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A Comparative Study of Telecommunication Policy in Japan, the U.S., and Korea: Diffusion of Broadband Service[†]

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We analyse the policy-making and market structures for telecommunications by reviewing broadband diffusion policy. We find that the policy-making processes of Japan, the U.S., and Korea are totally different from the traditional process. We also found that the broadband access market structure in these three countries (Japanese FTTx, American DSL/Cable, and Korean DSL) is now a facility-based competition. In this competition, the integrated service provision model is effective from the social point of view but has the problem that migration of technology/facilities is very expensive. Future competition policy should take account of the outcomes of both facility-based and service competition.

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Introduction

Our ultimate goal is to consider broadband policy making for the next generation network by comparing three countries, Japan, the U.S., and Korea, but here we limit the discussion to three representative case studies focused on facility-based competition, institutions, and public policy. Why did we choose these three countries and three cases? A look at Tables 0.1 and 0.2, which contain some impressive data from ITU[1] and OECD[2], provide part of the answer.

Table 0.1 Monthly DSL price in USD per 100 kbps/s

	2002	2003	2004	2005
Japan	0.09	0.08	0.07	0.07
Korea	0.25	0.24	0.08	0.08
Sweden	8.91	0.24	0.25	0.23
France	10.05	4.12	3.67	0.36
US	3.53	1.77	0.49	0.49
UK	6.37	6.18	1.35	0.63
Canada	3.25	1.14	1.05	1.01

Source: ITU (2006, 2005, 2004, 2003)

After the Yahoo! BB shock in 2000, the Japanese DSL market suddenly became very competitive, resulting in the lowest monthly DSL price (in USD per 100 kbps/s)[3] in the world. According to the Ministry of Internal Affairs and Communications (MIC)[4], people in Tokyo enjoy the lowest prices for FTTH, DSL, and cable of the seven cities of Tokyo, New York, London, Paris, Düsseldorf, Stockholm, and Seoul.

Though the U.S. had the fourth highest broadband services use per capita in OECD

[1] ITU (2006, 2005, 2004, 2003), *ITU Internet Report.*
[2] OECD (2006), OECD Broadband Statistics to June 2006, http://www.oecd.org/document/9/0,2340,en_2649_34223_37529673_1_1_1_1,00.html.
[3] see table 0.1
[4] MIC (2005), Examination of difference between domestic and foreign prices in electric communication service area.

rankings in 2001, four years later, in 2005, it was ranked 12th among OECD countries in per capita broadband use, behind Korea and Japan. However, the U.S. still has the largest subscriber base in the world.

Table 0.2 Broadband subscribers per 100 inhabitants

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	Subscribers
Australia	0.9	1.8	3.5	7.7	13.8	17.4	3,518,100
Austria	3.6	5.6	7.6	10.1	14.1	17.7	1,460,000
Belgium	4.4	8.7	11.7	15.5	18.3	19.3	2,025,112
Canada	8.9	12.1	15.1	17.6	21.0	22.4	7,161,872
Czech Rep.	0.1	0.2	0.5	2.5	6.4	9.4	962000
Denmark	4.4	8.2	13.0	19.0	25.0	29.3	1,590,539
Finland	1.3	5.5	9.5	14.9	22.5	25.0	1,309,800
France	1.0	2.8	5.9	10.5	15.2	17.7	11,105,000
Germany	2.3	4.1	5.6	8.4	13.0	15.1	12,444,600
Greece	0.0	0.0	0.1	0.4	1.4	2.7	298,222
Hungary	0.3	0.6	2.0	3.6	6.3	7.8	791,555
Iceland	3.7	8.4	14.3	18.2	26.7	27.3	80,672
Ireland	0.0	0.3	0.8	3.3	6.7	9.2	372,300
Italy	0.7	1.7	4.1	8.1	11.9	13.2	7,697,249
Japan	2.2	6.1	10.7	15.0	17.6	19.0	24,217,012
Korea	17.2	21.8	24.2	24.8	25.4	26.4	12,770,911
Luxembourg	0.3	1.5	3.5	9.8	14.9	19.7	81,303
Mexico	0.1	0.3	0.4	0.9	2.2	2.8	2,950,988
Netherlands	3.8	7.0	11.8	19.0	25.3	28.8	4,705,829
New Zealand	0.7	1.6	2.6	4.7	8.1	11.7	479,000
Norway	1.9	4.2	8.0	14.8	21.9	24.6	1,137,697
Poland	0.1	0.3	0.8	2.1	2.4	5.3	2,032,700
Portugal	1.0	2.5	4.8	8.2	11.5	12.9	1,355,602

Slovak Rep.	0.0	0.0	0.3	1.0	2.5	2.9	155,659
Spain	1.2	3.0	5.4	8.1	11.7	13.6	5,917,082
Sweden	5.4	8.1	10.7	14.5	20.3	22.7	2,046,222
Switzerland	2.0	5.6	10.1	17.5	23.1	26.2	1,945,358
Turkey	0.0	0.0	0.3	0.7	2.1	3.0	2,128,600
UK	0.6	2.3	5.4	10.5	15.9	19.4	11,622,929
US	4.5	6.9	9.7	12.9	16.8	19.2	56,502,351

Source: OECD (2006)

Korea had the highest per capita rate of broadband use from 2001 until 2005[5]. Japan and Korea both had higher per capita rates of broadband use and faster broadband services than the U.S. In terms of download speed, NTT East's measure was 100 Mbps, while that of Korea's KT was only 13 Mbps, trailed by the U.S.'s Verizon ADSL speed at only 7.1 Mbps[6].

Why did Japan and Korea have higher use rates and faster services? What was the effective drive? How was broadband service as fast as 100 Mbps made available in Japan? How did Korea develop high per capita broadband services rates so rapidly? What can the U.S. learn from Japan and Korea regarding the successful diffusion of fast broadband services? These questions attracted the attention of U.S. policy makers and telecommunications interest groups in 2005, and, in 2005 and 2006, the U.S. Congress tried to rewrite the Telecommunications Act of 1996 to bring the new technology more into line with the new broadband environment. Many bills were introduced to both the House and Senate, and the Communications Workers of America advocated that the U.S. adopt a national broadband policy to maintain world leadership, which is at least as ambitious as initiatives in Japan or Korea that aim to connect every business and household to

[5] http://www.oecd.org/document/9/0,2340,en_2825_495656_37529673_1_1_1_1,00.html

[6] Martin Fransman, Introduction in "Global Broadband Battles: Why the U.S. and Europe Lag While Asia Leads", 2006, Stanford Business Books, p.11

high-speed networks with speeds of 100 Mbps by 2010[7].

Their concerns form the basis for our research idea. Martin Fransman points out that the degree of directness of the national government's role in financing broadband infrastructural investment was the most noticeable difference between countries. This paper will discuss how the broadband services markets in Japan, Korea, and the U.S. evolved, focusing on the concept of governance, the state's role, and institutional structure of broadband service deployment.

Theory regarding the characteristics of the state-market relationship is a well-researched and much-discussed subject. In his book, *Global Political Economy* (2001), international political economy scholar Robert Gilpin introduces the concepts of the developmental state, state-led capitalism or developmental state capitalism, welfare state capitalism, and the competitive state[8]. First, according to Gilpin, the Japanese economy is developmental state capitalism the central idea of which is that the state must play a central role in national economic development and in competition with the West[9]. Also, Chalmers Johnson explains that Japan is a capitalist developmental state rather than an American-style capitalist regulatory state. Johnson and other revisionists indicate that the most important instrument of Japanese industrial policy was the device of administrative guidance[10]. Second, the U.S. is categorized as a successful competitive state[11]. The American economy approaches the ideal of the neoclassical model of a competitive market economy in which individuals are assumed to maximize their own private interests and business corporations are expected to maximize profits[12]. In the U.S., the rationale or justification for industrial policy is limited to areas such as national defence, agriculture, the computer industry, and other high-tech sectors[13]. Third, Korea is defined as a "developmental state model in which the state had to play the central role in guiding

[7] Telecommunications Reform, 02/15/06, Congress& Session: 109-2, Bill Status; http://www.cwa-legislative.org/fact-sheets/page.jsp?itemID=27454556, last accessed on 2007 January 19.
[8] Robert Gilpin, Global Political Economy: Understanding the International Economic Order, 2001, Princeton University Press
[9] Gilpin, p.158
[10] Gilpin, p.162
[11] Gilpin, p.183
[12] Gilpin, p.151
[13] Gilpin, p.154

economic development and had to lead rather than follow the market[14].”

In another study, Jong-Chan Rhee compares institutional arrangements and the changing roles of the state in restructuring the telecommunications market. He concludes, “the developmental state of Korea tried to rely on changes in state institutions and informal and formal policy networks rather than on market institutional changes in regulating the telecommunications market, whereas the regulatory state of the U.S. concentrated on the latter”[15]. He also points out that “Korea has mainly taken advantage of the government’s discretionary policy change and institutional design while the U.S. has placed a special emphasis on social consensus for as well as on political support for market institutional change[16].”

These studies focused on the state. However, it is difficult to distinguish which country is a developmental state or regulatory state in the telecommunications area. This paper focuses on the concept of governance rather than on the concept of the state. We chose the diffusion of broadband services as a case study and examined how the market has developed in the U.S., Korea, and Japan.

The paper is organized as follows. The first section discusses the status of the facility competition in the broadband market, focussing mainly on the Japanese case, and refers to the present status of facility competition in the U.S. and Korea. The second section gives an overview of the institutions responsible for diffusion of broadband in Japan, the U.S., and Korea. The third section discusses the kinds of policies each country chose for broadband deployment. In the last section we interpret our findings and draw some conclusions.

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[14] Gilpin, p.316

[15] Jong-Chan Rhee, “Regulatory Institutional Embeddedness and Changes: Telecommunications Market Restructuring in Korea and the United States”, presented at the 20th IPSA World Congress, Fukuoka, July 9-13, 2006.

[16] *Ibid.,*

Chapter 1: Broadband Market Overview

In this chapter, we start our analysis of broadband policy in the three countries with a brief overview of their markets. Based on this overview, we identify facility-based competition as the dominant model.

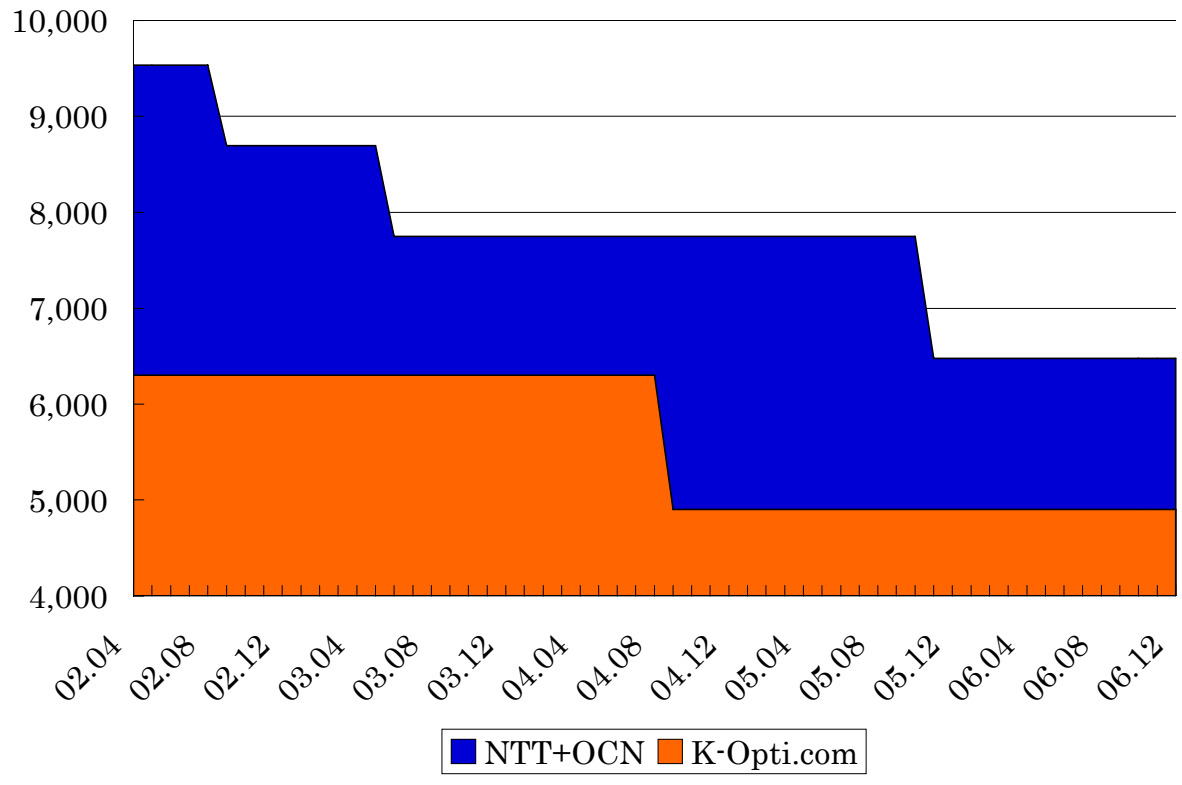
1-1 Japan

In April 2002, K-Opticom, a subsidiary of the Kansai Electric Power Corporation, entered the fibre-to-the-home (FTTH) market in the Kansai area (Osaka, Kyoto, Hyogo, Nara, Shiga, and Wakayama prefectures). K-Opticom features low priced FTTH services. This move stiffened competition for customer subscriptions in the Kansai area.

Pricing

Until K-Opticom's 2002 move, NTT West monopolized the FTTH market. After this event, there was a flow of FTTH customers from NTT West to K-Opticom. To compete with K-Opticom, NTT West changed their pricing strategies.

Figure 1-1. Monthly Charge



Unit: Japanese yen

Source: NTT West and K-Opticom WebPages

Figure 1 is a graph of K-Opticom and NTT West's (+ OCN) monthly charges since

April 2002. NTT West's monthly charges were 9,534 yen before K-Opticom entered the market, but they have since gradually lowered their prices. Between April 2002 and the end of 2006, NTT West lowered their prices three times, and K-Opticom lowered their prices once. Despite this difference, people in Kansai area generally, think that both NTT West and K-Opticom are repeating price cuts to compete with each other. However, NTT West's monthly charge has never been cheaper than K-Opticom's. K-Opticom's main marketing strategy is low prices. As a countermeasure, NTT West has presented a variety of discount systems.

Table 1-1. NTT West discount system

Period	Monthly Charge	Content of discount system	
		Monthly charge	Initial cost
Until August 2002	9,534	-	28,455
September 2002 to January 2003	8,694	After customer joins, charge is discounted for three months at 1,785 yen.	28,455
February 2003 to May 2003	8,694	After customer joins, charge is discounted for three months at 3,129 yen.	28,455
June 2003 to September 2003	7,749	After customer joins, charge is discounted for three months at 5,229 yen.	Free
October 2003 to March 2004	7,749	After customer joins, charge is discounted for two months at 5,780 yen and third month at 2,079 yen.	Free
April 2004 to October 2005	7,749	After customer joins, charge is discounted for first month at 6,594 yen and second month at 2,079 yen.	Free
After November 2005	6,478	After customer joins, service is free for	Free

		two months*.	

*Note: Charge is discounted for 1858.5 yen from third month to twelve month in Shizuoka, Aichi, Kyoto, Osaka, Hiroshima, and Fukuoka prefectures.

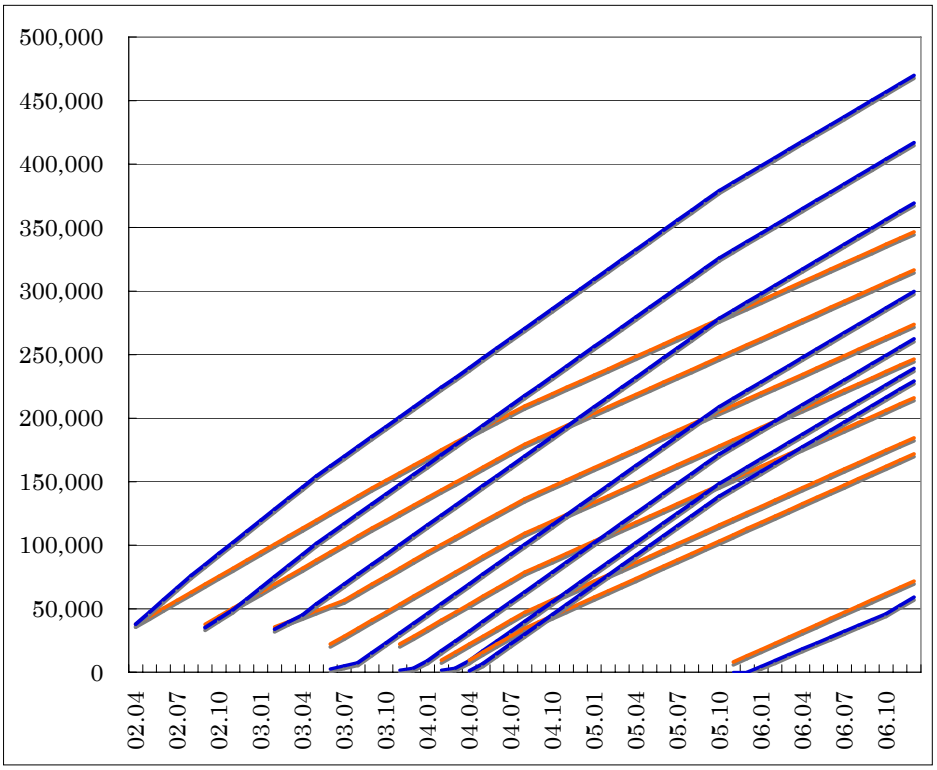
Source: NTT West WebPages

NTT is competing with K-Opticom using discount systems in addition to cutting monthly prices. There is a feature in the discount of the monthly charge for a certain period. Since September 2002, NTT West has continued its monthly charge discount system. This quite contrast with K-Opticom's discount systems. K-Opticom has hardly discounted the monthly charge up to now[17]. It seems that the deep discount in specific prefectures after November 2005 was meant to compete directly with the electric company's ISP.

With the monthly discounts the total cost a user pays from joining an FTTH service is lower with NTT West than with K-Opticom for a short period.

[17] K-Opticom provides discount of monthly charge for six months from February 2003 to May 2003. After June 2003 initial discount is given to all subscribers.

Figure 1-2. Total Cost of FTTH Service



Note: Blue lines represent NTT West and orange lines represent K-Opticom

Source: NTT West and K-Opticom WebPages

Infrastructure Improvement

Figure 1-2 shows the total cost of FTTH service including installation costs, monthly charge, and discount. In April 2002, there was no discount. As a result, NTT West service cost more than K-Opticom service. After NTT West introduced its discount, its service was cheaper than K-Opticom's for a certain period, but when the discount period ends, it returns to the original (higher) monthly charge. After several months or a few years, the total cost of NTT West service is higher than that of K-Opticom's.

Table 1-2. Estimated FTTH Infrastructure Improvement Cost

	# of Business Establishments (million)	# of households (million)	Unit cost of single Subscribers (1,000 Yen)	Estimated Cost (Trillion Yen)

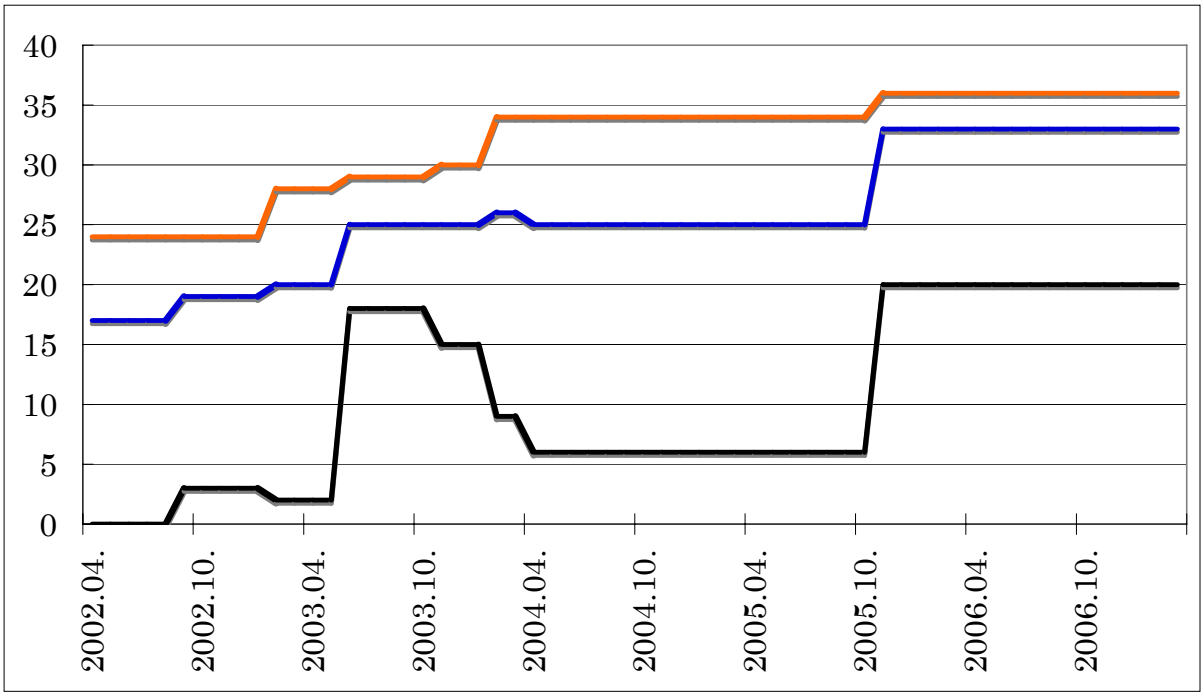
			SS	PON	All PON	Biz: SS, House: PON
Cabinet-order Designated Cities and Prefectural Capital Cities	2.6	170	240	140	2.7	3
Over 0.1 million (except COD/PC)	1.6	120	270	150	2.2	2.3
Under 0.1 million (except SPA)	2.1	140	380	210	3.4	3.8
Sparsely Populated Area	0.4	3	600	330	1	1.2
Total Cost	6.7	460	—	—	9.3	10.2

Source: MIC (2000)

For NTT West, the income from customers decreases during such a discount. This means there is a long period before NTT West collects on its investment. Development of FTTH infrastructure is more costly than that of other broadband infrastructure. According to calculations done by the Ministry of Internal Affairs and Communications, the average unit cost of FTTH infrastructure development is about 176,500 yen. This was true of all cases with PON (Passive Optical Network).

Figure 1-3 shows the estimated payment time (PT), over the amount of time it takes for the two companies to recoup the 176,500 Yen investment.

Figure 1-3. Payout Time in Each Entry Period



Note: Blue and red lines represent probable payout time for NTT West and K-Opticom, respectively. Black line represents resolution of adverse change.

Source: NTT West and K-Opticom WebPages

In 2002, because the discount campaign had just started, both companies reached PT in two years or less. After various discount campaigns had been introduced, PT increased to around three years. FTTH is called the 'ultimate' broadband, and it is more difficult for subscribers to switch to other carriers than in the age of ADSL when subscribers often changed carriers and ISPs. Now, both NTT West and K-Opticom have contracts requiring their subscribers to keep their service for certain period of time[18]. This is necessary due to the longer PT.

[18] If you accept continuing use of FTTH service for certain period you will receive a deeper discount. If not, you are charged a penalty for breach of contract.

1-2 US

Competition between Cable modem and DSL

The FCC definition of "high-speed" is services with subscriber transmission speeds in excess of 200 kilobits per second (kbps) in at least one direction. This is how the term broadband is commonly used by the FCC. "Advanced services", on the other hand, means subscriber transmission speeds in excess of 200 kbps in each direction, which are a subset of high-speed services[19]. The FCC began publishing information about subscriptions to high-speed and advanced services in the U.S. on June 30, 2006. This chapter will explain the status of broadband diffusion and competition for broadband services since these reports began being published.

The most significant characteristic of broadband service competition in the U.S. is that cable modems have been much more popular than DSL. Of the 64.6 million high-speed lines, 44.1% were cable modem, 34.9% were ADSL, 1.5% were symmetric DSL (SDSL) or traditional wire line, 1.1% were fibre to the end user premises, and 18.4% used other technologies[20]. However, 3.1 million ADSL lines were added during the first half of 2006 as compared to an increase of 2.0 million lines for cable modem service[21], and a year ago, the FCC reported that the increase in asymmetric DSL (ADSL) lines exceeded the increase in cable modem connections for the first time since they stared to collect the information. This is an opportunity to see real-time increase in ADSL service and broadband market competition. According to the FCC report on the percent of Zip codes with high-speed providers, in December 1999, only 10% of Zip codes had four or more providers, but by December 2005, that number had reached almost 80%[22]. Incumbent LECs or their affiliates accounted for 96.7% of ADSL connections and 52.8% of traditional wire line connections.

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[19] FCC Industry Analysis and Technology Division Wireline Competition Bureau, January 2007, "High-speed services for Internet access: Status as of June 30,2006",p.1

[20] FCC report (January 2007), p.2, others include wireless and electric power line and satellite, etc.

[21] Ibid.,p.2

[22] Ibid., Chart 12

When all technologies are considered, incumbent LECs accounted for 45.9% of total high-speed connections[23]. As a nationwide average, the FCC estimated that high-speed DSL connections were available to 79% of the households to whom incumbent LECs could provide local telephone service, and that high-speed cable modem service was available to 93% of the households to whom cable system operators could provide cable TV service[24].

Toward Facility-based Competition and Duopoly

In the U.S., as Verizon and AT&T launched their fibre-to-the home (FTTH) broadband services in late 2005 and 2006, facility-based competition was becoming more intense. Verizon's FTTH service Fios offers 5 Mbps (upstream) and 30 Mbps (downstream) for 34.95$ a month and is provided through their FTTH networks, Fios TV. As of January 2007, the number of Fios Internet customers had reached 522,000 in 16 states. Their current major concern is building optic fibre and providing video services through their FTTH networks.

Cable operators offer bundled services with digital telephone service (VoIP), broadband data transmission, and video services. Comcast has more than 11 million high-speed Internet customers. At the end of 2005, cable operators were servicing 5.6 million digital telephone customers[25]. However, triple play service is still very expensive. Comcast offers such a service for $99 a month.

Verizon and AT&T are pushing Congress and state legislators to change the current regulation to lower the entry barriers into video market. Under the Telecommunications Act of 1996, telephone companies are allowed to provide video services. However, they argue that they are struggling to enter the video service market because it takes a long time to get a local cable franchise from each local government. Their competitors, cable operators, have an edge in this sense. Verizon and AT&T lobbied Congress to pass telecommunications reform legislation in 2006, but Congress did not pass it. However, a number of states including Indiana, Virginia, California, and Texas passed such reform regulations. In these

[23] Ibid.,p.3
[24] Ibid.
[25] NCTA 2006 Industry Overview, p.13, (http://i.ncta.com/ncta_com/PDFs/NCTAAnnual%20Report4-06FINAL.pdf)

states, companies will be able to get state-wide franchises under the new laws.

Therefore, two important characteristics of U.S. service are that telephone companies launched the original FTTH broadband services and that facility-based competition has just started between large cable operators such as Comcast and telephone companies such as Verizon and AT&T. This triple play competition is expected to offer customers more content options and cheaper services.

1-3 Korea

Broadband Market in Korea

The Korean broadband market is characterized by fierce competition among six companies. Of these, we will focus on the broadband service development and strategy of three companies: Korea Thrunet Co, the first broadband services over proprietary cable infrastructure, Hanaro Telecom, the second largest provider, and KT, the incumbent operator.

Korea Thrunet Co, Ltd.

Korea Thrunet Co, Ltd. is a Seoul-based telecommunications company, one of the largest providers of high-speed broadband internet access, one of the largest telephone companies in South Korea, and one of only two companies licensed to provide local telephone services. A division of the company known as MultiPlus controlled a large portion of the South Korean Internet market. Thrunet had focused on its singular mission of leading the broadband access and content markets. In 1998, Thrunet was the first Korean company to offer broadband Internet services and had the largest cable network subscriber base in Korea[26].

Hanaro Telecom

Hanaro Telecom Inc., which was officially launched in September 1997, heralding the advent of a new era of competition in the Korean local call market, has grown to be the major high-speed Internet service provider in the region[27]. Already providing service to Seoul, Busan, Incheon, and Ulsan at the head of the list by April 1999, Hanaro expanded the Internet access market by deploying nationwide fibre optic networks to 100 cities by the end of 2002. Hanaro integrated broadband Internet access services, such as 'I am ADSL', 'HFC', and

[26] Thrunet was acquired by Hanaro Telecom in 2005.

[27] The first ADSL service was launched in April 1999 by Hanaro, around a year later than the first cable broadband service by Thrunet. Despite the late start, DSL became the dominant technology in the market during 2000 after strong growth in new connections.

'BWLL' into a single brand, 'HanaFOS', by June, 2001. Hanaro also leases parts of the HFC cable network owned by Powercomm (a subsidiary of the Korea Electric Power Corporation that owns a vast cable network infrastructure almost as large as KT's). Hanaro was one of the first movers in the broadband services market and was instrumental in moving the domestic communication market from voice phone service to high-speed data services.

Why did Hanaro aggressively push DSL Broadband service?

For any new start-up company entering a new market, a number of factors need to come together at the right time to make the proposition look sensible and to give the company a reasonable chance of success. Hanaro's original market entry strategy was based on the following objectives:

- To build the top brand image in the market.
- To focus their initial efforts on the most lucrative market segments and use these quick wins to further finance a network rollout programme.
- To use existing cable networks to achieve a robust position in the residential market.

Hanaro's original strategy was focused on a fast network build-out in high-density areas and initially based on the "if you build it, they will come" approach. This has today been replaced by a pre-subscription strategy in which demand is assessed prior to deployment of equipment. Hanaro's total CAPEX for this rapid network roll out was approximately US$4 billion.

Korea Telecom

Korea Telecom (KT) is creating a ubiquitous, cutting-edge technology that goes beyond world-class. KT, Korea's top integrated wired/wireless communications service provider, has been Korea's leader in the development of the information and communications business for the last 25 years. In that same time, it has helped turn Korea into an IT powerhouse with the world's leading broadband services technology. With the commercial launch of the world's first wireless broadband service (WiBro), KT is paving the way for "U-Korea", a ubiquitous infrastructure through which people can share information wherever

they are. The KT Group consists of several companies, namely: Korea Telecom, the incumbent operator which provides telephone, ADSL, Wireless LAN services and some satellite services; Korea Telecom Freetel (KTF), the cellular mobile arm providing 2.5 G (CDMA 2000) services; KTICOM which specialises in IMT2000 (WCDMA) services, and KTH, which provides content and on-line services.

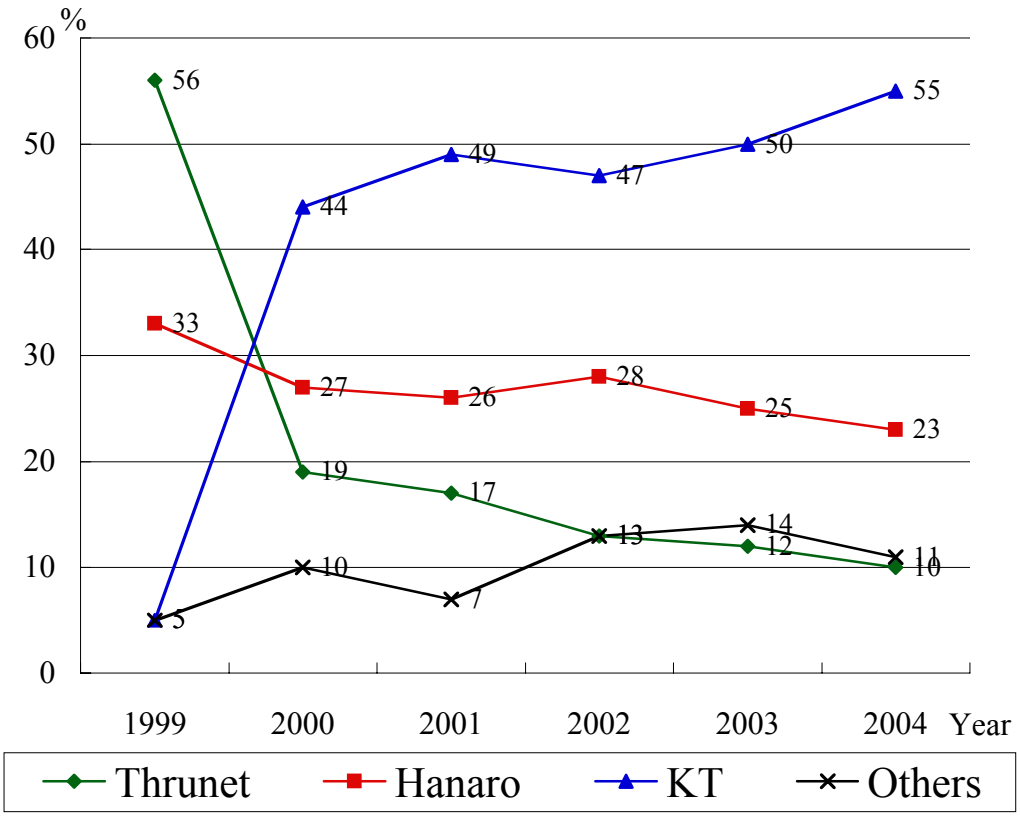
KT's Broadband Service Development

KT began pilot ADSL services in 1997 with 1500 subscribers. They determined that rolling out such commercial services would be unprofitable at the time given the high equipment costs and the long payback period, which was estimated at four years. To achieve a break-even point, it was thought that KT needed approximately half a million subscribers who were willing to pay US$50-60 per month for service. The business case for ISDN at the time appeared much stronger. However, two new entrants were then successfully launching (Thrunet and Hanaro), which persuaded KT to discard its plans to roll-out ISDN and to offer commercial ADSL services at its competitors' price of US$30 per customer (40% less than KT’s original price). Using their existing network and service and marketing capacities, KT had two million subscribers within a year-and-a-half of offering commercial ADSL service (June 1999), and doubled that number to over four million by March 2002. Of these four million subscribers, the majority of them (3.8 M) are connected via ADSL, with the remaining either connected via Ethernet (subscribers in new apartment buildings), satellite, or wireless LAN.

Facilities-based Competition

The Korean broadband market is characterised by strong facilities-based competition. KT, the incumbent operator, has approximately 55% of market share mainly based on DSL. KT’s main competitors are Hanaro Telecom (23%) using both DSL and cable networks, and Thrunet (10%) using mostly cable networks (See Figure 1-3).

Figure 1-3. Market Shares of Broadband Carriers (%)



Source: MIC (2005)

Strong facilities-based competition has put downward pressure on prices, encouraged aggressive rollout of services, and forced service providers to compete in providing quality service. The fact that the landlord, not the incumbent, owns the block wiring in apartment complexes made interconnection simpler at the access level. The consequent absence of a local loop bottleneck has reduced the need for heavy regulation of the incumbent, allowing KT to operate with comparatively few regulatory restrictions. Vigorous competition pushed prices lower. These have now stabilized at US$0.07 per 100 kbps.

Chapter 2: Institutional Analysis of Broadband Services

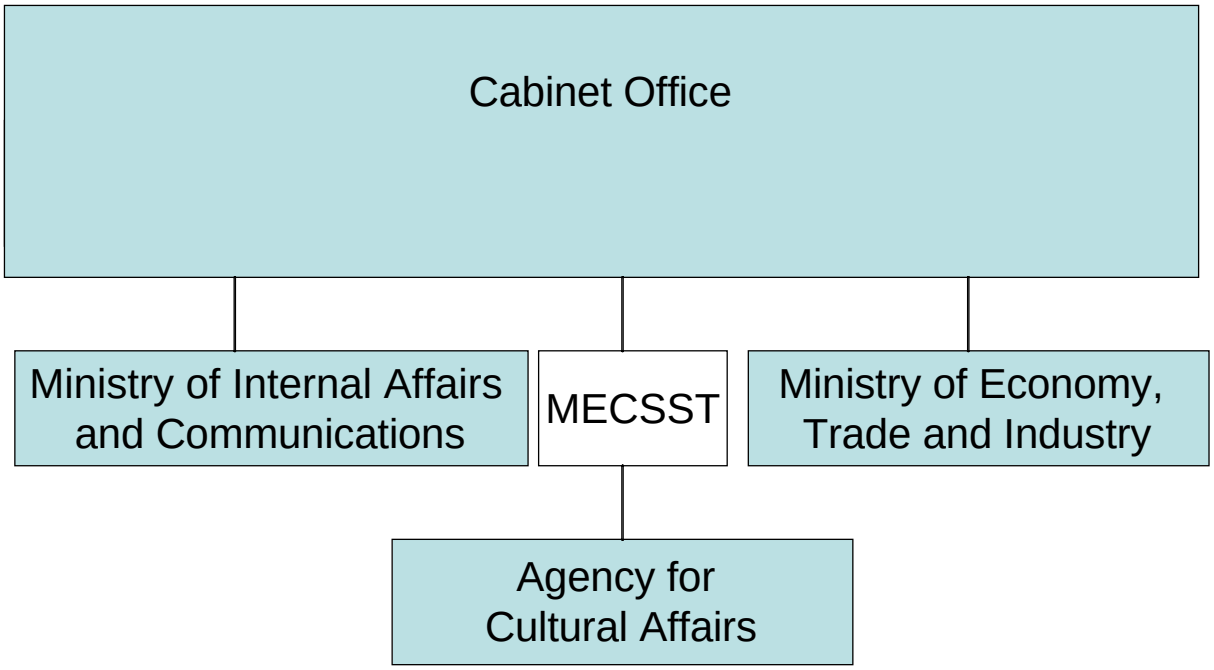
This chapter presents an overview of the institutions involved in broadband deployment. We focus here on government institutions that have primary authority regarding broadband infrastructure, how it is influenced by other governmental actors or legislation, and how they establish their policies.

2-1 Japan

No independent committee

Japanese regulation is unique. In most major OECD countries regulation of the telecom and policy planning sectors is divided between independent entities, but in Japan, the Ministry of Internal Affairs and Communications holds jurisdiction over both functions.

Figure 2-1. Japanese Government Structure for ICT



Information Technology Strategy Council

On July 7th, 2000 the Information Technology Strategy Council was set in Prime Minister Yoshiro Mori's Cabinet Office to promote and plan IT policy. It was renamed the IT Strategic Headquarters and issued e-Japan in 2001, e-Japan II in 2003, and u-Japan in 2005. These are grand visions for ICT policy. Concrete policy is made by related ministries.

In general, MIC controls telecom policy, METI controls equipment promotion and patent related policy, and the Agency for Cultural Affairs under the Ministry of Education, Culture, Sports, Science and Technology controls copyright policy. That is, the broadband

promotion, regulation, and arbitration bodies are divided among bureaus in MIC, the Information and Communications Policy Bureau, and the Telecommunications Bureau.

2-2 US

The Relationship Between Government Institutions

In Section 706 of the Telecommunications Act of 1996, Congress encourages the Federal Communications Commission (FCC) and the state public utilities commissions to deploy advanced telecommunications capability on a reasonably and timely basis. The FCC is an independent government agency in charge of regulating interstate and international communications by radio, television, wire, satellite, and cable[28].

The FCC was established by the Communications Act of 1934, which was replaced by the Telecommunications Act of 1996. The FCC is directly responsible to Congress, and its jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions. The state commissions manage telecommunications services within states. The FCC is not fully independent of the executive branch but is classified as an independent commission. That is, because the five commissioners are appointed by the President, and approved by the Senate, in a sense, both Congress and the White House have influence. The President has particular influence over the FCC's activities because he appoints the chairman from among the commissioners. The chairman is considered the chief executive officer of the Commission and controls its agenda. Gerald W. Brock writes that the chairman's powers are often used to exert a dominant influence on the functioning of the commission[29].

[28] http://www.fcc.gov/aboutus.html
[29] Gerald W. Brock, *Telecommunication Policy for the Information Age: from Monopoly to Competition*, 1998, 3rd edition, Cambridge, MA: Harvard University Press, pp.53-54.

Figure 2-2. Institutions Influencing Broadband Deployment in U.S.

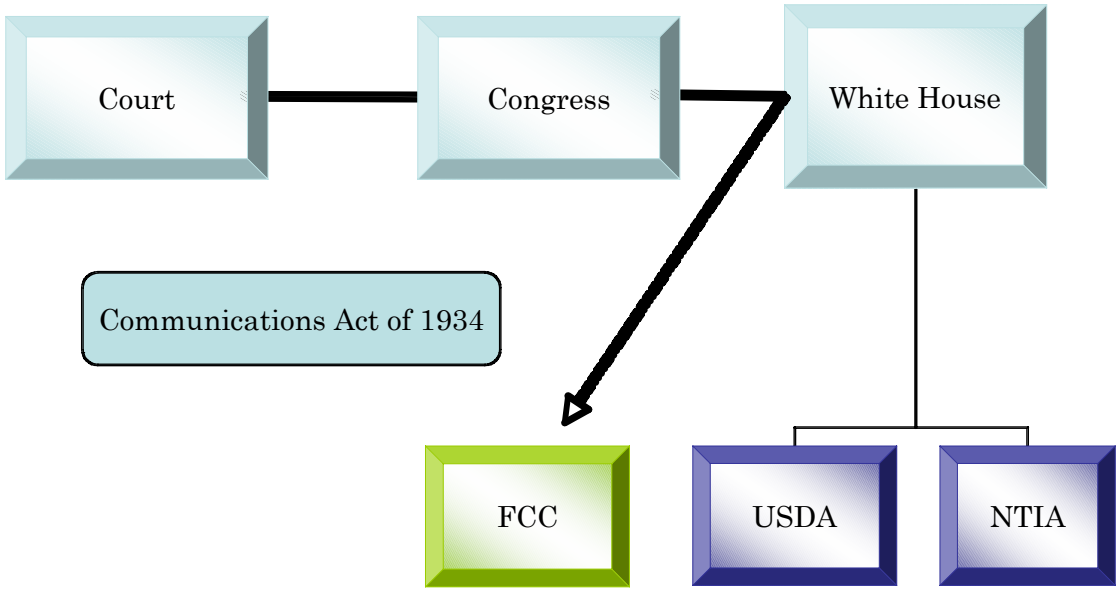


Figure 2-2 shows the relationship between the FCC, the White House and Congress. Courts also play an important role in telecommunications in the U.S. After the Telecommunications Act of 1996 was established, there were several lawsuits on unbundled network elements (UNEs), directly related to local telecommunications service competition. Moreover, the Supreme Court supported the FCC's classification of cable modem service as an "information service" in June, 2005. Therefore, cable companies do not have to open their facilities (networks) to their competitors. The FCC ruled in 2002 that cable modem service would not be regarded as a "telecommunications service" but as an "information service." The FCC suggested that less regulation on the cable modem service would foster wider diffusion of broadband services. However, the incumbents, such as the Bell companies, were strongly against the FCC's ruling[30]. The Supreme Court's decision supported the FCC and was subsequently criticized because the court expanded the FCC's discretion.

[30] Nancy Weil and Grant Gross, IDG News Service, "Supreme Court ruling a triumph for cable operators", June 27, 2005, http://www.infoworld.com/article/05/06/27/HNsupremecable_1.html

The National Telecommunications and Information Administration (NTIA) was created in 1978 to advice the President on telecommunications and information policy issues. NTIA frequently works with other Executive Branch agencies to develop and present the Administration's position on these issues[31]. NTIA often cooperates with the FCC in formal informal ways. The United States Department of Agriculture (USDA) is another important government institution of broadband diffusion. USDA Rural Development provides many programs for financing rural America's telecommunications infrastructure.

Structure of the FCC

Figure 2-3 shows the FCC's organizational chart

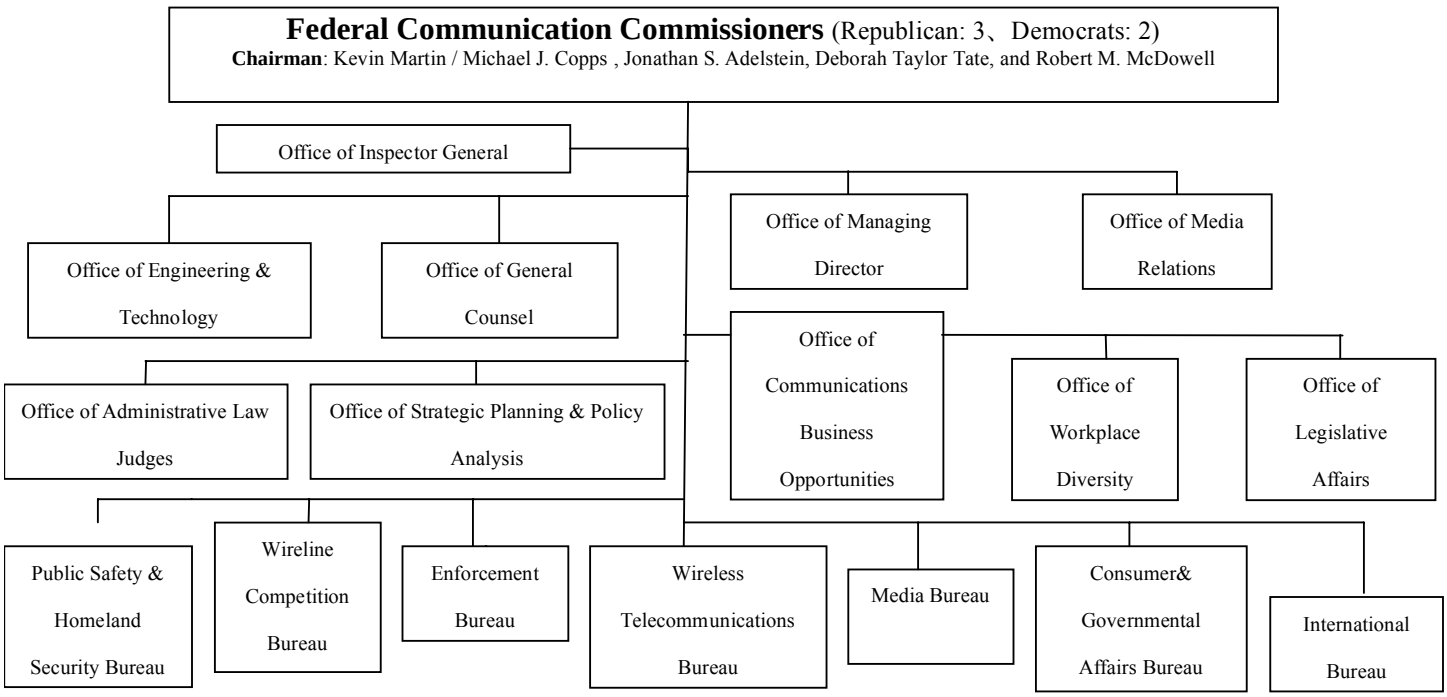


Figure 2-3. FCC's Organizational Chart as of February 25, 2007

The Broadband Division is in the Wireless Telecommunications Bureau. They are

[31] http://www.ntia.doc.gov/ntiahome/aboutntia/aboutntia.htm

in charge of the facilitating rapid, widespread deployment of wireless broadband services. Moreover, the Inside Wire Line Competition Bureau of the Telecommunications Access Policy Division "administers a comprehensive policy for Commission oversight over funds used to support universal service.[32]" Universal service is stipulated in Section 254 of the Telecommunications Act of 1996. It ensures access to advanced services for schools, libraries, and rural health care providers with affordable rates. They also review the deployment of advances in telecommunications capability to ensure that such deployment is reasonable and timely. Review is based on the Section 706 of the Telecommunications Act of 1996[33].

The Federal-State Joint Conference on Advanced Telecommunications Commission was formed in 1999 to fulfil the policy goal in Section 706 of the Telecommunications Act of 1996. The Joint Conference assists the FCC in its reports to Congress on the deployment of advanced telecommunications services. The Joint Conference is composed of all of the FCC Commissioners and up to seven state commissioners[34].

In addition, in May 2004, Chairman Michael Powell established the Wireless Broadband Access Task Force. The Task Force is required to assist the Commission in identifying and recommending possible changes in broadband services for the benefit of all American consumers. It reviews applicable spectrum management policies and regulations, cooperating with all relevant stakeholders. The FCC has strongly committed to facilitating broadband investment and deployment through different technological choices including wireless broadband. The FCC places a high priority on ensuring that Americans have access to broadband services though multiple facilities-based platforms[35].

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[32] http://wireless.fcc.gov/organization/broadband.html
[33] http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-208A1.pdf, "Availability and Advanced Telecommunications Capability in the United States--Fourth Reports to Congress", (FCC04-208), September 9, 2004, p.8.
[34] http://www.fcc.gov/jointconference/welcome.html
[35] http://wireless.fcc.gov/spectrum/proceeding_details.htm?proid=379#pn

2-3 Korea

Lee and Choudrie point out that the rapid roll-out and take-up of broadband services in South Korea has been achieved through a combination of six key factors: geography and demographics, government leadership, facilities-based competition, the PC Bang phenomenon, pricing, and the emergence of clear user benefits[36].

In this section, we will explain the Korean government's leadership and the institutions of Broadband Deployment. The Korean government has played a key role in the development and implementation of a detailed and sophisticated strategy for broadband deployment, focusing on both supply and demand side issues. The Korean government established a comprehensive informatisation promotion framework and systems such as 'The Framework Act on Informatization Promotion (1995)', 'Informatization Promotion Committee (1996)' and set up the government's evolving mid- to long-term vision and strategies such as 'Cyber Korea 21', 'e-Korea Vision 2006', 'Broadband IT KOREA VISION 2007' and close cooperation with the private sector in continuous enhancement of the nationwide information infrastructure, nationwide PSTN, and national computer network projects built in the 1980's[37].

Institutions

Korea's policies on information are shaped and promoted by several responsible bodies, including the Ministry of Information and Communication, the National Computerization Agency, and the central and local governments. Most of all, there are two important government forums. First, the Informatization Strategy Meeting, chaired by the President, and second, the Informatization Promotion Committee, legally based on the Framework Act on Informatization Promotion[38].

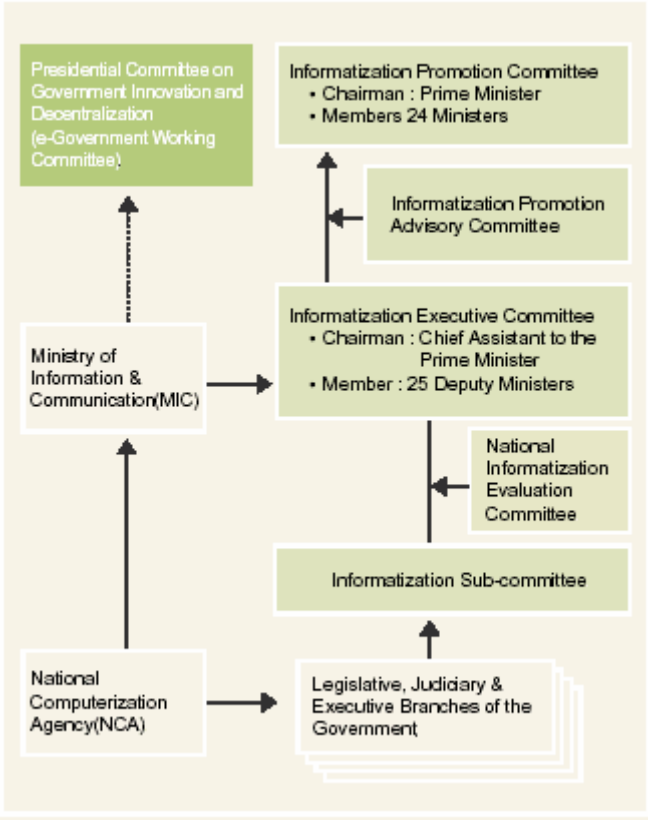
The Presidential Committee on Government Innovation and Decentralization (PCGID) is an organization created to further answer the needs of the people in today's

[36] H. Lee & J. Choudrie," Investing in broadband technology deployment in South Korea", 2002, Brunel-DTI International Technology Service Mission to South Korea.
[37] National Computerization Agency (NCA), "2004 Broadband IT Korea", Informatization White Paper 2005.
[38] *Ibid.*

fast-changing world. Citizens want more than a government that provides for their basic needs. They want a government that serves the people and they want to participate in the processes of governance. Autonomy, accountability, and transparency are just few of the things that the government needs to achieve. As an organization embodying these desires, the PCGID's mission is to make the government of Korea more open, transparent, and closer to the people. Public sector reform and government innovation in particular are daunting tasks at best but the PCGID, as an advisory body to the office of the president, has been charged with this difficult duty by the president as its foremost agenda.

The Information Promotion Committee evaluates the progress of the following: the implementation and alteration of the Master Plan for Informatization Promotion, project management and policy adjustment, and evaluation of Korea's Information Infrastructure. Moreover, to manage systematic and unified promotion of IT policies, the committee deals with many important issues regarding the Master Plan of NGIS Implementation, Baseline Framework for e-Commerce Promotion, Long Term Plan of e-Government Project, and Management of the Knowledge and Information Resources based on the following laws and regulations: Promotion of Digitalization of Administrative Work for the e-Government Realization Act, the Establishment and Utilization of NGIS Act, the Framework on e-Commerce Act, and the Management of the Knowledge and Information Resources Act. To promote efficient management of the committee, the Informatization Executive Committee directs the Informatization Promotion Committee.

Figure 2-4. Framework for National Information

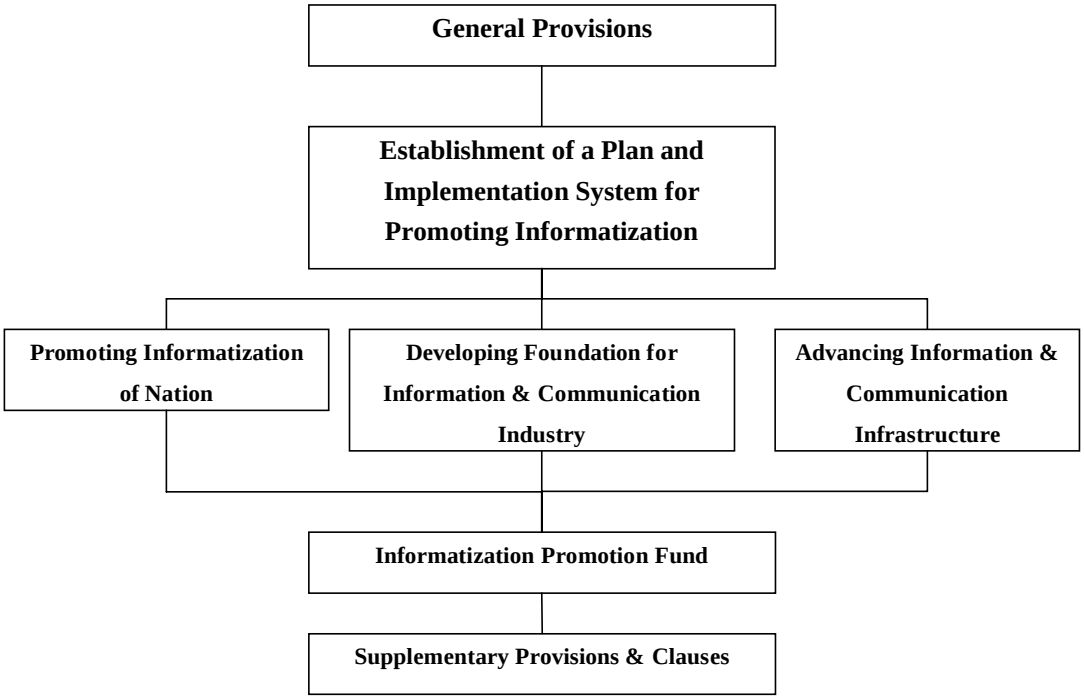


Source: NCA (2005)

Framework Act on Informatisation Promotion

The framework act for implementing the Informatisation of the nation was established in August 1995 and revised in January 1999. The act defines the basic foundation and system for effectively implementing the informatisation of Korea. The purpose of the Act is to improve citizens' quality of life and to contribute to the development of the national economy, thereby promoting Informatisation and laying the foundation for the information and communications industry and achieving the advanced information and communications industry infrastructure (See Figure 2-5). We will explain Informatization Promotion Fund in Section 3-3.

Figure 2-5 Structure of Framework Act on Informatisation Promotion



Source: KIPC's Homepage

Chapter 3: Public Policy for Broadband Deployment

This chapter discusses each country's regulatory framework and funding or subsidies for accelerating the deployment of broadband services.

3-1 Japan

ICT Promotion

The Japanese ICT promotion policy blue print was promulgated in the IT Strategic Headquarters. Table 3-1 shows the total promotional budget over five fiscal years.

Table 3-1. ICT Promotional Budget (Unit: 100 Million Yen)

Areas FY	2005	2004	2003	2002	2001
Seven leading Areas					
1. Medical	13	10			
2. Food	25	40			
3. Life	56	20			
4. SME finance	−	−			
5. Knowledge	49	61			
6. Employment	11	9			
7. Administration service	696	736			
1. Network Infrastructure	2,228	2,723	2,220	2,289	2,394
2. Education	505	490	1,125	965	875
3. E Commerce	65	69	67	87	42
4. E Government	3,449	3,449	5,755	9,540	9,269
5. Public Use	2,836	2,836	3,286	4,250	3,754
6. Advanced Network	213	206	264	223	140
7. R&D	1,138	1,154	1,990	1,236	1,164
8. International Relationship	21	29	29	30	144
9, Others	1,459	1,484	618	926	1,422
TOTAL	13,016	13,315	15,355	19,544	19,204

Source: IT Strategy Headquarters[39]

[39] See http://www.kantei.go.jp/jp/singi/it2/others/yosan.html .

The promotion policy of Japanese Government can be seen in this figure. The most impressive suggestion is that government use broadband itself. That is, the top three are always E Government, public use, and network infrastructure and the top two expenditures are funding for public investment for public use. Many people[40] say that the Japanese government supports the building of infrastructure, but the total budget for this is just two billion USD per year, which is less than 1/3 of the US universal fund. Also, network infrastructure accounted for just 7% of MIC's budget[41] in 2002, for instance. However, the National Land and Transportation Ministry (NLTM), MIC, and the Ministry of Agriculture, Forestry and Fisheries (MAFF) also have network infrastructure budgets. Over 90% of the total of such funds are administered by NLTM.

[40] Fransman (2006), for example.
[41] See http://www.kantei.go.jp/jp/singi/it2/others/yosan.html .

3-2 U.S.

Regulation

Though the U.S. Congress and the FCC have declared their intention to keep their "hands off the Internet," broadband is regarded as being outside this declaration[42]. The incumbent telephone companies are subject to dominant common carriers regulation, and their new broadband businesses are also regulated by existing telephone regulations. Robert W. Crandall wrote that the incumbent telephone companies are regulated in two ways. He stated that their broadband retail offerings were subject to price regulation by either the states or the FCC, and that the Telecommunications Act of 1996 required them to make their network facilities available to competitors at regulated prices whenever the facilities are considered a necessity for new entrants to offer their own DSL services[43].

The cable companies, on the other hand, have not been regulated for broadband Internet connections. As mentioned in Section 2-2, the FCC decided that cable modem service was not classified as a telecommunications service but as an information service, which was not regulated by the Telecommunications Act of 1996. That means the cable companies are not subject to the common carrier regulation. Therefore, in the U.S., asymmetric regulation for broadband Internet connections has been in place for a long time[44]. There was a big debate on broadband regulation of incumbent telephone companies and deregulation of cable companies.

However, the FCC revised the classification of DSL service in 2005. The FCC released its decision to place telephone and cable companies on an equal footing on August 5, 2005[45]. The FCC's action was in response to market and technological changes whereby availability of broadband service was increasing as multiple broadband pipelines were

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[42] Robert W. Crandall, "Competition and Chaos U.S. Telecommunications since the 1996 Telecom Act", NTT Shuppan, 2006, p.157.
[43] Robert W. Crandall, "Debating U.S. Broadband Policy: An Economic Perspective", The Brookings Institution Policy Brief, Policy Brief #117, March 2003, p.2
[44] Ibid., p.3
[45] http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260433A1.doc, FCC News, "FCC Eliminates Mandated Sharing Requirement on Incumbents' Wireline Broadband Internet Access Services", released on August 5, 2005.

deployed.[46] Then, the Report and Order adopted by the FCC put wire line broadband Internet access service, delivered by DSL technology, on an equal regulatory footing with cable modem service. This decision was consistent with the Supreme Court's decision upholding the FCC's light regulatory treatment of cable modem service[47]. In other words, since then, the regulatory framework for broadband service has been greatly changed from asymmetric regulation to equal footing.

Funding

The federal government funds some types of institutions that are involved with broadband deployment. These include rural health organizations, schools and libraries, and non-profit organizations in rural areas. It has been very important, in the United States, to help underserved areas in a competitive market construct telecommunications and broadband services. This is partly because there are many constituencies that do not have basic telephone service. Therefore, it can be said that many Senators such as Ted Stevens (R.-Alaska) have serious concerns about broadband deployment and universal service in their states.

Universal Service Fund

Section 254 of the Telecommunications Act of 1996 mandates that the FCC promote universal service "to promote the availability of quality services at just, reasonable, and affordable rates as well as to increase access to advanced telecommunications services throughout the Nation[48]". Another goal is "to advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas[49]".

The Universal Service Fund is composed of the four programs shown in Figure 1.

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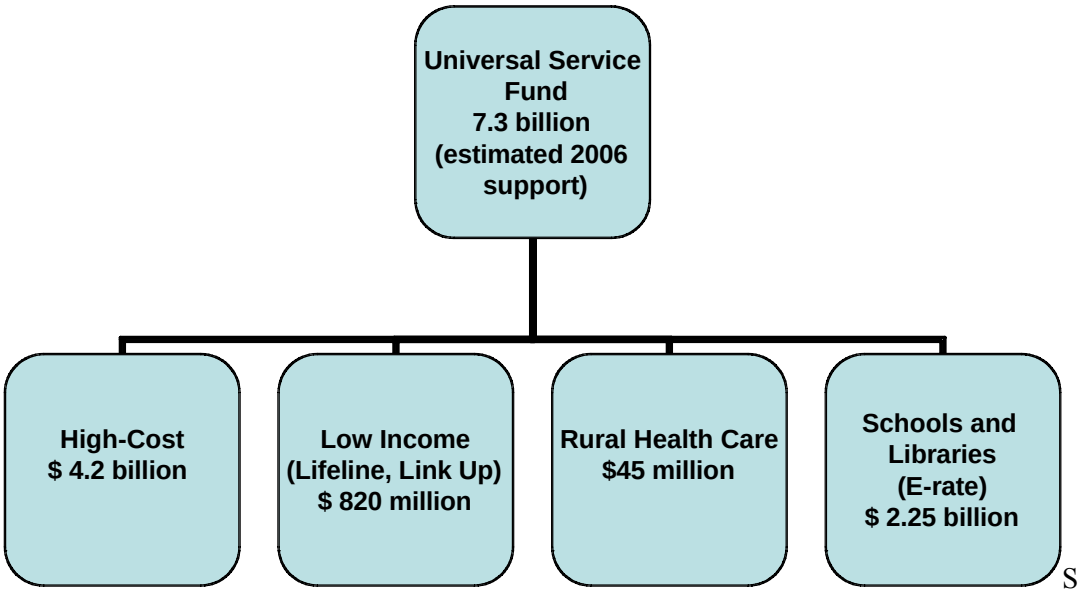
[46] *Ibid.*
[47] *Ibid.*
[48] http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-268591A1.doc
[49] http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-268591A1.doc

Figure 3-1. Universal Service Fund for 2006 (Universal Service Administrative Company)



Source: USAC website.

The Rural Health Care Program makes discounts available to eligible rural health care providers for telecommunications services and monthly Internet service charges related to use of the telemedicine and tele-health. The eligible discounted Internet services include mileage related charges, T3 or DS3 (45 Mbps), T1 (1.5 Mbps), fractional T1, ISDN(BRI and PRI), frame relay, ATM, off-premise extension, satellite service, centrex, dedicated private line, foreign exchange line, network reconfiguration service, direct inward dialing, and onetime (installation) charges[50].

The FCC also announced that they would establish the Rural Health Care Pilot Program on September 26, 2006. The program is expected to help public and non-profit health care providers build state and region-wide broadband networks dedicated to the provision of health care services and connect those networks to Internet2[51]. The pilot program will fund up to 85% of the costs incurred in deploying state or regional broadband networks dedicated to health care and up to 85% of the costs of connecting the regional

[50] Cf. USAC RHC Program website,

http://www.usac.org/rhc/tools/fequently-asked-questions.aspx#5

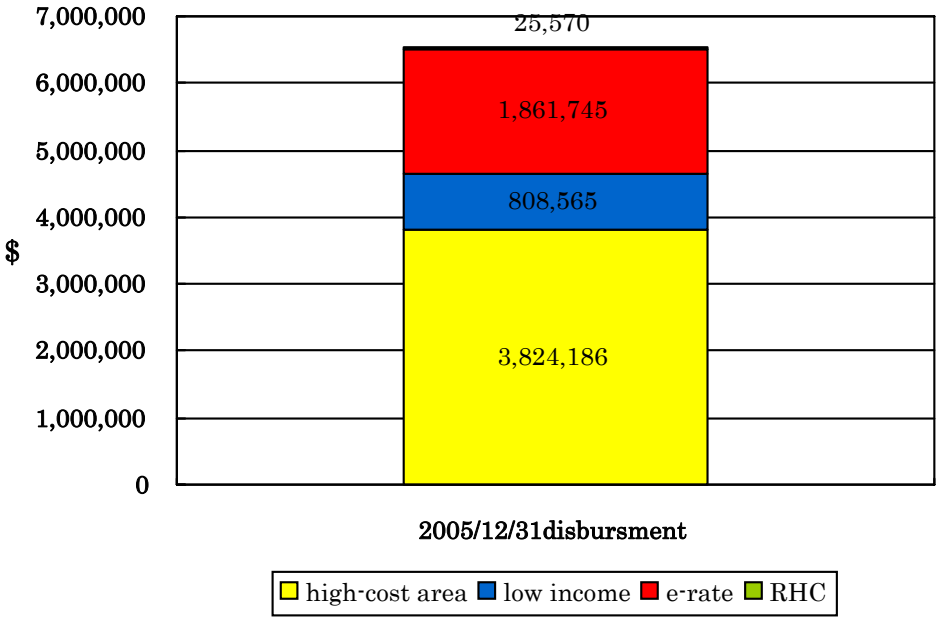
[51] http://www.usac.org/rhc/about/rhc-pilot-program.aspx

and/or state-wide to Internet2[52].

In contrast, the E-rate Program makes discounts available to eligible schools and libraries for telecommunication services, Internet access, and internal connections. According to the eligible services list updated on October 19, 2006, the Internet services include telephone dial-up, T-1 lines, Digital Subscriber Lines (DSL), cable modem, wireless[53]. In other words, the Universal Service Funds originally did not fund broadband services, but, as mentioned in Section 2-2, the FCC reviews the funding mechanism. Currently, the Universal Service Fund Programs for rural health care providers, schools and libraries provides the fund supporting for broadband access. There is now a big debate about expanding the Universal Service Fund.

Figure 3-2 shows the level of funding from each Universal Service Fund Program as of December 31 in 2005.

Figure 3-2. Disbursement of Universal Service Fund Programs (in thousands)



Source：USAC 2005 Annual Report

[52] http://www.usac.org/rhc/about/rhc-pilot-program.aspx

[53] http://www.usac.org/_res/documents/sl/pdf/els_archive/2007-eligible-services-list.pdf, p.6

The Telecommunications Act of 1996 mandates that all interstate telecommunications service providers contributes to the Universal Service Fund. They must pay a percentage of their interstate end-user revenues to the Universal Service Fund. This percentage, called the contribution factor, changes quarterly and is increased or decreased depending on the needs of the Universal Service programs. Now, the proposed contribution factor for the first quarter 2007 is 9.7%, according to the FCC[54]. Before the Telecommunications Act of 1996 was established, only long distance telephone companies contributed to support the Federal Universal Service Fund. The Act increased the types of contributors to include all interstate telecommunications service providers including long distance companies, local telephone companies, wireless telephone companies, paging companies, and payphone providers as well as carriers providing international services[55]. The companies can charge their consumers the Universal Service Fee which is about ten percent of their interstate telecommunications service bill. Conservative think tanks and Republicans have criticized the E-rate program, which they regard as a symbol of expanding the Universal Service Fund. In the late 1990's they dubbed E-rate the "Gore Tax" because former Vice President Al Gore was a strong supporter of the E-rate program[56]. As is often mentioned, he favoured promulgation of an information superhighway, making this policy a highly partisan issue.

Broadband Loans

As mentioned in Section 2-2, the Rural Utilities Service (RUS) of the USDA is another federal government institution that has been promoting universal service in rural areas. The RUS works with the FCC and established the Rural Broadband Access Loan and Loan Guarantee Program as authorized by the Farm Security and Rural Investment Act of 2002[57]. Section 6103 of the Farm Security and Rural Investment Act of 2002 amended the

[54] http://www.fcc.gov/omd/contribution-factor.html
[55] http://www.universalservice.org/about/universal-service/
[56] See also: Shoko Kiyohara, "The Analysis on the Implementation Process of the E-rate Program: The Roles of Education and Library Groups and Their Lobbying Activities", p.60-72, InfoCom Review, No.36, 2005 (in Japanese)
[57] Federal Register/ Vol.68, No.20/ Thursday, January 30, 2003/ Rules and Regulations, p.4684

Rural Electrification Act of 1936 to add Title VI, Rural Broadband Access[58]. This provides loans and loan guarantees to fund the cost of construction, improvement, or acquisition of facilities and equipment for the provision of broadband service in eligible rural communities[59].

The Farm Security and Rural Investment Act of 2002, Title VI-Rural Broadband Access, Section 601(c)(2), also requires that priority be given to eligible rural communities in which broadband service is not available[60]. An eligible rural community is defined under this program as any incorporated or unincorporated place in the U.S., its territories and insular possessions that has no more than 20,000 inhabitants based on the most recent available population statistics from the U.S. Census Bureau[61].

Broadband service means any technology identified by the Administrator as having the capacity to transmit data to enable a subscriber to originate and receive high-quality voice, data, graphics, and video[62]. Institutions such as cooperatives, municipalities, non-profit, limited liability companies, Indian tribes, and tribal organizations that provide broadband services in eligible rural communities can be applicants for the loan program[63].

On October 26, 2006, Deputy Agriculture Secretary Chuck Conner announced that broadband and telecommunications loans totalling about $210 million were awarded to communications firms in four states[64]. Since 1995, telecommunications loans have also been helping broadband deployment by constructing every telephone line capable of providing broadband service using digital subscriber loop (DSL) technology. For example, a broadband loan was being awarded to Fibre 520-522 LLC, of Salem, Illinois, to construct a fibre-to-the-home system in 12 counties[65].

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[58] *Ibid.*
[59] *Ibid.*
[60] http://www.usda.gov/rus/telecom/broadband/pdf/broadband-application-guide-9-16-2005-2.pdf
P.6
[61] *Ibid.*
[62] *Ibid.*
[63] *Ibid.*
[64] http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?contentidonly=true&contentid=2006/10/0427.xml, News Release, No.0427.06, October 26, 2006.
[65] *Ibid.*

3-3 Korea

The Korean government has played a key role in the development and implementation of a detailed and sophisticated strategy for broadband deployment, focusing on both supply and demand side issues. In this section we discuss the regulatory framework and public investment in broadband infrastructure.

Regulation

The Korean government has consistently pursued telecommunication policies emphasizing competition and based on deregulation and market principles[66]. The telecommunications sector was gradually liberalised throughout the 1990s and is currently regulated by the Ministry of Information and Communication (MIC), which was established in 1994. Competition was allowed on an incremental basis in the basic telecommunications services and the market for value added services was fully opened. The Internet market was also led by the same principle of deregulation and competition. MIC is responsible for approving rates for local service and interconnection services provided by the incumbent. However, the broadband market is an open market, free of regulation and controls over licensing and pricing. There has been little entry regulation of Internet services. MIC's 'hands-off policy' allowed any business to provide high-speed Internet access and a variety of services only through notification[67]. The Korean Internet access market is characterized by strong facilities-based competition. This has created downward pressure on prices, encouraged aggressive roll-outs of IT services, and forced Internet Service Providers to compete on the quality of their IT products; there were many content and game providers. As a condition of complete privatisation, KT has had to deliver broadband to all villages in the country, i.e. universal broadband service.

[66] Interview with Mr. DI Park of MIC, Korea, Jan 2007.

[67] Korea Information Society Development Institute (KISDI), Evaluation and Issues of the Regulatory Reforms in the Telecommunications Sector of Korea. 2001, December (in Korean).

Funding

The promotion of informatisation requires large-scale investment, calls for cooperation of various organizations, and takes several years. Therefore, it is difficult to carry out the projects using only the general budget. The Informatization Promotion Fund was established as a special vehicle to overcome the budgetary restrictions in promoting informatisaion. The fund is managed by MIC. The Fund, based on government budgetary and private sector contribution, created a system for reallocating the profits from ICT fields into the ICT sector[68].

Public Investment in Broadband Infrastructure

Since the mid-1990s, MIC has pursued a policy of high-speed telecommunications infrastructure as a foundation for building a knowledge-based society. The government started work on an initial plan for the Korea Information Infrastructure (KII) in 1993 and set up a comprehensive plan in March 1995. The Korean government published its broadband strategy in 1995. The Korea Information Infrastructure (KII) initiative was a US$24.5 billion project, in which the government invested US$1.5 billion (See Table 3-2). One part of the KII initiative, named KII-Private or KII-P, aimed to stimulate the broadband service market in the 'last mile', mainly through market competition and private sector investment[69]. Facilities-based service providers were allowed to enter the market with no entry or price regulation, which stimulated competition. Another part of the initiative, KII-Government or KII-G, involved the construction of a national high-speed public backbone network.

[68] KJ. Lee, “The Strategy for Building Information Society in Korea”, presented at the Conference for Financing Information Society, Santiago, Chile 2003.

[69] Originally planned to be completed by 2010, the project was completed at the end of 2005, well ahead of schedule.

Table 3-2 Government Budget for KII

	Construction of Backbone	Test-bed (KOREAN)	Public Funding Program	R&D etc	Total
Phase 1 (1995-1997)	133	8	0	269	410
Phase 2 (1998-2000)	208	15	154	142	514
Phase 3 (2001-2005)	320	40	926	610	1,896
Total	658	82	1,080	980	2,820

Note: Unit: Million US$

Source: MIC

Public Investment in R&D

The Informatisation Promotion Fund has played an important role as a source of public R&D investment. It ensures stable funding for the long-term R&D projects and enables policy makers to flexibly respond to rapid changes in ICT. Although the public share of R&D is relatively small, the public R&D of ICT has focused on technologies which have had a significant impact on the ICT industry and on living standards. These include technologies such as TDX and CDMA, which were developed by the Electronics and Telecommunications Research Institute (ETRI). Established in 1976, ETRI is a non-profit, government-funded research organization and one of the driving forces behind Korea's ICT success[70].

Some 30% of its almost 2000 staff hold Ph.D. degrees and another 60% a Master's degree. Its personnel hold over 2000 international patents and have published some 20,000 articles in Korean and foreign journals. As the country's premier developer of innovative technologies, ETRI's customers include both public sector entities, such as the MIC, and private sector entities, especially small and medium-sized companies. ETRI's technology transfer mechanism allows it to commercialize new technologies while also helping to support its existence. Once a project has been sufficiently developed and is ready to be commercialized, it is handed over to the private sector. Over 800 technologies have so far been transferred from ETRI to some 1800 private companies, an arrangement that has

[70] Interview with Mr. WG. Ha, IT Technology Strategy Research Division of ETRI, Korea, Jan 2007.

provided ETRI with over US$200 million in royalties. Through its development of products such as the TDX digital telephone exchange and Code Division Multiple Access (CDMA) technology, and its incubator facility for start-up companies, ETRI has helped make Korea a competitive force in the ICT field.

ETRI's success partly explains Korea's ICT success. In order for a nation to take a lead in ICT, it must play an active role in technology research and development. This helps to nurture local sustainability as well as competitive advantage. A number of ETRI's projects had their roots in uniquely Korean problems such as the need for a local telephone switch to meet overwhelming demand in the 1980s. Another example is automated Korean/Japanese/English language translators that ETRI has developed to generate technical manuals, translate web pages, and generate subtitles for television. ETRI has also helped overcome market uncertainty by carrying out R&D in areas where business has been reluctant to invest. The payoff has been big, with ETRI estimating that sales of products and services using technologies it developed were some 200 times higher than the initial R&D investment[71].

[71] ITU, Broadband Korea: Internet Case Study, 2003

Chapter 4

In this chapter we analyse the broadband market using a component model and strategic map. We find that broadband competition is mostly facility-based competition.

4-1 Industrial Competition

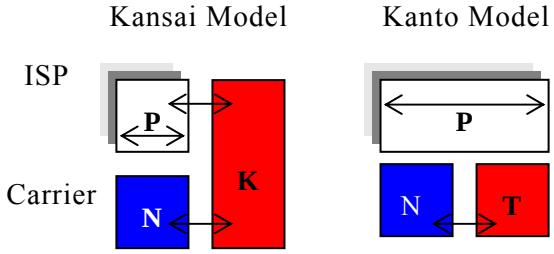
To analyze the structure of FTTH competition and migration to NGN (Next Generation Network) in Japan we must have an idea of future regulation for telecommunication. First, we analyze the FTTH facility-based competition and then we consider broadband competition models and methods of designing new regulation.

FTTH Modelling

Japanese FTTH service consists of an ISP function (ISP) and optic fibre access (carrier). The access service is thought to be a combination of the two. This means that the FTTH model should be a component model of two items, like a long-distance telephone service.

Figure 4-1 shows two models of this; one for the Kansai area and one for the Kanto area. In the Kansai area, K-Opticom provides integrated service while TEPCO[72] provides divided access service.

Figure 4-1. FTTH Market Model



Notice: N: NTT P: Providers K: K-Opticom T: TEPCO

Here, we suppose that each entity has the same efficiency, internal cross subsidization is not permitted, and perfect competition is achieved in sub-markets of the ISP market, in which there are many ISPs in both areas and in the carrier market. In the carrier sub-market, NTT and electricity related companies (K-Opticom and TEPCO) are the players. Each in sub-market competition is perfect and service price of each entity is the same.

[72] On January 1, 2007 it is transferred to KDDI and now it is served as 'Hikari One'.

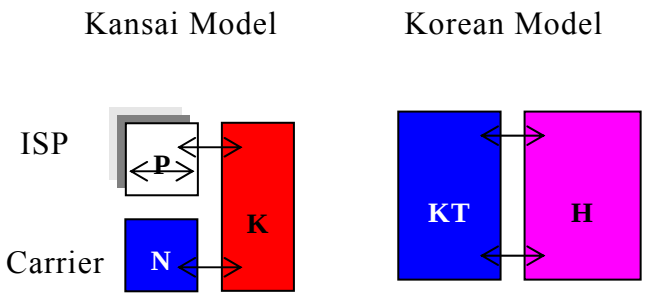
If internal cross subsidization is permitted, larger companies can undercut smaller ones. So the service price of the Kansai model[73] may be cheaper than that of the Kanto model.

Model for Broadband

Next we compare the Kansai model with Korea, where rapid diffusion of the DSL model took place. In the Korean DSL market, Korea Telecom (KT) and Hanaro Telecom are common carriers and each company has its own access lines and ISP functions. Hanaro Telecom, an NCC, which also has a certain local loop (LL) and rents lines from cable companies, doesn't depend on KT's LL when it provides DSL service. In this sense, the Korean DSL market is characterized by facility-based competition[74] while the Japanese ADSL market is characterized by service competition.

Here, we suppose that each entity is equally efficient, internal cross subsidization is permitted, and perfect competition is achieved in sub-markets of the ISP market. In each sub-market, competition is perfect and each entity service price are the same. In the Korean model both entities enjoy cross subsidization and have the opportunity to provide prices cheaper than those of Kansai.

Figure 4-2. Market Model Competition



[73] See Appendix.
[74] According to OECD (2006), OECD Outlook 2006, all carriers have full unbundling and line sharing obligations and 1005 lines are available, but in 2003 there are only 672 cases in use while 7,107,973 use in Japan where open access rule regulation is adopted for NTT only.

Notice: H: Hanaro Telecom KT: Korea Telecom

To summarize the modelling results, the cheapest price can be achieved by the Korean model, and the next cheapest is the Kansai model. This model analysis suggests that the integrated business model is effective in this model. Though most people involved in discussing the ICT field support layer based competition, this conclusion suggest the cheap price would be provided by competition among integrated companies. In other words, the integrated competition model is better than the partial competition model[75].

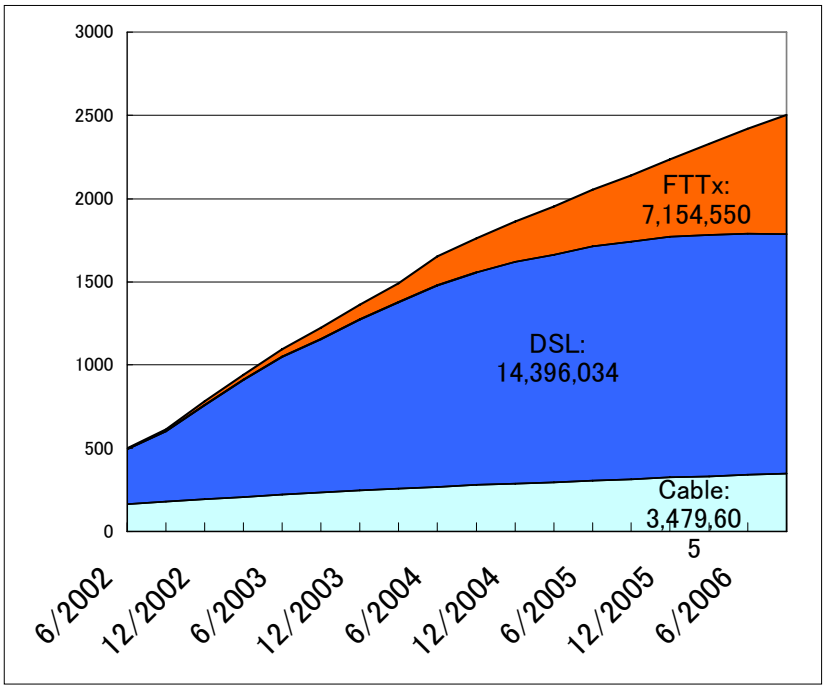
[75] Equal efficiency would change the set of results.

4-2 Migration

There is plenty of evidence of migration[76,77] from DSL to FTTH in Japan. The number of DSL subscribers started to decline in June 2006 and has continued to decline while FTTH is rapidly increasing. This rapid increase of Japanese FTTH is also mentioned the OECD report,[78] which reads "Japan leads the OECD in fibre-to-the-premises (FTTP) with 4.6 million fibre subscribers at the end of 2005. Fibre subscribers in Japan alone outnumber total broadband subscribers in 21 of the 30 OECD countries".

Next we review the social switching cost of some migration patterns. We assume that there is no switching cost within carriers/servicers but that there are certain switching costs across carriers/servicers.

Figure 4-3. Japanese Broadband Subscribers (Time Series, Technologies)



[77] According to MIC, the number of DSL subscribers peaked in March 2006 (14,517,859 subscribers) and started to decline after in June 2006 (-0.2%). http://eidsystem.go.jp/market_situation/telecom_market_situation/subscribers/ .

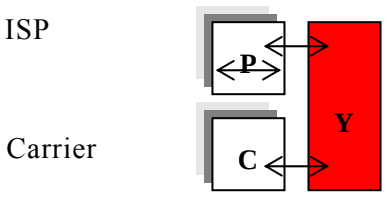
[78] OECD, OECD Broadband Statistics, December 2005, 2007. http://www.oecd.org/document/39/0,2340,en_2649_33703_36459431_1_1_1_1,00.html .

Source: MIC

Modelling for ADSL

We assume the model of the Japanese ADSL market shown in Figure 4-4. Here, all subscribers are divided among three companies: Flets service (PF, NTT line plus optional ISP), provided by NTT East or West, other services (PN, eAccess or ACCA line plus optional ISP), or Yahoo! BB (YY).

Figure 4-4 Japanese ADSL Model



Note: C: Carriers (NTT, eAccess, ACCA) P: Providers Y: Yahoo! BB

These users can switch to any of the three FTTH services: B Flets (PF, NTT optic line plus optional ISP), other services (PT, TEPCO optic line plus optional ISP), or K-Opticom (KK). In this context we assume two switching costs: ISP switching (SWi) and carrier switching (SWc). All switching costs are shown in Table 4-1.

Table 4-1 Types of Switching Cost

		FTTx		
		PF	PT	KK
ADSL	PF	0	SWc	SWi+SWc
	PN	SWc	SWc	SWi+SWc
	YY	SWi+SWc	SWi+SWc	SWi+SWc

As can be seen in Table 4-1, KK is the most costly of the FTTH services, though any type of ADSL could be used. The future cost of switching from YY is high, though any

switch of destination would be. If PF, PN, and YY had equal numbers of subscribers, the cost of switching between the Kanto model (SWe) and the Kansai model (SWw) would be the following:

Swe = NpfeSW/3c+2NptSWc/3+(Npfe+Npt)(SWi+SWc)/3

SWw = NpfwSW/3c+Npfw(SWi+SWc)+Nkk(SWi+SWc).

If the number of NTT East and NTT West subscribers is equal,

Swe = NeSWc+NeSWi/3-NpfSWc

= NSWc+NSWi/3-NpfSWc

SWw = NwSWc+NwSWi/3+2NkkSWi/3

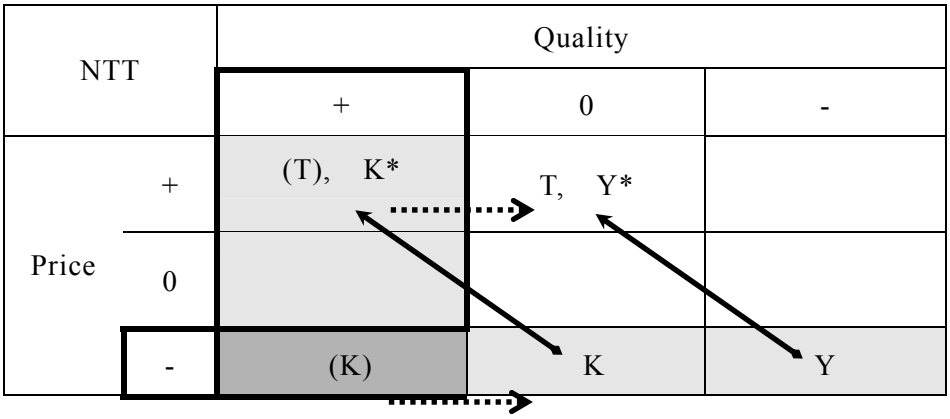
= NSWc+NSWi/3-NpfSWc+2NkkSWi/3.

This suggests that the switching cost of the Kansai model is 2NkkSWi/3, larger than that of Kanto. Therefore, when we think about migration from DSL to FTTH switching costs should count social switching costs because it suggests a result opposite to that discussed in Section 4-1.

4-3 Business Model for Access Service

Michael Porter has argued that a firm's strengths ultimately fall into one of two categories: cost advantage and differentiation[79]. Three generic strategies result from applying these strengths in either a broad or narrow scope: cost leadership, differentiation and focus[80]. In this section, we introduce a strategic map of Japan's broadband market and we will compare the business models, but we omit the focus strategy from this map because it is difficult for a service provider to select the focus strategy.

Figure 5: Strategic Map for Service Providers



Note: N: NTT, K: K-Opticom, T: TEPCO, Y: Yahoo! BB

This figure reflects the real situation, but as some consumers cannot recognize the high quality of K-Opticom and TEPCO, they may underestimate their quality. So the positions of K-Opticom and TEPCO may be shifted to 0, as shown by the arrow in the figure.

For example, in the case of TEPCO, they provide 100 M FTTH single star service and their service is different from 100 M FTTH PON service of type. However, most consumers do not understand the difference between the two types. K-Opticom will provide subscribers with 2wire FTTH service for CATV in the future. This fact doesn't necessarily

[79] M. E. Porter (1980), Competitive Strategy, Free Press.
[80] These strategies are applied at the business unit level. They are called generic strategies because they are not firm or industry dependent.

reflect the consumer's wishes though. K-Opticom started 1G service recently, thereby entering a high quality and high priced market.

In Japan’s broadband market, because the speed of best effort service has progressed geometrically (dial up (54 K), ISDN (64 K), ADSL (1.5 M、5 M、8 M、30, and so on.), FTTH (100 M or 1 G), the service providers should invest in large scale infrastructure because the industry’s competition has changed from service competition into facilities-based competition.

The above is summarized as follows: as Yahoo! BB provided cheap service although it was not necessarily a full service line-up. They chose the cost leadership strategy, and it can be said that Yahoo! BB’s strategy was a success. In contrast, although TEPCOS entered a high quality, high priced market, they failed to differentiation their service because most consumers did not understand that their service was higher quality. Finally, TEPCOS was sold its broadband business off. K-Opticom first aimed at a high quality, low priced market and they could have expanded into a high quality, high priced market.

4-4 Regulation for the Next Generation Network

In December 2006 ITU Telecom World 2006 was held in Hong Kong, the first time it was hold outside of Geneva. At this conference some new ideas for regulation in the next generation network (NGN) era were proposed.

One unique idea was proposed by Mr. Au, the secretary general of Hong Kong telecom authority. He suggested that people should start to think about the universal access license (UAL) based on technological neutrality. We analyzed service competition and facility-based competition in this paper, but if UAL would come into force providers would be able to introduce both service and facility-based competition to the broadband market. In other words, this is the introduction of modal competition for the access market and aquisition of equal footing for partial entrants to the service area. By using UAL, a company can provide access service in the most appropriate technology including telephone lines, fiber optics, and wirless networks.

In UAL-based regulation we must think about different levels of efficiency situation as we mentioned. This is the next subject of discussion.

Appendix: A Model for FTTH Competition

1.1 Model Setting

The basic setup of the model follows the guidelines laid out by Ida and Ueda (2004). We assume at this moment that there are two levels of 'components', *A* and *B*. For example, component *A* means FTTH-access service from a line company (LC) to end users while component *B* means Internet access service from an ISP. It is also assumed that each component has two types (A_1, A_2 and B_1, B_2). We call the combination of components a system. Systems can be A_1B_1, A_1B_2, A_2B_1, or A_2B_2. Defining the price of components A_i and B_j are P_i and Q_j respectively, the price of system A_iB_j, S_{ij}, can be represented as the sum of the prices of components.

$$S_{ij} = P_i + Q_j \ ; \ i, j = 1, 2 \quad (1)$$

Let us assume linear demand functions of systems A_iB_j, D_{ij}, for the sake of simplicity, following previous research into components model. The effect of price on demand is represented by coefficient b, the cross effects are represented by coefficients *c*, *d*, and *e*. Accordingly the demand functions of systems are given as follows.

$$D_{11} = a - bS_{11} + cS_{12} + dS_{21} + eS_{22}$$
$$D_{12} = a - bS_{12} + cS_{11} + dS_{22} + eS_{21}$$
$$D_{21} = a - bS_{21} + cS_{22} + dS_{11} + eS_{12}$$
$$D_{22} = a - bS_{22} + cS_{21} + dS_{12} + eS_{11} \quad (2)$$

$$D_{11} = a - S_{11} + c(S_{12}+S_{21}+S_{22}) = a - (P_1+Q_1) + c(P_1+2P_2+Q_1+2Q_2)$$
$$D_{12} = a - S_{12} + c(S_{11}+S_{22}+S_{21}) = a - (P_1+Q_2) + c(P_1+2P_2+2Q_1+Q_2)$$
$$D_{21} = a - S_{21} + c(S_{22}+S_{11}+S_{12}) = a - (P_2+Q_1) + c(2P_1+P_2+Q_1+2Q_2)$$
$$D_{22} = a - S_{22} + c(S_{21}+S_{12}+S_{11}) = a - (P_2+Q_2) + c(2P_1+P_2+2Q_1+Q_2)$$

The demand functions of components are given as follows. For example, the

demand for component A_1, D_{A1}, is represented as the sum of the demand for systems A_1B_1 and A_1B_2, D_{11} and D_{12}.

$$D_{A1} = D_{11} + D_{12}$$
$$D_{A2} = D_{21} + D_{22}$$
$$D_{B1} = D_{11} + D_{21}$$
$$D_{B2} = D_{12} + D_{22} \quad (3)$$

$$D_{A1} = D_{11} + D_{12} = 2a - (2P_1+Q_1+Q_2) + c(2P_1+4P_2+3Q_1+3Q_2)$$
$$D_{A2} = D_{21} + D_{22} = 2a - (2P_2+Q_1+Q_2) + c(4P_1+2P_2+3Q_1+3Q_2)$$
$$D_{B1} = D_{11} + D_{21} = 2a - (P_1+P_2+2Q_1) + c(3P_1+3P_2+2Q_1+4Q_2)$$
$$D_{B2} = D_{12} + D_{22} = 2a - (P_1+P_2+2Q_2) + c(3P_1+3P_2+4Q_1+2Q_2)$$

At this moment, we must make further assumptions to simplify the analysis without affecting the overall analysis.

The constant cross-effects of prices: $c = d = e$.

The non-negative equilibrium prices and quantities: $b > 3c > 0$.

The zero marginal costs of production.

Furthermore, all parameters are normalized by b: $b = 1$.

1.2 Two-way Model

A two-way model is one in which there is no dominant carrier and where firm 1 provides A_1 and B_1 while firm 2 provides A_2 and B_2. For example, it can be thought that component A is a FTTH-access service and component B is an Internet access service. Each component has two types: A_1, A_2, and B_1, B_2. Component B is compatible with two providers, and B_1can be combined with A_2 or with A_1 to produce systems A_1B_1 and A_2B_1, respectively. The same thing can be said of B_2. This means two way in this context. We have here four kinds of systems as final products: A_1B_1, A_1B_2, A_2B_1, and A_2B_2. Firm 1 sets the price of A_1, B_1, and firm 2 sets the price of A_2, B_2.

The companies' profit functions, P_1 and P_2, are given as follows.

$$P_1 = P_1 \{2a - (2P_1+Q_1+Q_2) + c(2P_1+4P_2+3Q_1+3Q_2)\} + Q_1 \{2a - (P_1+P_2+2Q_1) + c(3P_1+3P_2+2Q_1+4Q_2)\}$$

$$P_2 = P_2 \{2a - (2P_2+Q_1+Q_2) + c(4P_1+2P_2+3Q_1+3Q_2)\} + Q_2 \{2a - (P_1+P_2+2Q_2) + c(3P_1+3P_2+4Q_1+2Q_2)\} \quad (4)$$

$$P_1=2a\,P_1-2P_1^{\,2}-P_1Q_1-P_1Q_2+2cP_1^{\,2}+4cP_1P_2+3cP_1Q_1+3cP_1Q_2$$
$$+2aQ_1-P_1Q_1-P_2Q_1-P_2Q_1-2Q_1^{\,2}+3cP_1Q_1+3cP_2Q_1+2cQ_1^{\,2}+4cQ_1Q_2$$

$$\rightarrow \partial P_1/\partial P_1 = 2a-4P_1-Q_1-Q2+4cP1+4cP2+3cQ1+3cQ2-Q1+3cQ1$$
$$= 2a-4P_1-2Q_1-Q_2+4cP_1+4cP_2+6cQ_1+3cQ_2$$
$$=2a-(4P_1+2Q_1+Q_2) + c(4P_1+4P_2+6Q_1+3Q_2) = 0$$

$$\rightarrow \partial P_1/\partial Q_1 =-P_1+3cP_1+2a-P_1-P_2-4Q_1+3cP_1+3cP_2+4cQ_1+4Q_2$$
$$=-2P_1+6cP_1+2a-P_2-4Q_1+3cP_2+4cQ_1+4Q_2$$
$$= 2a-(2P_1+P_2+4Q_1) + c(6P_1+3P_2+4Q_1+4Q_2) = 0$$

$$P_2 =2aP_2-2P_2^{\,2}-P_2Q_1-P_2Q_2+4cP_1P_2+2cP_2^{\,2}+3cP_2Q_1+3cP_2Q_2$$
$$+2aQ_2-P_1Q_2-P_2Q_2-2Q_2^{\,2}+3cP_1Q_2+3cP_2Q_2+4cQ_1Q_2+2cQ_2^{\,2}$$

$$\rightarrow \partial P_2/\partial P_2 =2a-4P_2-Q_1-Q_2+4cP_1+4cP_2+3cQ_1+3cQ_2-Q_2+3cQ_2$$
$$=2a-4P_2-Q_1-2Q_2+4cP_1+4cP_2+3cQ_1+6cQ_2$$
$$=2a-(4P_2+Q_1+2Q_2) + c(4P_1+4P_2+3Q_1+6Q_2) = 0$$

$$\rightarrow \partial P_2/\partial Q_2 =-P_2+3cP_2+2a-P_1-P_2-4Q_2+3cP_1+3cP_2+4cQ_1+4cQ_2$$
$$=-2P_2+6cP_2+2a-P_1-4Q_2+3cP_1+4cQ_1+4cQ_2$$
$$=2a-(P_1+2P_2+4Q_2) + c(3P_1+6P_2+4Q_1+4Q_2) = 0$$

From each FOC, we derive

$$P_1 = \frac{-2a + 2Q_1 + Q_2 - 4cP_2 - 6cQ_1 - 3cQ_2}{4(c-1)}$$

$$Q_1 = \frac{-2a + 2P_1 + P_2 - 4cQ_2 - 6cP_1 - 3cP_2}{4(c-1)}$$

$$P_2 = \frac{-2a + Q_1 + 2Q_2 - 4cP_1 - 3cQ_1 - 6cQ_2}{4(c-1)}$$

$$Q_2 = \frac{-2a + P_1 + 2P_2 - 4cQ_1 - 3cP_1 - 6cP_2}{4(c-1)}$$

From the Bertrand-Nash equilibrium, we can say $P_1 = P_2 = P_T$, $Q_1 = Q_2 = Q_T$. These prices are at the no excess return level, which equals average cost.

$$P_T = \frac{-2a + 3Q_T - 9cQ_T}{4(2c-1)}$$

$$Q_T = \frac{-2a + 3P_T - 9cP_T}{4(2c-1)}$$

From these equations, we get P_T and Q_T.

If the cost or product function is the same structure between component A and B, we can say $P_T = Q_T$, which equals average cost.

$$P_T = Q_T = \frac{-2a}{17c-7} = \frac{-2a}{-(7-17c)} = \frac{2a}{7-17c} \quad (5)$$

But price is never negative, so we need a condition in which the price is positive.

1.3 Pure Components Model

The pure components model is one in which there is no bundle service in the world and each component is provided separately and independently. Therefore, each company's profit functions P_{A1},P_{A2}, P_{B1}, and P_{B2} are given as follows.

$P_{A1}=P_1D_{A1}$

$P_{A2}=P_2D_{A2}$

$P_{B1}=Q_1D_{B1}$

$P_{B2}=Q_2D_{B2}$ (6)

$P_{A1} = P_1 \{a - S_{11} + c(S_{12}+S_{21}+S_{22}) + a - S_{12} + c(S_{11}+S_{22}+S_{21})\} = P_1 \{2a - (2P_1+Q_1+Q_2) + c(2P_1+4P_2+3Q_1+3Q_2)\}$

$P_{A2} = P_2 \{a - S_{21} + c(S_{22}+S_{11}+S_{12}) + a - S_{22} + c(S_{21}+S_{12}+S_{11})\} = P_2 \{2a - (2P_2+Q_1+Q_2) + c(4P_1+2P_2+3Q1+3Q_2)\}$

$P_{B1} = Q_1 \{a - S_{11} + c(S_{12}+S_{21}+S_{22}) + a - S_{21} + c(S_{22}+S_{11}+S_{12})\} = Q_1 \{2a - (P_1+P_2+2Q_1) + c(3P_1+3P_2+2Q1+4Q_2)\}$

$P_{B2} = Q_2 \{a - S_{12} + c(S_{11}+S_{22}+S_{21}) + a - S_{22} + c(S_{21}+S_{12}+S_{11})\} = Q_2 \{2a - (P_1+P_2+2Q_2) + c(3P_1+3P_2+4Q_1+2Q_2)\}$

The first-order conditions of profit maximization can be obtained by differentiating profit functions P_{A1},P_{A2}, P_{B1}, and P_{B2} from prices P_1, P_2, Q_1, and Q_2.

$\partial P_{A1}/\partial P_1 = 2a-(4P_1+Q_1+Q_2)+c(4P_1+4P_2+3Q_1+3Q_2)=0$

$\partial P_{A2}/\partial P_2 = 2a-(4P_2+Q_1+Q_2)+c(4P_1+4P_2+3Q_1+3Q_2)=0$

$\partial P_{B1}/\partial Q_1 = 2a-(P_1+P_2+4Q_1)+c(3P_1+3P_2+4Q_1+4Q_2)=0$

$\partial P_{B2}/\partial Q_2 = 2a-(P_1+P_2+4Q_2)+c(3P_1+3P_2+4Q_1+4Q_2)=0$

From FOC, we derive

$$P_1 = \frac{-2a + Q_1 + Q_2 - 4cP_2 - 3cQ_1 - 3cQ_2}{4(c-1)}$$

$$P_2 = \frac{-2a + Q_1 + Q_2 - 4cP_1 - 3cQ_1 - 3cQ_2}{4(c-1)}$$

$$Q_1 = \frac{-2a + P_1 + P_2 - 4cQ_2 - 3cP_1 - 3cP_2}{4(c-1)}$$

$$Q_2 = \frac{-2a + P_1 + P_2 - 4cQ_1 - 3cP_1 - 3cP_2}{4(c-1)}$$

From the Bertrand-Nash equilibrium, we can say $P_1 = P_2 = P_C$, $Q_1 = Q_2 = Q_C$. These prices are at the no excess return level, which equals average cost.

$$P_C = \frac{-2a + 2Q_C - 6cQ_C}{4(2c-1)}$$

$$Q_C = \frac{-2a + 2P_C - 6cP_C}{4(2c-1)}$$

From these equations, we get P_C and Q_C.

If the cost or product function is the same structure between component A and B, we can say $P_C = Q_C$ which, equals average cost.

$$P_C = Q_C = \frac{-a}{7c-3} = \frac{-a}{-(3-7c)} = \frac{a}{3-7c} \quad (7)$$

But price is never negative, so we need a condition in which the price is positive.

1.4 Conclusion

We got the prices of two models and can compare the difference between them. We find that P_T is bigger than P_C. This means that the components model's competition provides better prices for subscribers in an oligopolistic situation.

$$P_T - P_C = \frac{2a}{7-17c} - \frac{a}{3-7c} = \frac{2a(3-7c) - a(7-17c)}{(7-17c)(3-7c)} = \frac{a(3c-1)}{(7-17c)(3-7c)} \quad (8)$$

From our assumption, $0<c<1/3$, so P_T-P_C is negative.

Assignation:

This paper is the collaborative work of four authors, but we note here the assignation of parts.

Introduction: Kiyohara and Ueda

1-1: Nakazawa and Ueda, 1-2: Kiyohara, 1-3: Park

2-1: Ueda, 2-2: Kiyohara, 2-3: Park

3-1: Ueda, 3-2: Kiyohara, 3-3: Park

4-1: Ueda, 4-2: Ueda, 4-3: Park and Ueda, 4-4: Ueda

Appendix: Ueda