Part 1

Chapter 1

Telecommunications Liberalization and Growth of the ICT Industry

Section 1 30 Years Since Telecommunications Liberalization: System, Service, and Market Transitions

In this section, we provide a general chronological overview of the growth of the ICT industry, from the telecommunications liberalization in 1985 to the present day, while touching on a few landmark events and turning points. For our discussion, we divided the 30 years from 1985 to 2015 into three major periods: (1) the age of the telephone (roughly 1985 to 1995), (2) the age of the Internet and the mobile phone (roughly 1995 to 2005), and (3) the age of broadband and the smartphone (roughly 2005 to present). Below, we sort through the distinctive transformations that occurred in systems, services, and market structures in each of these periods.

1. Period 1: The age of the telephone

(1) Summary of the telecommunications liberalization

The Japanese government presented three bills on telecommunications reform to the National Diet, which were approved in 1984 and went into force in 1985. The reform bills' aim was to affect far-reaching reformation of the telecommunications system, which had been predicated on a centralized system, and to proactively introduce private-sector dynamism, based on market competition principles, to the telecommunications sector. With these steps, the government hoped to stimulate the telecommunications business and boost its efficiency and to bring technological innovation to the telecommunications sector as well as engender social and economic development and progress in internationalization.

The Nippon Telegraph and Telephone Public Company, a government corporation, was reorganized into an incorporated public company, and the Nippon Telegraph and Telephone Corporation (NTT) was established, based on the Act on the Nippon Telegraph and Telephone Corporation. Establishing a new corporation was an undertaking to further stimulate and improve the efficiency of the company's management.

(2) Transformations resulting from telecommunications liberalization

a. Succession of new entrants

A succession of new companies entered the liberalized telecommunications market. In June 1985, three long-distance carriers—the DDI Corporation, Japan Telecom Co., Ltd., and the Teleway Corporation—and two satellite carriers—Japan Communications Satellite Co., Inc. and the Space Communications Corporation—were the first to be licensed as Type 1 telecommunications businesses after the business act was enacted. These were followed by two international carriers and nine regional (electric power) carriers.

b. Dramatically lower prices

Telecommunications prices fell dramatically due to escalating competition among carriers. In the long-distance communications market, for example, price-cutting competition broke out centering on the Tokyo, Nagoya, and Osaka markets and the routes joining these three largest domestic markets. Although the primary telecommunications services offered at the time were telephones and leased lines, competition focused on telephone services because of the market size.

The highest long-distance rate initially in 1985 had been 400 yen for three minutes, but this tumbled to 180 yen for three minutes 10 years later (Figure 1-1-1-1).

c. Emergence of new services

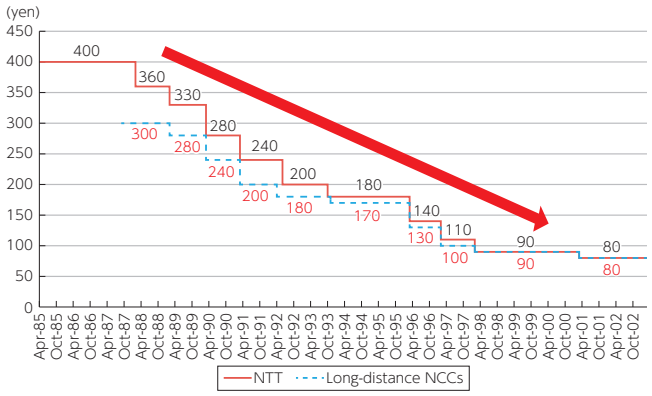
After telecommunications liberalization, new services, such as computer communications and facsimile communications, emerged, and gradually their members and subscriptions grew in number. In 1991, there were 1.15 million computer communications users, which soon swelled to 3.69 million in 1995 and 5.73 million by 1996 (Figure 1-1-1-2). The number of facsimile service subscriptions also soared during this time frame (Figure 1-1-1-3). The main factors behind these increases were the rising value of using networks, fueled by a mounting need for recorded communications and service area expansions, and long-distance communications prices that were inexpensive compared to using the telephone network.

(3) Recap of Period 1

In the first 10 years after the introduction of competition with the telecommunications liberalization in 1985, many new carriers entered the telecommunications market and competition among carriers drove down prices and diversified services.

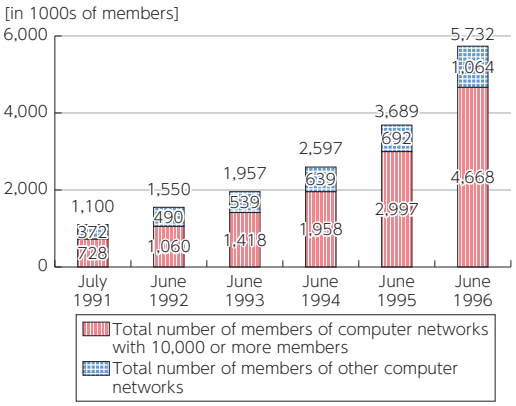
During this period computer communications, mobile phones, facsimiles, and other services started to expand as new businesses in the ICT field. This period also saw fiber optics and other technologies advance and, most importantly, the first signs of the Internet (broadband) and mobile communications, which would evolve into

Figure 1-1-1-1 Dramatically lower prices (prices for a three-minute afternoon call between Tokyo and Osaka)



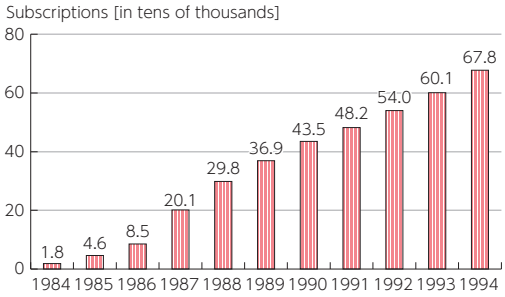
(Source) Prepared from Annual Reports of the Telecommunications Carriers Association

Figure 1-1-1-2 Transitions in the number of computer communications members



(Source) White Paper on Communications in Japan, 1997 edition

Figure 1-1-1-3 Transitions in the number of subscriptions to facsimile communications network services



(Source) White Paper on Communications in Japan, 1995 edition

the core services of the next period and that we use today. It was also a time when the Ministry of Posts and Telecommunications made policy adjustments to allow these technologies to flourish.

2. Period 2: The age of the Internet and the mobile phone

(1) Meteoric proliferation of the Internet

The Internet was initially the sole domain of specialized researchers and educational institutions, and Internet access services did not become commercially available until the early 1990s. Once the Internet did become commercially available in Japan in 1993, Internet user numbers skyrocketed. By 1998, just a mere five years after the first commercial services were launched, the Internet household penetration rate passed the 10 percent mark (Figure 1-1-2-1). This take-up speed was faster than any previous major ICT media. The first Internet connections were mostly dial-up connections that used telephone or ISDN lines. But later cable TV Internet and digital subscriber line (DSL) connection methods arrived, whose exponentially faster transmission speeds further spurred the Internet's popularity (Figure 1-1-2-2).

(2) Growth and advancement of mobile phones

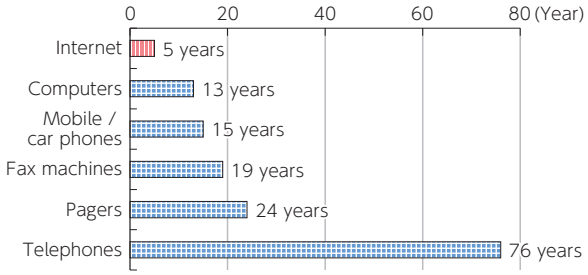
The number of mobile phone users increased at a pace of 10 million subscriptions per year from 1996 to 2002. In 2000, the number of mobile phone and PHS handset subscriptions surpassed the number of subscriptions to fixed-line telephone services (subscription telephones and ISDN), becoming the primary means of voice services (Figure 1-1-2-3). Rapid advances in network technology took place in tandem with the expansion in user numbers. Digital technologies advanced in the later 1990s, leading to the provision of mobile Internet starting in 1999. In 2001, Japan was the first country in the world to roll out full-scale third-generation mobile communication services (Figure 1-1-2-4).

(3) Recap of Period 2

During the second period, rules were studied and put into place to make competition among carriers more effective, especially the detailed rules on interconnections between NTT and new common carriers (NCCs). Furthermore, compared to the first period, more diverse and effective rules were enacted to promote competition in areas beyond interconnections, such as asymmetric regulations on market dominant carriers, priority connections, and number portability for fixed-line telephones.

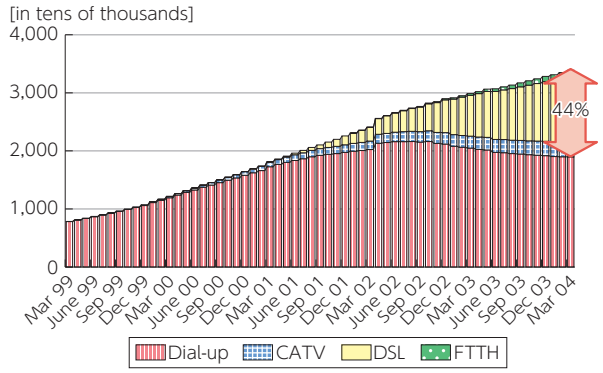
During this time mobile phones became a central

Figure 1-1-2-1 Time required for major ICT media to reach a 10 percent household penetration rate in Japan



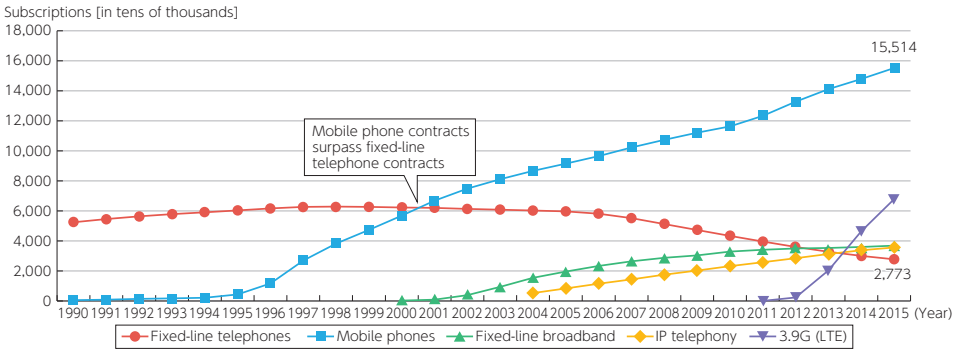
"Prepared from "Communications Usage Trend Survey" and other MIC materials
(Source) White Paper on Communications in Japan, 1999 edition"

Figure 1-1-2-2 Number of users of Internet connection services



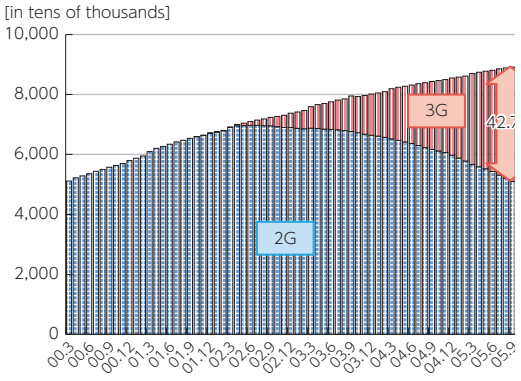
(Source) MIC

Figure 1-1-2-3 Transitions in communications service subscribers



(Source) Prepared from "Announcement of Quarterly Data on Telecommunications Service Contracts and Market Shares," MIC and materials from the Telecommunications Carriers Association

Figure 1-1-2-4 Transitions in subscribers by mobile phone system



(Source) Telecommunications Carriers Association

presence in not just voice but also Internet connections. Communications services and communications infrastructure also underwent massive changes over these 10 years. The proliferation of the Internet and mobile phones triggered desultory reforms to the ICT field. This was undoubtedly a huge turning point when considering the transformations this proliferation brought to our society.

3. Period 3: The age of broadband and the smartphone

(1) Further advances in network infrastructure and service diversification

At the beginning of the 2000s, the industry rapidly shifted from long-used metal lines to fiber optics as the primary technology for fixed-line communications networks. This proactive conversion to fiber optics for the last-mile access networks was unprecedented, even internationally. Fixed-line broadband migrated en masse to FTTH, with total FTTH subscriptions outstripping DSL subscriptions in FY 2008 and exceeding 25 million lines by FY 2013.

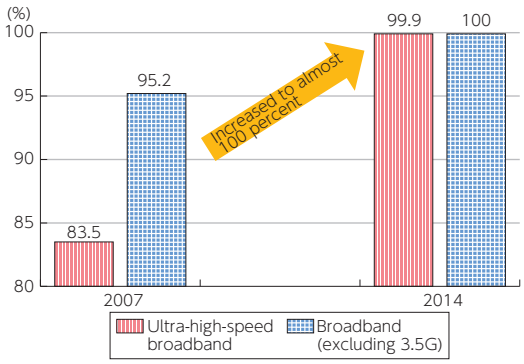
The broadband wave was not limited to fixed-line communications networks. After mobile phone networks completely went digital, efforts were made to increase speeds and bandwidths. Through heavy investment in 3G and 3.9G infrastructure, carriers achieved faster network speeds and, after the smooth migration from 2G systems to 3G and 3.9G, 3.9G subscriptions, in FY 2013, now account for the largest share of broadband subscriptions.

(2) Established the world's most advanced broadband environment

This period witnessed a major effort to build out the areas where broadband is available. In 2007, the percentage of Japanese households where broadband was available (i.e., the household coverage rate of all service areas) stood at 95.2 percent, while the household coverage rate for FTTH and other ultra-high-speed broadband connections was 83.5 percent. By 2014, the household coverage rate was 99.9 percent for ultra-high-speed broadband and 100 percent for broadband (Figure 1-1-3-1).

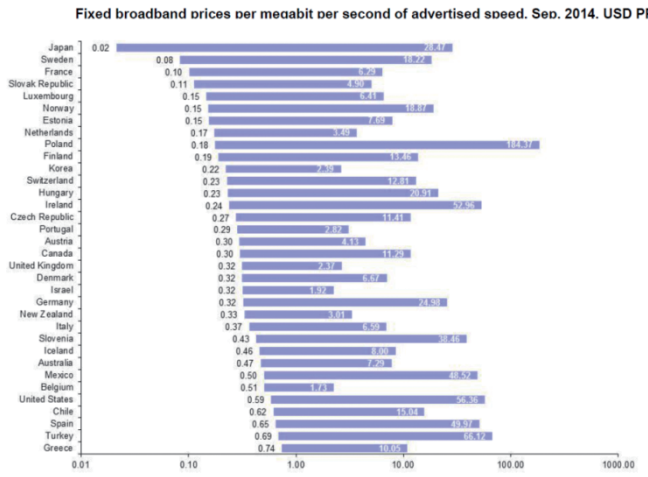
But what is the position of our broadband environment described above in comparison to other countries? A comparison of broadband prices per megabit per second among OECD member states as of September 2014 shows that Japan had the lowest broadband prices per megabit per second among OECD member states (Figure 1-1-3-2). When viewed by speed and price together, Japan can be said to have the world's highest standard broadband environment.

Figure 1-1-3-1 Transitions in the percentage of households with broadband availability



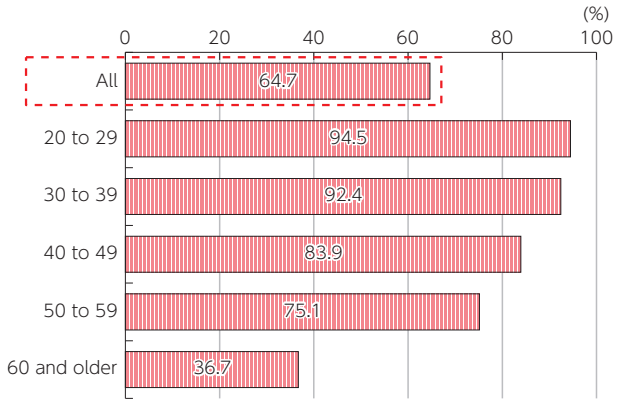
(Source) "State of Broadband Infrastructure Establishment," MIC

Figure 1-1-3-2 Broadband prices per megabit per second



(Source) 2015 OECD Digital Economy Outlook

Figure 1-1-3-3 Smartphone ownership



(Source) "2014 Communications Usage Trend Survey," (Household Edition) MIC

(3) Arrival and growth of smartphones

The arrival of the smartphone, typified by Apple's iPhone in 2007, further advanced the convergence of communications and computers that had been ongoing since 1995. Smartphone-related fields have been expanding day by day, such that businesses on the Internet started developing around the smartphone.

Results from the 2014 Communications Usage Trend Survey show that smartphones are owned in more than 64 percent of all households. Checking smartphone ownership by the age of the head of the household finds that the younger the head of the household, the higher the ownership rate: 94.5 percent among heads of households in their 20s, 92.4 percent among those in their 30s, and over 70 percent among those in their 40s and 50s. Even the smartphone ownership among seniors 60 and older approaches 40 percent. From this, we can surmise that citizens of all ages have embraced smartphones and that smartphones have largely proliferated society (Figure 1-1-3-3).

(4) Recap and future issues

Thanks to aggressive network investments, primarily by private carriers, over the last 30 years from the telecommunications liberalization in 1985 to today in 2015, broadband is available not only in the major urban areas but also in virtually all areas of Japan. Through these advances in infrastructure, the role of Japan's ICT has also transformed from a conventional communication tool to a new management resource that generates, accumulates, and processes information to create added value.

On the other hand, with the reorganization of the telecommunication industry starting in the second period, telecommunications carriers have today consolidated, for all practical intent, into a three-group system consisting of the NTT Group, the KDDI Group, and the Softbank Group. Therefore, it is more important than ever to sustain fair market conditions so that users are free to choose the devices, services, and price plans that suit their needs and so that new services are created while keeping watch over the formation of groups and oligopolies among carriers. Furthermore, we anticipate that maintaining safe and secure usage environments as ICT advances will also increase in importance.

And whereas previous policies have been oriented toward ubiquitous ICT, with continued progress in the ICT field, future policies will start venturing into the IoT world. Looking toward the future in 2030 and beyond, as described later, putting into practice what has been studied in the application area will be increasingly important. And a key question for ICT will be how to implement in networks devices that embody the added value created through the processing and analysis of information that has been stored or distributed on the Internet.

Section 2 30 Years Since Telecommunications Liberalization: Overview from a Data Perspective

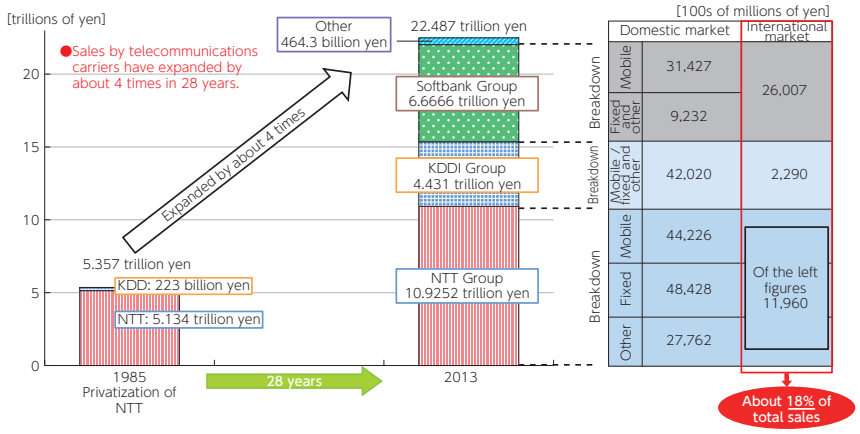
In this section, we provide a general overview, from a quantitative data perspective, of the entire ICT industry's growth from 1985's the telecommunications liberalization to the present time and verify where we have arrived after these 30 years.

1. Expansion of the ICT market and its contribution to economic growth

(1) Sales by telecommunications carriers

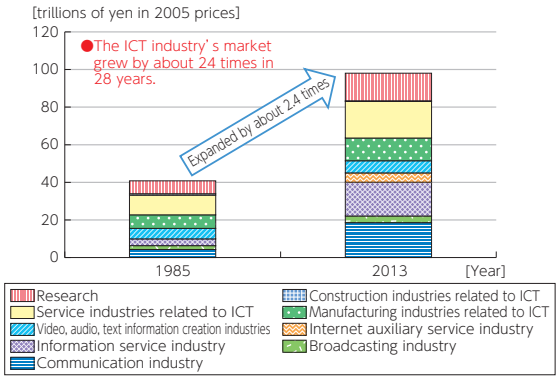
At the time of the telecommunications liberalization in 1985, Japan had only two telecommunications carriers, NTT and KDD, which had combined sales of 5.3570 trillion yen. In comparison, the combined sales of the leading domestic telecommunication carriers in 2013 were 22.4870 trillion yen, a jump of over 400 percent. These figures demonstrate that the overall market for telecommunications services has expanded greatly due to vigorous competition among carriers (Figure 1-2-1-1).

Figure 1-2-1-1 Sales by telecommunications carriers (total sales in the domestic market and international market)



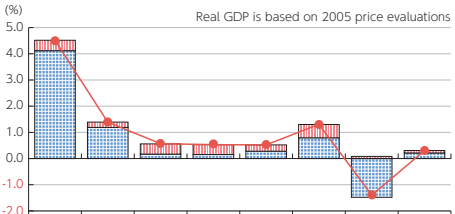
(Source) "Study Report on Structural Changes and Future Prospects for the Global ICT Industry," MIC (2015)

Figure 1-2-1-2 ICT industry's real domestic production value



(Source) "Study on Economic Analysis of ICT," MIC (2015)

Figure 1-2-1-3 ICT industry's contribution to the real GDP growth rate



	85 ~ 90 (yearly average)	90 ~ 95 (yearly average)	95 ~ 98 (yearly average)	98 ~ 01 (yearly average)	01 ~ 04 (yearly average)	04 ~ 07 (yearly average)	07 ~ 10 (yearly average)	10 ~ 13 (yearly average)
ICT industry	0.4	0.2	0.4	0.4	0.2	0.5	0.1	0.1
Other industries	4.1	1.2	0.2	0.2	0.3	0.8	-1.5	0.2
All industries	4.5	1.4	0.6	0.5	0.5	1.3	-1.4	0.3

(Source) "Study on Economic Analysis of ICT," MIC (2015)

(2) Size of the ICT industry's market

We looked at how much the entire ICT industry has grown, including telecommunications services. The ICT industry's real domestic production value, which was approximately 40 trillion yen in 1985, expanded by about 2.4 times to approximately 98 trillion yen in 2013. These figures highlight that the entire ICT industry, and not just telecommunications services, has seen massive growth, driven by ICT infrastructure build-out and progress in ICT applications since the telecommunications liberalization (Figure 1-2-1-2).

(3) ICT industry's contribution to economic growth

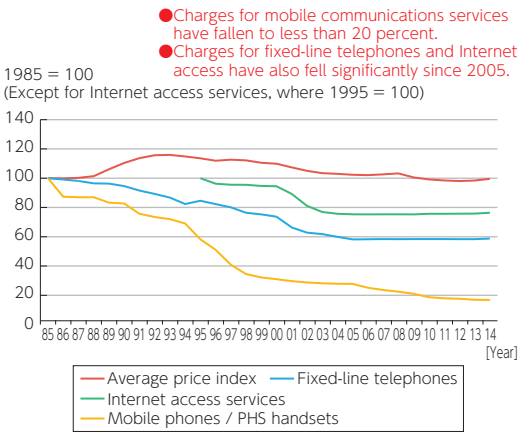
We next examined how much of a contribution the development of the ICT industry has made to our country's overall economic growth. To do this, we measured the ICT industry's contribution to the real GDP growth rate from 1985 to 2013. The results show that the ICT industry's contribution to economic growth has been consistently positive. Even during the 2007 to 2010 period when the real GDP plunged, the ICT industry continued to be a positive contributor (Figure 1-2-1-3). These figures substantiate the large contribution the ICT industry has made our country's overall economic growth.

2. Changes in communications charges

Finally, we looked at how the charges users pay to use communications services have changed over the 30 years since telecommunications liberalization. We graphed the transitions in primary communications charges from 1985 to 2014 with 1985 charges set as a baseline of 100, based on the Bank of Japan's corporate service price index (in constant 2005 values). These results show a tremendous decline in prices for mobile communications services (mobile phones and PHS handsets) in particular. Although the price decreases have started to level off in recent years, over the entire period, it is clear that competition among carriers has driven down communications charges (Figure 1-2-2-1).

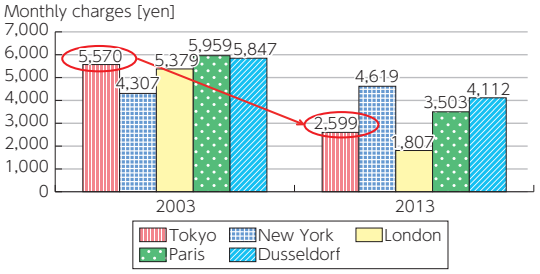
We end with an international comparison of transitions in user fees, taking mobile phone charges as an example. We estimated the mobile phone charges in Tokyo, New York, Paris, and Dusseldorf in 2003 and in 2013 using the call model (with an average of 82 minutes in calls per month (the actual average number of calling minutes in 2012)) from MIC's "Survey on Domestic and Overseas Price Variances for Telecommunications Services" (2013). Figure 1-2-2-2 below illustrates the transitions in the four cities, where it is evident that the drop in mobile phone charges in Japan (Tokyo) is striking, even when compared to other countries (Figure 1-2-2-2).

Figure 1-2-2-1 Transitions in communications charges



(Source) Prepared by MIC based on "Corporate Service Price Index (constant 2005 values)," Bank of Japan

Figure 1-2-2-2 International comparison of mobile phone charges



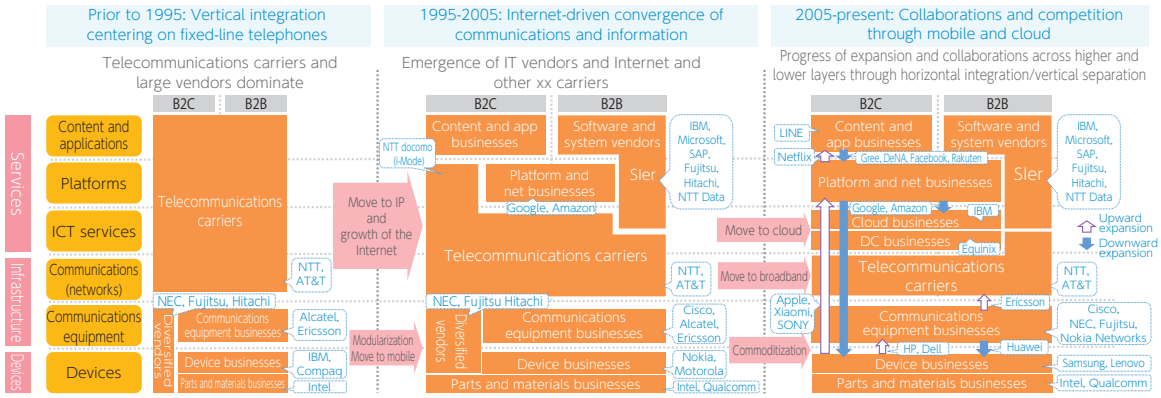
(Source) Materials prepared by MIC

Section 3 Structural Changes in the ICT Industry

1. Structural changes in the ICT industry

The structure of the ICT industry has changed, given various technological innovations and paradigm shifts. The transitions in the ICT industry since the telecommunications liberalization, looking at technological innovation, can be characterized into two roughly decade-long periods: the decade after 1995 when the Internet took off and the decade after 2005 when mobile went mainstream and cloud computing emerged (Figure 1-3-1-1).

Figure 1-3-1-1 Structural changes in the ICT industry (layers and players)



(Source) "Study Report on Structural Changes and Future Prospects for the Global ICT Industry," MIC (2015)

2. Responses by Japanese enterprises to structural changes in the ICT industry

(1) Adaptive strategies by Japanese enterprises to handle structural changes

As the structure of the ICT industry moved away from vertical integration and toward horizontal integration, Japan's communications companies embarked on diversification strategies that include not only communications equipment but also semiconductor and consumer device businesses. Below, we focus on some leading communication equipment corporations and provide a general overview of the history of how their business portfolios and organizations developed.

a. NEC

NEC, Japan's first joint venture, was established in 1899 by Kunihiko Iwadare with a 54 percent capital investment by Western Electric Company, a U.S. firm. The company laid the foundation to transfigure itself into a diversified information and communications electronics manufacturer when it adopted the slogan "C&C"—which stood for Computer & Communication—and advocated for the convergence of computer and communication technologies as its new corporate philosophy in 1977. Making use of its strengths in both fields, NEC held a global competitive advantage from the late 1980s

through to the middle 1990s. In the latter half of the 1990s, however, the company's business performance stagnated due to a worldwide slump in the computer business and due to increasing competition with powerhouses in the United States and South Korea in the semiconductor market.

Noting the rapid popularization of the Internet, NEC made "Internet focus" its core policy from 2000 on and began concentrating its management resources on its IT solutions business and network solutions business even as it spun off business units that previously were its strengths, such as the DRAM, semiconductor, computer, and mobile phone handset businesses. In 2013, NEC recognized ICT's place in advancing public infrastructure and resolving social issues as a growth opportunity and reorganized itself into five business segments: a social solutions business, which aims to establish new business models; a public business to serve domestic and foreign governments, public agencies, public institutions, and financial institutions; an enterprise business to address private-sector demand particularly from the manufacturing industry and the logistic and service industry; a telecom carrier business for telecommunications carriers; and a system platform business that provides solutions and services using various products. In this way, NEC has pivoted toward a solutions and infrastructure business while moving ahead with management diversification centered on networks and IT.

b. Fujitsu

Furukawa Electric and Siemens of Germany created Fuji Electric Co., Ltd. as a joint venture to produce generators and electric motors in Japan. Fujitsu (Fuji Tsushinki Manufacturing Corporation at the time) was established in 1935 when Fuji Electric spun off its Communications Division.

Fujitsu enjoyed success with its FACOM M series of IBM-compatible general-purpose computers from the late 1970s through to 1990, and the company expanded into the personal computer business, developed supercomputers and high-performance servers, and endeavored to grow while working to commercialize products.

Eyeing the full-blown expansion of the Internet, the company announced a new business strategy "Everything on the Internet," which was centered on broadband Internet, in 1999. Under this business strategy, Fujitsu concentrated its management resources on three business segments—services: providing solutions in the form of consulting, system integration, outsourcing services, and network services; platforms: providing mobile communications networks, optical networks, and server/client and other Internet-enabled products; and technology: adding higher value through state-of-the-art technology resting on system LSI, memory, and other electronic components—and directed its energy toward providing comprehensive solutions.

The company again revised its product categories in 2005 to accommodate its customers and reorganized into technology solutions—providing total solutions with high-performance, high-quality products and software services, ubiquitous product solutions to serve individual needs, and device solutions centered on the LSI business. More recently, Fujitsu has been developing businesses that deploy advanced technologies, such as big data technology and cloud computing technology, as platforms as part of its mid-term vision to construct an intelligent and abundant society through the application of ICT that the company calls a "human-centric intelligent society."

c. Hitachi

Hitachi, established in 1910, is a diversified electronics manufacturer that has expanded into many fields, ranging from industry and public infrastructure to consumer products and electronic components.

Hitachi had continually invested heavily in semiconductors, computers, and other aspects of the electronic field since the 1980s and revamped its business make-up by expanding the application scope of its electronics field, which had supported Hitachi's platforms since its establishment, into heavy electrical machinery and industrial machinery. Unfortunately, Hitachi, like other Japanese manufacturers, lost its global competitiveness and was forced to reorganize its business because of the commoditization of product prices, in addition to the breakneck pace of technological innovation in the semiconductor and computer business, and because of its failure to pursue the rapidly progressing trend toward international specialization. Although ICT systems have become the company's core business, since the mid-2000s electric power and industrial systems have been driving overall sales. To affect shifts in business fields, and to move ahead with overseas expansion, Hitachi has been promoting organization transformations without regard for business division or plant boundaries and creating organizations that span multiple business fields. For example, Hitachi instituted a company system on October 1, 2009, and has been pursuing independent accounting systems for each business unit in order to accelerate structural reform and bolster the competitiveness of each business unit.

In the midst of these developments, the company is positioning the social innovation business as its current and future mainstay business. In this segment, Hitachi will provide advanced public infrastructure powered by its control technologies and IT and other ICT system technologies, leveraging its strengths in materials and key device fields and other fields that combine the Hitachi Group's information and communications systems, industrial, transportation, and urban development systems, and power systems.