 percent in 2009. On the other hand, mobile originated voice traffic has increased 71 percent during the stated years.

Figure 3-1. Annual voice traffic volume, billion minutes



3.3.2 Fixed telephony market

The figure stated below (Figure 3-2) shows the number of fixed line subscribers and the penetration rate. From the year of 2008 to the third quarter of 2014, fixed line subscribers has decreased 27.1 percent, overall there has been a loss of 4.75 million subscribers in fixed market. This figure also in correlation with the reduction of fixed Annual Voice Traffic Volume, where it shows the trend in Turkish telecommunication market that fixed voice service is mostly replaced by mobile telephony. In addition, similar with the reduction in the number of fixed subscribers, penetration rate has been decreasing within the specified interval.

Figure 3-2. Fixed-line subscribers and penetration rate

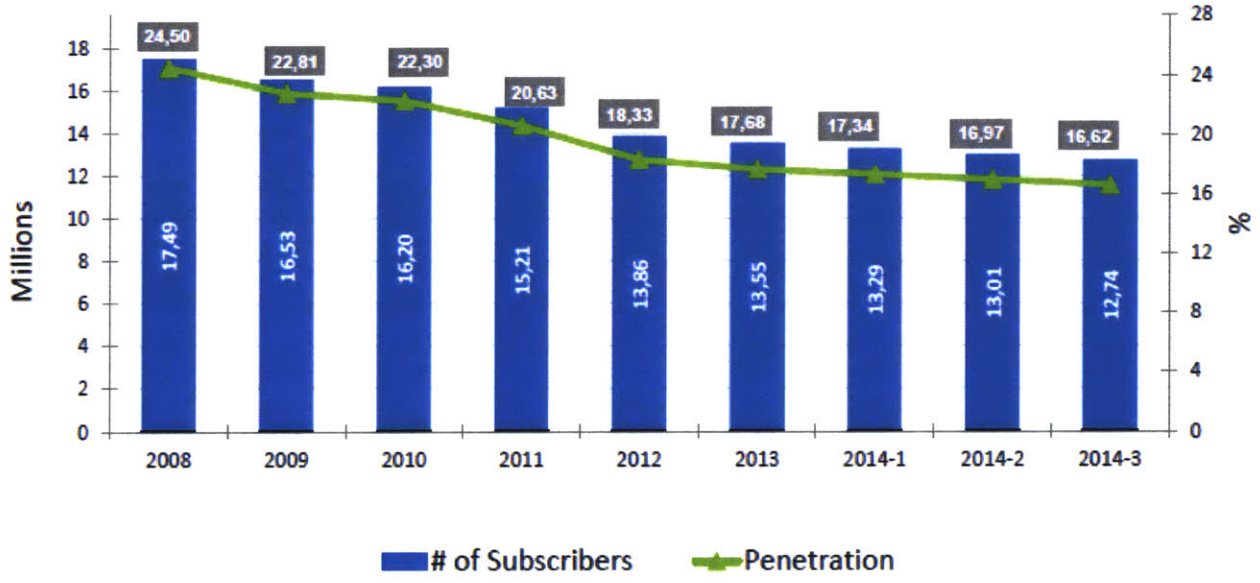


Figure 3-3 and Figure 3-4 show the percentage distribution of the calls between incumbent network operator Türk Telekom (TT) and other fixed telephony service (FTS) providers. For the local calls, Türk Telekom holds the dominant position with the level of 85.55 percent whereas FTS providers having the rest 14.45 percent. The market of fixed national calls is relatively more competitive. Türk Telekom's share has been decreasing around 12 percent during the period between the first quarter of 2013 and the third quarter of 2014, lasting around the level of 67%, whereas this level is around 33% for FTS providers. The relative difference between national and local call distribution also implies the situation that FTS providers having hardness to deepen their business to the local exchange levels.

Figure 3-3. FTS and TT comparison for local calls

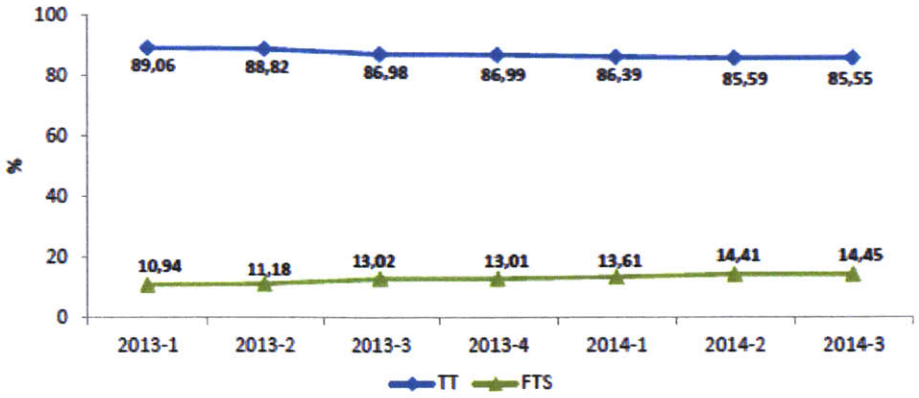
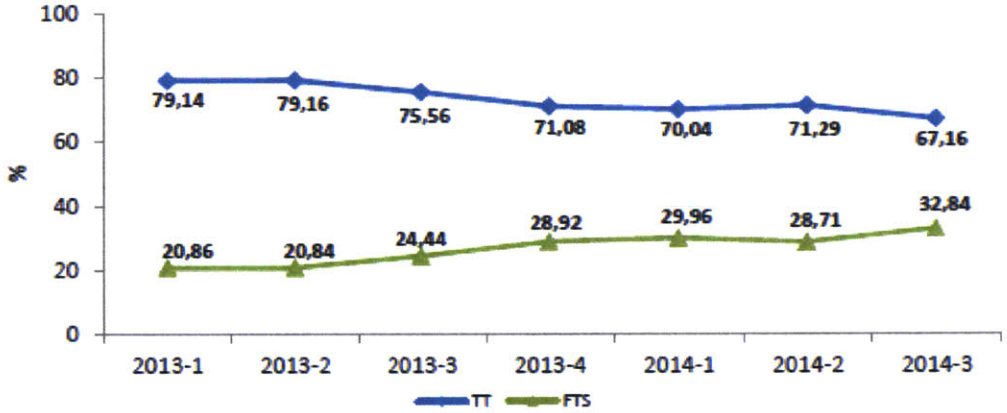


Figure 3-4. FTS and TT comparison for national calls



Breakdown of annual and quarterly fixed revenues of Türk Telekom gives much insight about the trends in fixed market. Between the years 2009 and 2013, PSTN revenues had the highest revenue item and the second one was the access revenues covering the broadband products. However, within the second quarter of 2014 leadership has changed and access revenues have become the highest revenue item. Between the years 2009 and 2013, percentage of leased line revenues has decreased remarkably from the level of %7.57 to %4.29. Lastly, share of the other services of Türk Telekom has been increasing significantly particularly for the last three quarters of 2014.

Figure 3-5. Breakdown of annual fixed revenues of Türk Telekom, %

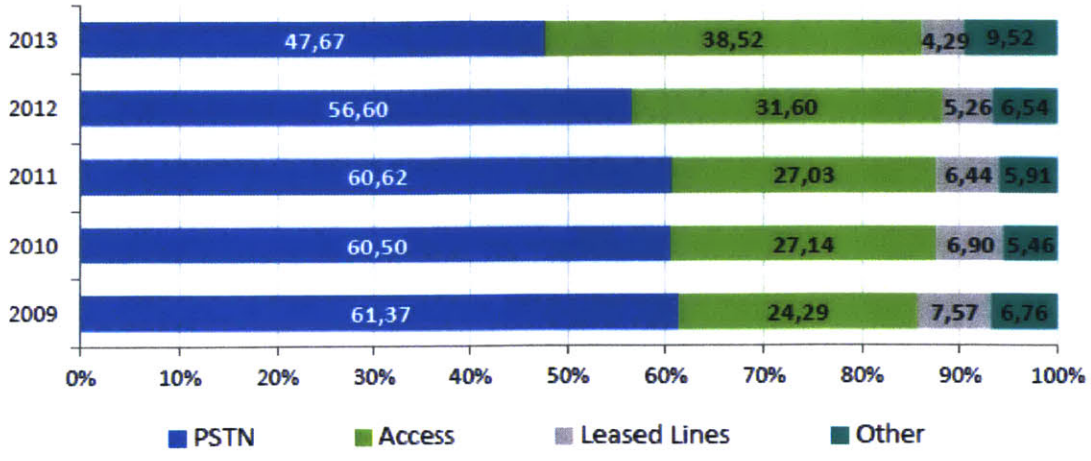
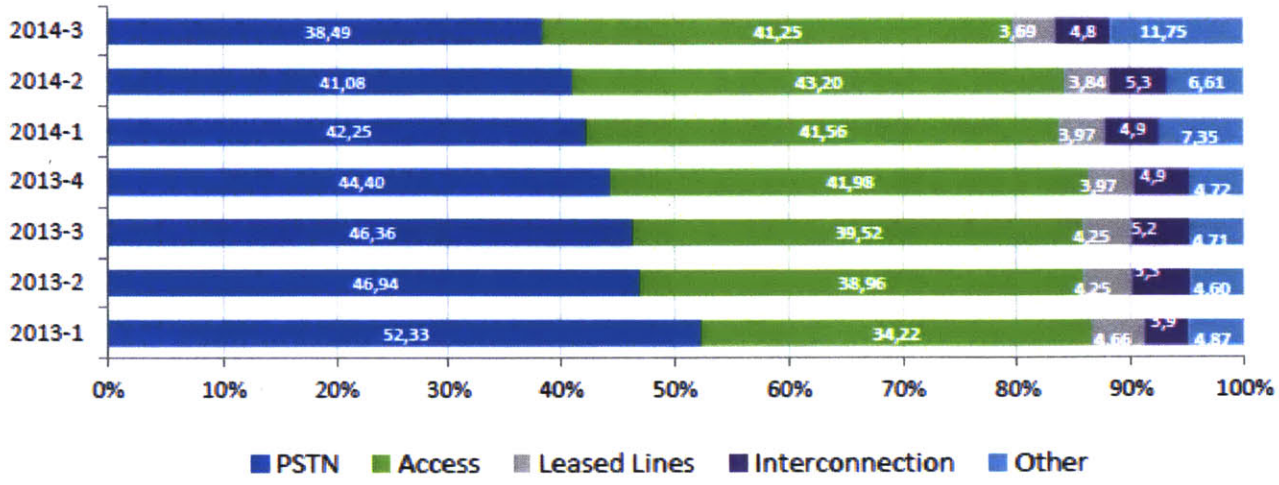


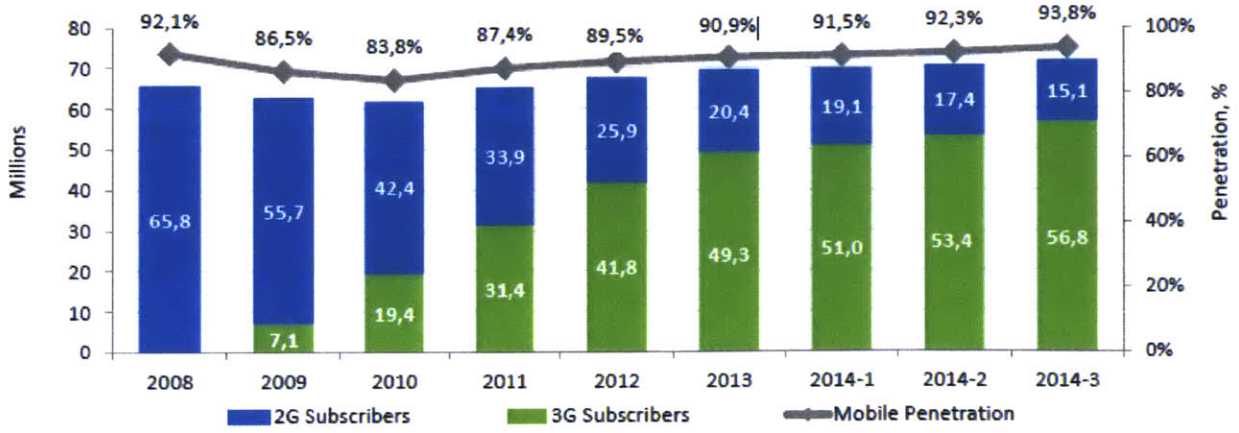
Figure 3-6. Breakdown of quarterly fixed revenues of Türk Telekom, %



3.3.3 Mobile market

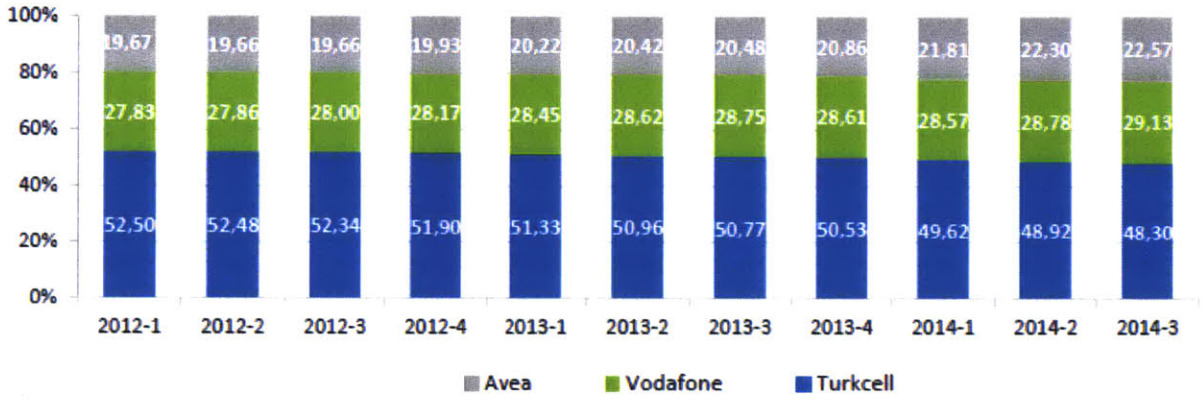
The figure stated below (Figure 3-7) shows the number of mobile subscribers and the penetration rate. The year 2008 was an overshoot point for the mobile industry, mainly because of the number portability regulation and termination rate reductions by ICTA, multiple telephony usage and so the overall mobile telephony penetration had decreased within the consecutive two years of 2008. In July 2009, three mobile operators has started 3G operations. As of 2014 third quarter, 79 percent of all mobile subscribers are having 3G subscriptions. Since from the year of 2010, the number of mobile subscribers and penetration rate has been increasing gradually. The latest point achieved in the total number of mobile subscribers is 72 million corresponding to penetration rate of %93.8.

Figure 3-7. Number of mobile subscribers and penetration rate



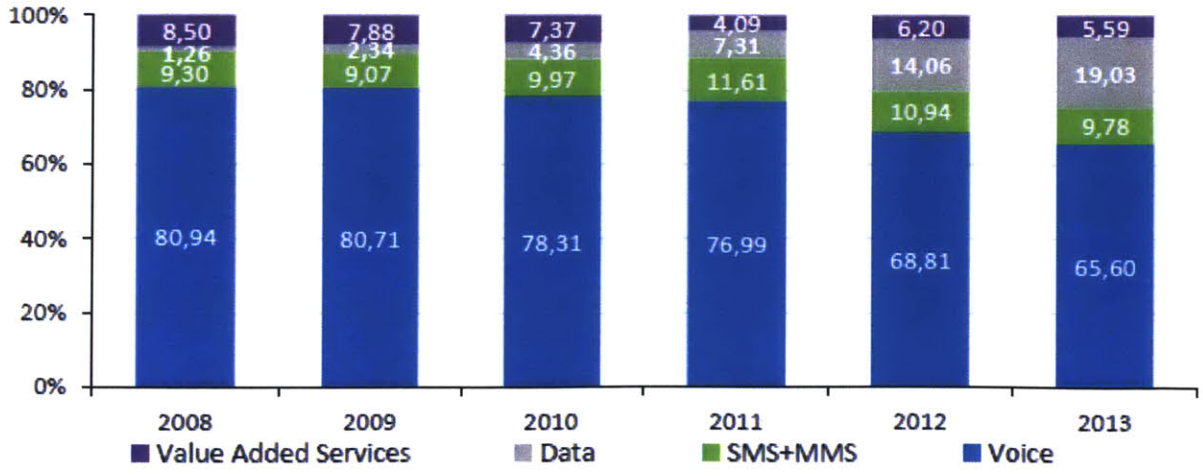
Compared with the fixed market, Turkish mobile market is rather competitive. Turkcell, however, has a prevailing leadership in the market with the market share of around 50 percent of total mobile subscribers (Figure 3-8). On the other hand, there has been a gradual improvement in Herfindahl-Hirschman Index (HHI). According to Figure 3-8 this index was 3917 in 2012 first quarter but it has decreased to 3718 in 2014 third quarter.

Figure 3-8. Market shares according to # of subscribers, %



Although, it has decreased around 15 percent between the years 2008 and 2013, the voice revenues are still the most important revenue item in Turkish mobile market (Figure 3-9). As 3G services has been started in 2009, since that date, the share of data revenues have been increasing remarkably. SMS and MMS revenues had reached the highest revenue percentage with %11.61 in 2011, nevertheless it has decreased within the consecutive years. That is mainly considered because of the competitive pressure arising from over the top messaging applications.

Figure 3-9. Breakdown of mobile revenues, %



3.3.4 Broadband market

The total fixed broadband connections is around 8.6 million in Turkey. The majority of fixed broadband subscribers connect to the internet over xDSL technology and this number has reached 6.7 million people as of 2014 third quarter. The annual growth rate of xDSL subscription is very low, around one percent. The second highest broadband subscription by technology is fiber broadband access which is around 1.4 million. Contrary to DSL, the annual growth rate of fiber is quite high and it has grown 44 percent within the last year. Cable internet is the third most common fixed broadband internet connection type, with the subscriber level around half million. It has a 6.6 percent annual growth rate for the last annual term (Table 3.3).

Table 3.3. Number of Internet Subscriptions by Technology

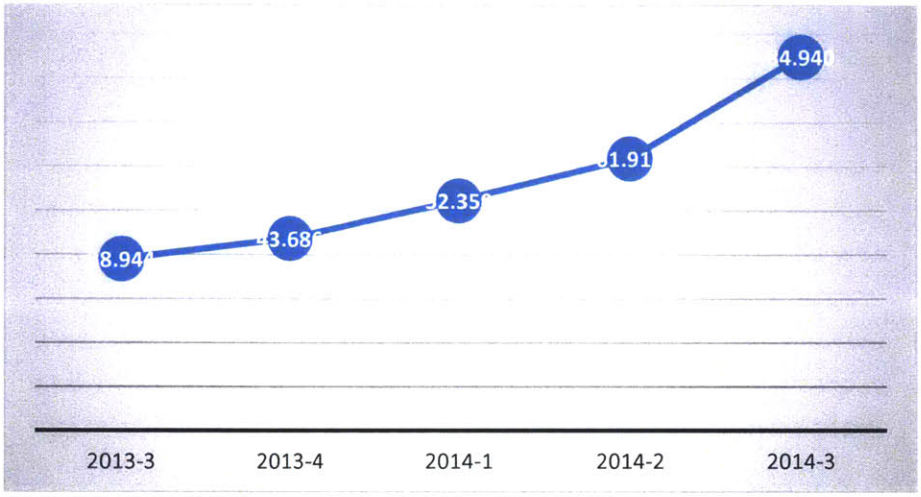
		2013-3	2014-2	2014-3	Quarterly Growth Rate (2014 Q1 - 2014 Q2)	Annual Growth Rate (2013 Q2 - 2014 Q2)
Fixed Broadband	xDSL	6.662.999	6.655.076	6.721.902	1,00%	0,88%
	Fiber	967.309	1.330.922	1.393.614	4,70%	44,07%
	Cable Internet	483.046	496.038	514.965	3,80%	6,61%
Mobile Broadband	Mobile Internet from Computer	1.742.995	1.379.300	1.277.070	-7,40%	-26,73%
	Mobile Internet from Mobile Handset	21.099.677	27.066.363	29.826.976	10,20%	41,36%
	Other	120.159	105.103	103.165	-1,80%	-14,14%

Source: ICTA 2014 Q3, modified by author

The number of subscribers having mobile internet connection from mobile handsets has reached to almost 30 million. The total increase in this number within the last annual term is close to 9 million which is a growth rate around 41 percent. On the other hand, the number of subscribers having mobile internet connection from computers through the devices like USB modem sticks has decreased to 1.3 million level from 1.74 million within the last annual term. The total mobile internet usage has more than

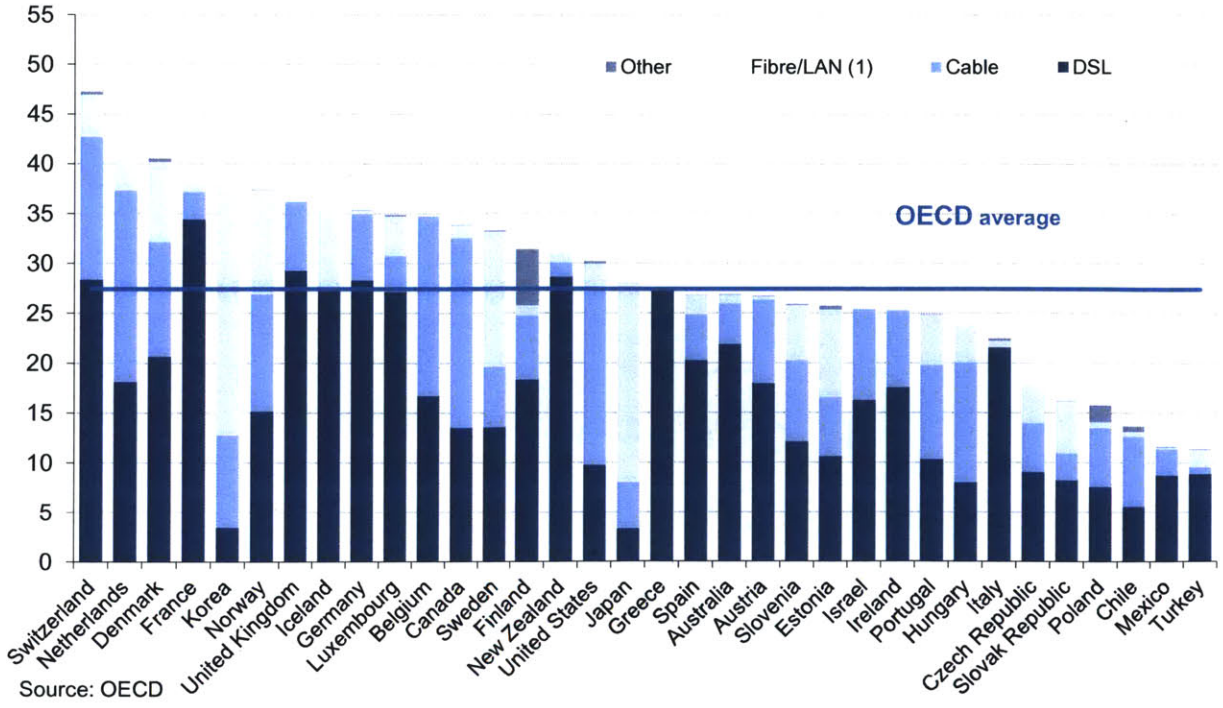
doubled from 2013 Q3 to 2014 Q3 and it has reached to the 84.940 Tbyte level (Figure 3-10).

Figure 3-10. Mobile Internet Usage, Tbyte



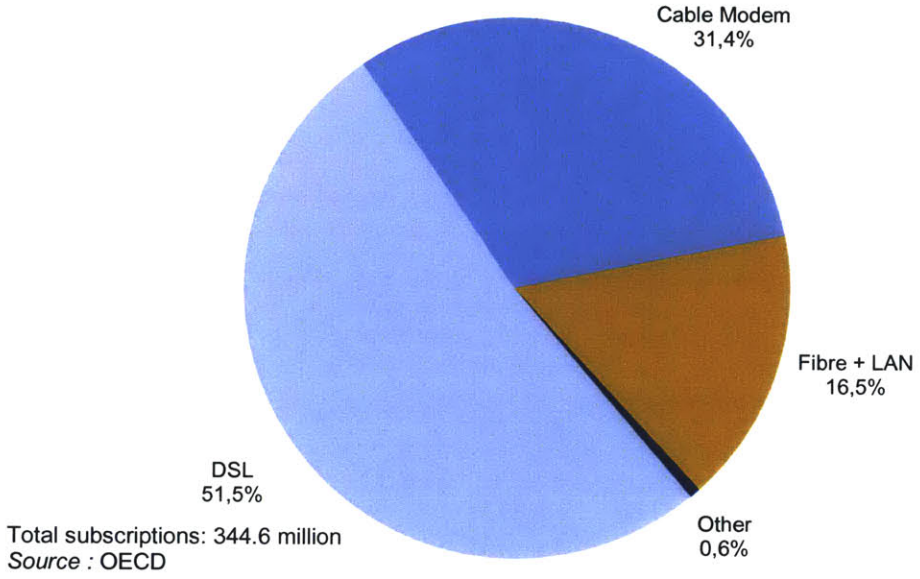
Although there is an upward progress in the number of fixed broadband subscriptions in Turkey, the current level of fixed broadband penetration is quite low compared with OECD countries. According to OECD cross country comparison about fixed (wired) broadband subscriptions per 100 inhabitants, Turkey is in the last position with the level of 12 whereas OECD average is around 27 per 100 inhabitants.

Figure 3-11. OECD Fixed (wired) broadband subscriptions per 100 inhabitants, by technology, June 2014



The figure stated below shows the distribution of the fixed broadband subscriptions by technology, among the OECD countries. According to OECD average DSL subscriptions constitutes 51.5 percent of the whole fixed broadband subscriptions. Cable modem has the second portion with 31.4 percent and the fiber has the third portion with 16.5 percent.

Figure 3-12. OECD Fixed (wired) broadband subscriptions, by technology, June 2014



Similar with the OECD average, fiber broadband access corresponds to the 16 percent of fixed broadband connections in Turkey. However, cable subscription level which is 6 percent of fixed broadband connections is far below than the OECD average that is 31.4%. In Turkey DSL connections corresponds to the 77 percent of all fixed broadband subscriptions that s considerably higher than the OECD average %51.5. One of the most remarkable point in Figure 3-13, showing the distribution of fixed broadband subscribers according to technology and operator is the dominance of xDSL service by a single operator TTNet, which is the subsidiary of the fixed incumbent network operator of Turkey, Türk Telekom.

Figure 3-13. Distribution of fixed broadband subscribers according to technology and operator, %

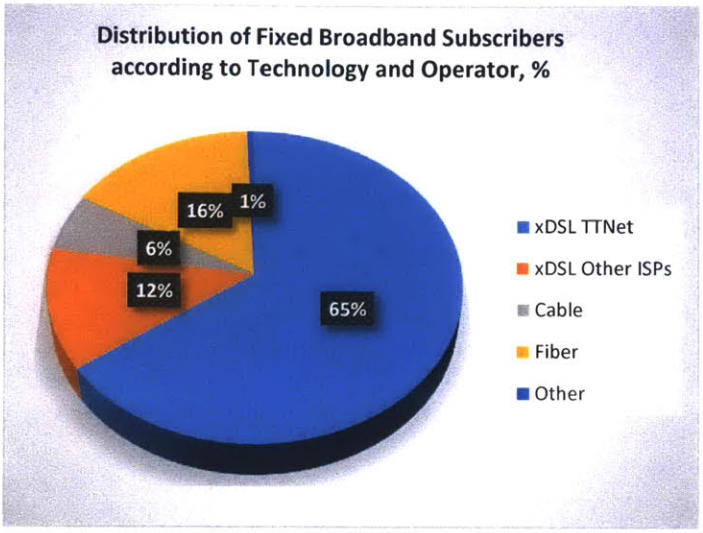


Table 3.4, shows the market shares of the ISPs in Turkey, with the exclusion of cable broadband. This table also indicates the severity of the concentration much clearly that TTNet holds the 77.5 percent of the ISP market share. The second highest market share belongs to Turkcell Superonline with 14 percent. Doğan TV Digital's market share is around 4.5 percent and the rest of all ISPs' total market share is around 4 percent.

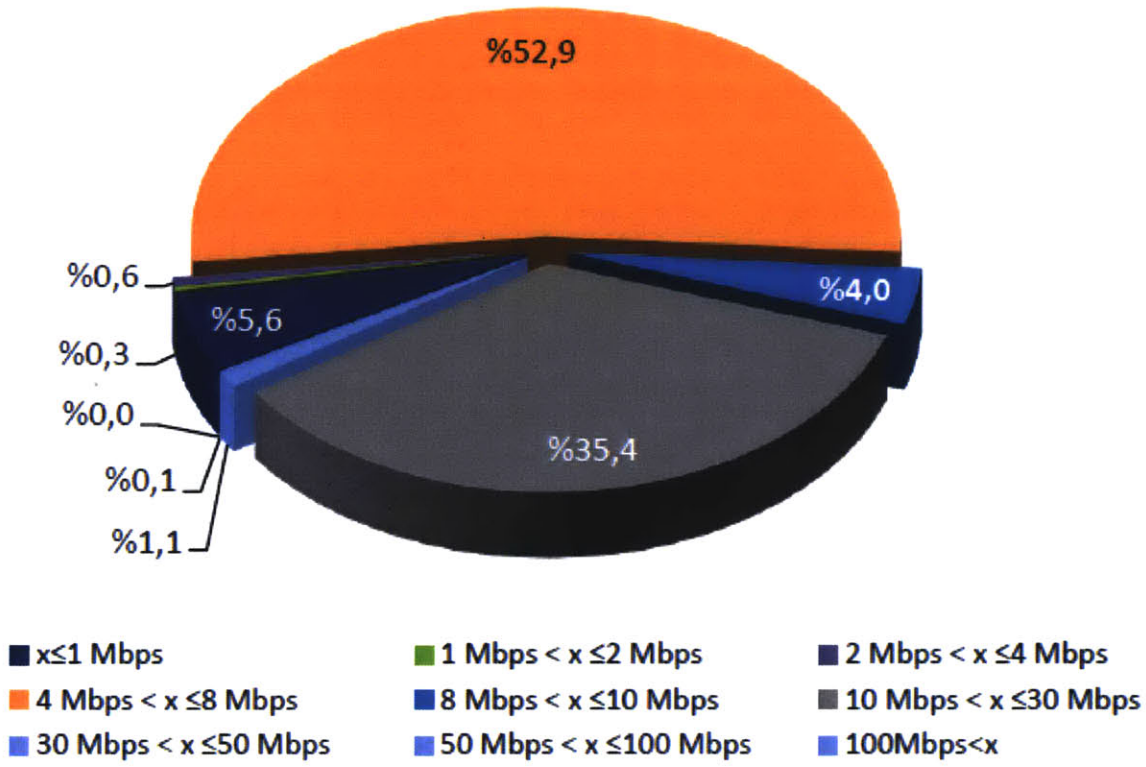
Table 3.4. ISP market shares*

Operator	%
TTNet	77,53
Superonline	14,16
Doğan TV Digital	4,49
Turknet	1,34
Millenicom	1,18
Vodafone Net	0,95
Himnet	0,08
İşnet	0,06
Eser	0,05
Telnet	0,03
Others	0,13

*Cable is not included

Figure 3-14 shows the breakdown of the fixed broadband speeds. Broadband packages providing speed between 4 Mbps to 8 Mbps is the most common broadband connection type corresponds to the 53 percent of total fixed broadband subscribers. The second highest common broadband packages are the ones providing 10 Mbps to 30 Mbps constituting the 35 percent of the all connections. The level of ultra high speed broadband connections which are 30 Mbps and over is lower than 2 percent. Lastly, there are still many subscribers having broadband connection up to 1 Mbps which is around 5.6 percent.

Figure 3-14. Connection speeds for fixed broadband, 2014 Q3



3.3.5 Digital satellite platforms

Digitürk and D-Smart are the leading digital satellite platforms of Turkey. As of second quarter of 2014 a new digital platform called Filbox has started to operate in this market (ICTA, 2014). Table 3.5 shows the number of domestic digital platform service user by digital platform. According to this table, Digitürk, has the highest number of subscribers which is around 3 million corresponding a market share of 64 percent. Digiturk has the monopoly rights over broadcasting Turkish national soccer league matches. In 2010, the tender, regarding the broadcasting rights of Turkish national soccer league

matches, was won by Digiturk for 4 years (NTV, 2010). Later on, Turkish Football Federation and Digiturk have extended their agreement, however this agreement has been subjected to a case at Competition Authority. D-Smart has the second highest subscription figures with 1.7 million and its market share around On the other hand, Filbox is just in the early phase of business and subscriber level. Between the first quarter of 2013 and the third quarter of 2014, there has been an almost 8 percent gradual increase in the number of digital satellite platform subscriptions.

Table 3.5. Digital platform services, # of domestic users

	2013-1	2013-2	2013-3	2013-4	2014-1	2014-2	2014-3
DIGITÜRK	2.869.292	2.877.170	2.957.884	2.963.161	2.956.344	2.957.205	3.019.947
D-SMART	1.523.009	1.544.058	1.592.722	1.636.762	1.649.191	1.669.284	1.708.716
FILBOX	-	-	-	-	-	361	1.110

3.4 Cable TV network

As seen in many country cases and also according to the OECD average by broadband technology usage, cable TV network is the main alternative platform to the DSL based incumbent fixed network. However, in Turkey, it has not been developed much both in terms of service coverage and the number of subscribers. Currently, cable TV infrastructure is being owned and managed by a government company called Türksat. In this part, history and the path dependence of the cable TV network development and the Türksat's figures related with cable TV network will be stated.

3.4.1 History of cable TV network

In Turkey, cable TV network investments has been started in 1990 by PTT, government monopoly of that times, within the 9 big cities of Turkey: Ankara, İstanbul, İzmir, Adana, Antalya, Gaziantep, Bursa, Konya and Kayseri (Telkoder, 2006). In 1991, cable TV network has reached to 1.570.000 subscriber capacity within these 9 cities. This first version of investments was just capable of one way analog TV transmission. Up to 1994, PTT, after this that it is facilitated as Türk Telekom, has managed cable TV operations and made investments with its own sources. However, after this date, due to the lack of budget constraints for cable TV, new investments on cable TV has stopped. (Decdeli, 2004). In 1997, Türk Telekom signed regional contracts with

operators based on revenue sharing model to open up cable TV operations in 11 new cities. For these new 11 cities the agreed infrastructure would be two way enabled, compatible with broadband internet, data and voice transmission (Telkoder, 2006). In this revenue sharing model, new cable TV deployment and the site maintenance would be under the responsibility of RSP (Revenue Sharing Partner), operations regarding subscription, billing, pricing and the content would be under the responsibility of Türk Telekom (Decdeli, 2004). Later on, in 1998, Türk Telekom has extended revenue sharing model with initial cable TV network deployed in 9 cities. Within the scope of the agreements between Türk Telekom and RSPs, the existent cable TV network in these 9 cities has been extended network with 25 percent service coverage and the network capacity has been upgraded to provide broadband, data and voice services (Telkoder, 2006)

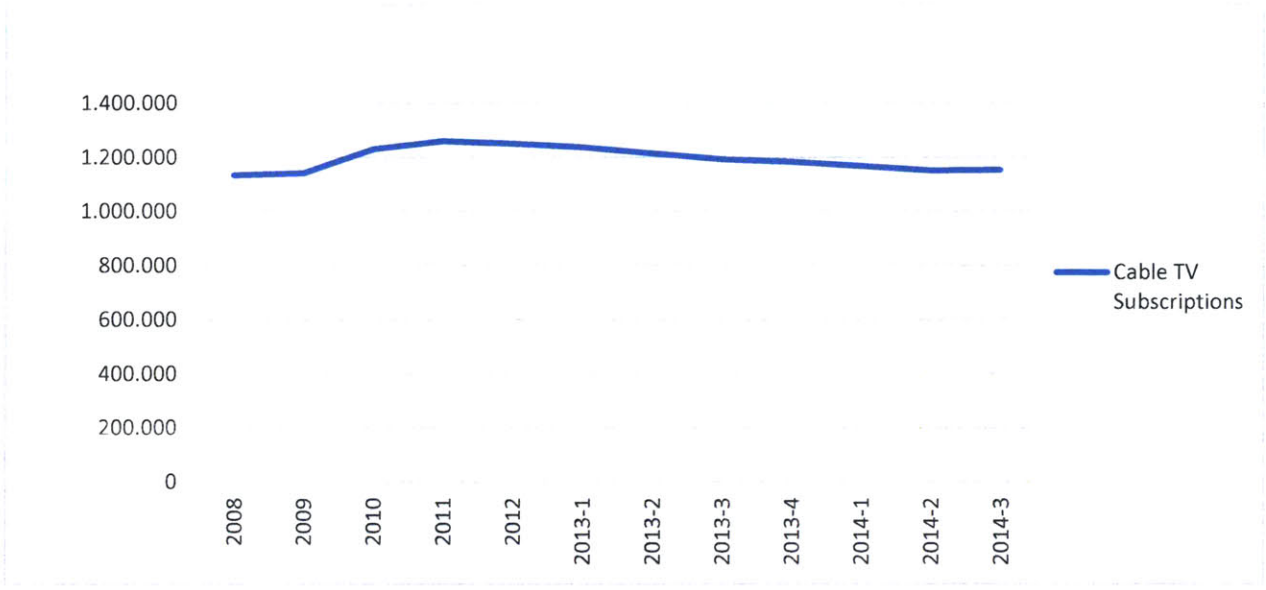
As a result of Competition Authority's investigation, concluded in February 2005, Türk Telekom has been alleged in abuse of dominant position by refusing to open and make use of the cable TV infrastructure for other ISPs (Atiyas, 2005). While during the privatization process of Türk Telekom, considering the proposal of Competition Authority for divesting cable TV assets of Türk Telekom, the Law numbered 5335 and dated in 21 April 2005 was enacted. According to this Law, it is ordered to transfer cable TV infrastructure to Türksat which is a state company mainly established for national satellite operations (Telkoder, 2006). Later on, Türksat did not extend the agreements with RSPs and currently it is managing cable TV network with its own resources.

3.4.2 Cable TV market figures

Türksat has three different main missions given by relevant laws. First and establishing objective of the Türksat is the management of the rights of the satellite orbital positions within the scope of national sovereignty. As also stated above, second one is the management of cable TV network. The third one is the establishment and dissemination of e-government services. Under this topic, the figures related with cable TV network operations of Türksat will be stated.

Cable TV as a technological feature of its network, it is a natural triple service player. These services are TV, broadband internet access and telephony. Following three figures show the Türksat's number of subscribers for these three services.

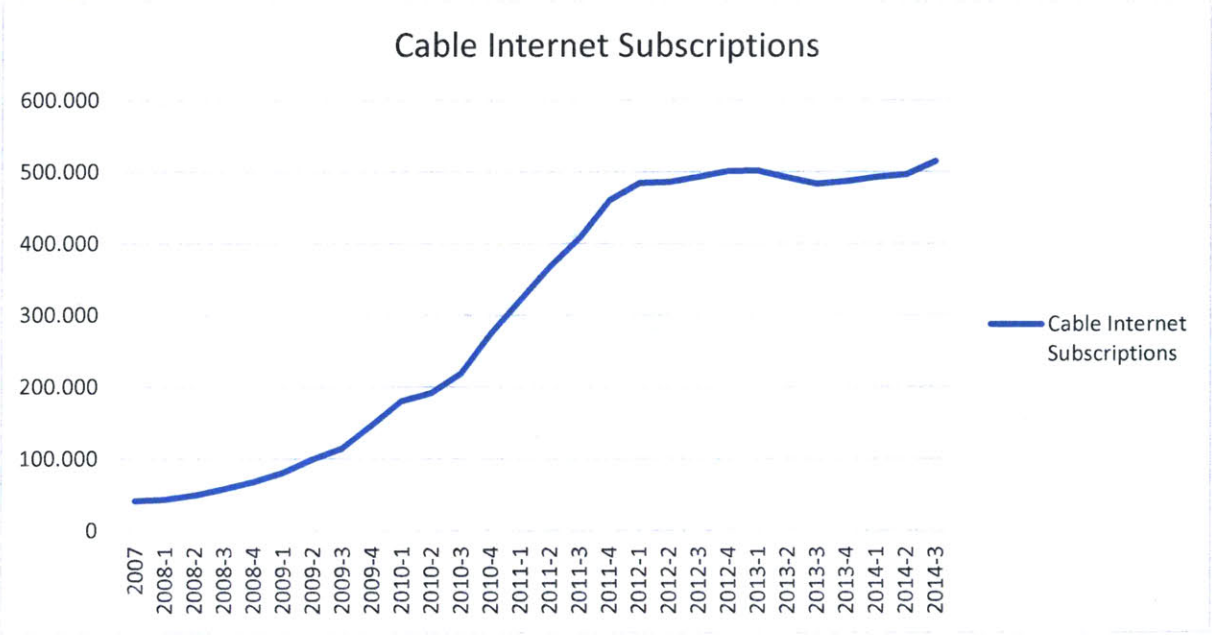
Figure 3-15. Number of cable TV subscribers



Source: ICTA Market Reports and Turkish Court of Accounts (2013), compiled by author

Above figure (Figure 3-15) shows the trend of cable TV subscribers of Türksat between 2008 and the third quarter of 2014. The general trend of the total number of subscriber is almost stable around 1.2 million. However, during the last three years, there has been a slight but a gradual decrease in the number of cable TV subscriptions.

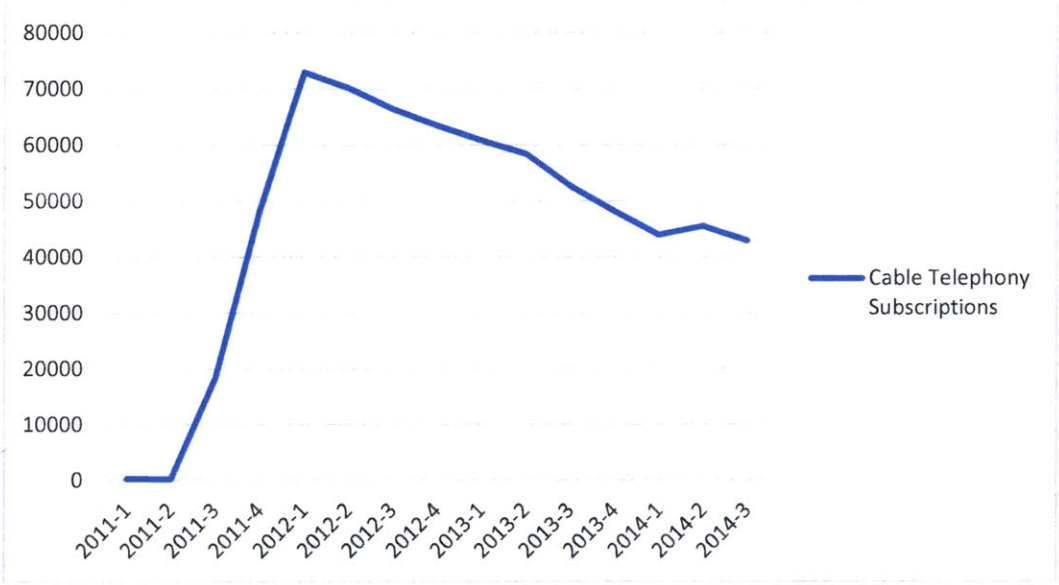
Figure 3-16. Number of cable internet subscribers



Above figure (Figure 3-16) indicates the number of cable internet subscribers between 2007 and the third quarter of 2014. The shape of the cable broadband subscriptions'

growth is very much like with S shaped growth curve. Particularly, for the years 2010 and 2011, the number of subscribers has been increased exponentially. After 2011, rapid rise in the number of broadband subscriptions has stopped and the level of broadband subscriptions has settled around 500.000.

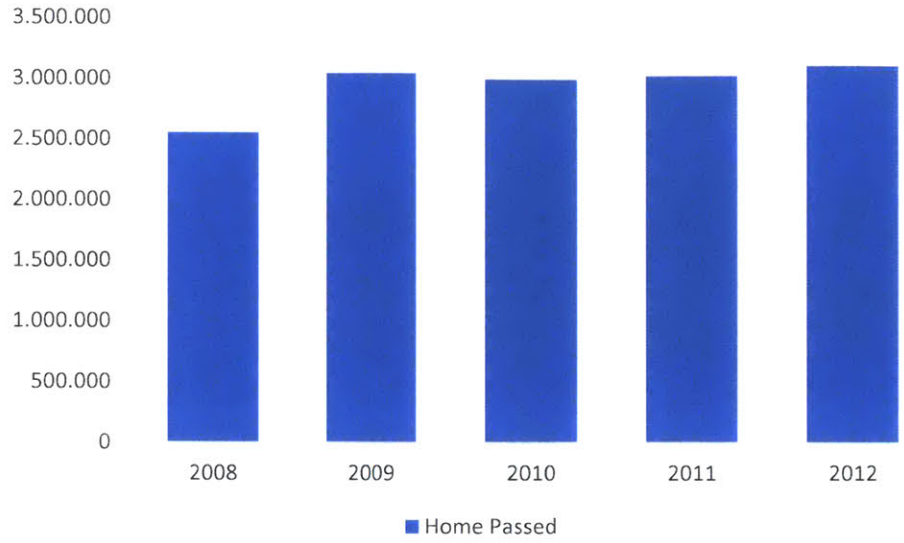
Figure 3-17. Cable telephony subscriptions



According to the figure located above (Figure 3-17), Türksat has started to provide cable telephony service since the beginning of 2011. This date is quite a long time after the liberalization of fixed voice market. Within one year of time after the provision of the cable telephony service, the number of cable telephony subscribers has exceeded 70.000 subscribers. Nevertheless, after this point the growth has not only stopped but also has decreased to 40.000 level.

According to the report of Turkish Court of Accounts (2013) regarding the activities of Türksat in 2012, Türksat's network capacity is 3.111.718 in terms of number of home passed and this network has updated to Docsis 3.0 standard enabling high speed broadband access. According to the figure 3-18, the remarkable attempt to increase the network coverage has occurred in 2009. In 2009 the total number of home passed has increased from 2.55 million to 3.05 million. However, for the following years there has not been much development in cable network in terms of number of homes passed.

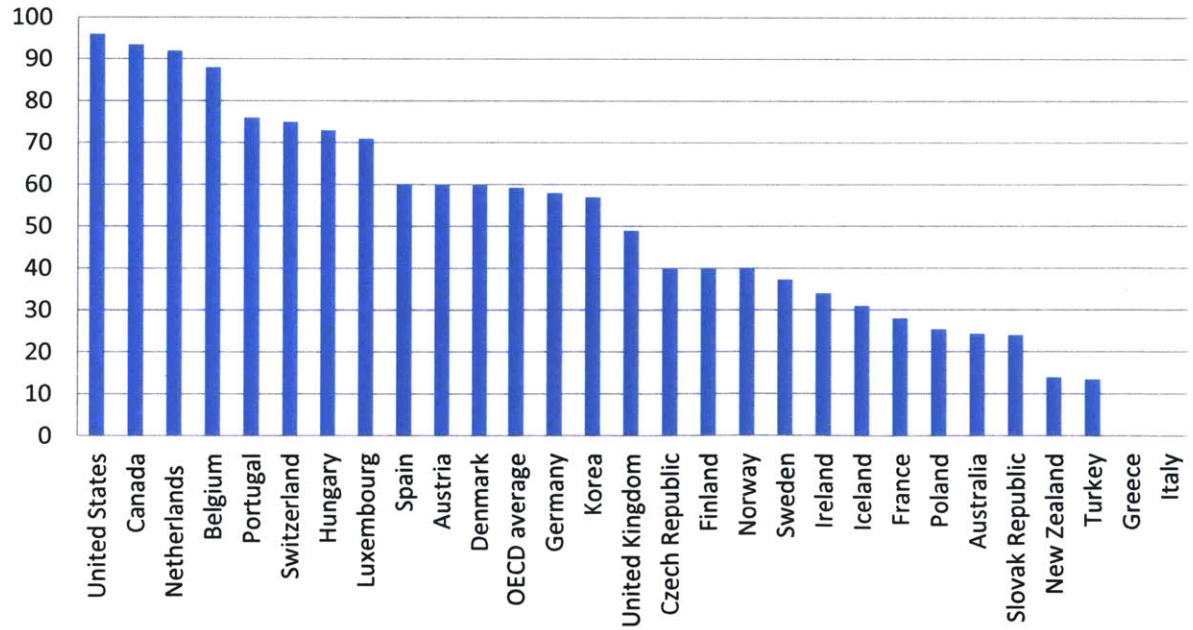
Figure 3-18. Cable TV network capacity



Source: Turkish Court of Accounts (2013)

As of 2012 the total number of households in Turkey was 19 842 850[3] whereas cable TV network coverage is 3.1 million implying a network coverage around 15 percent. Nevertheless, this network coverage is comparatively quite low with OECD average. According to the comparison of OECD countries in terms of availability of cable modem services, up to 2008, OECD average is above 50 percent while Turkey has the third position from the last just above Italy and Greece where there is no observable cable modem activity (Figure 3-19).

Figure 3-19. OECD, availability of cable modem services (%), 2008



[3] According to the data of Turkish Statistical Institute

3.5 Regulatory environment

ICTA, Competition Authority (CA), Ministry of Transport, Maritime Affairs and Communication (Ministry) are the prominent governmental authorities having regulatory power in Turkish telecommunication market. ICTA is the main responsible regulatory authority having the duties of sustaining competition, authorizing operators, protecting consumers etc. CA has competencies to act against the behaviors restricting competition. Ministry is the relevant governmental body responsible for determining national policy, strategy and objectives. In this part, firstly, these governmental authorities' duties and the responsibilities regarding Turkish telecommunication market, will be examined. Then, secondly, regulatory regime, particularly focusing on ICTA's secondary legislation and regulations about authorization, competition and access, will be figured out.

3.5.1 Regulatory institutions

Ministry of Transport, Maritime Affairs and Communication is the responsible ministry regarding communication market to determine national policy, strategy and objectives. Electronic Communication Law, dated 5 November 2008 and numbered 5809 article (5) points out the competencies, some of them as follows:

> a) Setting strategies and policies regarding electronic communications services which are based on scarce resources such as numbering, internet domain names, satellite position and frequency allotment."
>
> b) Determination of objectives, principles and policies towards the aim of encouraging the development of electronic communications sector in free competitive market and supporting the transformation into an information society, therefore taking promotional measures to this end.
>
> c) Determination of policies towards construction and development of electronic communications infrastructure, network and services in accordance with the technical, economic and social needs and in harmony with the national security objectives and the public interests, and towards ensuring their operation in a complimentary manner.

Legislative Decree on Organization and Duties of The Ministry of Transport, Maritime Affairs and Communication, numbered 655, which was enacted in 1 November 2011, states the similar duties regarding the policy determination over the communication market. However, beyond the policy point, the General Directorate of Communications of the Ministry has entitled with some regulatory power regarding the regulation of the rights of way and base station installment issues. Corresponding provisions about the duties of the General Directorate of Communications are stated as follows:

j) Determining principles and procedures concerning the right of way on passing any kind of cables and similar material used in fixed and mobile communication infrastructure or networks of this infrastructure in/on premises; and determining and supervising tariffs to be implemented for passing these on/in premises.

k) Determining principles and procedures on installation of any kind of base station, antennas, towers, waveguides, containers and similar materials and devices in fixed and mobile communication infrastructure or networks and on mounting these on premises; and determining and supervising tariffs to be implemented for mounting these on premises."

Information and Communication Technologies Authority (ICTA) is the main responsible authority for sustaining competition, authorizing operators, protecting the consumer rights and performing investigations in electronic communications sector of Turkey. Electronic Communication Law article (6) states that ICTA shall be competent:

a) In the electronic communications sector; to make regulations to create and protect competition and to eliminate the practices which are obstructive, disruptive or limitative for competition, to this end to impose obligations on operators with significant market power in the relevant markets and on other operators when required, and to take measures stipulated by the legislation."

b) To inspect the breaches of competition in electronic communications sector which are against this Law and against regulations based on of this Law, to impose sanctions and to take the opinion of Competition Authority on the issues regarding the breach of competition in electronic communications sector, if specified by the legislation.

c) To make necessary arrangements and supervisions pertaining to the rights of subscribers, users, consumers and end users as well as processing of personal data and protection of privacy.

...

l) To determine provisions and conditions for authorizations regarding electronic communications services, network and/or infrastructure, to supervise their implementation and conformity to the authorization, to perform necessary actions thereof and to take measures as deemed necessary by the legislation

Competition Authority (CA) with the Law on Maintenance and Promotion of Competition numbered 4054 dated 7 December 1994 is also entitled to perform examination and investigation against behaviors restricting competition. In Electronic Communication Law, Competition Authority's authorities protected but it is obliged to take into consideration, primarily ICTA's view while taking decision on electronic communication industry. The relevant provisions are stated in Electronic Communication Law as follows:

(1) Without prejudice to the provisions of Law no. 4054 dated 7/12/1994 on Maintenance and Promotion of Competition, the Authority is entitled to perform examination and investigation of any action conducted against competition in electronic communications sector, on its own initiative or upon complaint; to take

> measures it deems necessary for the establishment of competition and to request information and documents within the scope of its tasks.
>
> (2) The Competition Board while performing examinations and supervisions and while making any decisions on electronic communications sector, including decisions about merges and takeovers, takes into consideration primarily the Authority's view and the regulatory procedures of the Authority.

Later on, Competition Authority and ICTA presidents have signed a collaboration protocol to enhance efficient coordination between two authorities. In the protocol and also in the practice, it can be said that there is a duty sharing between two authorities that Competition Authority handles the ex-post competition violations and complaints whereas ICTA imposes ex-ante competition measures mostly within the scope of its market analysis.

3.5.2 Regulatory regime

Regulatory principles and procedures are mostly defined by Electronic Communication Law and its secondary legislations issued by ICTA. Since, Turkey is a candidate country for European Union, Turkish electronic communication framework largely inspired by European Union (Atiyas and Doğan, 2007). Up to the Electronic Communication Law, enacted in 2008, it has been observed that European directives are also anticipated during the preparation of the secondary legislations of ICTA. Electronic Communication Law is one of the most important primarily legislation aligning Turkish electronic communication legislation to EU framework. European Commission's 2009 progress report also emphasize this as "a significant step towards aligning Turkey's regulatory framework with the EU acquis, notably as regards the authorisation rules and the tasks of the regulator". Although, that was a mile stone, many critics of European Commission (2014) on authorization, spectrum management and universal service regime is still going on.

By-Law on Authorization for Electronic Communications Sector dated in 28 May, 2009 is the secondary legislation regulating the procedures and principles for authorization for electronic communication services, networks and infrastructures. According to By-Law, as a general principle, authorization can be performed by either "notification or granting right for use". These two authorization principles are stated as follows:

> If companies do not require source allocation such as number, frequency, satellite position for electronic communication services they intent to provide and/or electronic communication network or infrastructure they intent to install

> and operate, they shall be authorized by means of notification in accordance with procedures and principles specified under this By-Law and if they need source allocation they shall be authorized by obtaining right of use

The main irregularity to this general authorization principles are concession agreements signed with incumbent fixed network operator and mobile network operators and the authorization agreement signed with Türksat. According to Electronic Communication Law and the relevant by-law the validity of these agreements continue "until they expire with any reasons such as period termination, termination or cancellation". From the perspective of regulation, these operators, besides the general legislation, they might subject to additional regulatory treatment according to the agreement's provisions that they had signed with ICTA. Moreover, it has been observed that there are some government practices having commitment or embedding policy objectives while signing this concession agreements. For example, in 3G licensing process, it is demanded from mobile network operators to employ a certain level of R&D personnel in line with government policies regarding employment and R&D. ICTA's head PhD. Tayfun Acarer states these policy objective as follows (The Worldfolio, 2013):

> "We also have demand from companies and enterprises themselves regarding investment and research and development activities. It is not even demand; these things exist in their licensing agreement anyway. For example, for the third generation licensing period, they have to employ 200 people in the first year, then 350 people and in the third year, 500 research and development staff in their company

Although these concession agreements are signed for longer terms, many years has passed after the signature of GSM and Türk Telekom's concession agreements. Therefore, transition strategies after the expiration of these agreements will be the important issues needs to be handled by ICTA in the near future.

In Turkey, conducting market analysis is the main regulatory regime to protect and ensure effective competition in electronic communication sector. Similar with principals and the procedures stated in the framework directive of EU enacted in 7 March 2002, ICTA conducts market analysis and imposes competition remedies among the operator(s) which are designated as significant market power (SMP). By-Law on Market Analysis dated 27 December 2012, defines the concept of SMP as follows:

A position of economic strength enjoyed by an operator, whether individually or jointly with other operators within the relevant electronic communications market, enabling it to behave to an appreciable extent independently of competitors, users, and consumers

According to the stated by-law, market analysis suppose to include 5 steps, these are:

a) Definition of the relevant market,

b) Examination of the need for regulation in the relevant market,

c) Analysis of competition level in relevant market,

d) Designation of the operator(s) having significant market power,

e) Determination of the remedies to be imposed on the operator(s) having significant market power

By law also states the primary criteria while designating the operators having significant market power as the market shares within the specified market. Addition to the market share, a set of secondary criteria also listed in the by-law. Provision of access and/or interconnection, transparency, non discrimination, publication of reference access and/or interconnection offers, accounting separation, tariff control, cost accounting, providing minimum sets of leased lines, co-location and facility sharing are the remedies that ICTA has entitled to impose to operator(s) designated as SMP as a consequence of conducting market analysis.

Although the list of remedies stated in By-Law on market analysis, the definitions, principals and implementation procedures of these remedies have been set out in the By Law on Access and Interconnection dated 8 September 2009. Moreover, for conducting market analysis and the implementation of these remedies, organizationally ICTA has two separate departments; these are namely Sectoral Competition Department and Access and Tariffs Department. The logic behind this structure is enabling some level of organizational self check over the competition remedies. Some of the notable remedies are explained below.

In Turkish Electronic Communication Law and in the relevant By-Law, the scope of access is defined very broadly. It covers access to components of electronic telecommunications network and its associated facilities, physical infrastructure, relevant software and interconnection. Imposing access remedy on an operator

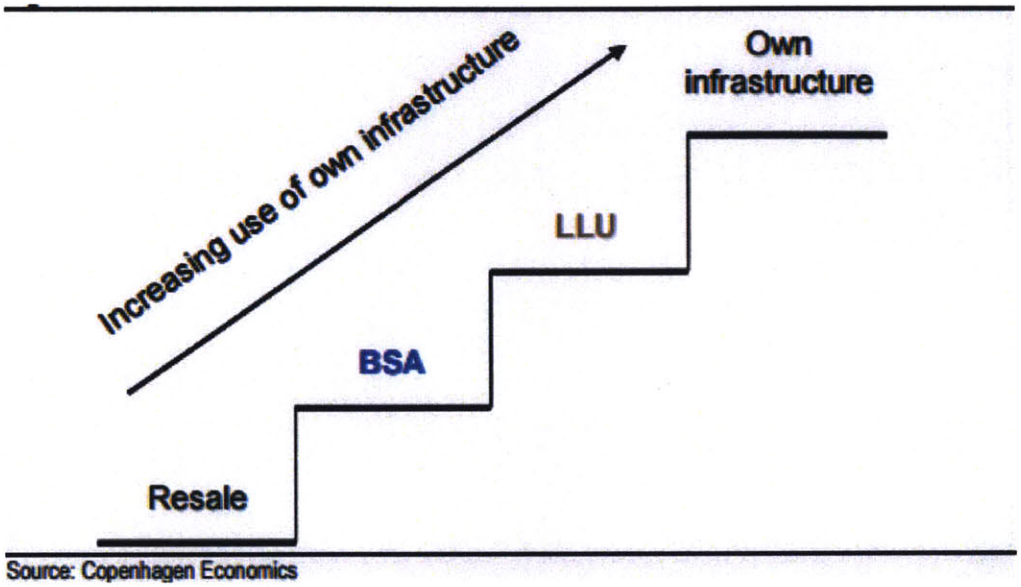
means, it is obliged to fulfill "the other operators' requests for access". The same logic is true for the interconnection remedy. Remedy of non-discrimination, which is also known as common carriage principle, is defined as the obligation where the operator having designated as SMP, has to provide relevant services, "to those requesting, on a non-discriminatory basis and upon the same conditions and qualities that are applied to their subsidiaries or partners or partnerships." Remedy of reference access offer publication intends to increase transparency over the services of SMP operator. Through reference access offers asymmetric information situation has mostly been eliminated and new firms gained a broad vision about technical, economical and legal aspects of the service agreement that will be come up with. As a general rule, operators are free to set their access tariffs, however ICTA has entitled to impose tariff control obligation for the operators designated as SMP. The premise method has been set to be used while imposing tariff control is cost based regulation. Moreover, it is narrowly tailored with the long run incremental cost allocation methodology, which is a common method used for cost calculations in telecommunication industry and it is also anticipated in The Telecommunications Act of 1996 of US.

Wholesale unbundled access and wholesale broadband access markets are the two relevant markets regarding fixed broadband competition. The definition and the scope of these two markets has been developed in Commission Recommendation dated 11 February 2003 and numbered 2003/311/EC. Even though this recommendation has changed within the following years and the number of total markets has been decreased, these markets are still known as Market 11 and Market 12 as stated in the recommendation 2003. Commission recommendation of 2003 defines wholesale unbundled access as access "to metallic loops and sub-loops for the purpose of providing broadband and voice services" and wholesale broadband access, generally it refers to bit stream access which is permitting "the transmission of broadband data in both directions and other wholesale access provided over other infrastructures".

The anticipated method and the rationale behind this two fold relevant market definition is the "ladder of investment" model. Regulation of Market 11 (LLU) and Market 12 (Bit Stream Access-BSA) fills the intermediary steps between the resale business and the ownership structure (Figure 3-20). In the ladder of investment model, the intended object is to make easier the network access with different levels and to transform

service based competition into an infrastructure based competition through climbing the steps of the ladder and gradually investing in its own infrastructure (Copenhagen Economics, 2006)

Figure 3-20. Ladder of investment



ICTA anticipates a similar approach with EU approach and it has been regulating the markets called wholesale access to physical network infrastructure and wholesale broadband access including bit-stream access. According to latest board decisions, dated 12.04.2013 and numbered 2013/DK-SRD/188 and dated 11.01.2013 and numbered 2013/DK-SRD/29, due to the very high market share concentration of Türk Telekom, it has been designated as SMP both in the relevant markets and it has been obliged with almost all remedies stated in By-Law. As of June 2014, among the regulated broadband services, there are 3.451 LLU, 54.033 resale and around 1 million bit stream access subscribers. These figures show that the competition has mostly stayed at bit stream access level and there has been scarce attempts to move up to LLU state. Köksal and Ardıyok (2013) criticize the situation, where service based competition figures are low and infrastructure based competition is hardly seen contrary to expectations from the ladder of investment, and they describe the broadband policy to develop a service-based competition not only as a failure but also a retardant effect on facility based competition.

4 Country cases

From the point of history and path dependence of the market development of cable platform, Turkey has unique situation. So, it is challenging to make a comparative benchmark analysis with other countries or to follow the steps of a country that follows a similar path to promote inter-platform competition by privatizing cable TV network. Nevertheless, in this part, in order to deepen the knowledge about competition dynamics of cable TV operators and to look more closely at their development strategies, four cable platforms from three different countries will be examined. These four companies Virgin Media of UK, Kabel Deutchland and Unitymedia Kabel BW of Germany and Numericable of France. The reasons to select these country cases can be listed as first, in these countries, cable platforms are in the challenging position to the incumbent fixed network operators, secondly, similar with Turkey, the early development of the cable platforms has been through regional operators and third these countries, across Europe, are the comparable countries with Turkey in terms of population.

4.1 UK cable market

4.1.1 Brief history of cable TV network

Similar with the United States, in United Kingdom the reason of the cable TV network deployment was to reach to areas which are not covered by the television broadcasting transmitter. Up to 1950s, there has not been much expansion in the cable TV coverage, however, from this date, cable industry had an important development for the places where TV signals are poor and the the towns do not want the antenna cluttering. Later on, from the 1960s, the development of cable TV had been slowed down because of the enhancement in over the air broadcasting (Fox, 1990). The initial deployment of cable TV network had been done with the government facilities. The radical liberalization of the cable TV market in UK has started in 1982 with the offer of Information Technology Advisory Panel to enhance a next generation of broadband cable system. Afterwards in 1984, the Cable and Broadcasting Act and the Telecommunications Act were entered into force allowing the cable network operators to present regular telephony service and the interactive services including internet service to their customers. Up to 2000s the main strategy of the UK government to franchise cable TV operations within the specified regions. The cable TV franchises,

however, were not successful to satisfy intended network coverage and the business performance (Aldrich, 2008). Later on, the merger and the consolidation process of the UK Cable TV market resulted in a duopoly of NTL and Telewest at the beginning of the 2000s. Nevertheless, the consolidation of the UK Cable TV market continued with merger of the NTL and Telewest. In March 2006, NTL's cable division merged with Telewest's cable division through a reverse acquisition. This merger led NTL:Telewest to become the U.K.'s largest triple play service supplier of the television, fixed line telephone and the broadband services. Later on, in February 2007, NTL changed its name to Virgin Media Inc. and continued its operation with its new brand Virgin Media. With the inclusion of the services of Virgin Mobile, Virgin Media Inc. has became the first quad play service play supplier of the U.K. (Virgin Media, 2008)

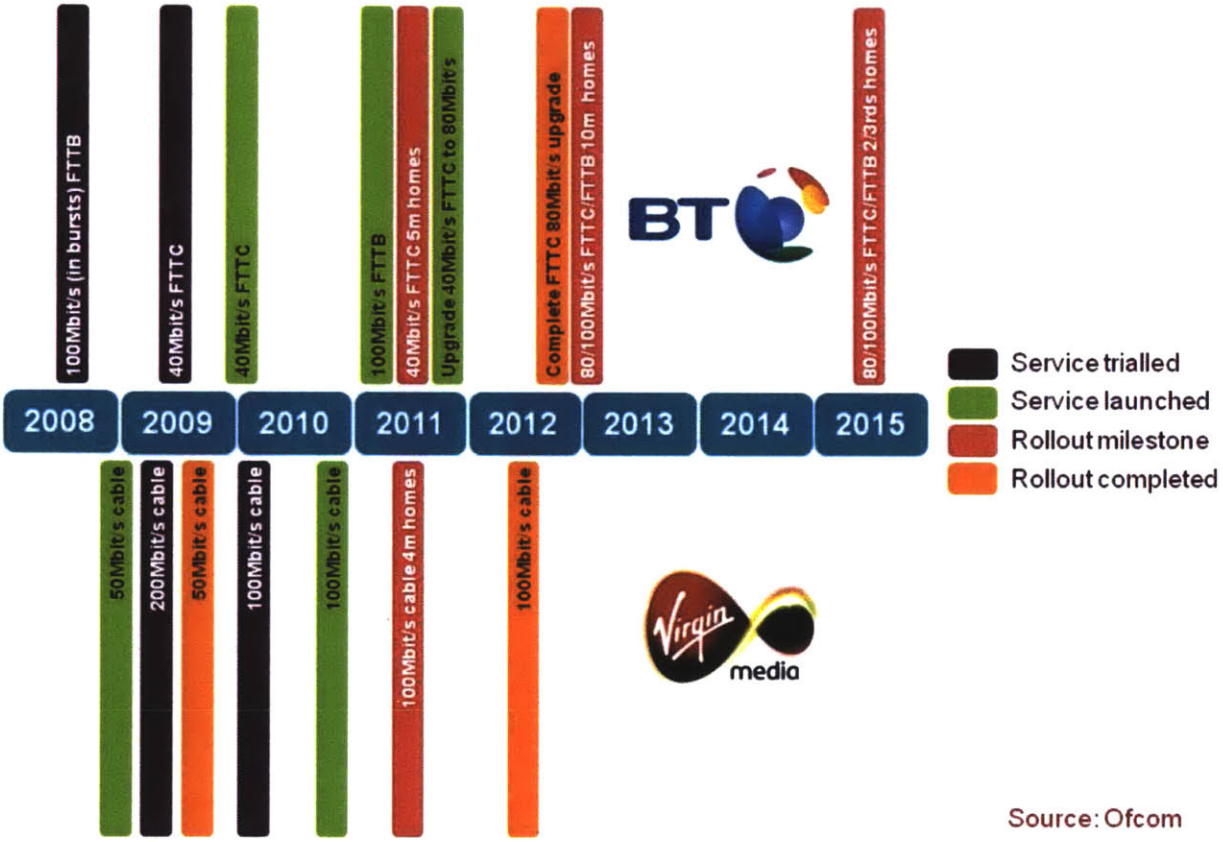
4.1.2 Market figures

Virgin Media defines its competitive advantage over its competitors with their outstanding marketing and packaging approaches (Virgin Media, 2006). The results of its launch campaign was affirmative. Within just three months, Virgin Media's awareness had achieved to 80 from 2 per cent. During its launch campaign Virgin Media not only improved its brand successively but also recover the negative associations from the NTL (Boothby, 2009). Virgin Media classified its broadband packages with an easy to understand approach. Moreover, it provided PC security software for all of its broadband subscribers; for the premium broadband package owners anti spyware program additionally provided. As of these distinctive service features, Virgin Media won the Best Consumer ISP award of Internet Service Provider Association in February 2007 (Virgin Media, 2008). At the end of 2007, according to brand consideration, Virgin Media suppressed its competitor Sky which is also famous in broadband internet marketing (Boothby, 2009).

After the successful launch of Virgin Media, its main broadband competition strategy to offer faster broadband packages. In line of this strategy, Virgin Media powered up its network with fiber deployment and upgraded its cable access network to DOCSIS 3.0. Technological superiority of DOCSIS 3.0 over DSL technology enabled Virgin to offer remarkably faster broadband internet connections to its customer. Virgin, consecutively, launched 50 Mbit/s and 100 Mbit/s broadband which are the prominent broadband speed levels in UK. British Telecom, however, has responded,

subsequently, to fast broadband competition with 40 Mbit/s, 80 Mbit/s, 100 Mbit/s service offers based on FTTC and FTTB technologies.

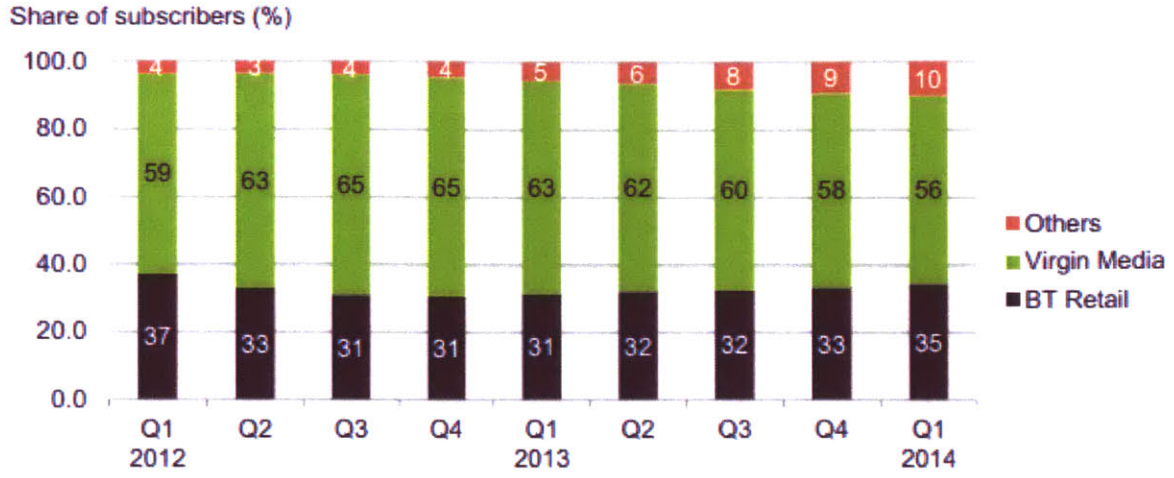
Figure 4-1. High speed broadband service competition: BT vs Virgin



Source: Ofcom

Virgin Media currently holds the majority of superfast broadband subscribers of the UK. Ofcom defines superfast broadband as broadband service delivering headline download speeds at least 30 Mbit/s. As of first quarter of 2014, Virgin Media holds 56 percent of all superfast broadband subscribers while its main competitor BT retail has 35 percent and other operators has 20 percent share.

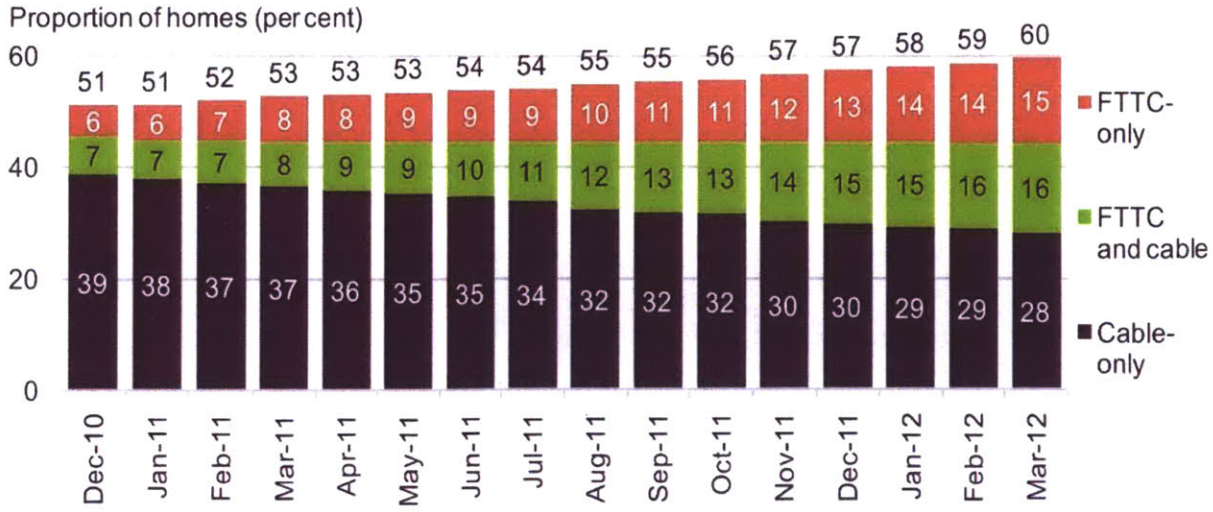
Figure 4-2. Operator share of superfast broadband subscribers



Source: Ofcom

As of March 2012, the proportion of estimated household availability of superfast services is 60 percent. 28 percent of superfast available homes in UK is covered by only cable technology, 16 percent is covered by FTTC and cable together and the rest 15 percent is covered by only FTTC. There is a superiority of cable platform in superfast broadband coverage in UK. However, from December 2010 to March 2012, percentage of cable only superfast broadband available homes had decreased 11 percent, and the total FTTC coverage percentage increased from 13 to 31.

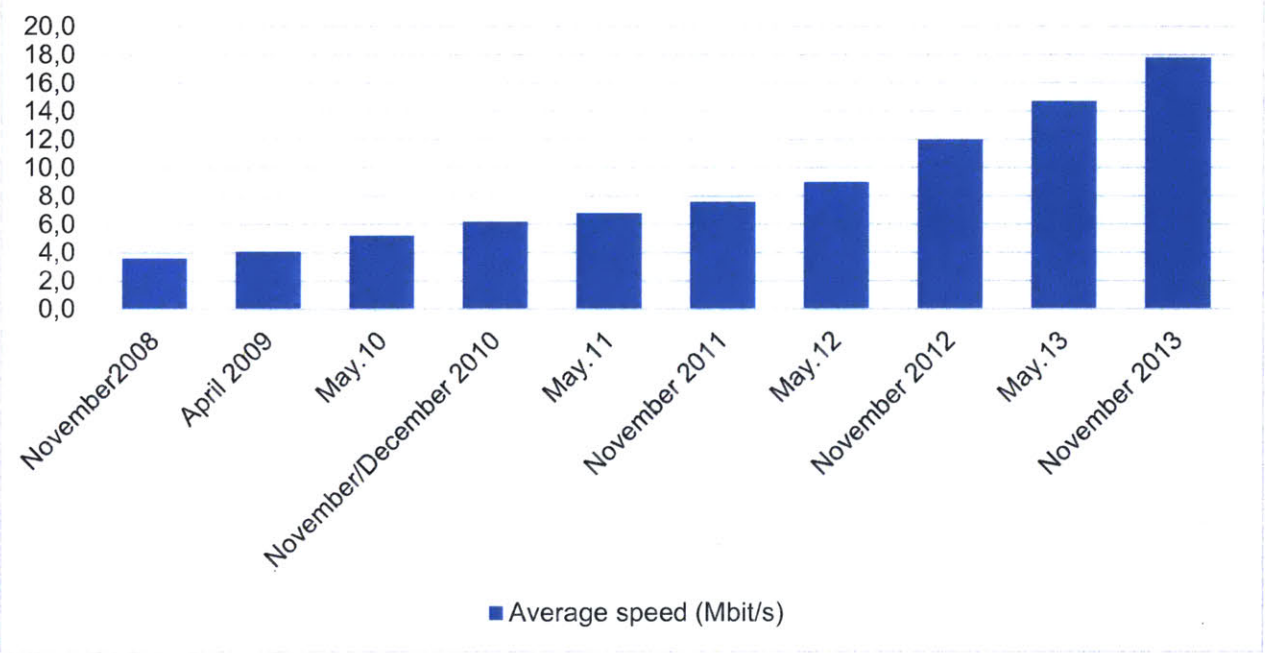
Figure 4-3. Estimated household availability of superfast services, by technology



Source: Ofcom

In line with the broadband speed competition between platforms and the operators, the average internet speed has increased substantially in UK. From November 2008 to November 2013, average speed increased almost 5 times.

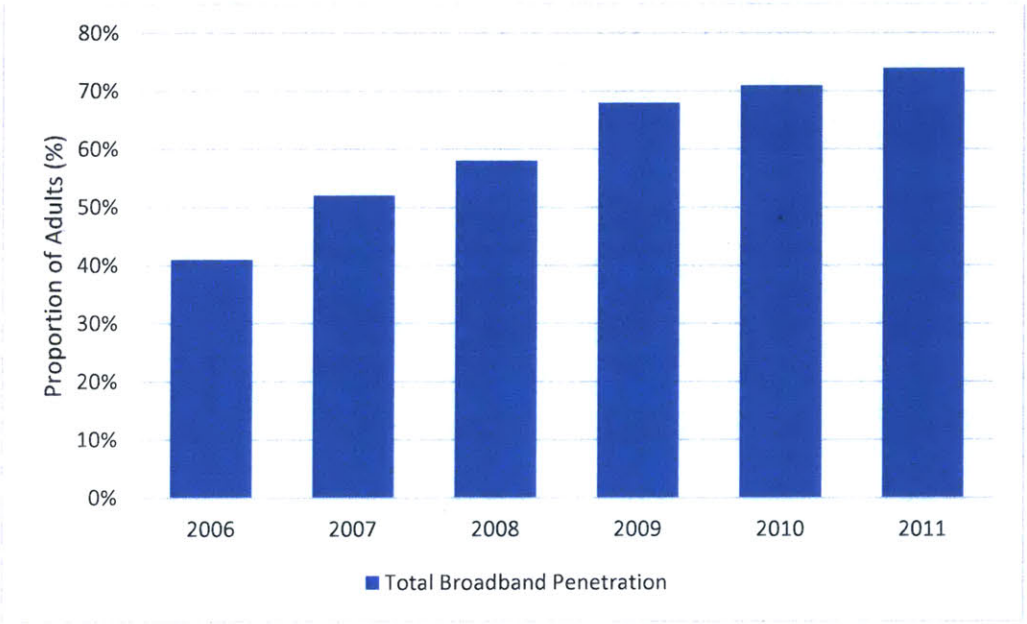
Figure 4-4. Average broadband speed evolution in UK



Source: Ofcom, combined by author

There is also a substantial increase in UK broadband penetration between 2006 and 2011. During the years, overall proportion of adults having broadband has increased 33 percent and it reached to 74 percent in 2011 (Figure 4-5).

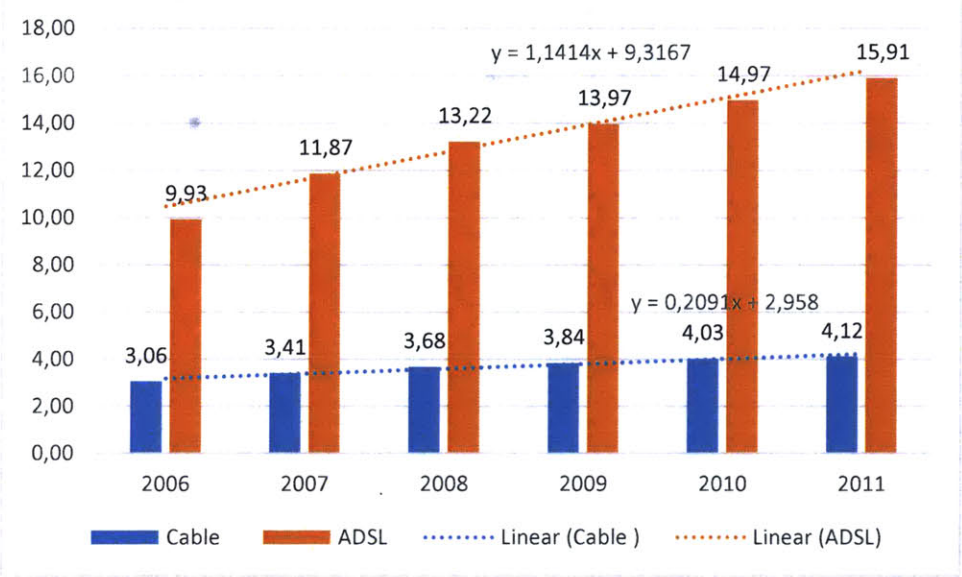
Figure 4-5. UK total broadband penetration (2006-2011)



Source: Ofcom

Although, cable platform has superiority in fast broadband and fast broadband availability, total number of ADSL connections is much higher than cable broadband connections in UK. During the 5 years after the merger of NTL and Telewest, the number of cable broadband subscriptions has increased steadily. Within the same time interval, the number of DSL connections also increased but more steeply with the total of 60 percent increase (Figure 4-6).

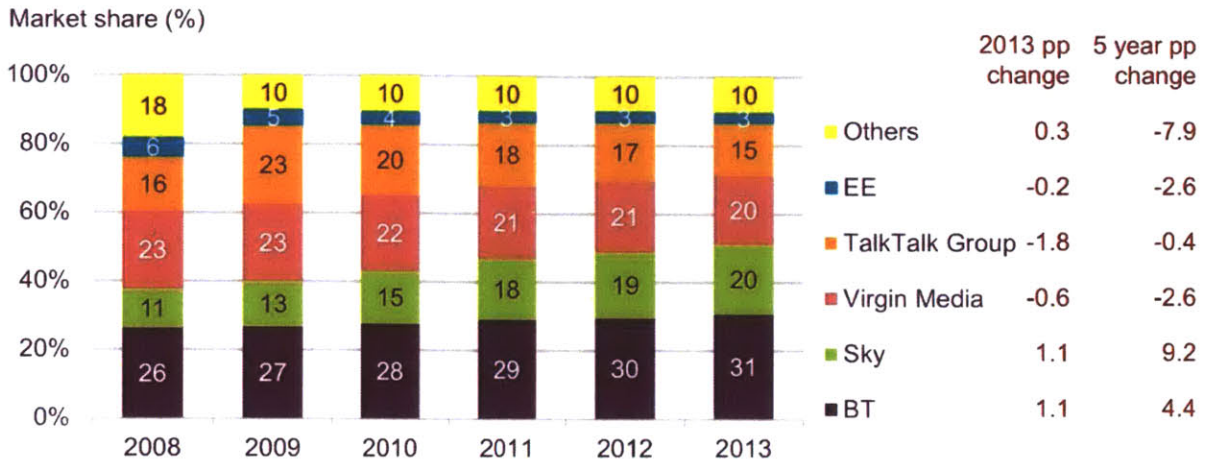
Figure 4-6. UK Fixed Conncetions: ADSL vs Cable



Source: Ofcom, modified by author

Beside British Telecom, Talk Talk and Sky are the other important competitors of Virgin Media. They provide broadband access service through regulated LLU and resale products. During the years between 2008 -2013, market share of the leading operator BT has increased from 26 percent to 31 percent. Sky, leading digital satellite platform owner, has increased remarkably from 11 percent to 20 percent with the same interval. However, Virgin Media's market share has decreased from 23 percent to 20 percent. Talk Talk's market, first, has jumped from 16 percent to 23 percent between 2008 and 2009, but later on its market share gradually decreased to 15 percent as of 2013 (Figure 4-7).

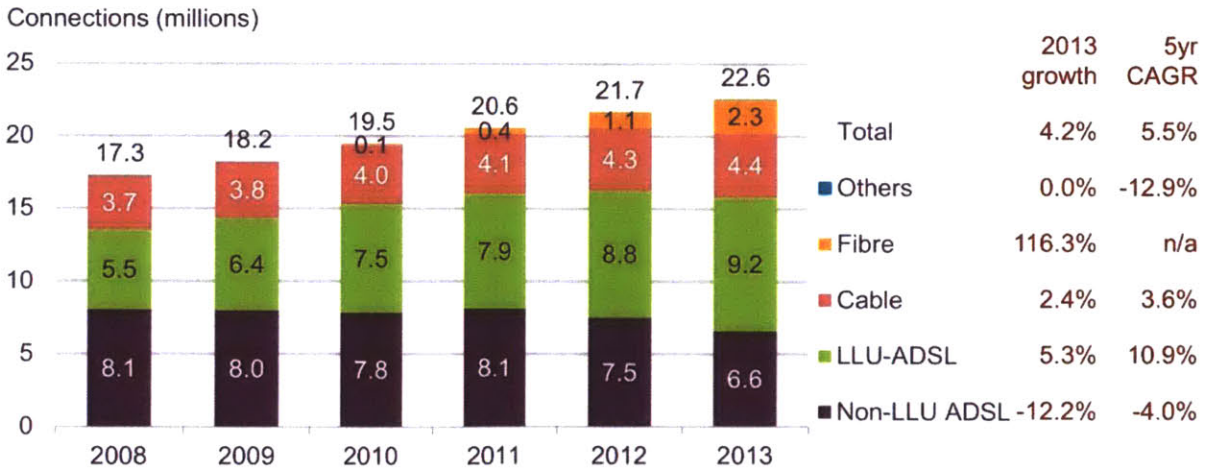
Figure 4-7. Retail residential and SME fixed broadband market shares



Source: Ofcom

Total fixed connections in UK between 2008 and 2013 has gone up from 17.3 million to 22.6. During the same interval, a conservative increase in the number of cable broadband connections has been occurring. As LLU operators' total market share has increased between 2008 and 2013, LLU ADSL connections has increased almost 70 percent.

Figure 4-8. Fixed broadband connections by technology

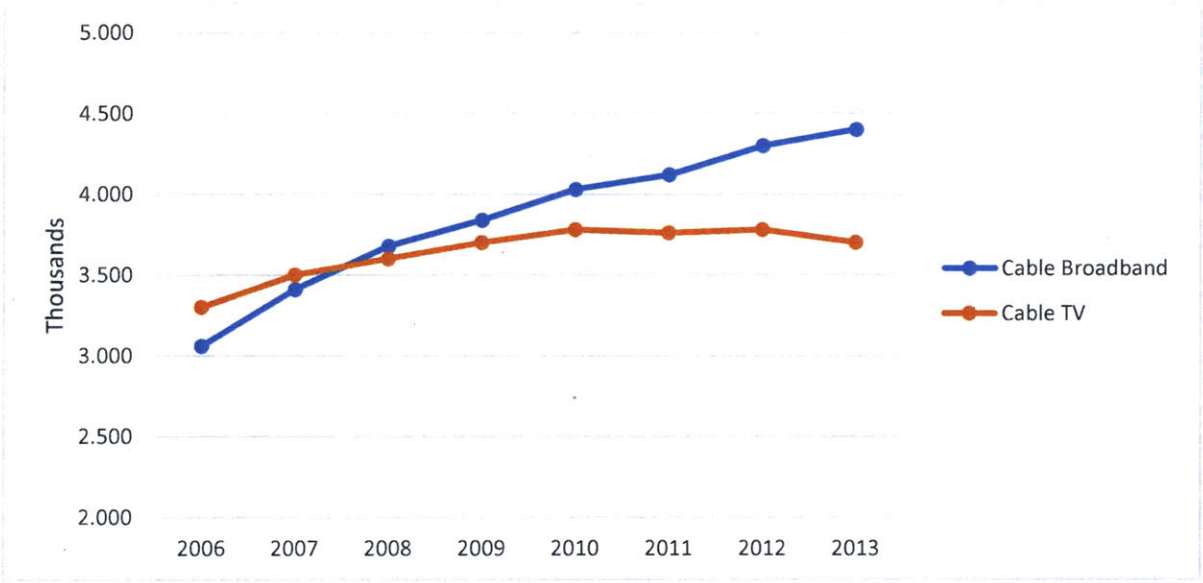


Source: Ofcom

As seen in the above two figures, LLU regulations make alternative network operators important competitors to cable network operator in broadband market. As well as broadband market competition, competition in television segment also effects the development of cable platform.

As seen from the below figure, during the years between 2006 and 2010 Virgin Mobile has increased its cable broadband subscribers from 3.1 million to 4 million. For the following years, the rate of increase is relatively slow but the total number cable broadband subscribers has reached to 4.4 million. When it is examined the total number of cable TV subscribers, which is an essential part of its triple play, it has also increased from 3.3 million to 3.8 million for the first 4 years. After 2010, however, it has remained almost same around 3.8 million and in 2013 it has decreased to 3.7 million. Compared with the broadband subscriptions, therefore, cable TV subscriptions has a decreasing trend and the number of cable TV subscribers lags behind the broadband subscribers for Virgin Media.

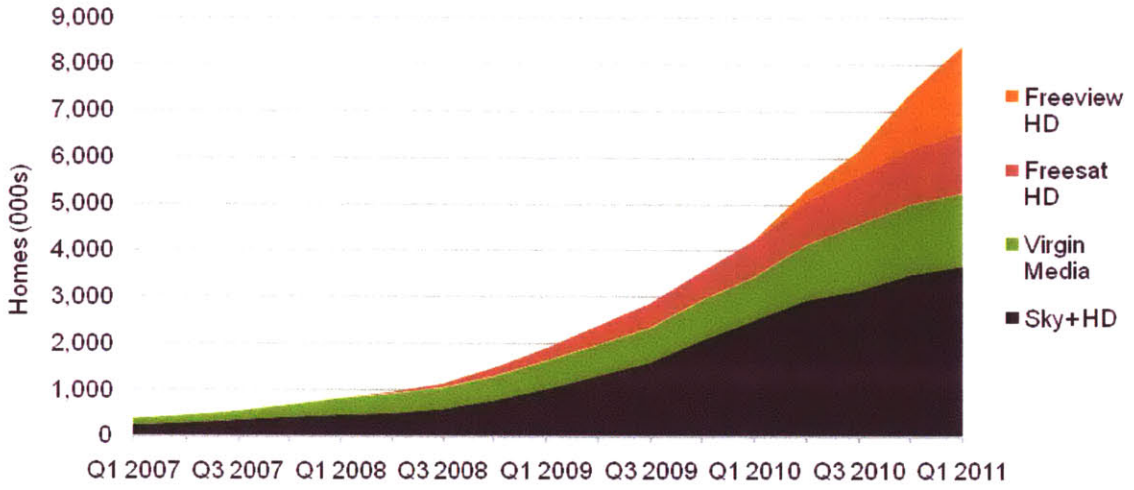
Figure 4-9. Virgin Mobile cable broadband and cable TV subscribers



Source: Virgin Media Co. Annual Reports, combined by author

To analyze the situation above stated, it is important to focus on pay TV market competition. In pay TV market the most important competitor of the Virgin is BSkyB (Sky formerly known as British Sky Broadcasting), the satellite television platform operator. BSkyB, has the right holder of most popular premium pay TV channels and sports programing. Moreover, BSkyB, at the same time, is an important content supplier to Virgin Media (Virgin Media, 2010). The figure stated below indicating the number of broadcast HD homes by provider also emphasizes the market power of Sky in broadcasting market

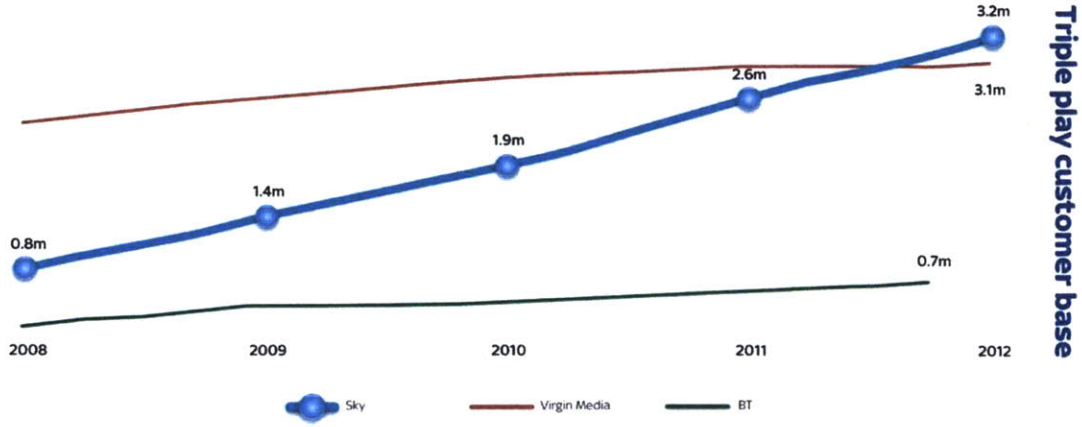
Figure 4-10. Number of broadcast HD homes: BSkyB, Virgin Media, Freesat and Freeview



Source: Ofcom

Below figure (Figure 4-11) shows number of triple play customers between and gives much insight about competition between Sky, Virgin Media and BT in triple play. Sky's continually growing very fast between 2008 and 2012 and within such a relatively short time it has seized the leadership in triple play market. On the other hand both BT and Virgin Media haven't shown such a significant growth.

Figure 4-11. Number of triple play customer, Sky, Virgin Media, BT

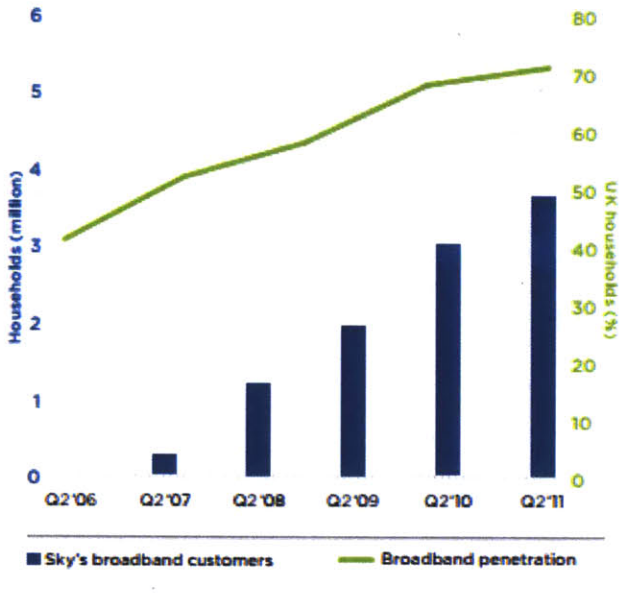


Source: www.digitaltvnews.net

The figure below indicates UK broadband penetration and Sky broadband customers. It is also a complementary figure to the above one that shows number of Sky broadband customers is very much same with number of triple play subscribers of Sky. This implies that almost all the broadband subscribers churn to Sky broadband service

is attracted by TV packages of Sky. It also signifies the superiority of content over the triple play bundles for the relevant segment.

Figure 4-12. UK broadband penetration and Sky broadband customers

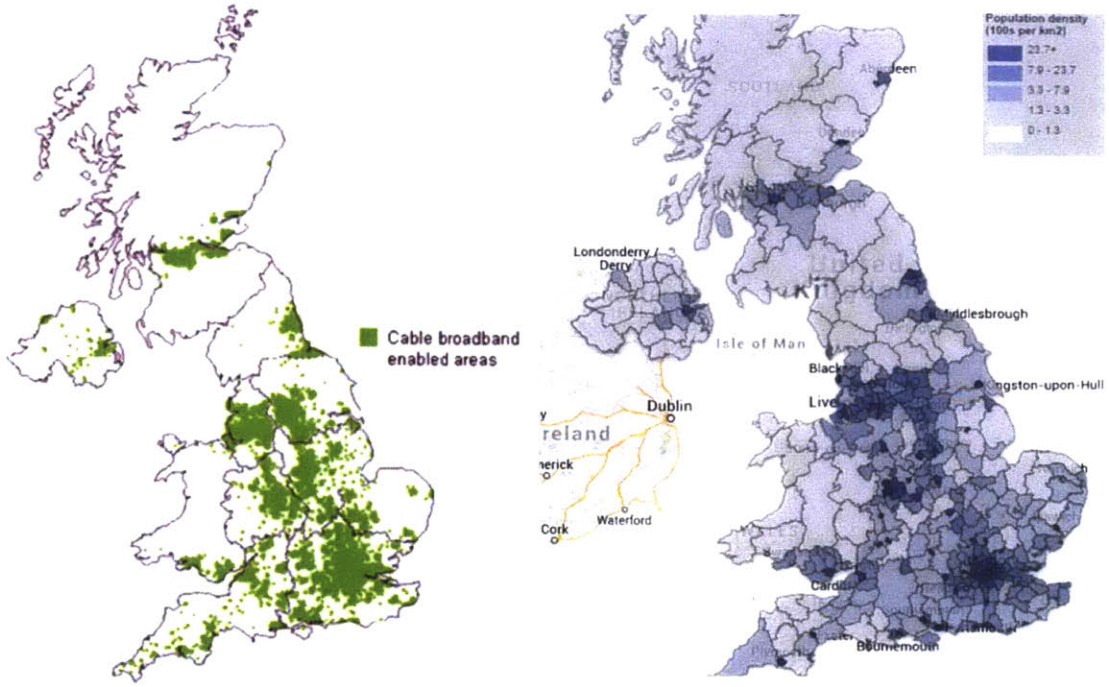


Source: Oxford Economics, 2012

Another issue that limit the growth of cable subscriptions is the available service coverage area of cable network. In UK, almost all households connected to DSL enabled BT exchange, in other words DSL has 100 percent coverage. On the other hand, as of 2006, Virgin Media's cable network coverage was 12.5 million house across the U.K. with %94 broadband availability (Virgin Media, 2008). This number has reached nearly to 13 Million, with almost entirely broadband available (Virgin Media, 2011). According to latest figures, this number has not changed much that Virgin Media cable broadband service availability is around 48 percent (Jackson, 2013)

The below map shows cable broadband enabled areas and the population density of UK together. As expected, cable broadband service mostly available in higher population density area; urban and suburban. Contrary, there is rare or no cable broadband coverage in rural areas.

Figure 4-13. Cable broadband coverage and population density map of UK



Sources: Ofcom and Office for National Statistics, merged by author

Broadband adoption is higher in urban and suburban areas where economic activity is higher and the unit cost to deploy infrastructure is lower. When the broadband penetration is significantly high, it is expected that contribution of rural areas to the broadband adoption rate starts to overwhelm. According to the statistics, as of 2009, in UK, broadband penetration has almost reached to 70 percent. Such a high penetration level implies new broadband subscribers from rural areas are significant part of the broadband adoption where cable platform has not got market share due to its limited service coverage area.

4.2 German cable market

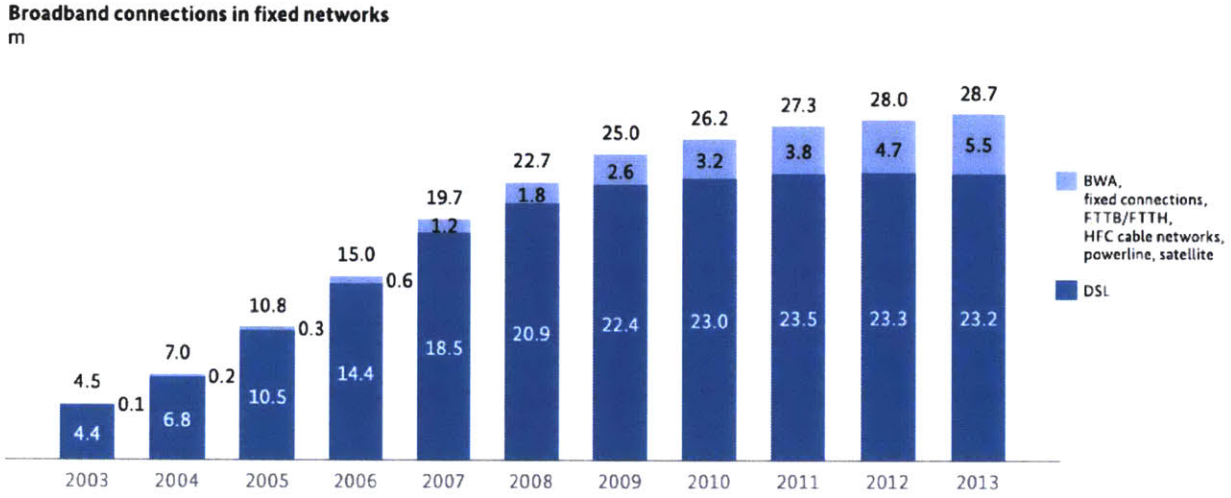
4.2.1 Brief history of cable TV network

In 1978, pilot cable deployment project has been started by individual state governments for the cities Berlin, Ludwigshafen-Mannheim, Munich, Cologne and Wuppertal. By the time of Minister Christian Schwarz-Schilling (CDU), in 1982, the cable TV network deployment has been accelerated. Meanwhile, in order to reduce the pressures from small and medium enterprises, cable operations of Deutsche Bundespost, the relevant government monopoly, has been restricted from customer premises, so the house level network, network level 4, has been left to the regional service companies. The cable TV network has been expanded remarkably: in 1990 14.1 million households passed with cable TV network in Germany (Kabel Deutschland, n.d.). European Commission (1999), has taken an enforcing decision "to ensure that telecommunications networks and cable TV networks owned by a single operator are separate legal entities" As a consequence of this decision, Deutsche Telekom has separated its telecommunication network operations from cable operations and divided cable operations into nine regional companies to divest (Kabel Deutschland, n.d.). Out of nine regions Baden-Württemberg, Hesse and North Rhine-Westphalia were sold individually, however in 2005 cable TV companies in Hesse and North Rhine-Westphalia have merged under the name of Unity media. Later on Kabel BW, operating in Baden-Württemberg state, and Unity Media, as both of them wholly-owned subsidiary of Liberty Global, have merged and with effect from 8 August 2012, the company's name has changed to Unitymedia KabelBW GmbH (Unitymedia KabelBW, 2013). The other six regions covering the rest 13 states of Germany, have bought by an investor group formed by Providence Equity Partners, Apax Partners and Goldman Sachs Capital Partners in 2003. It still continues with the name of Kabel Deutschland, however the initial ownership has changed during these years, as of 2013 Vodafone has owned and obtained merger control of the majority shares of Kabel Deutschland (Kabel Deutschland, 2013). Therefore, currently, German cable TV market has been dominated by these two companies: Unitymedia KabelBW and Kabel Deutschland

4.2.2 Market figures:

DSL is the most common broadband access technology in Germany. According to the figure stated below, between the years 2003 and 2005 almost all the broadband connections were based on DSL technology. Later on, mainly increase in the number cable subscribers has decreased the portion of total DSL subscription in German broadband market and as of 2013 this portion has decreased to 80 percent.

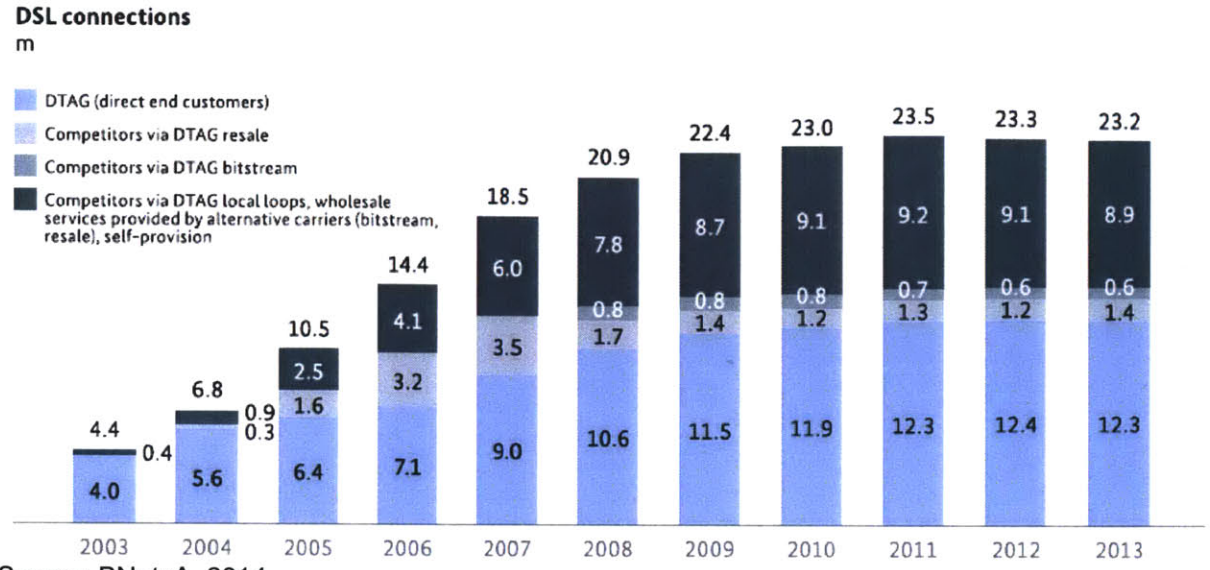
Figure 4-14. Broadband connections in fixed networks, Germany



Source: BNetzA, 2014

Among the DSL connections, incumbent network operator Deutsche Telekom has the highest number of subscribers which is 12.3 million as of 2013. There are 1.4 million and 0.6 million competitors' subscribers having broadband access via DTAG's resale and bitstream service respectively. Other alternative DSL based access methods, including the most common one local loop unbundling, constitutes the majority of Competitors subscribers which is 8.9 million.

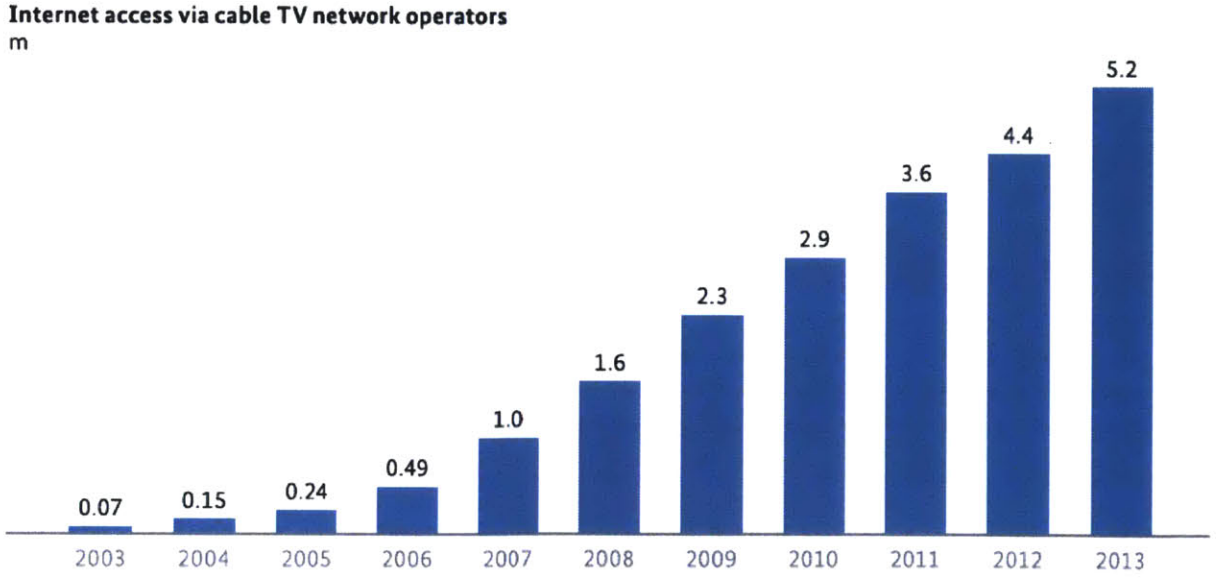
Figure 4-15. Breakdown of DSL connections



Source: BNetzA, 2014

Figure stated below shows the cable broadband subscriptions between 2003 and 2013 in Germany. In 2003, cable broadband subscriptions compared with the DSL was almost zero. However, later on particularly after 2005, cable broadband subscriptions has shown a steady increasing trend. As of 2013, the total cable broadband subscriptions have reached to 5.2 million.

Figure 4-16. Cable broadband subscriptions



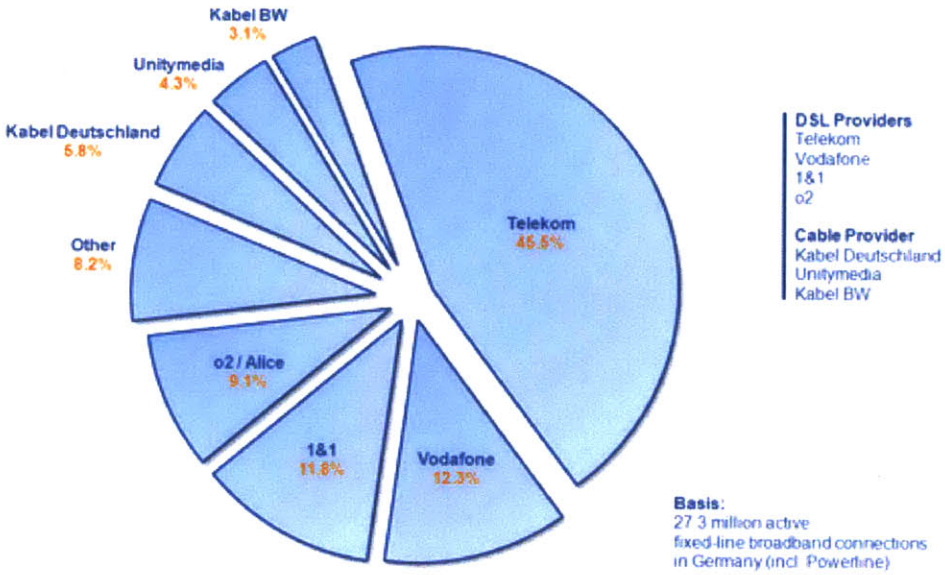
Source: BNetzA, 2014

Although German cable TV network has a wide service coverage area, the cable broadband subscriptions corresponds to a small portion, particularly for the years

before 2006. Wallsten and Hausladen (2009) explain this backwardness of cable broadband with three reasons. First one is Deutsche Telekom's reluctance to upgrade the cable network as a competing platform against its copper based broadband service during the years it was controlling both copper and cable networks. The other reason is the cost to upgrade cable TV network from one way communication to internet access enabled two way communication. The third reason is highly fragmented structure of the local level retail cable TV providers.

The pie chart stated below indicates the market shares of the fixed broadband operators as of 2012 second quarter. Deutsche Telekom holds 45.5% share of the whole fixed broadband market. Market shares of other outstanding DSL providers Vodafone, 1&1 and O2 are 12.3%, 11.8%, 9.1% respectively. On the other hand, total market shares of the cable operators is around 13 percent.

Figure 4-17. Fixed broadband market shares, 2012 Q2

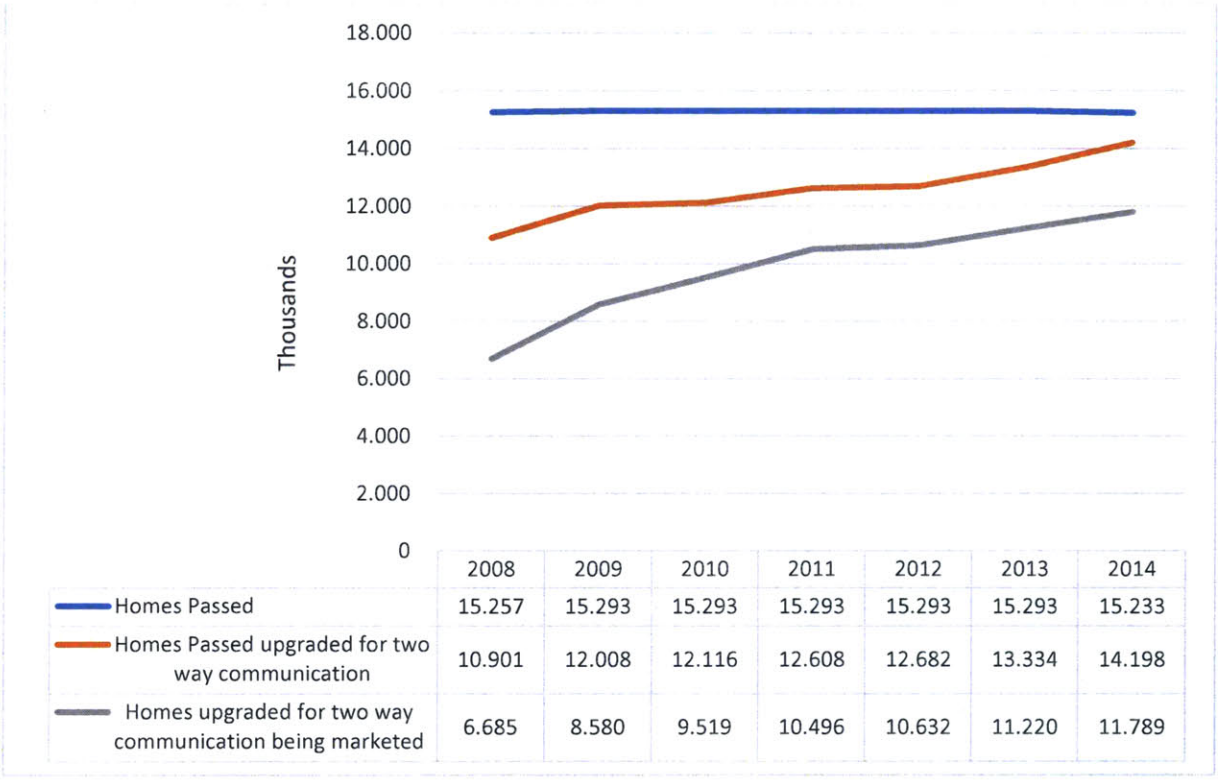


Source: www.dslweb.de

Figure 4-18 indicates the development of Kabel Deutschland's cable TV network in terms of home passed numbers between 2008 and 2014. The intriguing point from the figure is during these years the network size has not been expanding in terms of home passed which is almost stable around 15.3 million, even there has been a 60 thousand house coverage drop in the number of total coverage. However, between 2008 and 2013, its main network expansion strategy is to upgrade its existent cable network to two way communication and marketing these upgraded these two way communication

enabled areas. During stated years more than 3 million homes upgraded to two way communications and as of 2014 this number has reached to 14.2 million of all 15.2 million homes passed. As a follow up strategy to upgrade network for Kabel Deutschland is marketing these upgraded areas. The number of homes upgraded for two way communication and being marketed has been increased from 6.7 million to 11.8 million between 2008 and 2014

Figure 4-18. Kabel Deutschland cable TV network development

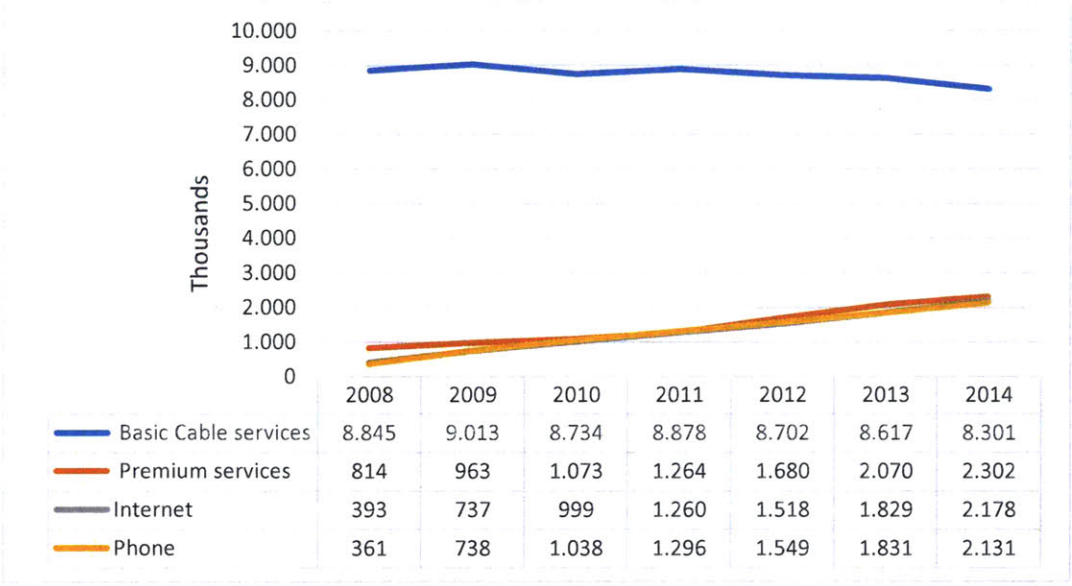


	2008	2009	2010	2011	2012	2013	2014
Homes Passed	15.257	15.293	15.293	15.293	15.293	15.293	15.233
Homes Passed upgraded for two way communication	10.901	12.008	12.116	12.608	12.682	13.334	14.198
Homes upgraded for two way communication being marketed	6.685	8.580	9.519	10.496	10.632	11.220	11.789

Source: Kabel Deutschland Financial Reports, combined by Author

Figure 4-19 shows the number of Kabel Deutschland subscribers between 2008 and 2014. Basic cable TV service holds the highest number of subscribers which is around 8.3 million as of 2014. Overall trend in the number of basic cable service subscribers can be described is slightly decreasing. Internet and phone subscriptions have very similar trend, both of them have showed a significant increase starting from 0.3 million level to 2.1 million subscriber level between 2008 and 2014. During the stated years a remarkable increase also can be observed in premium service subscriptions of Kabel Deutschland, where it has increased from 0.8 million to 2.3 million

Figure 4-19. Kabel Deutschland subscribers

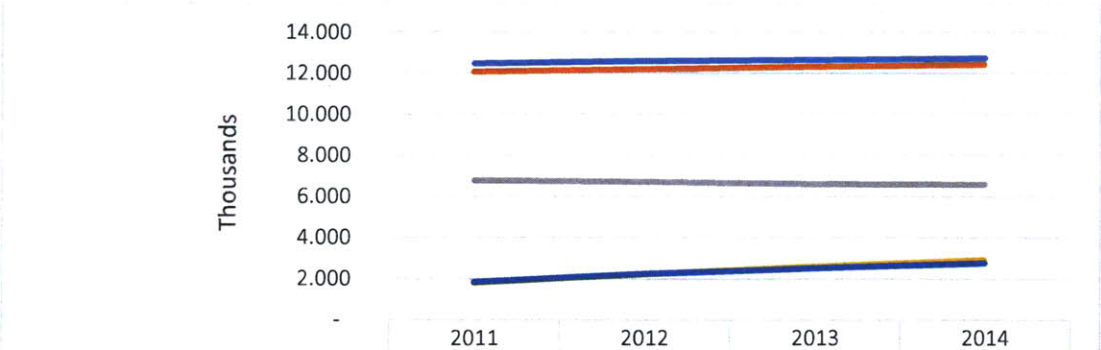


	2008	2009	2010	2011	2012	2013	2014
Basic Cable services	8.845	9.013	8.734	8.878	8.702	8.617	8.301
Premium services	814	963	1.073	1.264	1.680	2.070	2.302
Internet	393	737	999	1.260	1.518	1.829	2.178
Phone	361	738	1.038	1.296	1.549	1.831	2.131

Source: Kabel Deutschland Financial Reports, combined by Author

Figure 4-20 indicates the development of Unitymedia KabelBW's cable TV network in terms of home passed and the subscriptions between 2011 and 2014. The number of total homes passed by Unitymedia KabelBW's cable network is around 12.7 million as of 2014. There has been very slight increase in service coverage area in terms of homes passed. More than %97 of the Unitymedia KabelBW's network has been upgraded to two way communications. Between 2011 and 2014, Unitymedia KabelBW's total TV subscribers both including digital and analog have decreased from 6.75 million to 6.55 million. Similar with Kabel Deustchland, internet and telephony subscriptions of Unitymedia KabelBW's have very similar trend, both of them have showed a significant continues increase starting from 1.8 million to 2.8 million subscriber level within specified time interval.

Figure 4-20. Unitymedia KabelBW cable TV network development and subscriptions



	2011	2012	2013	2014
Homes Passed	12.445	12.568	12.634	12.713
Two-way Homes Passed	12.035	12.162	12.295	12.402
Total Video (Digital+ Analog Cable)	6.752	6.690	6.601	6.558
Internet	1.800	2.219	2.580	2.896
Telephony	1.832	2.232	2.518	2.748

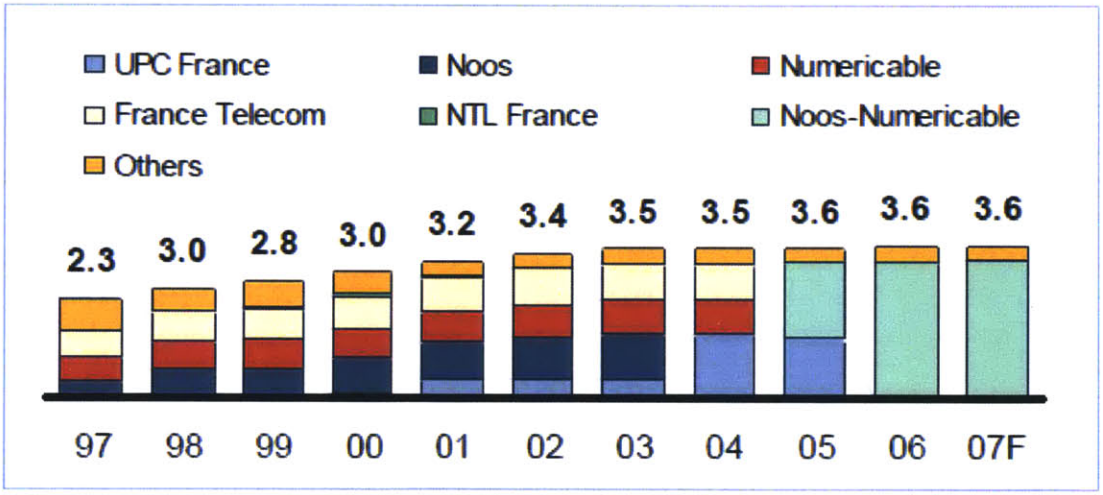
Source: Unitymedia KabelBW Annual Reports, combined by Author

4.3 France cable market

4.3.1 Brief history of cable TV network

In 1982, French socialist government announced a comprehensive plan regarding development of cable TV network across the country. According this plan, the plan cable, it was aimed to cover half of French households with cable TV network by the year 1995. However, targeted economic level cable TV service coverage has not been achieved (Lutzhöft and Machill, 1999). During the development of cable TV networks, some municipalities had the tendency to prefer companies having previously awarded with water supply contracts, on the other hand some of the others had concession agreements with Directorate of Telecommunications or TeleDiffusion de France (TDF) (Devita et al, 2013). Fragmented structure French cable TV network has continued till 2007. At the beginning of the 2000s, French Cable TV market has dominated by four different companies: Noos, UPC, Numericable and France Telecom Cable.

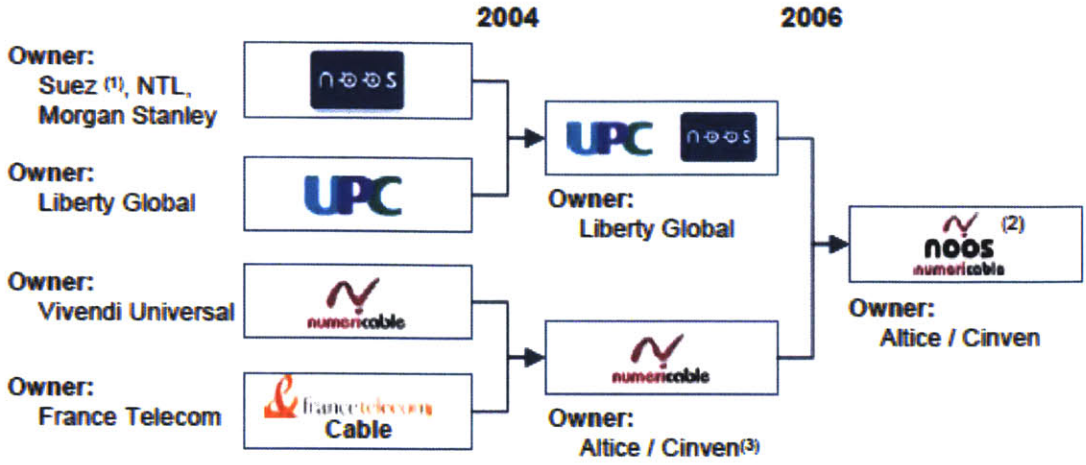
Figure 4-21. French cable TV subscribers by operator, million



Source: Ofcom, 2007

The years between 2004 and 2006 have been the most active years of consolidation for French cable TV operators. As seen in Figure 4-22, first, in one branch Noos owned by Suez, NTL and Morgan Stanley and UPC owned by Liberty Global merged in 2004. In the other branch Numericable and France Telecom Cable acquired by Altice and Cinven groups keeping the brand name Numericable. In 2006 consolidation continued with the acquisition of Noos-UPC and Numericable with the ownership of Altice and Cinven groups. At the end of these consecutive mergers and acquisitions, the brand of Numericable has turned out to be main the cable TV provider of France.

Figure 4-22. Overview of cable mergers, 2004-2006



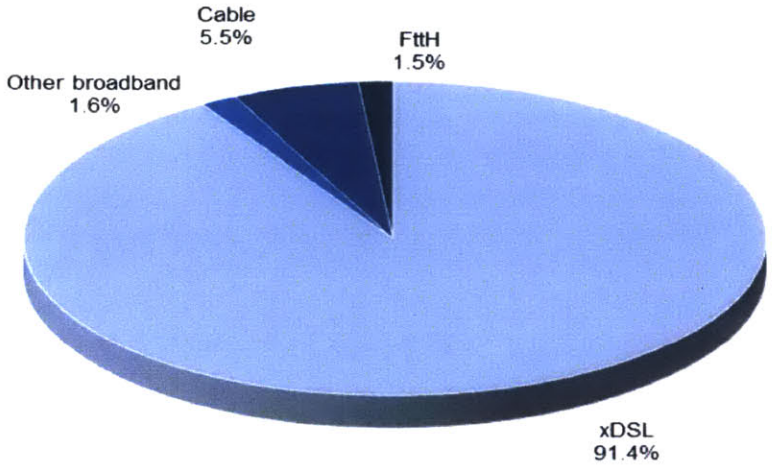
Source: Ofcom, 2007

In 2007, Altice and Cinven acquired Completel which is the second largest challenger of France Telecom in the French business to business telecommunications market (Numericable Completel, 2012). Lastly in 2014, merger between Numericable and SFR Group has occurred. After this merger Numericable SFR has become an important telecommunication provider with the inclusion of mobile network services.

4.3.2 Market figures

French fixed broadband market is highly dominated by xDSL technology, which corresponds to 91.4 percent of all fixed broadband subscriptions. The percentage of cable broadband subscriptions holds only 5.5% share of the fixed broadband market. The percentage of fiber subscribers, fiber to the home (FTTH), corresponds to a 1.5% market share. The rest of the fixed broadband subscriptions are being provide with other broadband technologies holding 1.6% percent of the all fixed connections

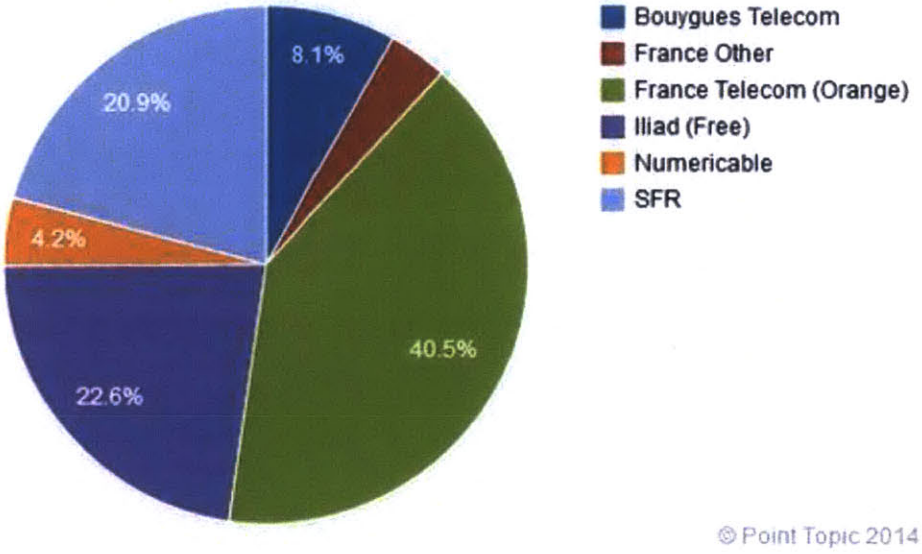
Figure 4-23. Market share by technology in fixed broadband services, 2013



Source: Arcep, retrieved from CM-CIC Securities

According to Point Topic (2014) as of Q4 2013 the number of fixed broadband subscribers was 24.9 million. France incumbent network operator, France Telecom (Orange), is the largest internet service provider with the market share of 40.5%. SFR and Iliad are the strongest competitors of the France Telecom with the market shares of 20.9% and 22.6% respectively. Bouygues Telecom and cable operator Numericable holds the fourth and fifth highest market share position with the shares of 8.1% and 4.2%.

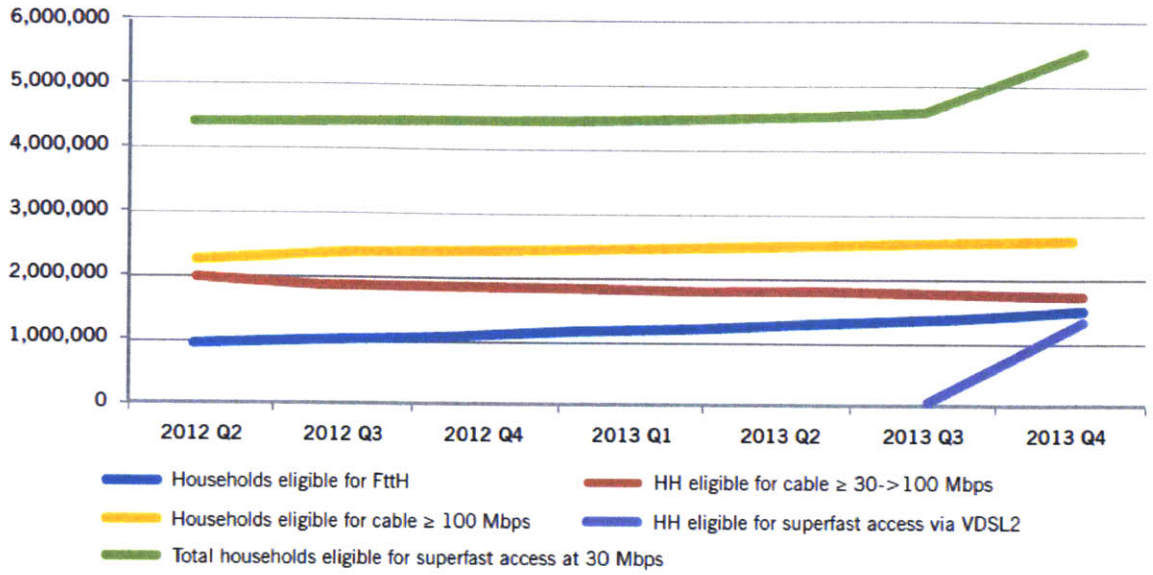
Figure 4-24. France ISP market shares, 2013 Q4



Source: Point Topic, 2014

According to French national regulatory authority Arcep (2014) 5,179,000 French homes are covered with ultra-fast broadband providing broadband access speed more than 100 Mbps based on cable technology with last meters and supported with fiber network. This ultra fast broadband speed enabling cable system is particularly referring the Numericable's network. In addition, 3,397,000 households covered by cable network are eligible to have broadband connection between the speeds 30 Mbps and 100 Mbps. FTTH and the VDSL2 technologies are the other way of superfast internet access in France, however cable network holds the leadership with superfast broadband coverage. (Figure 4-25)

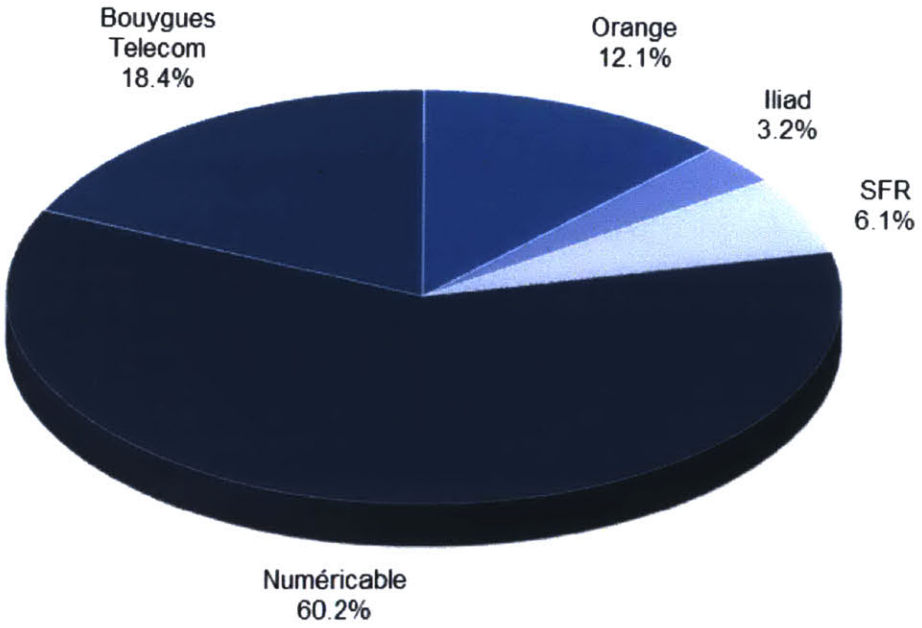
Figure 4-25. Households eligible for superfast access, by technology



Source: Arcep, 2014

The figure below shows the market shares in ultra-fast broadband services affirms the leadership of Numericable in ultra-fast broadband services with the market share of 60.2%. Bouygues Telecom and France Telecom (Orange) follow the Numericable with market shares of 18.4% and 12.1%. The other ultra-fast broadband competitors SFR and Iliad have relatively smaller market shares which are 6.1% and 3.2%.

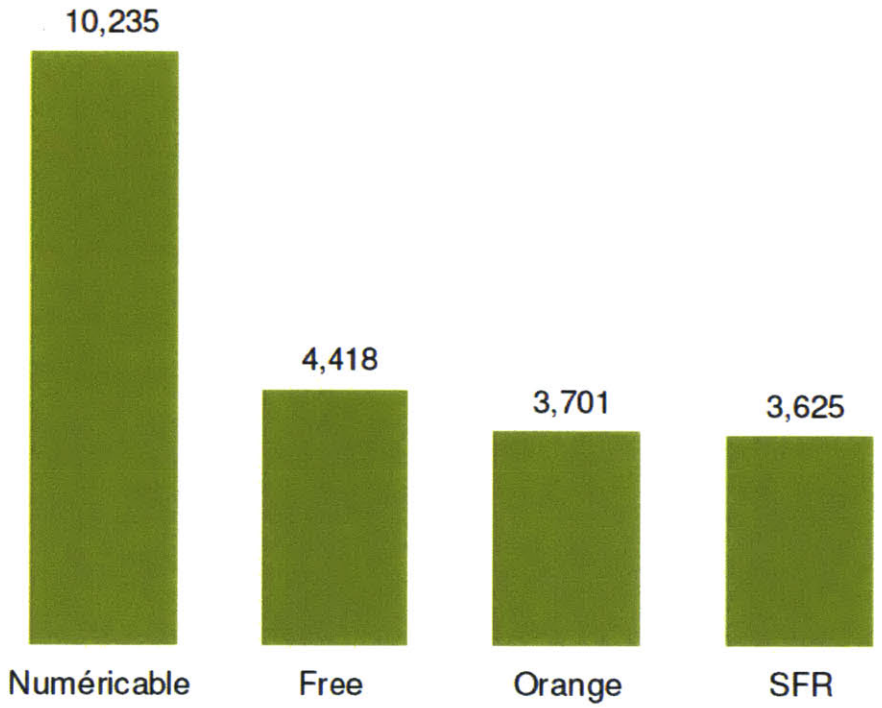
Figure 4-26. Market share in ultra-fast broadband services, 2013 Q1



Source: Arcep and company data, retrieved from CM-CIC Securities

Service quality and higher speed broadband offerings are strategically high in the agenda of Numericable Completel. Thanks to its cable networks superiority over DSL services, Numericable states comparison of average broadband download speeds with other providers in its annual reports. According the below figure comparing the average download speeds of internet service providers, as of 19 April 2012, Numericable is the fastest operator far from its competitors.

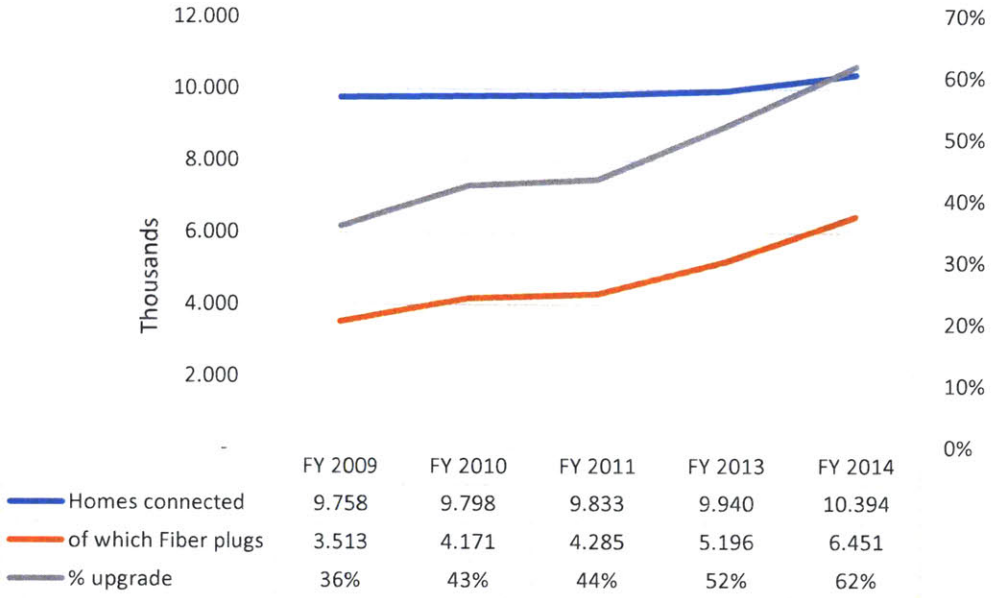
Figure 4-27. Average download speed (kbits/sec), as of 19 April 2012



Source: www.ariase.com, retrieved from Numerical Completel annual report 2011

Figure 4-28 indicates the development of Numericable cable TV network between 2009 and 2014. The number of homes passed is around 10 million, it is almost stable, a very slightly increase can be observed between 2009 and 2013. However, there has been a remarkable increase of cable TV footprint with the additional 400.000 homes passed. Rather increasing the size of cable platform coverage in terms of homes passed, it has been targeted to upgrade network with fiber plugs. Between 2009 and 2014, there has been a significant achievement to upgrade network with fiber optic infrastructure. As of 2014 financial year, 62 percent of cable network infrastructure, 6.4 million homes out of 10.4 million cable covered homes, cable has been upgraded with high speed fiber connection.

Figure 4-28. Numericable cable network development, 2009-2014



	FY 2009	FY 2010	FY 2011	FY 2013	FY 2014
Homes connected	9.758	9.798	9.833	9.940	10.394
of which Fiber plugs	3.513	4.171	4.285	5.196	6.451
% upgrade	36%	43%	44%	52%	62%

Source: http://numericable-sfr.com, KPIs

4.4 Lessons learned from country cases

From the brief histories of cable TV network development of the selected countries and the figures both about cable platform operators and the general market figures mainly related with fixed broadband market, a couple of important lessons can be learned. First, it has seen in the studied country cases that the late history of cable TV network and operators have passed with mergers and acquisitions. There is a tendency to form a geographically consolidated country wide cable platform rather than regionally fragmented company structure. Second, cable operators hold the leadership position of ultra-fast/super fast broadband both in subscriptions and the service availability which is an important performance index for the countries having set serious broadband access speed targets. The leadership of cable operators in broadband access speed is mainly related with architectural and technological superiority of cable platform against its contemporary xDSL technologies. Third, the strategic investment trend for cable operators about network development is to upgrade existing network, upgrading to two way communications and/or supporting with optical fiber to a much closer point to households, rather than extending the network in terms of homes passed. This investment strategy is consistent with maximizing the profit from the available infrastructure in short term and the ultra fast broadband leadership. However, for the long term sustainability and competition, particularly where the market is started

to mature, a comparable network size of cable platform with DSL coverage would be more crucial. Fourth and the last, cable operators are natural triple service players, where the cable network supports TV, broadband and telephony services quite satisfactorily, and the TV content is very important part of the triple play competition. As seen in the case between Virgin Media and BSkyB, the existence of a nationally attractive premium content, in the world this content is mainly sports broadcasting, may affect triple play competition and the development of cable TV customer base.

5 Research design and findings

5.1 Research design

The research methodology used in this study is expert interviews. For this study, experts can be defined as professionals having at least ten years of working experience and/or having managerial positions in a company or organisation related with telecommunication and media sectors in Turkey. As the aim of this study developing policy implications for Turkey, while selecting participants, it is targeted to reach experts specifically having experience in regulation, public policy and government relations. In order to ensure multi-stakeholder approach and to minimize biases, it is aimed to select experts from different parts of the industry as much as possible. These different stakeholders can be listed as incumbent operator, alternative network operators, mobile network operators, digital satellite operators and telecommunication associations.

After the first contact, the consent form including the aim and the scope of the study and the set of predefined questions to be covered during the interview have been sent to interview candidates. It is intended to give time for mental preparation by sending interview questions in advance. Later on a common time interval have been arranged with the candidates accepting to participate to the study. Interviews have been held via phone or Skype calls, taking mostly 45 to 60 minutes. Although all of the experts are proficient in English, as I am native Turkish speaker, for the convenience, the interviews were conducted in Turkish. Later on, manuscripts of the quotes from interviews have been translated into English.

There has been eight interviews conducted with eight participants during the study. A brief introduction regarding the participants are stated as follows. First interview has been conducted with Tolga Kılıç who was the regulatory director of Avea when the interview was carried out. As also stated in previous sections, Avea is one of the three mobile network operators in Turkey. Mr. Kılıç had been working at Avea since 2009. Moreover, before Avea, he has working experience more than 10 years at ICTA and State Planning Organization of Turkey on telecommunication related issues. Melih Özgüç, the second participant, is a freelance ICT consultant. Previously, he was the regulation and human resources unit manager of Millenicom which is an alternative network operator in Turkey. Mr. Özgüç, has more than 25 years of working experience

in Turkish telecommunication sector within various companies. The third participant, Rıdvan Uğurlu, has been the general secretary of Telkoder since 2002. Telkoder is the Turkish Competitive Telecommunication Association. Mr. Uğurlu, in total, has more than 35 years experience in Turkish Telecommunication market. PhD. Ramazan Demir, the fourth participant, is the chief regulation officer of Türk Telekom which is the incumbent network operator of Turkey. After having his PhD degree from MIT Sloan School of Management, Mr. Demir founded and successfully managed a start up. Later on, he worked as the director of marketplace design for Yahoo!'s between 2005 and 2009. Since 2009, he has been working for Türk Telekom group. Fuat Tolga Yalçın, the fifth participant, is working as a senior research analyst for a private consultant company. Since 2013, he has been working in Arab Gulf region and contributing to Turkey's office of his company on telecommunication issues. Before 2013, he had been working for ICTA approximately for 10 years. The sixth participant Oktay Demir is the head of the legal of D-Smart. D-Smart is the prominent digital satellite platform company of Turkey. It is also operating as internet and telephony service provider. Oktay Demir has been working more than ten years in media and telecommunication sector in Turkey, within the group of Doğan Media. Since 2010, he has been working as the head of the legal department of D-smart responsible with the legal and regulation issues and relations with government institutions. The seventh participant Ogün Sarı is the public policy senior manager of Vodafone Turkey. Vodafone Turkey is one of the three mobile network operators and it is also operating in fixed telecommunication service area. Mr. Sarı has been working at Vodafone Turkey, since 2012. Before Vodafone, he has more than ten years experience at Turkish Competition Authority of Turkey, mostly on telecommunication, media and digital broadcasting topics. The last and the eight participant did not want to include the name in the publication but wanted to be stated as 'Regulatory Manager' (RM). The regulatory manager has ten years experience in Turkish telecommunication sector mainly on regulation issues. Considering the limited number of network operators actively operating in telecommunication sector and the specific profession targeted within these companies, with these eight sector experts an important diversity has been reached.

5.2 Research findings

The main research focus of this study is to understand the possible effects of the privatization of cable TV network on the competition dynamics of Turkish fixed broadband market and developing policy implications for Turkey to enhance sustainable broadband ecosystem. In line of this aim, the questions have been asked to the experts during the interviews can be described as the sub-research questions of the main research question. This part is also structured according to these sub-research questions and the responses of the experts.

Research findings have been developed based on the experts' answers regarding the questions passed through the interviews. Overall, the perspective of the majority of the participants is an important reference point to develop research findings. In addition, the plausible explanations of the experts, as a sector insider, not only contribute to understand the research problems deeply but also help to develop specific policy implications for Turkey. The quotes from interviews have been used as the main supporting points, Moreover, the supportive figures and the country examples also have been used, where it is available.

5.2.1 Current competitiveness and management of cable TV platform:

Under this sub-topic, two questions, stated below, have been asked to the participants.

> Do you think the government owned cable TV operator (Turksat) is competitive in broadband, TV and telephony markets?
> Do you agree with the idea about ineffective and inefficient management of government owned cable TV operations? If yes, do you think privatization of the cable operator would eliminate these management inefficiencies? How?

The aim of asking these two question is to reveal the current competitive position of the Cable TV platform and how the management of cable platform under the government ownership is related with the competitive/uncompetitive situation.

The findings are affirmative that privatization of cable TV platform is needed because of uncompetitive company behavior and lack of private sector motivations in management under the ownership of state. Almost all participants in some level agree with the uncompetitive company behavior of Turksat regarding cable platform

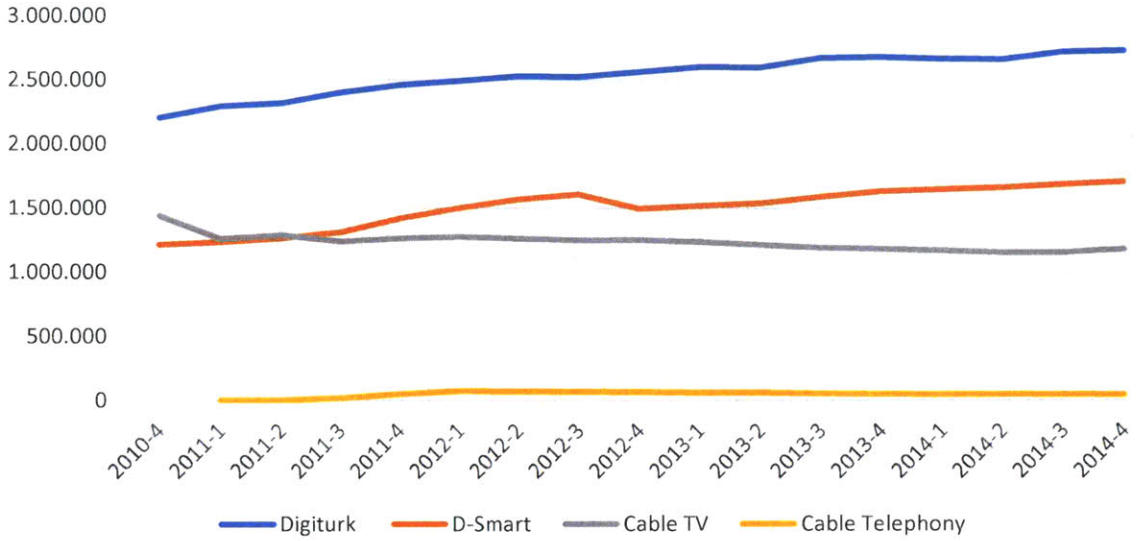
operations. Moreover, the majority of the participants agree with the management problems under state ownership, and propose plausible explanations regarding the inefficient management practices.

Some of the selected quotes regarding the competitiveness of state owned cable TV platform in broadband, TV and telephony markets are stated as follows.

> "If we look from the perspective of whether it is an effective operator bringing new services or giving directions to the market, it is not." (Kılıç)
>
> "In TV area, it has the same TV subscriber number when it had the cable TV [operations]. Moreover, there is no success of Türksat against its TV competitors, Digitürk and D-Smart which are established later than... It is not facilitating in telephony area, we can say zero. It did not give effort to use this network for telephony, so could not get the result" (Uğurlu)
>
> "I think Türksat's competitive power is below than it supposed to be." (Yalçın)
>
> "Currently, Turksat's broadband and pay TV service is not in the position of competitor in the sector." (Oktay Demir)
>
> "At this stage, I do not think that it has a lot of pressure on the competition... [It] seems to have lagged behind the digital platforms to provide content" (Sarı)

As some participants stress the uncompetitive situation of cable platform against its digital satellite platform operators and criticize the development of cable telephony, below comparative figure was prepared. The figure below is also affirmative with the critics. First, cable TV subscribers almost stable during the last four years while its digital satellite platform competitors, Digiturk and D-Smart have had significant development in their customer base. Second, the cable telephony customer base is very tiny compared with cable TV subscribers, and it does not have increasing trend during the stated time interval.

Figure 5-1. Comparison between cable and digital satellite platform subscribers



Source: ICTA market reports[4], combined by author

Some of the selected quotes regarding the management of government owned cable are stated below.

> "I think that there are some problems of managing under the monopoly of government, because of these problems, it has not been sufficiently widespread and has not got the attention it deserved, compared with the other countries" (Özgüç)

> "Privatization of this is a must. According to our Association's opinion, as a policy this should be privatized much earlier." (Uğurlu)

> "The situation is understandable that state is being timid about investing and not being eager to use public resources to compete in the market with private sector.... The qualification of the professionals are working here also supports this notion. Currently, the people, which are being recruited in Türksat, are having public background and trying to manage these places with public mentality, rather than to compete and to maximize profit [they are] having the aim of finishing the assigned duties without a problem. So it is not possible to expect a lot productivity from here." (Oktay Demir)

> "Currently, I think there is an inefficiency in [management]. Although, with a more professional management, they are trying to change the products and to invest on more innovative services, ultimately that is a government agency, staff

[4] The number of digital satellite platform subscribers is based on the number of contracts signed

are government employees. In such a dynamic sector, with a government agency structure, difficulties of providing services are obvious". (Yalçın)

"If it is privatized, I think it could be a positive reflection in all these areas [intending investment decisions, decision-making processes and marketing]. It becomes a more effective more competitive player." (RM)

5.2.2 Possible effects of cable TV platform privatization to consumer welfare

Under this sub-topic, the question stated below, has been asked to the participants.

> Do you think privatization of the cable operator would enhance consumer welfare? What would be the possible consequences of the privatization for Turkish consumers?

The aim of asking this question to reveal the possible consequences of privatization to the consumers whether it improves consumer welfare or not. Some participants clearly accept that it would enhance consumer welfare either increase in service quality and variety or affordability of the services but some of them attribute consumer welfare to some preconditions. It can be concluded that under the assumption of a healthy privatization process and a taken-over by a company having serious private investment motivations, privatization is high likely to enhance consumer welfare.

Some of the selected quotes regarding the possible effects of cable TV platform privatization to consumer welfare are stated below.

"I think that the price would be better on the consumer side, and also triple play offers would be another advantage for the consumers" (Özgüç)

"..., this makes an additional high speed broadband choice for the consumer" (Kılıç)

"I guess the consumers would benefit the most from quality of service" (Yalçın)

"...I think it will be very helpful both for its current customers, the consumers currently using its service, in terms of getting better service and for the customers having the service from the different firms, in terms of developing better more attractive alternative." (RM)

"In Turkey there is a demand to the local content, in case where privatization occurs that means serious CAPEX investments, serious human resource structuring and the most importantly serious content investments. These preconditions should be well examined from the perspective of privatization... I attribute the discourse of 'after the privatization that consumer wins' to preconditions." (Ramazan Demir)

"If a single company [which does not have prior operations in Turkey] comes to here alone and tries to manage cable operations, it will always be obsolete against its other competitors having much wider resources, having much higher [service] reach. .... if a company buys [cable TV operations] alone, it does not contribute to consumer welfare." (Oktay Demir)

"... if the privatization is made after determining a transparent framework by putting forward right market conditions, in my view, it will be a practice that increase consumer welfare, service variety and allow prices to fall. Even it does not [lead] to fall [prices], it will be a practice that increase service variety and quality. (Sarı)

5.2.3 How the cable TV platform should be privatized: fragmented or geographically consolidated?

Under this sub-topic, the question stated below, has been asked to the participants.

> Do you think the consolidated structure of the current cable operator would be an advantage for the privatization process and the later on competition dynamics? Should the cable company privatized in a geographically consolidated structure or fragmented? Why?

There are two options for the policy makers to privatize this cable platform either in geographically consolidated or fragmented. The aim of asking this question is to reveal which option is more beneficial to reach a more sustainable competition in broadband ecosystem. Before asking this question a brief information has given to the participants about the path dependence that how the current geographically consolidated structure of cable TV platform formed in Turkey whereas mergers and acquisitions among regional operators as a way of consolidation have been observed in most European countries.

According to the studied country cases in above chapter, the cable TV platform needs to be privatized in geographically consolidated structure, because it has seen in the studied country cases that the late history of cable TV network and operators have passed with mergers and acquisitions and there is an ultimate tendency to form a geographically consolidated country wide cable platform rather than regionally fragmented company structure. Affirmatively, a high majority of the participants agree with the necessity of privatization in geographically consolidated structure. Moreover, plausible explanations have been put forward regarding the necessity of scale in telecommunication and media operations. Considering both studied country cases and participants' responses, it can be proposed that the cable TV platform should be privatized in a geographically consolidated structure

Some of the selected quotes regarding whether to privatize the cable platform in geographically consolidated or fragmented are stated below.

> "Before coming to the cable TV issue, I am in favor of consolidation. Currently, in Europe cable operators having tendency to merge and the number of operators are decreasing: the main reason of this is scale." (Kılıç)
>
> "I have the opinion that regional [sale] would not be a plus to competition. It is operating in three areas, and these only be meaningful when it is done in national scope." (Uğurlu)
>
> "[In Europe and US], even though [cable operators] are not subjected to regulation, they are tending to consolidate because of content and the necessity of scale economy, so I don't think that regional model would be sustainable" (Ramazan Demir)
>
> "If we are talking about a company that will compete with giants such as Türk Telekom, Vodafone, Turkcell, I think it is needed to be empowered as a whole." (Yalçın)
>
> "If your desire here, as public, to have an advanced cable infrastructure throughout Turkey and to improve service availability and consumer welfare, it may not be correct to divide [cable TV operations geographically] (Oktay Demir).
>
> "Once content, which is particularly critical for cable infrastructure, is obtained after, how much wider the audience it is reached, the cost per person will be at

that lower rate... My idea, this structure if and only if in a consolidated manner, carries a meaning" (Sarı)

5.2.4 Service coverage area of cable TV platform

Under this sub-topic, the question stated below has been asked to the participants.

> "Do you think current service coverage area of the cable operator would be enough to make a significant impact on the broadband market competition after privatization? Why?"

Currently, cable TV services are available only some regions of 22 big cities of the Turkey out of 81 cities. According to the report of Turkish Court of Accounts (2013), Türksat's cable platform network capacity is around 3.1 million in terms of number of homes passed. Considering the number of households in Turkey is nearly 20 million cable TV network coverage is around 15 percent whereas OECD average is above 50 percent. In this question, it is aimed to understand the cable platform's potential competitiveness regarding the relative small service coverage. Intriguingly, important number of participants agree with the potential of cable platform coverage which is mainly concentrated in the areas where economic activity high. Some of the others think the coverage area is not enough to make significant impact on competition but needs additional coverage investments to achieve that. It can be concluded that despite the low service coverage level, the cable company has a potential to make a significant impact on competition but it needs follow up coverage investments.

Some of the selected quotes regarding cable platform's potential competitiveness considering the limited service coverage area are stated below.

> "It makes a significant impact, these 22 cities correspond to the 80 percent of the national income" (Uğurlu)

> "If the operator enters to this market to invest, that would have significant impact to the market. Because these 22 cities are the areas where the population mostly concentrated." (Kılıç)

> "... If we are talking about facility based competition, this [cable TV platform] is one of the rare firms that can bring [facility based competition]" (Sarı)

"Firstly, the current prevalence [of cable TV infrastructure] is not to be underestimated. Secondly, to have the infrastructure in major urban centers is a great advantage." (RM)

"After the privatization, with the existing facilities, the number of home passed can be doubled in the coming years... If cable TV operator's service coverage reaches to the level of 6 to 10 million level in terms of home passed number, then it becomes a serious competitor." (Özgüç)

"I don't think much [it has potential for a significant impact]. 15 percent is really, considering Europe and OECD averages around 50-51 percent, low. However, being in 22 cities and having a certain infrastructure is a good start." (Ramazan Demir)

5.2.5 Investment incentives to roll out cable TV network

Under this sub-topic, the question stated below has been asked to the participants.

> Do you think there is a sufficient investment incentive in Turkish Telecommunication market for cable operator to roll out (expanding infrastructure, mainly the number of homes passed) its network? Why?

As the service coverage of cable TV is relatively low, one of the important thing to deepen broadband competition would be increasing size of the network. In line of this perspective, it is asked whether there is enough incentives in Turkish telecommunication market to invest for network roll out. Majority of the participants agree with the availability of economic incentives to roll out network. On the other hand, some participants point out the challenges with municipalities and coordination problems between public institutions. So, the research finding under this sub topic can be stated that there are economical incentives to invest in network roll out, however there are challenges, mainly with municipals, to deploy new infrastructure.

Some of the selected quotes regarding investment incentives to roll out network in Turkish telecommunication market are stated below.

"In Turkey the level of CAPEX is above 15 percent which is much higher than the Europe's average. That means there are operators believing the potential of Turkey, we are believing too" (Ramazan Demir)

"There are still economical incentives to invest, otherwise there wouldn't be the operators still trying to pursue their claim." (Özgüç)

"Yes there is sufficient incentive because broadband penetration is still not at the desired level, there is still a potential in broadband [market]" (Yalçın)

"As a [government] policy there is no incentive to invest. Contrary to other countries putting broadband targets and giving incentives to companies where investments are not feasible, there is no concrete plan like that" (Kılıç)"One of our main problems is fiber deployment, Ministry of Transportation has doing something about fiber deployment but none of the municipals taking care, every municipal have different practices." (Uğurlu)

"Private sector does not have any reluctance to invest in telecommunications infrastructure in Turkey, even it can be said it is much more eager than other markets. But, there is a public understanding which can not keep pace with this in Turkey." (Oktay Demir)

"In respect of general market conditions in the country, investment conditions, the young population of the country, technology usage habits, the increase in income etc. I think there is a serious potential... There are some obstacles in front of [investments], regulations needs to be coherent. You need to convince, to get permits, and to establish contact with municipal, central ministry, regulatory agency and other government agencies separately."(RM)

5.2.6 Embedding policy objectives into privatization process

Under this sub-topic, the question stated below has been asked to the participants.

"Do you think government should embed policy objectives such as increasing the cable TV infrastructure coverage, upgrading the internet access technology etc. into the privatization process to enforce the applicant firms? If you had the ability to implement any policy you wanted, what would you choose?"

Considering the previous government practices; as embedding policy objectives into the processes in spectrum auctions and concession agreements, it is asked for the participants whether there should be a policy objective included in the privatization process of cable TV platform or not.

There are different views expressed regarding this question. Some of the participants are in favor of embedding policy objectives, some of the others in favor of letting it to the market conditions. Considering the experiences of the participants regarding previous policy objective practices, this would be the most important part that the intended objectives and the relevant policy tool need to be very well tailored, otherwise it may generate inefficiencies and result with diversion from the targeted objective. Moreover, privatization and/or spectrum auctions are the financial resources for the governments and imposing policy objectives to these auctions effects the value of the privatized company or financial gain from spectrum auctions. From this perspective, it is also important to bring balanced policy objectives between the public benefits would be attained through embedding policy objectives and the financial public gain from auctions. Considering the answers of the expert to this question, it can be reached to the finding that if the government wants to embed a policy objective into the privatization process, this should not deter attractiveness of the auction, and it should be flexible with the company investment plans, mainly encouraging to extend service coverage area.

Some of the selected quotes regarding embedding policy objectives into privatization process are stated below.

> "Policy objectives enforcing the firms like employment of R&D personnel, establishment of R&D center etc. it is not meaningful from an operator's perspective. We are currently suffering about such kind of restrictions. ... It is meaningful to implement a flexible policy to enhance cable network coverage for a certain time." (Kılıç)
>
> "Certainly, it is needed. The success of the privatization and to reach its aim depends on this... I, of course, think first, how to incentivize investments. I would rather to gain public welfare from the picture that will emerge after the privatization than the [financial] source to be obtained after the privatization. It is necessary to look what are the measures can expand the cable infrastructure throughout Turkey." (Oktay Demir)
>
> "I think that such kind of policy objectives are beneficial. I have no doubt where it should or should not be, it certainly should be. It is important to look what to

be in the cable TV case... For Cable TV case, it would better to [embed policies] that encouraging investments." (Özgüç)

"....if you embed some kind of provisions such as employment [requirement] that would deter the buyer, it would loose the attractiveness. Therefore, I would not like to put such things" (Uğurlu)

This [embedding policy objective to increase service coverage] is an issue that needs to be worked on and analyzed, because it effects the valuation of that company [Turksat Cable TV Operations] (Ramazan Demir)

"As this would be a small enterprise, and the infrastructure that would be bought is not very important infrastructure and it is needed to promote infrastructure investments to new places, I think that there should not be any policy obligation. If an obligation is brought, it could only be related with [infrastructure and coverage] investments." (Yalçın)

Perhaps, the market mechanism will give answers to many things... binding [coverage requirement] to very strict conditions can only be done through the way of universal service, except that I frankly do not think that the creation of this type of artificial markets is right (Sarı).

5.2.7 Future of triple play and the existence of killer content

Under this sub-topic, the questions stated below have been asked to the participants.

What do you think about the future of the triple play offers (TV, broadband internet and telephony) in Turkey? Is there a potential TV content that would suppress other triple play offers and lead a significant impact on triple play competition?

As cable platforms are natural triple players, in other words cable network is capable of providing TV, broadband and telephony, the future of the triple play will be crucial for the development of cable platform business. In addition, there are cases like UK, where the company holing the premium content has successive figures in triple play subscribers leading to the hypothesis that content has important effect in triple play competition. So, this part has two folds, first, it is aimed to figure out the future of triple play in Turkey, second, it is aimed to find whether there exists a killer content in Turkey that would suppress triple play competition or not.

Almost all the participants see the future of triple play in Turkey favorable. There is also a consensus on national soccer league has superiority over other content. Some participants also pointed out the drawbacks, within the scope of competition, of tendering the monopoly broadcasting rights of national soccer league for longer terms and the necessity of overviewing the TV content under the scope of competition law. However, there are different views whether this content by itself can distort triple play competition or not. Therefore, considering the potential superiority of national soccer content, for the next auction and tendering procedures of soccer content, it needs a higher regulatory scrutiny both from competition authority and national regulatory authority.

Some of the selected quotes regarding the future of triple play and the existence of killer content are stated below.

> Under normal circumstances, I see a good future for triple play [at Turkey]... I don't see the situation where a single content [soccer] that lead the [triple play competition] (Özgüç)

> Currently, there is no super content in Turkey that you pointed at the question... [However], giving the monopoly rights of national soccer broadcasting license rights for 7 years has many drawbacks in terms of competition. These [rights] could be divided into packages such as A, B and C group broadcasts. Packaging and dividing into groups, would have more benefits to the market. This would also effect broadband market development. National Competition Authority should focus on this issue. (Uğurlu)

> Telecommunication market of Turkey compared with the media/ pay TV market, is much bigger and for any content it is not likely to shake telecommunication market... Premium TV content more or less mostly regarded as sport content all over the world. For Turkey, it is Turkish soccer league broadcasting license rights and the European soccer match licenses...For Turkey, there is a need to overview TV content within the scope of competition law rules. (Kılıç).

> "It is hard to say that TV content will have effect on triple bundle excessively. Of course, it will have effect in coming second decade. However, the most important thing in this point that the [triple play] war will be between [operators] can provide high speed and quality broadband." (Ramazan Demir)

"Sport content is the game changer. For Turkey Digiturk holds the soccer [broadcasting rights], lets think that another firm wins the [national soccer league broadcasting] auction, TTnet or Superonline, this would seriously change the game because you are already hesitant between the triple play offers but one of them adding the soccer with a reasonable price." (Yalçın)

From the perspective of TV content, the killer content in Turkey is [national soccer] super league broadcastings...If you do not have this killer content, this market turns out to be an imperfect [competitive] market, therefore the intervention of the regulator in Turkish market might be needed. (Oktay Demir)

In this sense, in Turkey, the premium content is only and only match broadcast rights. In particular, it is an issue that has been subject to competition authority's decision... This is the content in Turkey that can have impact to the other areas and could lead to the distortion of competition (Sarı).

5.2.8 Implications for current government policies and regulatory actions

Lastly, under this sub-topic, the questions stated below have been asked to the participants.

> Considering the above discussions, do you think a change or an enhancement is needed about government policies and regulatory actions? If yes, what these should be and why?

With this question, it is aimed to reveal broadband eco-system level or telecommunication sector level policy concerns, rather than focusing on the privatization of the cable platform. It is hard to develop and to reach comprehensive sector level policy implications with a single question. However, it gives a general insight about the points where a change or an enhancement is needed regarding government policies and regulatory actions. Moreover, the responses of the participants might be a good starting point for future policy studies on Turkish telecommunication market.

Within the scope of this question various concerns expressed by the participants. Some of the participants have emphasized on the necessity of a national broadband plan and some of the other participants have complaint about the overregulation situation. Minimizing political interventions in regulatory decisions, increasing

regulatory predictability, strong standing behind the regulatory decisions, taking regulatory and policy decision with a wide angle of views, having a balanced approach between consumer and operators while taking regulatory decisions, instead of having strict consumer protective regulations are other responses expressed by the participants.

During the interviews almost all of the evaluations expressed by the participants are conceptual level critics, instead of reflecting company specific interests. This enables me to develop at least conceptual level policy implications within the scope of general public policy concepts and the current trends in broadband policy. Many of the developed/developing countries have published their national broadband plans due to the strategic importance of broadband services to national economies. It is also necessary for Turkey to develop a national broadband plan where it can benefit more form the broadband services considering its young population prone to technology. Moreover, developing a national broadband plan would decrease the uncertainty in the market and increase regulatory predictability which is also another point expressed by the participants. In many countries and in many markets, appropriateness of the regulations is a matter of debate. To mitigate the critics and to put forth the legitimacy and the necessity of the regulations, it is crucial to make regulatory impact analysis and evaluation practices. Therefore, considering the critics expressed above, for the case of Turkey, it would be beneficial to increase its existing practices. Moreover, it would increase the credibility of the regulation evaluations if they are done by independent parties such as academic institutions. This would also trigger to form an environment where the high level intellectual discussions can be made for the sake of better regulation. Lastly, transparency is an important concept that increases accountability of government and builds trust between governors and the relevant stakeholders. Some critics stated by participants such that minimizing political interventions in regulatory decisions, strong standing behind the regulatory decisions can be addressed with transparency implications. Therefore, increasing existing transparency practices both in policy and regulatory decision taking process would help to improve both broadband eco-system in inner circle, and the telecommunication sector in bigger circle.

6 Conclusion and policy implications

Turkey is one of the most important emerging markets in the world with its population approximately 80 million. Considering its young educated population prone to use computer technologies, it has the opportunity to benefit more from broadband services which have strategic importance for national economies. However, current broadband access penetration in Turkey, particularly for fixed broadband service, is quite low compared with the OECD countries. Moreover, considering the internet service providers' market share distribution, competition is very limited in Turkish fixed broadband market, which is highly dominated by a single incumbent network operator.

Cable TV infrastructure, which is an important part of facility based competition in fixed broadband market, different than many developed countries, in Turkey, is still owned and governed by the state company called Türksat which is established primarily responsible for national satellite operations. On October 6, 2014, Turkish government's new privatization agenda covering cable TV operations of Turksat announced by Finance Minister Mehmet Şimsek. In light of these developments, it is focused on this thesis to research possible effects of the privatization of Cable TV network on the competition dynamics of Turkish fixed broadband market and the policy implications for Turkey to enhance sustainable broadband ecosystem.

The research methodology used in this study is expert interviews. Experts selected from different parts of the industry as much as possible to ensure multi-stakeholder approach and to minimize biases and also it is specifically reached to the experts having experience in regulation, public policy and government relations as the aim of this study developing policy implications for Turkey. The research findings and the relevant policy implications are pointed as follows.

The research finding supports the government's privatization decision that privatization of cable TV platform is needed because of uncompetitive company behavior and lack of private sector motivations in management under the ownership of state. Moreover, under the assumption of a healthy privatization process and a taken-over by a company having serious private investment motivations, privatization is high likely to enhance consumer welfare.

Two options are emerging for the policy makers to privatize this cable platform either in geographically consolidated or fragmented. However, considering the consolidation trends in cable markets and the affirmative responses of the expert participants regarding the necessity of scale in cable TV operations, cable TV platform should be privatized in a geographically consolidated structure, not in fragmented structure.

Currently, cable platform service coverage is relatively low compared with the average coverage level of OECD countries. Despite the low service coverage level, the cable company has a potential, to make a significant impact on competition but it needs follow up coverage investments. Complementarily, there are economical incentives to invest in network roll out in Turkey. However, there are challenges mainly arisen from municipals' attitude toward new infrastructure deployment. Therefore, developing policies eliminating the reluctance of municipals toward telecommunication infrastructure deployment and the coordination problems between the relevant authorities would be the key policy implications to increase the attractiveness of the cable platform auction and to sustain competitive environment after the privatization.

In Turkey, embedding policy implications into spectrum auction processes or having commitments while signing concession agreements is an important policy practices in telecommunication sector. Considering the experiences of the participants regarding previous policies, this would be the most important part that the intended objectives and the relevant policy tool need to be very well tailored, otherwise it may generate inefficiencies and result with diversion from the targeted objective. Specifically for the privatization process of cable platform, the policy objectives intended to be brought should not deter attractiveness of the auction, and should be flexible with the company investment plans, mainly encouraging to extend service coverage area. This also forms a consistent chain with the necessity of follow up coverage investments fro cable platform to attain a sustainable competition in broadband market.

Cable platform operators are natural triple players, as their network is capable of providing TV, broadband and telephony services together. In triple play competition, there is the possibility of imperfect competition among the operators where the rights to broadcast highly attractive contents belongs to single operator, which is most likely for sports content. In Turkey, the future of triple play is favorable and national soccer

league matches have superiority over the other content. However, there are different views whether this content by itself can distort triple play competition or not. Therefore, considering the potential superiority of national soccer content, a higher regulatory scrutiny is necessary both from national competition authority and national regulatory authority for the future auction and tendering procedures of soccer content.

Lastly, participant experts have expressed their views about the points where a change or an enhancement is needed regarding government policies and regulatory actions and some of them can be listed as; necessity of national broadband plan, minimizing overregulation and political interventions in regulatory decisions and increasing regulatory predictability. For the future policy studies on Turkish telecommunication market, these topics can be covered comprehensively and in detail. In conceptual terms, however, it would be beneficial for broadband eco-system and the development of telecommunication sector; to publish a national broadband plan which would decrease the uncertainty in the market and increase regulatory predictability, to increase the existing regulatory impact analysis and evaluation practices for better regulation and to improve existing transparency practices both in policy and regulatory decision taking process would help to enhance accountability and to strength the trust to the decisions.

References

4G Americas. (2012). Mobile Broadband Explosion. 2012 Rysavy Research, LLC. Retrieved from: http://www.4gamericas.org/files/5414/0759/4533/4G_Americas_Mobile_Broadband_Explosion_August_20121.pdf.

Aldrich, M. (2011). History of UK Cable. Retrieved from http://www.aldricharchive.com/cable_history.html

Anadolu Agency. (2014). Turkey marks World Population Day as EU's youngest country. Retrieved from http://www.aa.com.tr/en/news/357365--turkey-marks-world-population-day-as-eus-youngest-country

Arcep. (2014). Arcep's Annual Report 2013. Retrieved from http://www.arcep.fr/uploads/tx_gspublication/rapport-activite-2013-english-version.pdf

Aron, D. J. and Burnstein, D. E. (2003). Broadband Adoption in the United States: An Empirical Analysis. Down to the Wire: Studies in the Diffusion and Regulation of Telecommunications Technologies, Allan L. Shampine, ed., July 2003. Retrieved from SSRN: http://ssrn.com/abstract=386100

AT&T. (2015). Long Term Evolution (LTE). Retrieved from http://developer.att.com/technical-library/network-technologies/long-term-evolution

Atiyas, I. (2005). Competition and Regulation in the Turkish Telecommunications Industry. Retrieved from http://www.tepav.org.tr/upload/files/1253713703r6688.Competition_and_Regulation_in_the_Turkish_Telecommunications_Industry.pdf

Atiyas, I. and Doğan, P. (2007). When good intentions are not enough: Sequential entry and competition in the Turkish mobile industry. Telecommunications Policy Volume 31, Issues 8–9, September–October 2007, Pages 502–523.

Bagdadioglu, N. and Cetinkaya M. (2010) Sequencing in telecommunications reform: A review of the Turkish case. Telecommunications Policy Volume 34, Issue 11, December 2010, Pages 726–735Baker, J., Cagenius, T., Goodwin, C., Hansson M. and Hatas M. (2007). Deep-fiber broadband access networks. Ericsson Review No. 1, 2007. Retrieved from

http://www.ericsson.com/al/res/thecompany/docs/publications/ericsson_review/2007/1_deep_fiber_web.pdf.

Bidgoli, H. (2008). Handbook of Computer Networks: LANs, MANs, WANs, The Internet, and Global, Cellular, and Wireless Network. 2008 John Wiley & Sons, Inc.

Boothby, K. (2009). The IDM Business Performance Awards 2008: Overall business award winner Campaign: Launching Virgin Media. Journal of Direct, Data and Digital Marketing Practice Vol. 11 No. 1

Bouckaert, J., Dijk, T., and Verboven F. (2010). Access regulation, competition, and broadband penetration: An international study. Telecommunications Policy 34 (2010) 661–671

Bourreau, M. and Doğan,P. (2004).Service-based vs. facility-based competition in local access networks. Information Economics and Policy 16 (2004) 287–306

Briglauer, W., Ecker, G., and Gugler, K. (2013). The impact of infrastructure and service-based competition on the deployment of next generation access networks: Recent evidence from the European member states Information Economics and Policy 25 (2013) 142–153

Bundesnetzagentur-BNetzA (2014). Annual Report 2013. Retrieved from http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/ReportsPublications/2014/2013AnnualReport.pdf?__blob=publicationFile&v=2

Burnham, J. B. (2007). Telecommunications policy in Turkey: Dismantling barriers to growth. Telecommunications Policy 31 (2007) 197–208 Telecommunications Policy 31 (2007) 197–208

Cambini, C. and Jiang, Y. (2009). Broadband investment and regulation: A literature review. Telecommunications Policy 33 (2009) 559–574

Cisco. (2010). Cisco Model DPC3000 DOCSIS 3.0 Cable Modem. Retrieved from http://www.cisco.com/c/dam/en/us/products/collateral/video/model-dpc2505-channel-bonded-cable-modem-americas/product_data_sheet0900aecd8072a168.pdf

Cisco. (2012). Digital Subscriber Line. Retrieved from http://docwiki.cisco.com/wiki/Digital_Subscriber_Line. The page was last modified on 16 October 2012.

Copenhagen Economics. (2006). Regulation of broadband A descriptive study of the regulation in eight countries. Retrieved from http://www.kkv.se/globalassets/english/publications-and-decisions/regulation-of-broadband-and-buyer-power-in-telecom.pdf

Corning, Inc. (2005). Broadband technology overview white paper: Optical fiber. Retreived from http://www.coming.com/docs/opticalfiber/wp6321.pdf

Dahlman, E., Parkval, S. and Sköld, J. (2014). 4G: LTE/LTE-Advanced for Mobile Broadband Second Edition, Published by Elsevier.

Decdeli, N. (2004). Multiple Internet Service Provider Applications in the Internet Service to be Provide over Cable TV Network: Current Regulations and Recommendations for Turkey. In Turkish. Thesis of Expertise. Telecommunications Authority. Retrieved from http://btk.gov.tr/ekDosyalar/tezler/Neset_DECDELI.PDF

Devita, A., Pehl, A., Jareno, D. C., Birbos, D., Santos, G. V., Köster, J. and Stenvall, K. (2013). Numericable, the hub of industry consolidation. ESN Telecommunications France Sector update. Retrieved from https://www.cmcics.com/fr/publication/FWEB_Publication.aspx?DocName=3D4196B3A8582EBFDCFDE00B90ED17EB5C47EB

Dieter Elixmann, D., Ilic, D., Neumann K., and Plückebaum, T. (2008). The Economics of Next Generation Access - Final Report. WIK-Consult Report: Study for the European Competitive Telecommunication Association (ECTA). Retrieved from http://wik.org/uploads/media/ECTA_NGA_masterfile_2008_09_15_V1.pdf

Distaso, W., Lupi P., and Manenti, F. M. (2006). Platform competition and broadband uptake: Theory and empirical evidence from the European Union. Information Economics and Policy 18 (2006) 87–106

European Commission. (1999). Commission Directive 1999/64/EC of 23 June 1999 amending Directive 90/388/EEC in order to ensure that telecommunications networks and cable tv networks owned by a single operator are separate legal entities. Commission Directive 1999/64/EC.

European Commission. (2014). Turkey Progress Report. Retrieved from http://ec.europa.eu/enlargement/pdf/key_documents/2014/20141008-turkey-progress-report_en.pdf

Fageda, X., Campillo R. R., and Rife, M.T. (2014). Determinants of broadband access: Is platform competition always the key variable to success?. Information Economics and Policy 26 (2014) 58–67

FCC. (2010). Connecting America: The National Broadband Plan. Retrieved from http://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf

FCC. (2015). FCC Finds U.S. Broadband Deployment Not Keeping Pace. FCC News. Retrieved from http://www.fcc.gov/document/fcc-finds-us-broadband-deployment-not-keeping-pace.

FCC. (n.d.). Getting Broadband, retrieved from http://www.fcc.gov/guides/getting-broadband.

FTTH Council. (2011). Definition of Terms. Retrieved from http://www.ftthcouncil.eu/documents/Publications/FTTH_Definition_of_Terms-Revision_2011-Final.pdf

Fox J.R, (1990). A brief history of cable television in the UK: cable television network options in the UK for the 1990s. LCS, IEEE Volume:1 , Issue: 1.

Gold J. (2014). 255 terabits a second: New fiber speed record?. Retrieved from http://www.networkworld.com/article/2839248/lan-wan/255-terabits-a-second-new-fiber-speed-record.html

Gorshe, S., Raghavan, A., Starr, T., and Galli S. (2014). Broadband Access: Wireline and Wireless – Alternatives for Internet Services, First Edition. Published 2014 by John Wiley & Sons, Ltd.

Höffler, F. (2007).Cost and benefits from infrastructure competition. Estimating welfare effects from broadband access competition. Telecommunications Policy 31 (2007) 401–418

ICTA. (2014). Electronic Communications Market in Turkey, Market Data (2014 Q3). Retrieved from http://eng.btk.gov.tr/kutuphane_ve_veribankasi/pazar_verileri/2014_Q3_ECM_Market Data.pdf

ITU. (2010). Definitions of World Telecommunication/ICT Indicators. Retrieved from https://www.itu.int/ITU-D/ict/material/TelecomICT_Indicators_Definition_March2010_for_web.pdf

ITU. (2012). Impact of Broadband on the Economy. Retrieved from http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf

Jackson, M. (2013). Superfast Broadband Covers 73 Percent of UK Postcodes as Uptake Surges. Retrieved from http://www.ispreview.co.uk/index.php/2013/08/superfast-broadband-covers-73-percent-of-uk-postcodes-as-uptake-surges.html

Jensen, M. (2009). Promoting the Use of Internet Exchange Points: A Guide to Policy, Management, and Technical Issues. Internet Society Briefing Papers. Retrieved from http://www.internetsociety.org/sites/default/files/promote-ixp-guide_0.pdf

Johnson, O. (2013). The DSL king is dead long live the VDSL king. Retrieved from: http://point-topic.com/press-and-events/2013/the-dsl-king-is-dead-long-live-the-vdsl-king/

Kim Y., Kelly T., and Raja S. (2010). Building broadband: Strategies and policies for the developing world. Global Information and Communication Technologies (GICT) Department World Bank. Retrieved from http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Building_broadband.pdf

Kabel Deutschland. (2013). Vodafone obtained merger control approval for Kabel Deutschland takeover. Press Release. Retrieved from http://www.kabeldeutschland.com/static-com/tx_kdgnews/130920_KDH_PM_Vodafone_Control_Approval_EN.pdf

Kabel Deutschland. (n.d.). The Evolution of the Cable TV Network. Retrieved from https://www.kabeldeutschland.com/en/unternehmen/geschichte/tv-kabelnetz.html

Koutroumpis, P. (2009). The economic impact of broadband on growth: A simultaneous approach. Telecommunications Policy 33 (2009) 471–485.

Köksal, E. and Ardiyok, S. (2013). Reviewing Regulatory Policy for Broadband in Turkey: Does EU Jacket Fit Everyone? Retrieved from SSRN: http://ssrn.com/abstract=2185866

Lehr W. H., Osorio C. A., Gillett S. E. and Sirbu M. A. (2006). Measuring Broadband's Economic Impact. Presented at the 33rd Research Conference on Communication, Information, and Internet Policy (TPRC) September 23-25, 2005, Revised as of January 17, 2006. Retrieved from http://www.andrew.cmu.edu/user/sirbu/pubs/MeasuringBB_EconImpact.pdf

Littman, M.K. (2002). Building Broadband Networks. Auerbach Publications.

Lutzhöft, N. and Machill, M. (1999). The Economics of French Cable Systems as Reflected in Media Policy. The Journal of Media Economics, 12(3), 181–199.

McKinsey & Company. (2012). Online and upcoming: The Internet's impact on aspiring countries. Retrieved from http://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/high%20tech/pdfs/internet_in_aspiring_nations_report_april_2012.ashx

Middleton, J. (2009). WiMAX vs. LTE vs. HSPA+: who cares who wins? Retrieved from http://telecoms.com/11695/wimax-vs-lte-vs-hspa-who-cares-who-wins/

Numericable Completel. (2012). 2011 Annual Review. Retrieved from http://www.cinven.com/lib/docs/131321-numericablecompletel-2011-annual-report.pdf

NTV. (2010). Süper Lig için 321 milyon dolar. In Turkish. Retrieved from http://www.ntv.com.tr/arsiv/id/25044109/

OECD. (2008). Broadband and the Economy Ministerial Background Report. Retrieved from http://www.oecd.org/internet/ieconomy/40781696.pdf

OECD. (2009). Indicators of Broadband Coverage. Retrieved from http://www.oecd.org/internet/broadband/44381795.pdf

OECD. (2013). The Internet Economy on the Rise Progress since the Seoul Declaration, OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264201545-en

OECD (2014). The Development of Fixed Broadband Networks. OECD Digital Economy Papers, No. 239. OECD Publishing. http://dx.doi.org/10.1787/5jz2m5mlb1q2-en

OFCOM. (2007). Summary profiles of pay TV in France, Germany, Italy, Spain, Sweden and United States Annex 9 to pay TV market investigation consultation. Retrieved from http://stakeholders.ofcom.org.uk/binaries/consultations/market_invest_paytv/annexes/annex9.pdf

OFCOM. (2013). UK fixed-line broadband performance, May 2013. Retrieved from http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/may2013/Fixed_bb_speeds_May_2013.pdf

OFCOM. (2014). The Communications Market Report. Retrieved from http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/2014_UK_CMR.pdf

Oxford Economics. (2012). The economic impact of Sky on the UK. Retrieved from http://annualreview2012.sky.com/_assets/downloads/pdfs/The-Economic-Impact-of-Sky-on-the-UK.pdf

Point Topic. (2013). World Broadband Statistics Q1 2013. Retrieved from http://point-topic.com/wp-content/uploads/2013/02/Point-Topic-Global-Broadband-Statistics-Q1-2013.pdf

Point Topic. (2014). France broadband overview. Retrieved from http://point-topic.com/free-analysis/france-broadband-overview/

Poole, I. (n.d.). WiMAX IEEE 802.16 technology tutorial. Retrieved from http://www.radio-electronics.com/info/wireless/wimax/wimax.php.

Qiang, C. Z., Rossotto C. M., and Kimura K. (2009). Economic Impacts of Broadband. Retrieved from: http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf

Shami A., Maier M. and Assi C. (2009). Broadband Access Networks Technologies and Deployments. Published by Springer: Dordrecht Heidelberg London New York.

Statista. (n.d.). Global HSPA and LTE subscriber growth forecast from 2012 to 2018 (in millions). Retrieved from http://www.statista.com/statistics/205723/global-umts-and-hspa-subscriber-forecast/

Statista. (n.d.). Number of WiMAX subscriber worldwide from 2010 to 2014 (in millions). Retrieved from http://www.statista.com/statistics/277656/number-of-wimax-subscriber-worldwide-since-2010/

Telkoder (Turkish Competitive Telecommunication Association). (2006). Broadband Report. In Turkish. Retrieved from http://www.telkoder.org.tr/core/uploads/page/document/cr_26.doc

Telli, C. (2011). Broadband in Turkey: Compare To What? Washington, D.C: infoDev / World Bank. Retrieved from http://www.broadband-toolkit.org/.

The Worldfolio. (2013). Turkey's smart approach to ICT development gains pacehttp://www.theworldfolio.com/interviews/tayfun-acarer-chairman-of-turkey-ict-authority-turkey-n2200/2200/

Torres, L. M. and Beltran, F. (2011). Analysis of an integrated plan for expanding broadband access in Colombia. Telecommunications Policy 35 (2011) 871–882

Turkish Count of Accounts. (2013). Türksat Uydu Haberleşme Kablo TV ve İşletme A.Ş. (Türksat) 2013 Yılı Denetim Raporu. In Turkish. Retrieved from http://www.sayistay.gov.tr/rapor/kit/2013/4-T%C3%9CRKSAT%202013.pdf

Unitymedia Kabel BW. (2013) Unitymedia Kabel BW Annual Report for the Year Ending December 31, 2012, retrieved from http://www.libertyglobal.com/pdf/fixed-income/Unitymedia-KabelBW-2012-ANNUAL-REPORT.pdf

Virgin Media. (2007). 2006 Annual Report. Retrieved from http://library.corporate-ir.net/library/13/135/135485/items/234256/VIRGINMEDIAINVE10K.pdf

Virgin Media. (2008). 2007 Annual Report. Retrieved from http://library.corporate-ir.net/library/13/135/135485/items/287050/2007AnnualReportFinal.pdf

Virgin Media. (2010). 2009 Annual Report. Retrieved from http://media.corporate-ir.net/media_files/IROL/13/135485/Virgin_Media_Annual_Report2009.pdf

Virgin Media. (2012). 2011 Annual Report. Retrieved from http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MTI3NTYzfENoaWxkSUQ9LTF8VHlwZT0z&t=1

Wallsten, S. J. and Hausladen S. (2009). Net Neutrality, Unbundling, and their Effects on International Investment in Next-Generation Networks. Technology Policy Institute. https://www.techpolicyinstitute.org/files/wallsten_unbundling_march_2009.pdf

Whitacre B., Gallardo R. and Strover S. (2014). Broadband's contribution to economic growth in rural areas: Moving towards a causal relationship. Telecommunications Policy 38 (2014) 1011–1023.