The Challenge of Smooth Transition from R&D to Business for Innovation in a Telecom company

by

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SUBMITTED TO THE MIT SLOAN SCHOOL OF MANAGEMENT
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2005

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Submitted to the MIT Sloan School of Management
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ABSTRACT

The environment surrounding telecom companies has changed dramatically since most were privatized in the 1980s. Under the influence of regulations, they had faced globalization and have repeatedly divided and consolidated to improve competitiveness.

From the technology and marketing points of view, two disruptive innovations occurred in the 1990s: IP and wireless communications. Originally, IP was used only for data communications, but it has now evolved to include voice communications as VoIP. This had a huge impact on telecom companies because IP has destroyed the legacy cost structure that was based on a pay-as-you-go system; the new demand is for a flat rate fee structure. IP also moved forward the commoditization of communication network services. At the same time, demand for cellphone service grew exponentially, and the number of cellphone subscribers surpassed that of fixed phone in 2000 in Japan. As a result, competitive superiority is shifting from long-distance companies to local and wireless companies.

In this thesis, I discuss the telecom industry's situation, and compare three major carriers: AT&T, BT and NTT. I describe the organizational structures of each company to determine where there are—or if there is a requirement to improve—smooth transitions from R&D to business as one way to enhance the telecom companies' competitiveness.

My research found that their strategies regarding the acquisition of competence are totally different: AT&T did internal development; BT purchased necessary technologies from the market; NTT led joint development with manufacturers. From the comparison and analysis, I determined that the R&D structure should be changed from the legacy linear model to a circular model that produced fast clock speed. In addition, companies must have relationships with external companies and universities in order to purchase products or technologies quickly and efficiently. Managing NTT Group effectively is another key issue to be executed.

If NTT can turn these changes into an opportunity, the company can transform itself into an IP communication services company that is able to use its huge technical resources to give themselves a marketing advantage.

Thesis Supervisor: Henry B. Weil
Title: Sloan Management Review Professor of Management

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ACKNOWLEDGEMENTS

As I worked on this thesis project, my company, professors, and friends at MIT all helped me gain broader perspectives while giving me opportunities to enhance my talents. There are many individuals to whom I would like to extend my sincere thanks and appreciation:

Professor Henry B. Weil for his remarkable direction of my thesis and his able assistance throughout my research activities.

Mr. Hiromii Wasai, Senior Executive Vice President of NTT Communications Inc., for giving me this great opportunity to study at MIT Sloan.

Mr. Mitsunobu Komori, Mr. Yuji Uenishi and Mr. Masato Inaba, Senior Manager of NTT Inc., for giving me many opportunities and kind encouragement.

Dr. Hiroshi Miyabe, Associate Senior Vice President and Exective Director of NTT Cyber Communication Laboratory Group, *Mr. Yoshitsugu Obashi,* Director of NTT Service Integration Labolatories, *Mr. Kazuhiro Nagayama*, Senior Manager of NTT Service Integration Laboratories, *Mr. Masatoshi Shimizu,* Senior Manager of NTT Access Network Service Systems Laboratories, for giving me many opportunities and strong support during my attendance at the MIT Sloan Fellows Program.

Mr. Steve Whittaker, Principal Consultant, BT Strategic Research Centre, and *Mr. Howard Anderson*, founder and former president of The Yankee Group, and co-founder of YankeeTek Ventures, for their thoughtful suggestions and helpful coordination with my interviews.

Mr. Hirohiko Sato, Exective manager of NTT Soft Inc., for his thoughtful suggestions for the contents of my thesis and kind encouragements.

Ms. Cherie Potts, for her excellent editing.

Mr. Stephen J. Sacca, for his great coordination and work on behalf of MIT Sloan Fellows Program in Innovation and Global Leadership.

This thesis is dedicated to all the people of NTT Group.

Introduction

For a number of years, telecom companies have functioned well as a result of their own self-contained development, that is, they supplied services through vertical integration, and developed technologies and products internally or in conjunction with other manufacturers. However, everything changed as the Web and cellular phones penetrated all facets of life. As a result, many external suppliers, such as router venders, service providers, and cellular companies, surged to the forefront in the telecom industry. This resulted in the shortening of service lifecycles and a greater dependency on the capabilities of others, i.e., horizontal relationships. Traditionally, the key features of the telecom industry were engineering and operations, but today these hold a less important position, replaced instead by marketing and creating new services. Today, network services have changed from cutting-edge to commodities. Under such conditions, telecom companies are questioning the importance of R&D.

NTT Group, a holding company consisting of five main subsidiaries, takes partial responsibility for R&D expenses in laboratories belonging to the holding company and the other small group companies. In NTT Group, fundamental research and technologies used in the subsidiary companies are developed in holding company, On the other hand, development of an application field used by a subsidiary company or customized requests for specific customers, are executed in the development section of each subsidiary. In a traditional, vertically integrated organization, such an arrangement works well. However, in today's technological

and economic climate, which requires quick development and production, the existing R&D structure simply cannot cope sufficiently. And in the transition from R&D to market, a lack of communication often occurs between the technology and marketing people.

The objective of this thesis is to analyze the organizational structures of telecom companies to determine where there are—or if there is a requirement to improve—the smooth transitions from R&D to business as one way to enhance the telecom companies' competitiveness. I seek to answer following questions:

- What are the key factors for successfully transitioning from R&D to business?
- How can we change an organization to incorporate these factors? There are three perspectives to be considered in organizational change: (a) strategic design: transition standards designed to guide a diverse R&D team that uses external relationships for strategic design; (b) political: identifying the right R&D field and assigning (if necessary, hiring) the right leader to bring about political change; and (c) cultural: producing a change in the corporate culture by transforming the thinking of executives and employees.

I begin by reviewing the history of world telecom companies, then I identify comparisons between AT&T and BT, both of which were broken up or privatized similar to NTT. Then I analyze the transition from R&D to business as it is practiced at NTT.

The thesis has seven chapters. In Chapter 1, I analyze the present state of telecom industry, followed in Chapter 2 by a description of NTT's current situation. In Chapter 3, I describe the history and strategies of AT&T and BT. In Chapter 4, I compare NTT with AT&T and BT to show the key points affecting success and

failure. In Chapter 5, I explain several factors effecting the growth of telecom companies and scenarios for the future. In Chapter 6, I mention about R&D objectives and then transition models from R&D to business to realize the objectives. In Chapter 7, I analyze NTT's possible strategy using a familiarity matrix[1]. In Chapter 8, I conclude with my assessment of the keys needed to accomplish a smooth transition from R&D to business for NTT.

Endnotes for Introduction

[1] Edward B. Roberts, Charles A. Berry, "Entering New Businesses: Selecting Strategies for Success", Sloan Management Review/Spring 1985

Chapter One

Telecom Industry

1.1 BACKGROUND

Over the years since it was invented, telecommunication has greatly improved its function and performance until now it is a fundamental part of the infrastructure in every major society. Before analyzing the strategies of several telecom companies, I conducted a survey of economical situation, political issues such as privatization and globalization, marketing trend and technological trend.

1.1.1 Current Conditions in the Japanese economy

Following the collapse of the so-called "bubble economy" in the 1990s, the Japanese economy has remained sluggish. In 2004, the International Institute for Management Development (IMD) issued a world competitiveness scoreboard[1] which ranked Japan at 23rd, slightly improved from its rank of 25th a year earlier. Several Asian countries, such as Singapore and Taiwan, were ranked better than Japan. The scorecard is a comprehensive ranking based on factors such as economic performance, government efficiency, business efficiency, and infrastructure. Until 1993, Japan had been at the top five years in a row, but it dropped in succeeding years due to a degradation of various economic indicators such as GDP growth rate.

In 2004, the competitive landscape changed as economic recovery took hold in Asia and new competitors emerged. Productivity began to spread via globalization into low-cost areas of the world. For example, the manufacturing industry in east Asia, especially China, has experienced major growth and its markets have expanded into Japan. Japan's manufacturing base also has extended abroad. The next paradigm shift will directly affect the service industry.

The excellent condition of Asian countries can also be seen in the IT-related trade values shown in Table 1-1. While the all-around trade values of the U.S., several European countries, and Japan have declined, China and Hong Kong reflect extremely high growth rates, well ahead of Germany and the UK. This explains why there is still room for growth in the economies of these countries.

Table 1-1 IT-related trade values in major countries

$100 M%

	USA	Japan	China	Hong Kong	Singapore	Germany	UK
Export	1,426	1,048	838	703	694	667	564
Import	1,957	596	832	753	512	679	536
yr/yr (export)	-12.7	-2.1	40.8	16.5	2.2	-2.1	-4.7
yr/yr (import)	-0.9	-6.6	32.7	11.6	0.1	-9.0	-11.1

Source: "White paper on telecommunications 2004", Ministry of Internal Affairs and Communications in Japan

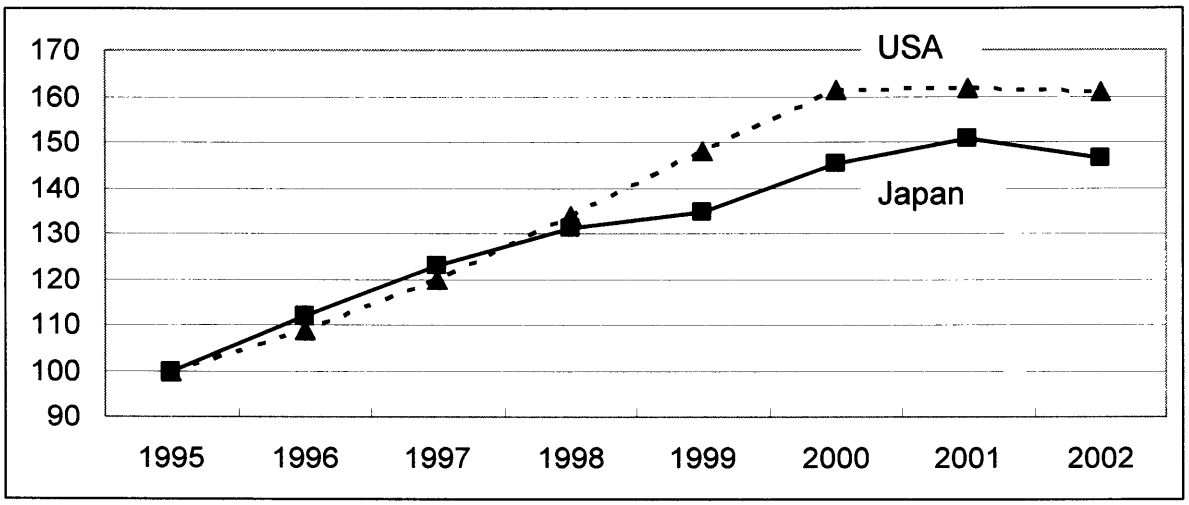
On the other hand, the IMD's technological indicator shows Japan is second only to the U.S. on the basis of technology-related markers such as the number of patents granted. Japan has received a tougher evaluation because there are still few signs of improvement in the overall macro economy. However, a persistent willingness to continue technical development—one of the signs of long-term

economic rebirth—is viewed as cause to expect future improvements in competitiveness.

The results of a questionnaire about the superiority of information technologies, targeting both domestic and international information and communications technical experts, which was handled by Ministry of Internal Affairs and Communications (MIAC) in Japan, showed that Japan has the advantage in the field of mobile terminals, home information appliances, and electronic tags and sensors.[2] In contrast, it is weak in the areas of security, certification, and content applications. As for the technologies used in optical and mobile networks, MIAC believes the US and Japan are at a similar level, and that information and communication technologies will be leading forces in the improving trend.

1.1.2 Japan's Information and Communication Industry

In 2002, the market size of Japan's information and communication industry (including telecom) was ¥116 trillion—a year-by-year decrease of 2.7%, and the first declining year since 1995. The reason was deemed to be reduced investment in equipment. (The communication industry's capital investment in 2002 was ¥2.72 trillion, a decrease of 15.6.) As shown in Figure 1-1, the market size of the information and communication industry in the U.S. showed a similar decline.



Year	1995	1996	1997	1998	1999	2000	2001	2002
Japan(¥Billion)	79,224	88,722	97,502	103,849	106,630	115,013	119,327	116,070
USA($10 million)	118,635	129,364	142,287	158,717	175,475	191,209	191,792	190,782

Note: Indexed on the basis of size in 1995 as 100
Source: "Analysis of IT-related economy," Ministry of Internal Affairs and Communications in Japan

Fig. 1-1 Transition of information and communication industry's market size

1.2 PRIVATIZATION AND GLOBALIZATION

Historically, industries such as electricity, gas, and railways have been allowed to operate as monopolies in order to maintain stability of service and/or supply. However, this required enormous investment in equipment and the provision of service. Telecom companies around the world also enjoyed some form of monopoly until the 1970s, but by the end of the twentieth century the situation had changed dramatically.

1.2.1 The U.S. Situation

The domestic telecommunications market in the United States was dominated by AT&T for most of the twentieth century. In 1982, AT&T was broken into seven

regional holding companies and their operating company subsidiaries (known as "Baby Bells"). The new AT&T was comprised of long distance (including international) and manufacturing divisions.

As dramatic as the breakup of AT&T was, it is useful to remember that entry into long-distance (trunk) carriage by MCI and Sprint, and entry into equipment manufacturing by Nortel, Ericsson, and others had been allowed prior to divestiture. The new AT&T had both carrier and manufacturing arms and maintained the strong international presence of its predecessor. Later, the manufacturing functions were spun off into Lucent Technologies.

From the start, the Baby Bells sought to expand beyond their local-service orientation by entering the long-distance business and, in several cases, cable television or video delivery. Several have invested in operating companies abroad, and all have sought international roles. As the result of mergers, at the time of this writing there are five remaining Baby Bells, each with a number of international holdings but no significant long-distance or international traffic.

On a worldwide scale, market openings and competition have progressed, and the industry has evolved into private company initiatives. Political measures have provoked global competition beyond the borders of International/domestic, fixed/mobile, or voice/data/internet/CATV. This enormous surge was caused by the reaction of EU in response to Internet policies implemented by the Clinton administration, which had a major influence on the privatization of communications and pan-European network policy.

1.2.2 The UK Situation

British Telecom (BT) was privatized during the Thatcher administration in 1984, and a duopoly structure began with Mercury (currently called Cable and Wireless). In 1991, British communications policy was reviewed with an eye to abandoning the duopoly structure and to refrain from splitting BT. To accelerate competition in the telecom industry, the UK government gave cable companies permission to handle telecom business as well.

1.2.3 The EU Situation

The privatization of telecom companies in other European countries continued throughout the last half of the 1990s, including Deutch Telecom in 1995, France Telecom in 1996, and Telecom Italia in 1998. All pressed ahead with huge capital investment into their networks and M&As to enhance globalization. As of 1998, three large groups had been formed across borders: Concert (BT/MCI), Global One (DT/FT/Sprint), and World Partners (AT&T/Unisource and many other European and Asian telecom companies).

There were two major purposes for these strategic alliances. One was that international traffic had increased 15% every year over the past decade, and such alliances hoped to take advantage of continuous growth.

Another purpose for strategic alliances was that deregulation was deemed to cause a lack of capital for investing in building infrastructure in developing countries and for deepening the range of services available in developed countries. Companies considering such alliances believe that a globalized team would help

both sides solve their respective problems. In other words, globalization was seen as an answer for increasing the quantitative output of telecom companies.

In 1999, World Partners announced it would not extend its plan; Concert (the alliance between BT and MCI) was also eliminated. About the same time, AT&T and BT began an international joint venture—the new Concert—in 2000 to supply backbone networks, voice and data communications for multinational companies, international communications careers, and Internet providers as a world largest communication company. However, in 2001, Concert was eliminated due to slumping business. In addition, BT paid expensive fees for licenses for third-generation cellular services. However, demand for communications did not increase as much as anticipated, and soon the entire telecom industry was in trouble.

1.2.4 Privatization of the Japanese Telecom Industry

In 1985, Japan began to reform its telecommunications industry. In April of that year, competition was introduced by privatizing NTT and allowing new common carriers (NCCs) to operate domestic long-distance and international telephony. NCCs were also allowed to operate regional mobile telephones and satellites.

From 1985 to 1991, NTT and the NCCs have maintained competing prices in the long-distance market. The Ministry of Post and Telecommunications (MPT) believed that NTT's monopoly power, particularly the bottleneck in access services, was slowing development in the Japanese telecommunications industry. It was thought that splitting NTT would introduce more competition and the industry would grow more quickly.

In 1996, MPT and NTT agreed on a restructuring plan, and in 1999 NTT was divided into NTT Communications (long-distance operations), and NTT East and NTT West (local service operations).[3] NTT East and NTT West remain heavily regulated by MPT, while NTT Communications has been allowed to enter the international telecommunications market. KDD, a major supplier of international services in Japan, was allowed to supply domestic telecommunications services.

Thus the telecom industry was changed as follows:

(1) Monopoly in the 1970s,

(2) Deregulation and new entry in 1980s; and

(3) Roll again of existing companies and further new entries in the 1990s.

In the future, consolidation may again occur with peripheral industries such as broadcasting. I will look at this scenario in Chapter Four.

1.3 ANALYSIS OF MARKET DYNAMICS

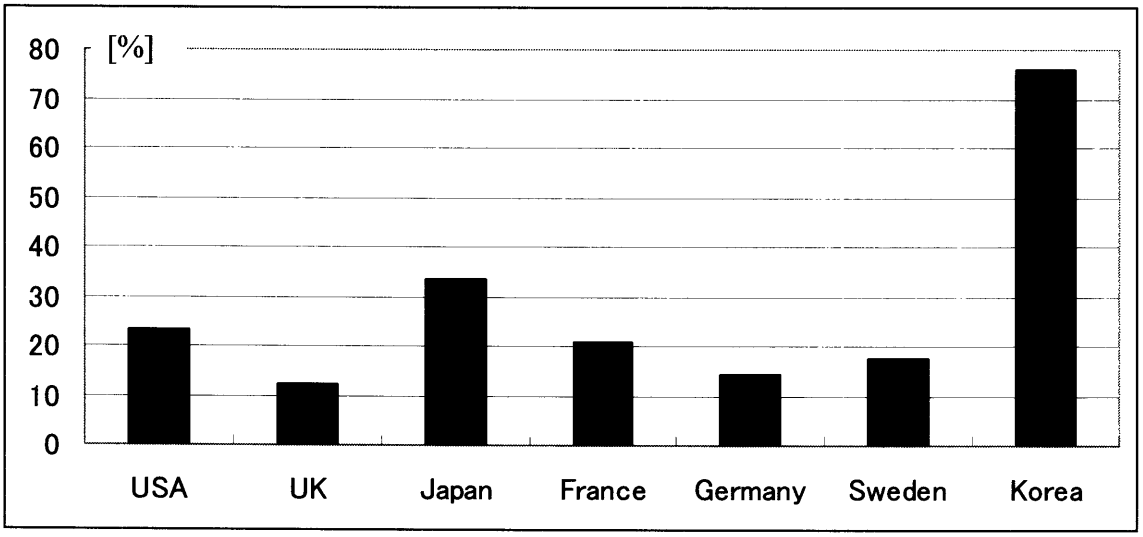
1.3.1 Trends in the Telecom Industry

Current trends in today's telecom industry include broadband, IP, and wireless communication. In the following sections, I discuss the current situations of each trend.

(1) Trend #1: Broadband

Korea has the greatest penetration rate of broadband for household use, followed by Japan and the U.S. (see Figure 1-2). This is the result not only of

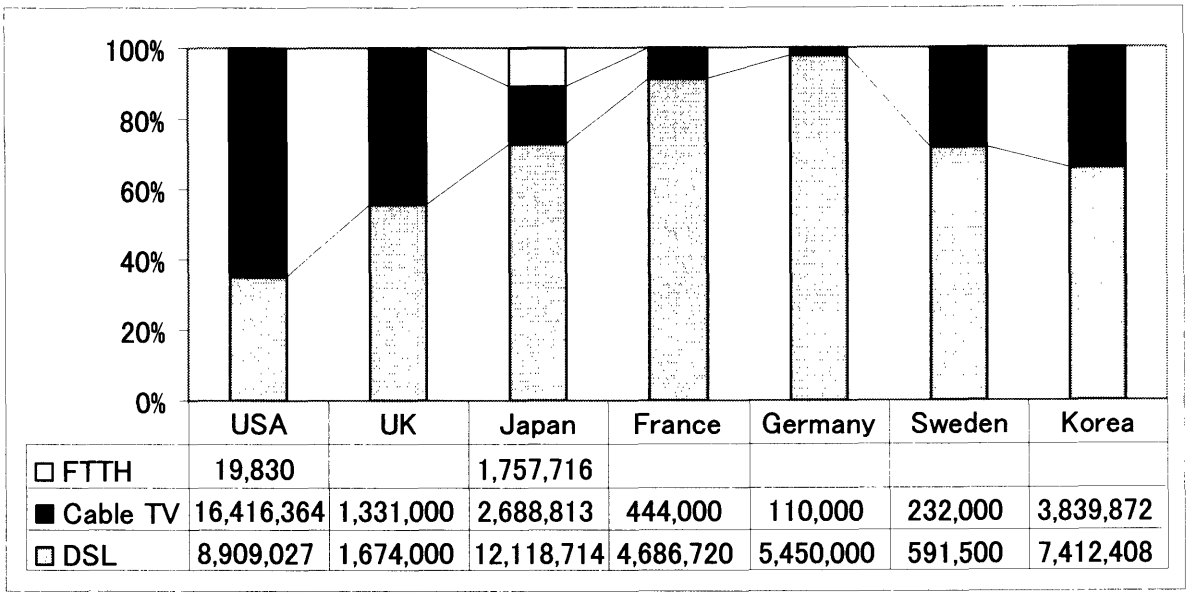
technological advances but also reflects the Korean government's leadership in implementing policies to improve the communications infrastructure. Indeed, growth rate of broadband in Korea has almost reached saturation level now.



Source: Information Communications Handbook 2005, InfoCom Research, Inc., NTT Data Institute of Management Consulting, 2004.

Fig. 1-2 Penetration rate of household broadband use

In countries outside the U.S., DSL is the main form of broadband Internet, as shown in Figure 1-3. In the U.S., cable modem holds more than 60% of the market. In the U.K., DSL use is increasing but cable still counts nearly half of all users. The strong role of cable in the U.S. and U.K. evolved out of their respective regulatory histories. Both countries agreed in the early stages to enter the telecom business using cable after the breakup of the AT&T and BT monopolies. As regulations became more relaxed, cable companies expanded their capabilities within the telecom services.



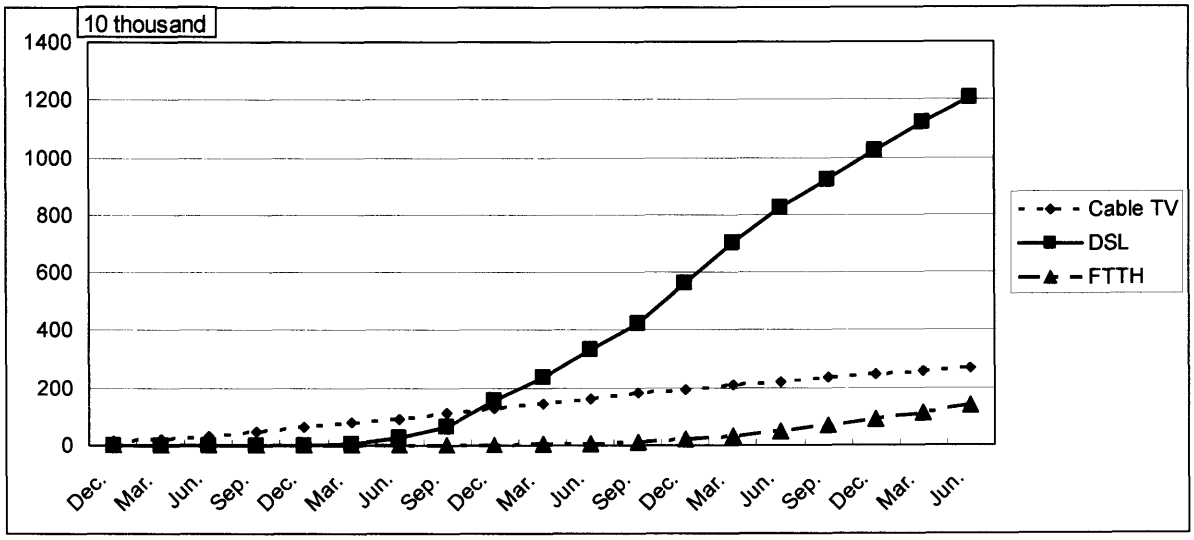
	USA	UK	Japan	France	Germany	Sweden	Korea
□ FTTH	19,830		1,757,716				
■ Cable TV	16,416,364	1,331,000	2,688,813	444,000	110,000	232,000	3,839,872
□ DSL	8,909,027	1,674,000	12,118,714	4,686,720	5,450,000	591,500	7,412,408

Source: Information Communications Handbook 2005, InfoCom Research, Inc., NTT Data Institute of Management Consulting, 2004.

Fig. 1-3 Numbers of broadband subscribers

Until recently, U.S. cable companies had retained their majority hold on broadband users. However, in the U.K., BT and Mercury were prohibited from supplying video transmission service using public networks; the ban was lifted in 2001. As a result, both telecom and cable companies went into their core businesses and competition for broadband services became much more intense.

Figure 1-4 shows changes in the rate in Japan. The number of DSL users overtook cable users by the end of 2001. This was caused by a price war instigated by DSL.



Source: Ministry of Internal Affairs and Communications

Fig. 1-4 Changes among broadband subscribers in Japan

Broadband penetration in Japan is a good example of the relationship among markets, technologies, and regulations. I will describe the key factors of breakthrough innovations in established firms and a story that provides the background of DSL's rise in Japan.

Managing in a way that encourages breakthrough innovation in an established firm involves three key factors, which I have identified below:

1. Technology life cycle

Technology life cycles have four phases: fluid phase, transitional phase, mature phase, and discontinuities phase.[4] Ideally, established firms will have an s-curve[5] that is in good condition, meaning the technology will almost certainly lead to success, and another technology will follow. If firms can generate successive s-curve in a timely manner, they will be very successful. But if the firm cannot bring its technology to the mature phase in a timely fashion, it will fail. To lead their

technology successfully, each project should be small and the company should allocate authority to each project leader so that projects can be managed flexibly in concert with its current phase in the technology life cycle.

2. Human resource allocation

Allocating human resources is a key to managing breakthrough innovation. Hiring excellent employees and placing them appropriately supports the possibility of developing a breakthrough innovation. Existing team members do not necessarily need to be changed in order to sustain innovation; they can continue to generate incremental innovations using the abilities they have already acquired. When it comes to radical innovation, however, it may be necessary to create a new team or perhaps add some people with special skills. To create such a team, a top-down approach is useful. Moreover, managers need to maintain a high level of motivation among their team members because new projects tend to be risky and sometimes upsetting to team members.

3. External environment

Decisions regarding innovations involve real uncertainty—about the future, about scramble uncertainty, which means that newly supplying service scrambles for the same market share with existing service, as well as concerns regarding margin erosion and implementation. These uncertainties cannot be predicted, except perhaps for internal market share scramble. If possible, such situations should be avoided.

In the following, I describe an example involving ISDN and DSL in Japan.

NTT East and NTT West are the regional telephone companies of Japan, major subsidiaries of NTT holding company. Until 2000, ISDN (integrated services digital network) was widely used all over the country with approximately ten million lines. NTT Group decided that ISDN was a short-term solution for digital services that could be used to lead into FTTH (fiber to the home) as a breakthrough innovation for the long term. In fact, optical fibers have already been laid over 50% of Japan as of 2001.

In 2001, Japan's Telecommunication Business Law (TBL) was revised. The revision included two policies: one regarding unbundling of services, and the other regulation of dominant companies. NTT East and NTT West, which were regarded as the dominant companies, were required to divide their network infrastructures and services in order to encourage greater competition in the telecom industry. Under the new policies, new telecom entrants could use NTT's infrastructure at low cost.

Soon thereafter, Softbank Corporation (established in 1981 as a distributor of personal computer software and now expanding into broadband networks and e-commerce)[6] began to sell DSL and IP phones at very low cost, which caused totally disrupted telephone rates being charged by NTT East and NTT West. At the time, NTT East and West were steadily increasing their sales of ISDN. But with Softbank's incursion, both NTT companies were forced to change direction and join the booming DSL competition. This change resulted in serious financial damage to NTT East and NTT West because ISDN sales declined.

It is true that DSL transmission rates are much faster than ISDN. In fact, DSL is considered a "best effort" service, despite the fact that and its performance can be reduced owing to external factors such as microwaves. But the technology functions by using existing analog telephone lines, which means less engineering is required and maintenance costs are cheaper. Thus, DSL has quickly penetrated the Japanese market.

However, from a technological standpoint, it is not an innovation; rather it closer to a backward step, moving from digital back to analog. At the time, NTT had just changed from analog lines to digital ISDN lines. But with the DSL boom, NTT was forced to rethink their plans for investment—perhaps even changing back from ISDN to DSL in some areas. This change also resulted in an erosion of employee motivation because ISDN and FTTH were key projects for NTT at the time.

This example shows how established firms are sometimes forced by external pressures to provide new services, even if that change results in internal market share scramble. It also means that the transitional phase of new technologies, such as ISDN and FTTH, are unexpectedly extended. NTT had developed both its DSL and ISDN technologies from the initial stage. Especially with ISDN, NTT laboratories had invented and developed the technology in the early 1980s. And the company followed its strategic plan to offer the service for digital data networks, subsequently leading to FTTH. But external circumstance interrupted the plan, and the project could move forward. From this example, it is clear that existing external factors influence innovation. In 2001, NTT was unable to convince consumers about the long-term benefits of their product.

It is my belief that in order to manage for breakthrough innovation, a firm should be convinced of the innovation's long-term success. If the company views the issue only in terms of immediate gains and losses, it could easily "kill the golden goose." Even if many high hurdles develop, a firm must continue to encourage their innovation projects and perhaps allow for the possibility of some period of stagnation. It is a classic example of the truism: "no pain, no gain."

(2) Trend #2: IP Networks

Many providers supply VoIP (Voice over Internet Protocol) as part of the development of broadband. VoIP is currently one of hottest trends in the telecom industry.

It began in December 2003, when AT&T, TWC (Time Warner Cable, the second-largest cable company), and Quest (a Baby Bell) each announced they would begin offering VoIP service. Following this announcement, Verizon and Comcast also entered the competition. Although VoIP in the U.S. has grown steadily since 2003, the number of users remains low at this point.

Long distance telecom companies have seen a 10% decrease in revenues and they consider VoIP phone service an annoyance. In response, they have made strong efforts to bundle local area and long distance services as a way to retain customers. However, wholesaling of local lines remained a problem. So the long-distance providers also began to look at VoIP, which would enable them to supply end-to-end communications without relying on wholesale local lines. Among the long distance telecom companies, AT&T supplies its own VoIP service; others, such as

MCI and Sprint, aligned themselves with cable companies, which got into VoIP via their "triple play" service that offers cable TV, Internet, and VoIP. The Bell companies, forced to offer VoIP service because of strong competition from cable companies, has appealed to its investors and to regulatory authorities. As a result, the regulation of VoIP has been under discussion in the U.S. since 1998.

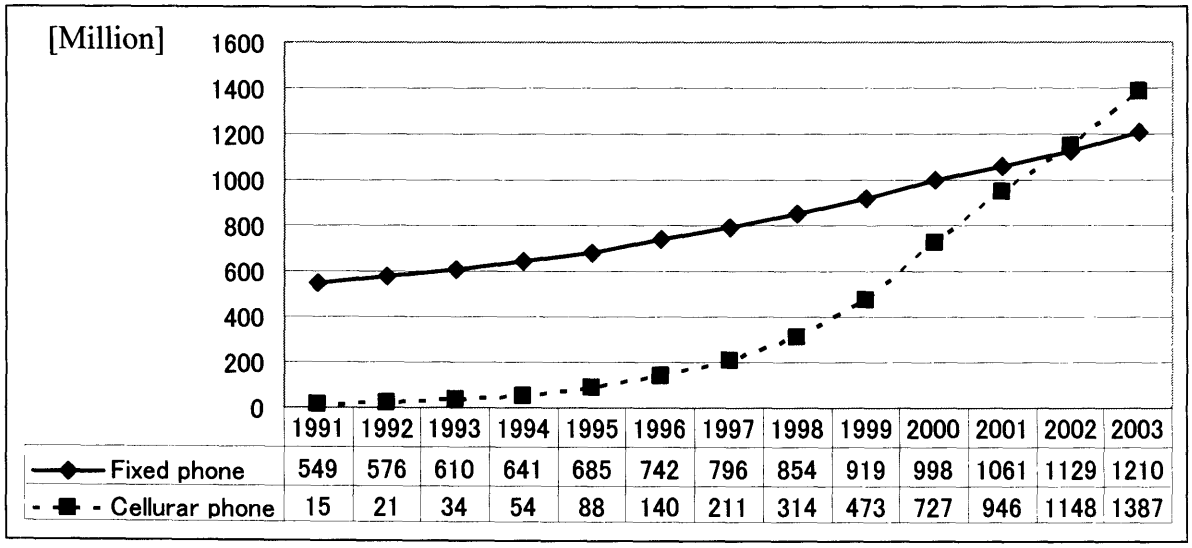
In the U.K., NTL and TeleWest (cable companies) are the major suppliers of cable telephone service. Together they have four million subscribers, about 17% of the residential telecom market. In December 2003, BT announced it would begin supplying VoIP, with a special focus on cable telephony users. Moreover, by 2006, BT plans to change 28.7 million telephone subscribers, including local networks, to IP networks. The EU has been formulating IP phone regulations since June 2004.

In Japan, the number of VoIP users has grown to almost five million. Japanese ISP provides VoIP service as an added bonus, so the service fee is set extremely low. As the forerunner of VoIP, each company began preparing various services, including VoIP communication between different manufacturers' phones as well as IP television phone service.

(3) Trend #3: Mobile communications

The number of cellphone users in the world had increased about 50% per year since 2000. More recently, the increase has dropped to 20% per year. At the same time, the number of cellphone users has surpassed fixed phone users, as shown in Figure 1-5. For example, fixed phones accounted for more than 90% of

total voice traffic in the U.K. in 1994; since then it has declined about 80% (survey by OFCOM).[7]

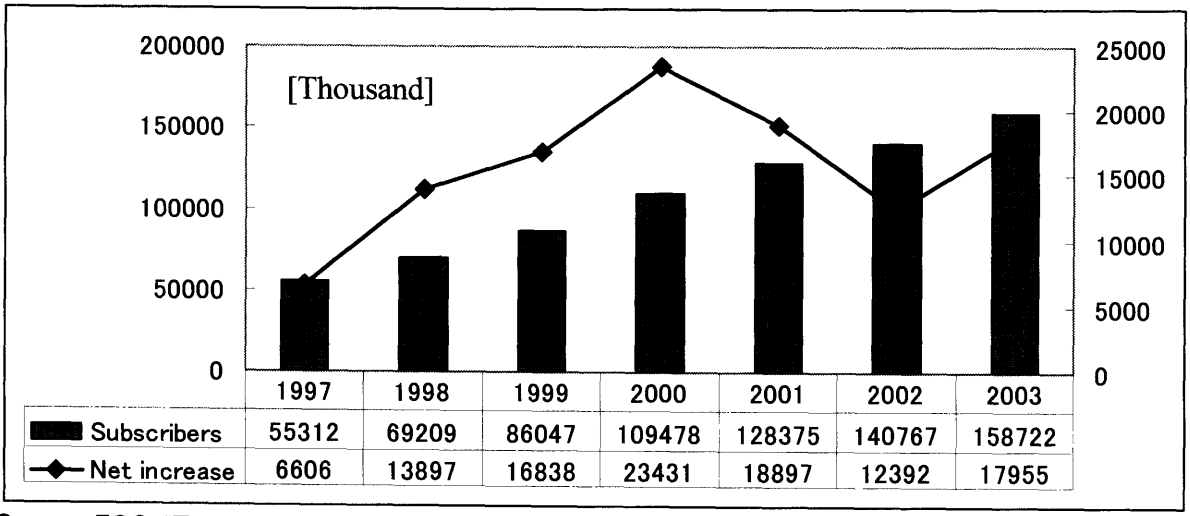


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Fixed phone	549	576	610	641	685	742	796	854	919	998	1061	1129	1210
Cellurar phone	15	21	34	54	88	140	211	314	473	727	946	1148	1387

Source: Information and Communication Outlook 2005, InfoCom Research, 2004

Fig. 1-5 Number of subscribers in the world

A Figure 1-6 shows, in the U.S., growth of cellphone penetration has almost reached saturated. However, in developing countries the growth rate remains very high.



	1997	1998	1999	2000	2001	2002	2003
Subscribers	55312	69209	86047	109478	128375	140767	158722
Net increase	6606	13897	16838	23431	18897	12392	17955

Source: FCC, "Trends in Telephone Services", 2004

Fig. 1-6 Changes in cellphone subscribers in the US

Table 1-2 shows the average revenue per user (ARPU) of each country's major cellular companies. Compared with other countries, ARPU for Japanese companies is high due owing to strong demand for data via cellphones. The ARPU for cellphones has already exceeded that of fixed phones in Japan. Even so, volume is declining every year. Expenses for data use, such as for i-mode, is steadily increasing, but it cannot cover the gap of declining expense for voice service. In 2004, major cellular companies in Japan announced the introduction of fixed rates for packet usage. The impact of that decision on ARPU will be not available until after fiscal year-end 2005.

Table 1-2. ARPU among cellular service providers

Country	Company	ARPU	Currency unit	ARPU yen equivalent
Japan	NTT DoCoMo	94,680	yen	94,680
Japan	au	89,120	yen	89,120
USA	AT&T Wireless	718	dollar	76,037
USA	Verizon wireless	604	dollar	64,000
UK	Vodaphone UK	309	pound	59,476
USA	T-Mobile	528	euro	55,947
UK	Orange UK	271	euro	52,162
France	Orange France	379	euro	49,846
Italy	Vodaphone Italy	361	euro	47,479
UK	T-Mobile UK	360	euro	47,347
Italy	TIM	338	euro	44,506
Germany	D2 Vodaphone	310	euro	40,771
Germany	T-Mobile Germany	288	euro	37,878

Source: Information communication Outlook 2005 [8]

Several major trends are apparent in the broadband market:

- shrinking fixed voice service,
- expanding, but tending to become saturated, cellphone service,

- expanding broadband use,
- strong competition to increase market share, even price wars.

These are critical situations, especially for fixed phone providers.

To cope with this situation, FMC (Fixed and Mobile Convergence, a bundled service between fixed and mobile communications based on levels of service and network) is one place where companies can offer differential service in an attempt to increase revenues.

There are three major types of FMC: packages (one-stop billing), network service, and terminal.

In the *package type*, the benefit for users is one bill that includes both fixed and cellphone use. This is already being done by major telecom companies in the U.S.

With *network service*, users can transfer calls going to their cellphone to a specified fixed phone. In the U.S., because a communication fee is charged when receiving a cellphone call, users who transfer to a fixed phone benefit because they do not have to pay for a cellphone call. Fast Forward, a plan offered jointly by Cingular, SBC, and Bell South, is an example of this kind of service.

Terminal type enables users to use both fixed and cellphone services in one cellular terminal. Recently, major telecom companies joined One-Phone Project. In addition, an alliance among these companies is created. BT has a similar Blue Phone project which I will describe in greater detail in Chapter Three.

1.3.2 Effect of Regulations

As mentioned earlier, regulations have a great impact on the strategies of telecom companies and the industry as a whole.

In the U.S., the Federal Communications Commission (FCC) implemented the Telecommunications Act of 1996 to promote competition in local communication markets, which forced incumbent local exchange carriers (ILEC) to open their network resources. This regulation remains under discussion in the telecom industry.

The latest directive from the FCC[9] eliminates the obligation to unbundle the FTTH loop for ILEC.

As for VoIP, the FCC has been evaluated it specifically. But as VoIP service becomes increasingly popular, the FCC will implement procedures to regulate it. Such regulations will undoubtedly relate to access fees, universal funds, federal wiretap law, and so on. Some say that the 1996 act, instituted in the era of the legacy telephone companies, is already out of date, and it will need to be updated.

In the UK, Ofcom, which regulates the UK communications industry and is responsible for television, radio, telecommunications and wireless communications services, is working to revise its communication policy for the first time in thirteen years.

Telecom companies across the board are having to rethink their strategies as they take steps to comply with the stream of regulations. Sometimes it is necessary to appeal regulatory authorities before proceeding with strategic policy making.

1.3.3 Evaluating Current Technologies

Today's technologies require high speed, mobility, and transparency. Basic technologies in each field of network, platform, and terminal have been progressing well, with various technology innovations in these fields.

Transparency means that users should not be conscious of networks and/or computers when they use telecom technologies. FMC is one example of a transparent technology. However, it seems that technologies for transparency are still somewhat unsatisfactory. To realize a better level of such service, related technologies including security, certification, user interfaces, and convergence network controlling should be explored in the future.

Endnotes for Chapter One

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[1] World Competitiveness Scoreboard 2004: see: <http://www01.imd.ch/documents/wcc/content/ranking.pdf>

[2] White paper on telecommunications 2004: <http://www.johotsusintokei.soumu.go.jp/whitepaper/ja/h16/index.html>

[3] NTT East, see: <http://www.ntt-east.co.jp/index_e.html>; for NTT West, see: http://www.ntt-west.co/jp/index_e.html>.

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[8] Information and Communication Outlook 2005, InfoCom Research, 2004. Printed in Japan.

[9] FCC, "Trends in Telephone Services," 2004, see: <http://www.fcc.gov/bureaus/common_carrier/reports/FCC-State_link/IAD/trend504.pdf>.

Chapter Two

An Overview of NTT

2.1 NTT's Current Situation

The rapid penetration of broadband has brought substantial changes in the telecommunications services market in Japan. In particular, DSL services continue to grow, while optical access services are also accelerating. On the other hand, the fixed-line telephone market in Japan has been shrinking due to the availability of flat-rate dedicated Internet access services and the rapid growth of telephone services based on IP technologies. In the mobile communications market, the use of packet telecommunications continues to expand.

Faced with these challenging business conditions, NTT Group has tried to reform its earnings structures and cut costs. In April 2003, NTT announced the NTT Group Three-Year Business Plan.[1] NTT Group is focused on discount pricing and strategic infrastructure investment to boost sales activity of B-FLET'S,[2] an optical access service with high-level reliability. In the mobile market, NTT Group will aggressively promote FOMA,[3] NTT DoCoMo's third-generation mobile phone system.

The success of these initiatives contributed to higher sales and profits during the fiscal year ending March 31, 2004. Consolidated operating revenues increased to ¥11,096 billion, and operating income rose to ¥1,560 billion, both new highs for

NTT Group (see Table 2-1). Major factors contributing to these record-high results include strong growth in packet communication services, including i-mode at NTT DoCoMo (see number of subscribers in Table 2-2 and ARPU in Table 2-3), and substantial reductions in costs at NTT East and NTT West, which more than offset declines in sales due to falling fixed-line telephony revenues.

Table 2-1 NTT's financial data as of March 31, 2004

	¥, billions		% change	$, millions
	2003	**2004**	**2004/2003**	**2004**
For the year:				
Operating revenues	¥10,923	¥11,096	1.60%	$105,672
Operating income	¥1,364	¥1,560	14.40%	$14,860
Net income (loss)	¥233	¥644	175.90%	$6,131
Cash flows:				
Net cash provided by operating activities	¥2,439	¥3,481	42.70%	$33,149
Net cash used in investing activities	(¥1,987)	(¥2,137)	-7.50%	($20,351)
Net cash (used in) financing activities	(¥454)	(¥1,223)	-169.20%	($11,643)
Capital investment	¥1,987	¥2,014	1.80%	$19,177
R&D expenses	¥396	¥355	-10.40%	$3,380

Source: NTT HP, Annual report 2004[4]

Financial results in 2004 were better than expected, but this was mainly caused by strong cost reduction efforts that cannot be continued at the current pace. Moreover, NTT Group will need to make a substantial investment to develop plans for the next-generation network, including replacement of all legacy telephone networks with IP networks over the next several years. Thus, NTT Group will have to

plan on enormous financial outflows for the foreseeable future in order to accomplish these plans.

Table 2-2 Number of subscribers

Details		(a)	(b)	change	(c)
		Mar-04	Jun-04	(b)-(a)	Mar-05
Fixed line	Fixed telephone	60,072	59,724	(348)	59,117
	Telephone	50,938	50,959	21	50,800
	ISDN	9,135	8,765	(369)	8,318
	DSL	4,089	4,739	650	5,489
	BB(optical)	840	1,215	375	2,040
	OCN	4,118	4,361	243	4,500
Mobile	Cellular	46,328	47,363	1,034	48,200
	FOMA	3,045	6,488	3,443	10,800
	I-mode	41,077	42,362	1,284	43,400
	FOMA	2,997	6,414	3,417	-

Source: NTT HP, presentation document for IR[5]

Table 2-3 ARPU

Details			FY			[yen]
			Mar-02	Mar-03	Mar-04	Mar-05
Fixed line	NTT East	Telephone	3,020	2,990	2,970	2,880
		ISDN	5,850	5,750	5,560	5,470
	NTT West	Telephone	2,950	2,900	2,880	2,820
		ISDN	5,830	5,730	5,530	5,470
Mobile	NTT DoCoMo	FOMA+Mova	8,130	7,890	7,340	7,190
		FOMA	7,740	10,280	9,890	9,550

<Note> FOMA + Mova are used for data communications.

Source: NTT HP, presentation document for IR[5]

As of March 31, 2004, the number of employees in NTT's holding company, including headquarters staff and the R&D laboratories, was 3,056, with 205,288 employees in the combined NTT Group. As shown previously in Table 2-1, Capital investment was up 1.8% from the prior year, to ¥2013.6 billion. On the other hand, R&D expenses have reduced by 10% from the previous year, to ¥355 billion. In this

way, now R&D is also affected by cost reduction program in the points of the number of researchers and R&D expenses. The effect of this stringent policy is emerged that the evaluation of products for transition from research to business, which needs prototyping and developing, becomes very strict and self-manufacturing prototypes are increased instead of outside order. So far, cost reduction effect to R&D not to bring in products or technologies from outside but to make them by themselves.

2.2 History

Significant changes have occurred in recent years in the legislative and regulatory frameworks governing telecommunications in Japan; indeed, changes are ongoing, including implementation of telecommunications reform laws aimed at promoting competition in the telecommunications services market.

Prior to April 1, 1985, the predecessor corporation, Nippon Telegraph & Telephone Public Corporation, was the sole domestic telecommunications carrier in Japan. On April 1, 1985, NTT was incorporated as a limited liability, joint-stock company under the NTT Law[6] and the new entity received all the assets and liabilities of the predecessor corporation. (Government and municipal corporations still own 46% of NTT.)

In 1953, the predecessor corporation's international division, which operated Japan's international telephone, telegraph, and related telecommunications services, was transferred into a separate corporation, Kokusai Denshin Denwa Co., Ltd., which became KDDI.

In 1988, sales activities covered by the central data communications division were transferred to NTT Data Corporation. In addition, the sales division of car phones and other mobile phones were transferred to NTT Mobile Communications Network, Inc. (NTT DoCoMo) in 1992. NTT was reorganized into an NTT holding company comprised of NTT East, NTT West, and NTT Communications in 1999.

The telecom business began in 1890 in Japan. From a technological point of view, the business had centered on voice communications through the 1960s. In the 1970s and 1980s, the digital era took over, the networks for voice and data converged. Moreover, ISDN and convergence with computers also entered the picture. In the 1990s, IP and mobile networks became the next major target of the telecom business.

From the voice communication era through the 1980s, NTT continued its long-established practice of leading and working with a small group of suppliers, manufacturers, subsidiaries, and group companies in order to jointly develop advanced equipment. By and large, NTT maintained its strategies throughout the 1990s. While this period, NTT had tried to promote procurement of switches and many peripheral equipment from both domestic and international manufacturers, but it was took over by domestic telecom related manufacturers practically. AT this point, the relationship with domestic vendors was really tight and NTT R&D took a role of directing and leading what they should make based on their long-time research about network infrastructure. Through this scheme, manufactures were also enhancing their technological capabilities. However, as IP and mobile communications became dominant, the old NTT style not enough sufficient to handle

both domestic and international competition. Recently, NTT decided lessen its reliance on independent R&D in favor of faster development.

2.3 Current Strategies

NTT has decided on two major strategies to improve its market position:

- IP on optical fiber networks and
- RENA (Resonant communication network architecture)

These strategies are really historical shakeup for NTT, because this means that NTT decided to put an end to legacy telephone networks, which have been their backbone and biggest source of income quite a long time. Moreover it was shift in strategy of laying optical fibers from demand estimation to demand boosting. As is the case with other telecom companies like AT&T and BT, NTT has been taken their position against VoIP as Denial, Anger, Reluctant acceptance and Capitulation in this order.[7] Now NTT set down VoIP as one of key applications of FTTH (Fiber To The Home).

2.3.1 IP on Optical Fiber Networks

In November 2004, NTT announced that its fixed-line telephone networks will be replaced by next-generation networks that use IP technologies over optical networks.[8] The company has set a target of moving 30 million users (among its current base of 60 million fixed telephone users) to its new IP networks by 2010.[9] To accomplish this plan, NTT Group will invest ¥5 trillion over the next six years, including ¥3 trillion for developing next-generation networks.

This kind of shift in strategy is extremely rare for NTT. In the past, NTT has not attempted to be proactive but instead has responded reactively to its competitors. However, this strategy change comes as the result of a demand-and- supply analysis which was conducted to determine how to boost demand as a result of changes in the competitive environments. In 2004, both BT and KDDI announced they would change over their fixed telephone networks to IP networks. NTT countered this announcement by cutting the price of the base charge for fixed telephone service. However, that was not enough to make NTT more appealing to customers. Therefore, NTT announced its drastic solution: a complete transformation from legacy networks to IP on optical fiber networks.

Behind this announcement, many uncertainties remain. Two primary concerns are deregulation of the optical fiber networks' open obligation for NTT East and NTT West and revision of universal funds. These issues are strongly tied to political positions and moves by other countries. NTT must move the plan into action but will have to do so with some conditions.

2.3.2 RENA (Resonant Communication Network Architecture)

As revenues from fixed telephones have decreased, NTT Group has had to find new sources of income. While it has gained increased revenue from both basic FTTH charges and from a variety of added services, NTT is now adopted a new strategy known as RENA (resonant communication network architecture), which provides a variety of applications and secure network services on IP over optical fiber networks. With a primary focus on visual communication, it will feature a multi-

function, easy-to-use TV phone, convergence between wired and wireless data communications, a sensor and wireless IC tag application, and distribution of high-volume content.[10] RENA can also handle real-time and non-real-time applications simultaneously using optical path routing technology and moving firewall technology.[11] To realize these services and networks, NTT will use technologies developed in their own laboratories.

In order to realize RENA, NTT established a new company named NTT Resonant at the end of 2003. The new company is a merger of the NTT-X operating portal site "goo" and NTT-BB content distribution supplier for broadband users. The other members of NTT Resonant are from NTT laboratories. All of them believe that NTT laboratories' technologies will be RENA frontrunners. Actually the reason why NTT decide to rely on internal technology for RENA was that almost all fields of technologies related RENA has been studied inside NTT labs with pouring a large amount of R&D expenses. So, they would like to maximize the contribution of R&D to business by using their own technologies.

In reality, NTT is a technology-oriented company, and have had a major role in leading related companies such as manufacturing companies, subsidiaries, and NTT group companies. For this reason, technological innovations are very much dependent on internal development. When technologies were brought to market, they were often spun off from NTT holding company or its subsidiaries and then established as a new group company. This scheme was not totally satisfactory, but it worked passably well. However, the clock speed of the telecom industry continues to shorten with each passing year. Therefore, for both IP over optical fiber networks

and RENA, it is necessary to develop and supply services in an extremely short time frame. It has become clear that it is critical to rethink the scheme and culture of NTT Group to bring it in alignment with today's rapidly changing telecom market. The other problem is that R&D in product-based structure is far from selling section and customers and hard to gain an understanding of customer needs. As a result, it tends to supply over specification products more than customer expected, regardless of customers want simpler and lower cost products honestly. I'd like to describe in detail in the next section.

2.4 Organization

Figure 2-1 shows the organization chart for NTT Group. Each business group has its own support group to execute the business of that group; the holding company also has many other affiliates to support, such as administrative services and engineering. These small companies are mainly comprised of internal resources from the holding company and five main subsidiaries. The smaller companies are joint ventures, and those obtained through merger and acquisition. Advanced technology development, R&D, system integration, and information process business support companies all conduct R&D to help develop products and do business, making use of their own facilities rater than the laboratories of the holding company.

Two conclusions can be drawn from this organization. The first is that each major subsidiary and holding company, including their respective laboratories, maintains a specified number of employees and makes every effort not to increase

that number. The second conclusion is that supporting companies can operate their business effectively in short time frames due to their small size.

Based on these points, it can be said that the organization works well, and helps to avoid any business stagnation in the existing company.

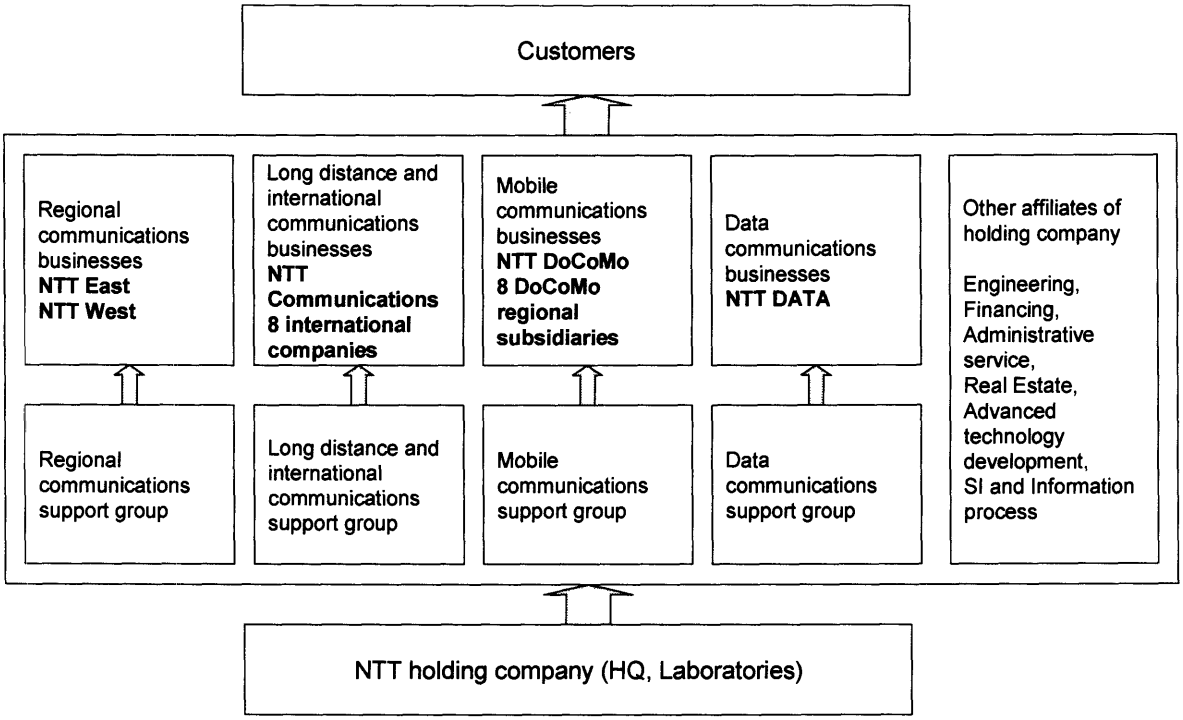

Fig. 2-1 Organization Chart of NTT Group

However, there are also two problems with this organizational structure. The first problem is that most of the small companies were spun off from inside of NTT Group's resources in order to support their parent companies. Therefore, the culture and strategy of these small companies strongly reflect the culture and strategy of the parent company, and there is less diversity of thinking. Consequently, there are

many small companies in NTT Group but they are not accustomed to producing innovative technologies, services, or products.

The second problem is that the laboratories and R&D sections in the holding company are located far from customers, which tends to make the company less able to identify marketing trend and customer needs. To improve this problem, NTT holding company has created a producers' section whose producers are composed of technical people from the laboratories and marketing people from the subsidiaries. Together they manage both the development and marketing. Almost all of the technologies and services in the laboratories are supplied through producers to each subsidiary and then to customers.

With regard to NTT Resonant, that company takes the producers' parts for RENA services, and flows from R&D to business are now being executed via this scheme. Some time will be needed before a proper assessment can be made, but so far it appears that the gap between R&D and the customers is larger than expected.

Once companies have experience with value networks, they tend to form skills, organization structure, and a corporate culture that corresponds to a demand that is far ahead of others.[12] In the past, NTT has made its abilities, organization, and culture fit with its existing operating network services. Now it is trying to change its organization structure. This is the time to make further innovative changes in concert with the changing circumstances surrounding the telecom industry in general.

2.5 Competitors in the Japanese Market

Competition between NTT and Softbank has been especially intense in the past few years. Softbank was originally a wholesale dealer of PC software, but it has grown very large through numerous M&As. It merged with Japan Telecom[13] in the local phone market, and Cable & Wireless IDC [14] in the long distance and international phone market. It also allied with Yahoo Japan in the broadband services market.[15]. Now it is considering getting into the cellular phone services market. Thus, each company has offered distinct benefits to the services they offer, and this has served to widen their competitive positions.

The major differences between NTT and Softbank are their strategy and culture. NTT enjoys hard-and-fast brand power due to its long history as a leader in the Japanese telecom industry. In contrast, Softbank gives priority to marketing as a result of its earlier core business as a wholesale dealer. The company makes full use of its marketing skills and speed in its competition with NTT. NTT is superior in its technical strength and general abilities.

As for FMC (fixed and mobile convergence), both companies are aiming squarely at achieving dominance in this field. But Softbank is at a disadvantage because it is legally barred from entering the cellular phone business. At NTT, fixed phones and cellular phones are operated by different companies, so it too has a regulation problem. So both companies are still reviewing this issue.

The phases of competition are usually function, reliability, convenience, and price in this order. However, Softbank, a radical reformer, entered the competition at the convenience and price phase. So far, Softbank has grown by using its marketing

capabilities, but now it will need to think about fundamental issues in the telecom business. As for NTT, the key elements to its growth will be its marketing abilities and business speed to supply timely services using innovative technologies.

Endnotes for Chapter Two

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[2] NTT East, B-FLETs: <http://www.ntt-east.co.jp/product_e/05/index.html>.

[3] NTT DoCoMo, FOMA: <http://www.nttdocomo.co.jp/english/p_s/service/foma/index.html>.

[4] NTT Annual report 2004: <http://www.ntt.co.jp/ir/pdf/04/e/p2.pdf>.

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Chapter Three

An Overview of AT&T and BT

3.1 AT&T

3.1.1 History

The history of AT&T is one of continuous breakup and restructuring.[1] I have split the history in segments by date and will discuss each segment.

(1) Privatization and breakup: to 1984

In 1876, Alexander Graham Bell invented the telephone, for which he received two patents. Later, he founded the company that became AT&T, which was comprised of three major sectors: local and long distance, R&D, and production. For many years, until its breakup in 1984, this company held a virtual monopoly on telephone service in the U.S. In 1984, American antitrust laws were applied to AT&T, and as a result of Judge Green's historic ruling, the company was divided into seven local telephone companies known as "Baby Bells."

During its dominant era, AT&T provided long distance services; its subsidiary, Bell Laboratories was world famous for research and development; and other subsidiaries manufactured and installed telephone equipment that incorporated Bell Labs' R&D innovations. Vertical integration dominated, upstream to downstream. In 1984, AT&T created a vertical separation between local and long distance service.

(2) Horizontal diversification: 1984 - 1993

At the same time, AT&T was allowed to diversify horizontally, which meant the company could enter the computer business. In 1991, it acquired NCR Corporation, a computer manufacturer, in an attempt to created synergies which AT&T believed were coming with the integration of computing and communications. AT&T also merged with McCaw Cellular Communications, the largest provider of cellular service in the United States; that division was renamed AT&T Wireless in 1993.

(3) Spin-off of Systems, Computers: 1984 - 1996

After numerous twists and turns, AT&T spun off a products and systems company (later named Lucent Technologies) and a computer company (which reassumed the NCR name). Bell Laboratories were taken over by Lucent Technologies.

(4) Vertical integration and horizontal separation: 1996 - present

In 1998, AT&T acquired Teleport Communications Group (TCG), the largest alternative provider of local telecommunications service in the U.S. In 1999 it acquired Tele-Communications, Inc. (TCI), the second-largest cable company in the U.S. (later renamed AT&T Broadband), and in 2001 it added NorthPoint Communications, a provider of high-speed local data network services. As a result of these acquisitions, AT&T now had local and broadband companies that could be used as access networks.

In 2000, AT&T announced a restructuring plan to create four new AT&T companies: AT&T Wireless, AT&T Broadband, AT&T Business, and AT&T Consumer, which enabled the parent company to realize "'horizontal capital separation." Later, AT&T Broadband merged with Comcast Corporation, and AT&T Wireless split off to become an independent company.

Most recently, in January 2005, SBC Communications' announced its acquisition of AT&T. Prior to acquiring AT&T, SBC had 163,000 employees and AT&T had 47,000. However, after the acquisition, SBC announced it would cut 12,800 employees. It is expected that these cuts will help to offset losses, and will create operating synergies.

3.1.2 Reorganization

AT&T has experienced three major turning points as it repeatedly merged with and acquired other companies following privatization. The first was the privatization and the divestiture of the seven local phone companies which became the Baby Bells. The second turning point was the divestiture of NCR, the computer company acquired in 1991, and Lucent Technologies, a products and systems company sput off in 1996. This was the first false step of their M&A business. In 2000, the third turning point occurred when AT&T announced the divestiture of AT&T Consumer, AT&T Business, AT&T Wireless, and AT&T Broadband. These divestitures were driven by an immediate need to raise funds.

For many years, AT&T was known for its unparalleled quality and reliability in communications backed by the research and development capabilities of Bell

Laboratories. To compete, the Baby Bells established BellCore as their independent R&D organization. However, Bell Lab's performance was impacted by the negative operating performance of Lucent Technologies with the result that some researchers left Bell laboratories.[2] It seems that AT&T did not sufficiently consider the fact that in order to remain competitive and produce new technologies as an outgrowth of ongoing R&D, it is necessary to retain excellent researchers, in addition to assuring funds for R&D expenses.

Considering this cycle of reorganization, it appears that although AT&T has had excellent foresight and engaged in repeated M&As to ensure its competitive growth, the company also has divested several key companies. It appears the firm was too concerned about realizing immediate gain and failed to develop long-term future policies. One could conclude that these cumulative failures were caused by management problems in the company.

3.1.3 Competitors in the US market

There are four major competitive sectors in the U.S. telecom industry: local, long distance, cellular, and cable providers. As regulations change and become loosened, competition has become extraordinarily fierce.

AT&T still earns the largest share of long distance revenues in the market with 34.9%, although this figure continues to decline as more local companies enter the long-distance business. AT&T held 90% of the market in 1984, so there is a strong possibility the company will tumble from its top position.

In terms of local communications market share, Verizon holds the top spot with 40%, followed by SBC which acquired AT&T at 34.2%, Bell South at 15.2%, and Qwest at 10.5% (2003 figures).

Regarding cellular market share in the U.S., in 2003 Verizon Wireless had 24.2%, Cingular had 15.5% (SBC has a 60% stake), AT&T Wireless had 14.2%, followed by Sprint at 10.2%. When Cingular acquired AT&T Wireless in 2004, it became the largest cellular company in the US.[3]

The impact of the U.S. stock market carries much more weight than in other countries. The result is that every company, including those in the telecom industry, tends to seek short-term growth, causing waves of mergers and acquisitions in an effort to realize further growth within the industry. SBC's acquisition of AT&T is one example, and it others may occur in the near future. I question whether so much focus on short-term growth weakens the scientific and technical capabilities of the telecom industry; at the very least it seems to have had a negative impact on the industry.

3.1.4 Current Situation

More recently, the major long distance operators—AT&T, MCI, and Sprint—have watched their income decline by about 10% per year. In addition, AT&T's share among Inter Exchange Carriers (IXC) has also declined every year, dropping to 34.9% by the end of 2002.[4]

Depending on deregulation trends in long and local communications, mutual entrance into the market is now occurring. Consumer services are being supplied

primarily by local and cable companies; services for business users are offered as a bundle by long distance companies. However, the news that SBC has acquired AT&T means reorganization is still continuing and that competition will remain intense.

3.1.5 Current Strategies

After AT&T was privatized in 1984, it tried to diversify horizontally by creating convergence between computers and telephones (NCR), cellular networks (McCaw Cellular Communications, later AT&T Wireless), and broadband using cable TV (TCI). In the end, the company reluctantly concluded that these tactics did not work. AT&T lost $50 billion as well as its shareholder value. As a result, AT&T tried to create greater shareholder value through growth.[5]

AT&T has now gone back to vertical integration with a series of acquisitions, including the deal with SBC. That deal, and its related domino effects, should produce major changes in the telecommunications industry, forcing companies to offer a wider range of services in local calling, long distance, Internet access, wireless and cable television.[6] To date, however, most of the action has occurred with the companies repositioning their existing telecom services; unfortunately, there have been no proposals for new services from these companies.

3.2 British Telecom

3.2.1 History

The Electric Telegraph Company (ETC) was established in the U.K. in 1846. BT is the world's oldest communications company, with a direct line of descent from the first commercial telecommunications undertaking in Europe. ETC was taken over by the government's Post Office Telecommunications, but in 1980 it was renamed British Telecom and became a state-owned corporation independent of the Post Office. In 1982 BT's monopoly on telecommunications disappeared with the grant of a license to Mercury (current called Cable and Wireless).

Under the influence of changes in the U.S. telecom industry, the privatization of BT took place as a result of the Telecommunications Act in 1984, with the sale of 51% of the company's shares to the public in November. Afterward, a duopoly structure with Mercury continued until 1991. The company officially changed its name to 'BT' in March, 1991, and the remaining state holdings in the company were sold in 1991 and 1993.

In the 1990s, BT entered the Irish ISP market through a joint venture with ESB, the Irish state-owned power provider, with an aim to eventually provide Internet service over power lines. This venture did not advance beyond ocean dialup ISP, and was eventually sold back to ESB, who sold it to Esat. In 2000, BT bought Esat and all its subsidiaries. BT's cellular phone operator, Cellnet was spun off from the company in 2001, including BT-owned or operated networks in other countries. Then it was renamed O2.[7]

In 2003, the UK regulatory agency Oftel, established at the time BT was privatized, was integrated into Ofcom, which included five regulators for communications and broadcast.

Today virtual markets, electronic commerce, broadband, and mobility are the buzzwords that are causing radical changes in the way companies and people do business. For BT, the willingness to embrace new relationships in both the technical and commercial sectors will be key to maintaining the company's influence on the development of the communication industry.

3.2.2 Organization

In 2002, BT substantially completed a radical restructuring program, including the following key elements:

- the UK's largest-ever rights issue – raising £5.9 billion
- the split off BT's mobile businesses
- the dissolution of Concert, BT's joint venture with AT&T
- the creation of customer-focused lines of business

This restructuring resulted in a significant reduction of BT's debt levels.

BT consists of three principal lines of business: BT Retail, BT Wholesale, and BT Global Services (see Figure 3-1). BT Retail and BT Wholesale operate almost entirely within the UK, handling public consumers, major corporate customers, business and wholesale markets. It offers a broad spectrum of communications products and services. BT Global Services is BT's managed services and solutions provider serving the needs of global, multi-site corporations and European multi-site

organizations. These three lines of business provide a simple, complete experience for all customers.

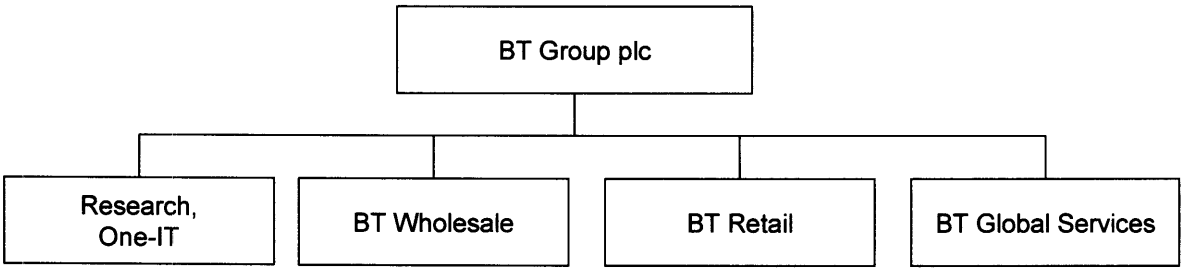

Fig. 3-1 Organization Chart of BT Group

BT research is handled by 300 people in its core research section and 8,000 technologists in its advanced development section called One-IT. The work undertaken by the core research and One-IT sections is part of an investment of £334 million in R&D made by BT in 2004. This compares with £380 million and £362 million invested in the 2003 and 2002, respectively.

Core research is done at Adastral Park, which is responsible for some of the world's most far-reaching advances in telecommunications technologies. This research concentrates on forty research themes, and on other products and technologies already developed by other companies. The core research group has relationships with twelve strategic IT partners including worldwide universities with whom they can more quickly innovate, implement, and introduce new technologies and services. The research section used to supply their technologies only to the development section. However, there were many problems in the legacy structure such as a lack of flexibility and being far from market and customers. So they

changed the positioning of research to a group wide-function rather than just for development. As a result, the research team contributes to all phases of BT business, bringing with it the support of commercial partners and academic partners.

3.2.3 Competitors and Partners

BT and France Telecom (FT) have made enormous progress in presenting new innovative benchmarks, while other European telecom companies still have work to do. In particular, Deutsche Telecom (DT) seems to be focused only on technologies, not on commercial innovation, and as a result lost 7.5% of its domestic wired line revenues in Q1 2004. During the same period, BT executed its restructuring which had the beneficial effect of differentiating BT from its competitors.

Between 1999 and 2002, BT made a number of significant acquisitions, including J-Phone Communications and Japan Telecom in Japan, and Viag Interkom in Germany. However, reflecting the change in BT's strategy in 2002, the company disposed of several businesses and assets, including Yell (its international directories and e-commerce business), Japan Telecom, J-Phone Communications, and Airtel, the Spanish wireless operator. In 2003, BT sold Cegetel Groupe, the leading alternative fixed-line operator in France, to Vivendi Universal and a number of non-core investments, including BSkyB, Mediaset, Blu and SmarTone.

In December 2003, BT issued bonds worth £99 million, which are exchangeable into 16.6% holdings in LG Telecom (LGT) shares. LGT is a wireless telecommunications service provider in South Korea. In 2003, BT sold its 7.8% stake in Inmarsat Ventures, a provider of global mobile satellite communication services. In January

2004, BT acquired NSB Retail Systems, a supplier of software products and services to the retail market and became the exclusive distributor of NSB in the UK and Ireland. BT also announced an offer for the entire issued share capital of Transcomm plc, one of the leading providers of data-only wireless services in the UK. In this way, BT has been more focusing on external innovation and commercial and productive partnership with wide range of players.

3.2.4 Current Situation

As one of Europe's leading telecommunications services, BT provides local, national, and international telecommunications services; higher-value broadband and Internet products and services; and IT solutions. In the UK, BT serves over 20 million business and residential customers with more than 29 million exchange lines, as well as providing network services to other operators.

For the last few years BT has undergone a process of transformation that is now accelerating. The change is being driven by the company's plan to provide customers with new technology and services that offer greater capabilities and lower costs. BT's performance has benefited from growth in new activities such as Information and Communications Technology (ICT) solutions, broadband, mobility and managed services, and continued cost efficiency programs.

During this transformation, BT has continued to deliver strong financial results. BT Group's turnover was £18.5 billion and revenues grew by 30% to £3,387 million. Earnings per share grew by 19%, almost doubling in two years. While continuing to invest for the future, BT generated cash flow of over £2 billion and reduced net debt

to £8.4 billion, a reduction of two-thirds from the amount three years ago.[8] The strong growth shows that BT's strategy is working well so far.

BT's goal is to help its customers benefit from improved communications and to spread the benefits of new technology widely. This is demonstrated by the firm's strategies regarding broadband, IP and Fixed Mobile Convergence (FMC), and its BT Education Program, which has enabled more than two million young people to participate in a drama-based campaign designed to help them improve their communications skills. In the future, BT plans to install IP to replace PSTN (Public Switched Telephone Networks), which has been operated for several decades, and Bluephone service as part of its FMC plans. These plans will require enormous resources in order to begin the changeover in 2006 and have it completed by 2008—much quicker than is typical for telecom network replacement.

Given BT's excellent condition, the UK regulator Ofcom recently announced a strategic review of the entire telecommunications sector, which will cover 21 key strategic questions, including the possibility of a structural separation of BT. Depending on the outcome of the review, BT may have to change its organization structure and response to the market. However, almost all of the world telecom companies have to compete under such regulations simply because they are one of the key infrastructure industries.

BT has been made strong efforts to reduce debt, manage costs, and improve customer satisfaction since 2001. This is apparent in the finance results described above and in the reduction in number of employees. In the 1980s BT had approximately 240,000 employees; by March, 2004, the number of employees had

dropped to 99,900.[9] In response, R&D expenses as a percent of group revenues increased to 1.9% in 2003 from 1.5% in 2002,[10] while most other telecom companies saw a decrease in expenses. One factor influencing this increase is the UK government's desire to increase the R&D share of GDP from its present 1.9% to 2.5% in 2014 by increasing spending on collaborative R&D and knowledge transfer.[11]

3.2.5 Current Strategies

BT's current strategy is to build long-term partnerships with its customers and maximize their satisfaction. The firm promises to supply traditional services with excellent quality of service as well as new-wave services such as ICT (Information and Communications Technology), broadband, mobility, and managed services.

Two major plans are on the horizon for execution in the coming years, as part of BT's overall strategy of improvement: Bluephone Project, a service of FMC (Fixed and Mobile Convergence), and replacement of all PSTN with IP networks.

(1) Bluephone Project

Bluephone will enable customers to have "one device, one number, and one bill."

"One device" means Bluephone can be used as a fixed phone indoors and as a cellular phone outdoors by taking advantage of GSM technology (Global System for Mobile communications) on a cellphone loaded with cutting-edge Bluetooth technology. Customers will only need one telephone number and will receive one bill

for from BT. BT leverages the MVNO (Mobile Virtual Network Operator) function supplied by Vodafone. As a result, customers have the advantages of low cost for a fixed network combined with all the functions and mobility of a cellular phone.

From a technical standpoint, Bluephone will accomplish this using UMA (Unlicensed Mobile Access) without a voice break between Bluetooth and the cellular phone networks. BT plans to use Bluetooth technology initially but it will also supply Bluephone with wireless LAN interface, WiFi, in 2006. The main differences between Bluetooth and WiFi are that WiFi consumes greater power but it will function at longer distances from the base station and at a faster communication speed than Bluetooth.

In 2001, BT sold its wireless division owing to increasing debt. Since then, BT has taken steps to improve its financial situation, recording increases in revenue in 2004. However, growth in the cellular phone business, which is highly profitable, is critical to maintaining that upward growth curve. As a result, BT decided that instead of acquiring a cellular company to supply Bluephone, they would use their own FMC services using MVNO. BT expects this service will earn £1 billion per year within five years.[12]

As a comparison, Korean Telecom (KT) has been offering its 'DU' service on a trial basis since July 2004. This service uses CDMA (Code Division Multiple Access) phones combined with Bluetooth, but there is no handover function between Bluetooth and the cellular phone networks.[13]

(2) Replacing PSTN with IP Networks

In October 2004, BT announced plans to replace all PSTN networks with IP networks. This task will begin in 2006 and finish in 2008. This announcement startled BT's competitors owing to the extraordinarily short timeframe for such an undertaking.

BT plans to develop IP networks and change half of its subscribers (about 10 million) to the new networks by 2008. By 2010, it will finish replacing all subscribers' lines. BT calculates it will require £2 billion per year for the IP replacement and expects to realize £1 billion per year as a result of lower costs resulting from the replacement. The conversion will reduce the number of network nodes and switching centers, resulting in reduced operating expenses.

As for access to IP networks, BT uses DSL and existing fixed lines (compared to NTT which uses FTTH). BT chose this access method which should will show a cost reduction much sooner than would occur if the access networks were replaced.

Endnotes for Chapter 3

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[1] For a history of AT&T, see: <http://www.att.com/history/>.

[2] InfoCom News Letter. See: <http://www.icr.co.jp/newsletter/topics/2001/t2001K005.html>.

[3] *Information and Communications handbook* 2005. InfoCom Research, 2004. Printed in Japan.

[4] For information on the percentage share of long distance communications, see: *Information Communication Handbook 2005*, InfoCom Research, Inc., NTT Data Institute of Management Consulting, Inc. 2004. Printed in Japan

[5] Clayton M. Christensen and Michael E. Raynor. *The Innovator's Solution: Creating and Sustaining Successful Growth.* Cambridge, MA: Harvard Business School Press, 2003.

[6] For information about SBC's acquisition of AT&T, see: <http://www.infoworld.com/article/05/01/31/HNsbcatt_1.html>.

[7] For a history of British Telecom, see: <http://en.wikipedia.org/wiki/British_Telecom>.

[8] For annual reviews and summary financial statement of British Telecom, 2004, see: <http://www.btplc.com/Sharesandperformance/Howwehavedone/Financialreports/Financialreports.htm>.

[9] British Telecom company profile, see: <http://www.btplc.com/Thegroup/Chartingourprogress/Numberof employees/employee.CFM>.

[10] For information on R&D spending, see: "Telcos must restructure the way they innovate," *Forrester Report*, October 6, 2004.

[11] For information on the UK government position for R&D share, see: Department for Education and Skills, "Science & innovation investment framework 2004 – 2014".

[12] For information on Bluephone, see: "Information and Communications Outlook 2005," InfoCom Research, Inc. 2004. Printed in Japan.

[13] For information on KT's DU service, see: Nikkei Communications, 1/15/2005.

Chapter Four

Comparing Three Telecommunications Companies

Following the overviews provided in the previous two chapters, I can now compare the characteristics of these companies and highlight key factors that may enable them to regain lost ground.

4.1 Current Financial Situation

In this section, I will review the profit structure of the three telecom companies. When discussing AT&T, I will include in the discussion the SBC acquisition of AT&T in January 2005.

Table 4-1 illustrates that operating revenues reflect a lateral movement or a decrease, while operating income is dependent on each company's situation. While AT&T and SBC show a deficit balance, BT and NTT have turned profitable. In terms of profit structure, fixed voice revenues have declined while revenues from mobile, broadband, and IT have increased. The differences between them seem to depend on whether or not the company has caught up with current trends.

Table 4-1 Summary of business results (2003)

	Operating revenue	Operating income	Net income for the year
AT&T	34,529	3,657	1,865
(unit: $million)	-7.8%	-16.2%	-
SBC	40,843	6,469	8,505
(unit: $million)	-5.3%	-25.0%	50.5%
BT	18,519	2,873	1,417
(unit: £million)	-1.1%	11.7%	-47.2%
NTT	10,923	1,364	233
(unit: ¥billion)	-0.9%	-	-

Source: Annual reports of each company

4.1.1 AT&T

For AT&T, the picture is one of stagnation in its business. For SBC, its voice revenues decline by 10.6% to $2,618 million, but data revenue including DSL grew by 5.3% to $511 million and long-distance voice grew by 10.2% to $237 million. However, these increases cannot cover declining local voice revenues. (SBC owns 60% of Cingular Wireless, but this is not included in SBC's consolidated group.)

4.1.2 BT

In comparison, BT's traditional business declined by 6.1% but revenues from new-wave innovations such as ICT and broadband grew by 29.7%. So far, traditional businesses account for over 80% of revenues. Even if the new wave innovations are going strong, the amount remains a very small percentage of total revenues. As a result, BT recorded 1.1% yield decrease overall.

4.1.3 NTT

As for NTT, voice revenues are decreasing, but the cellular business has made an excellent recovery, which has meant an overall recovery in NTT's business results. With regard to the ICT business, it is expected to keep growing but will not increase dramatically. Moreover, the cellphone market is becoming saturated.

Thus, each carrier will need to identify ways to develop a more stable profit structure that will fill the gap created by the decline in revenues caused by the replacement of fixed voice communications.

4.2 R&D

4.2.1 Changing Circumstances

The R&D intensity of telecom companies is shown in Table 4-2, which indicates that AT&T used to have the highest R&D intensity with a ratio of R&D to sales 3.5 times larger than BT, which had the lowest intensity.

Table 4-2 R&D as percent of sales

	1987	1991	1993	2001	2002	2003
AT&T	7.3%					
BT	2.1%	1.9%		1.2%	1.5%	1.9%
NTT	3.8%	4.1%	4.7%			3.6%

Sources: Martin Fransman, *Visions of Innovation*[1]; each company's annual report[2,3]

In the last two decades, this scenario has changed dramatically. AT&T shifted its Bell Laboratories to Lucent Technologies wing to competition with Baby Bells and then spun off Lucent Technologies. Then AT&T built other laboratories inside the company to improve its competitiveness. Considering their business results, the ratio of R&D in AT&T and Lucent Technologies is not as high as in previous years.

In 2001, Alcatel tried to acquire Lucent Technologies. This merger fell through, but this bold move caused other telecom companies to think about their R&D laboratories. One effect of this series of moves was to make researchers at Bell Laboratories and other AT&T Laboratories feel as thought they were unimportant. For researchers and technicians, it is important to keep their motivation and passions high. We can learn from AT&T's case that motivated researchers and stable circumstances with sufficient R&D funding is critical for enabling researchers to continually develop innovations.

4.2.2 Transition from Research to Markets: BT, NTT

The percentage of R&D also reflects a company's strategy for making the transition from research to market. The differences appear in how the company depends on its internal R&D.

(a) BT

BT changed its R&D structure dramatically after the 2001 restructuring. In the past, the research section supplied its achievements only to the development section. Then the results moved from one part of the business to the next, in order:

from research, to development, deployment, operations, marketing, sales and finally to customers. After the restructuring, however, the research section now gives it know-how and products to every part of the business. And if necessary, they can contact customers directly. To achieve this, they also leverage academic and commercial partners more often than before. This scheme helps implement new plans, such as IP replacing PSTN and the Bluephone project, using variety of available technologies that are low cost and effective in the short term.

Bringing the marketing capability to laboratories is another key factor for R&D in today's rapidly changing markets. This was especially necessary because it required a major change in corporate culture and the employees' mindset. All employees, including the R&D people, are now more focused on their customers, and the company is more willing to take risks and be the first user. This new strategy sometimes causes confusion but overall it has had a beneficial effect on reactivating the entire company. Now everyone is working their business and restructuring simultaneously, and the new management team put in place in 2001 has been actively advancing this strategy.

(b) NTT

Before IP and mobile communications appeared, NTT Laboratories was the center of vertical integration because product specifications were decided in the lab and the technologies studied there were leveraged by the company's operating and marketing sections for their businesses. The product development process was

linear, from research to sales, and laboratories seldom had encounters with customers.

After changing some of these circumstances, NTT tried to hold onto the original scheme for a while long, thinking it could respond to the change in its legacy scheme, but it could not. At first, NTT Laboratories tried to increase their contribution of technology and know-how to meet the requirements of the subsidiaries. Again, this strategy failed because there was no evaluation of the requirements.

In 2003, NTT established a producers' institute composed of researchers and marketing people, which was responsible for both development and marketing. This strategy has been successful and NTT is using it to execute R&D that is balanced between technology and marketing.

4.2.3 VoIP's influence to R&D and the Telecom Market

Here I would like to describe a typical example of bringing existing technology to markets—the case of VoIP penetration. The boom in the use of VoIP began in 2001 in Japan and in 2003 in the U.S. and the U.K.

In Japan, the trigger was Softbank's sudden decision to enter the Japanese telecom industry with a DSL product and VoIP service. At the time, Softbank was in serious financial trouble with a huge deficit caused by a slump in its investment business. So it decided to move into the communication infrastructure business as a revival measure. The company focused on DSL, which had not yet penetrated the Japanese market, and on VoIP services—both of which could use existing technologies and infrastructure. With the entrance of VoIP into the market, the rate

structure for telephone use was destroyed. NTT already had these technologies for some time but it had refused to introduce DSL and VoIP. Prior to VoIP, ISDN was actually increasing revenue to NTT, and the company had future plans to transfer ISDN users to FTTH, both of which use digital technology, not analog, like DSL. In addition, NTT thought that VoIP's quality of service would not satisfy demanding telephone users.

However, it turned out these were easy problems to conquer. NTT was actually more worried about the destruction of its profitable rate structure and the cannibalization of its existing telephone services, which are their core businesses and make a major addition to the company's revenue stream.

So, when Softbank decided to enter the VoIP market, it forced NTT to do the same; NTT could not longer ignore the situation nor allow Softbank to take away its telephone user base. If NTT lost its market share, its option would be to collect future revenue from broadband services. Once NTT decided to enter the VoIP market, it had no way to join the price war against Softbank.

The introduction of VoIP has had three impacts on the telecom industry:

1. The competitive structure of the industry has changed. Any company offering VoIP finds that local, long distance, cellular, satellite communications, and cable companies are now all competitors.
2. The rate level for telephone calls is changed. When competition between bundled services gets tougher, price destruction also occurs, both in the U.S. and in other countries.

3. VoIP allows users to keep their phone number no matter where they move. The telephone number is not linked to a user address, so it is possible to remove the differences between local and long distance calls. Thus IP will have a major impact on pricing strategies for telecom companies. Competition is no longer waged over service areas and fields. From an R&D standpoint, it is necessary to change their primary research focus from infrastructure to new services.

4.3 Strategies

In the U.S., AT&T has gone through repeated doing mergers and acquisitions since privatization in order to maintain its growth and to satisfy stock market pressures (see Table 4-3).

Table 4-3 History of AT&T's market fields

	R&D	Manufacture	Computer	Local	Long-distance	Wireless	Broadband
1984 Privatization & Division	Bell Labs. ->Spin-off Lucent Tec.	AT&T ->Spin-off Lucent Tec.		AT&T ->Baby Bells	AT&T Consumer/ Business		
1991			Acquire NCR ->Spin-off				
1993						Acquire McCaw	
1996 Divestiture							
1998	AT&T Labs.			Acquire TCG			
1999							Acquire TCI
2000 Division				AT&T Consumer/ Business		AT&T Wireless ->Spin-off	Acquire MediaOne
2001							AT&T Broadband ->merge with Comcast
2002							
2003							
2004							
2005				SBC		SBC (Cingular)	SBC

Source: Author, 2005

The acquisition of NCR was done to achieve bring AT&T into the computer arena. But the acquisition of McCaw Cellular ended up being spun off as AT&T Wireless. AT&T Broadband, originally composed of TCI and MediaOne, then merged with Comcast. In the local communications sector, AT&T acquired TCG, renamed it, and created a new family of companies called AT&T Business/ Consumer. AT&T wasted $50 billion on M&As over a decade, but in the end nothing remained.

AT&T's current business segments are shown in Table 4-4. AT&T will have local, wireless, and broadband in addition to its remaining long-distance section, depending on the outcome of its acquisition by SBC.

Table 4-4. Current Business Segmentation

	AT&T	BT	NTT
R&D	AT&T Labs.	Research, One-IT	NTT Labs.
Manufacture	Lost Lucent	Not own	Not own
Computer	Lost NCR	Not own	Not own
Local	SBC	BT Wholesale/ Retail	NTT East/ West
Long-distance	AT&T	Global Services	NTT Communications
Wireless	SBC (Cingular)	Lost O2	NTT DoCoMo
Broadband	SBC	Wholesale, Retail	NTT East/ West/ Communications/ Resonant

Source: Author, 2005

BT found itself in a predicament due to its huge investment to create an overseas presence and the expensive purchase of a 3G cellphone license, which was forced on the company by strong competition from Vodafone. BT restructured the company, focusing on customers in an effort to emerge from its stagnant status.

Today, all sectors except international communications are handled by BT Wholesale and BT Retail. BT no longer has a wireless sector due to the spin-off of O2. The company plans to supply Bluephone as an FMC service, using Vodafone's Mobile Virtual Network Operator (MVNO) function.

In sharp contrast to AT&T, BT has announced two innovative plans: replacing all legacy telephone networks with IP, and the Bluephone service. The company is also moving forward with information and communications technology. Clearly, BT is taking serious steps to survive in the telecom industry.

As for NTT, it is also seeking the next "killer application" for communication services, such as all-IP replacement and RENA services. However, in its current organizational structure as NTT Group, business areas are duplicated within each of the group companies. As a result, it sometimes results in competition between group companies. Another concern with the Group's organizational structure is potential problems with supplying FMC services.

Endnotes for Chapter 4

[1] Martin Fransman, "Visions of Innovation, The Firm and Japan", Oxford university press, 1999

[2] BT's annual reports: http://www.btplc.com/Sharesandperformance/Howwehavedone/Financialreports/Annualreports/AnnualReports.htm

[3] NTT's annual reports: http://www.ntt.co.jp/ir/e/report.html

Chapter Five

Growth Factors and Scenarios for the Future

5.1 Factors Effecting the Growth of Telecom Companies

Several factors affect trends in the telecom industry. In this chapter, I will discuss several and explain how they influence growth in telecom companies.

5.1.1 Changes in Technologies

(1) VoIP & Consumer Broadband

VoIP and consumer broadband have moved into high gear since 2000 in Japan and since about 2003 in the U.S. VoIP makes it possible to use the Internet as the network structure so operating costs are much lower than fixed-phone networks. In other words, IP technology forces a rebuilding of traditional cost structures and results in market disruptions in the current telecom industry. It was originally thought that this transition would take more time to appear. However, BT, KDDI, and NTT announced in 2004 their plans to replace legacy telephone networks with all-IP networks. In addition, wireless communication is also following the trend of replacing with IP networks.

Therefore, the company that can take the lead in making a smooth transition from legacy networks to new IP networks will find itself in the strongest competitive

position. However, there are many competitors in the IP technology sector, such as manufacturers, telecom carriers, cable companies, computer software companies and Internet service providers. At present, it is not clear who has sufficient strength to lead this movement. Moreover, network equipment becomes commoditized and the price of network usage will be not as high, so use of this technology as a major source of revenue is not practical; it will be more useful in software that enhances user-friendliness or adds fun to an application.

(2) Fixed and Mobile Convergence (FMC)

Cellphone penetration in developed countries is coming close to saturation. As mentioned earlier, the use of IP will bring disruption to the cost structures not only for fixed phone service but also cellphone service.

A recent survey showed that 30% of cellphone use in the U.K. occurs inside buildings, and wireless network technologies, such as WiFi, have become widespread in recent years. In such a scenario, cellular companies and telecom companies are seeking new killer services that will recover the decreasing income caused by IP technology. FMC, a combination of fixed and mobile networks using one terminal, could be one such killer service because it is possible to use Bluetooth or WiFi inside buildings.

5.1.2 Changes in the Markets

(1) Open Source

In the telecom industry, carriers used their own proprietary systems and software to run their operating networks, which enabled them to supply unique services for customers of each carrier.

In Japan, NTT has a strong lead in the industry, even over manufacturing companies such as Fujitsu, NEC, Oki, and Hitachi. NTT has realized major profits as a result of its own R&D and manufacturing. The manufacturing companies produced hardware equipment and software to meet the requirements of NTT.

Today, however, as IP technology begins to penetrate the industry, proprietary software is not only very costly but also requires a long development period. For this reason, most telecom companies have switched to using open-source software—as have many other IT industries in recent years. This switch to open-source software has caused major changes in relationships with manufacturing companies, as well as in the development process and clock speed of the industry.

(2) Proactive Commoditization

As other telecom companies have begun to offer VoIP service, competition on IP networks has accelerated. In Japan, VoIP and DSL services have suddenly increased dramatically, which resulted in a price war with Softbank. As a result, commoditization in telecom services, including price competition, segmented users, and advanced services, have progressed far more quickly than NTT expected. DSL expanded rapidly as a result of synergies between increased user demand for

Internet service and a high-speed network. However, after achieving 35% penetration, DSL expansion hit its limit and now growth is increasing among FTTH users. In the early days of FTTH, customers felt both initial installation costs and the operating fees were very expensive. But today the price of FTTH is dropping.

Thus, even if technologies continue to progress, commoditization continues at the same time. The time has come for telecom companies to decide how they can best earn a profit, not just from network use but also from content and advanced services.

5.1.3 Changes in Company and Industry Structure

Change is occurring the organization structure of the industry as well. Several functional consolidations have occurred recently that have produced organizational structure quite different from legacy conglomerates. On the other hand, abolishing or merging between telecom carriers has occurred repeatedly following privatization of carriers in developed countries. This has resulted in changed relationships between fixed and cellular companies. For instance, in Europe, FT and BT use the cellular network as a reseller which helps to reduce capital intensity for these companies. In the U.S., mergers are booming again. In Japan, each telecom group has cellular companies as subsidiaries. The only exception is Softbank which has been refused to enter the wireless communication business, but it has not entirely given up yet. In addition, as telecom companies shift to advanced network service suppliers, new competitors appear in the form of computer software companies and Internet service providers.

In the long term, it is not likely to be a simple structure, such as a few mega carriers, that capture the global market. Instead it will be more apt to be reorganized from geographical segmentation to functional specialization, like the following:

- High-profit businesses supplying advanced services via mega carriers
- National brands business that has become commoditized
- Solutions-oriented business for solving regional problems and various niche businesses.

Advances in technology, such as broadband and IP, created tremendous user interest and a requirement for greater bandwidth capacity and low prices for communications. In the other words, broadband promoted the need for greater capacity in the communication networks, and IP technology disrupted traditional cost structures. As a result, communication has evolved from peripheral services based on disruptive innovations to commoditized services. If other innovations are developed, it will accelerate the speed of commoditization even more and reduce cost. Achieving cost leadership is one of the major objectives of innovation.

5.2 Scenarios for the Future

A number of factors influence corporate value growth, and these must be understood in order to improve the profitability of business structures and allocate resources adequately. R&D also bears a major portion of the responsibility for sustaining growth in the telecom industry. Table 5-1 shows several of these factors.

Table 5-1 Sources of Corporate Growth

Source	R&D input	Sustain-ability	Industry consolida-tion	Proactive commod-itization	Key factors
Price	Low	Medium	Low	**High**	Inflation Capacity/demand
Market growth	Low	**High**	Medium	Medium	GDP growth Geographical expansions
Market penetration	Medium	**High**	Medium	**High**	Substitutions Technology-driven products
Market share	**High**	**High**	Medium	**High**	Product performance and cost position
Manufacturing cost	**High**	Medium	**High**	Medium	Competitive pressure Cost of capital
Overhead reduction	Low	Low	**High**	Low	Competitive pressure Consolidation

Source: Boer, 1999 (modified by author, 2005)

Price is a major source of growth. Over the long term, price increases are driven by inflation. Commoditization used to be a natural trend when a market became mature and excess supply caused prices to drop. Nowadays, proactive commoditization can be driven strategically by companies in a mature industry to control the speed and amount of commoditization.

Market growth is an important and sustainable source of corporate earnings growth. Strategic positioning in the right markets affects growth projections, independent of R&D intensity.

Market penetration is also effected by R&D, when the products are technology-driven. However, most popular products are market-driven these days, and require a proactive strategy.

Market share is closely related to market penetration and price. In a highly competitive, commoditized market, R&D contributes to reducing cost and creates differentiation from other products. Strategic price setting and release timing are crucial factors for capturing more market share.

Manufacturing cost can be an important component of growth. To decrease cost, manufacturing processes must be improved and R&D can often support such a move. In addition, industry consolidation can cause functional partnerships between companies, and bring cost savings to manufacturing. This phenomenon is also shown in overhead reduction.

In this way, R&D and sustainability play a major role in the preparation and takeoff phases for industry. But when the industry reaches the mature phase, collaboration among related companies and well-planned marketing strategies become crucial.

The efficiency of R&D in Japan has been declining for over two decades, as reported by a White Paper on Science and Technology in 2003.[1] In this report, efficiency of R&D is defined as follows:

Efficiency of R&D = Operating profits per company over the past five years / R&D expenses per company over the past five years

This equation shows that uncertainty in markets has been increasing, making it difficult to set R&D goals due to ambiguous market needs. Nevertheless, it remains true that R&D will continue to bring success to a business.

In a commoditized situation, the essential problem is not technological improvement (although, of course it is necessary) but is marketing capabilities that devise new strategies to accelerating clock speed and reform cost structures. Three factors influence competition in the telecom market: price, service content, and systems. However, system reliability, efficiency and stability are things every company should have. So it is not such a strong differentiator for customers. On the other hand, price and service content reflect a company's marketing strategies and price structures, and they have direct appeal and power with customers.

The key factors influencing marketing strategies and cost structure are the speed of proactive commoditization and market organization. I have developed some possible scenarios for the future of the telecom industry using the matrix shown in Table 5-2.

Table 5-2 Possible Scenarios

		Proactive commodities	
		Rapid growth	Slow growth
Industry consolidation	Progressed	Scenario 2	Scenario 1
	Not progressed	Scenario 3	

(1) Scenario 1

If proactive commoditization is slow, the telecom industry would be reorganized along the lines of functional consolidation. In this scenario, a changed organization structure and promotion of efficiency would prevail over learning more about customers. The focus is to take control of cost leadership from other companies. On the other hand, with slow commoditization, it would be much easier for employees to accept the changes than in the other scenarios.

(2) Scenario 2

If proactive commoditization is rapid, the telecom industry would be reorganized along the lines of functional consolidation. In this case, it is necessary to promote reform for both external relationships and internal structure. It would be hard for front-line employees to accomplish such reform, but in this scenario the effect of reform on competitiveness would be the strongest of the three scenarios.

(3) Scenario 3

If proactive commoditization is rapid, the telecom industry would retain its current structure. In this scenario, a company would seize the initiative and promote proactive commoditization independently. But there are major financial and competitive risks. And it would require consistent, strong convictions on the part of all employees throughout the company.

Endnotes for Chapter Five

[1] Ministry of Education, Culture, Sports, Science and Technology: "White Paper on Science and Technology," 2003.

Chapter Six

R&D Objectives and Models for Transition to Business

6.1 R&D Objectives

In this section I describe objectives for R&D and organizational issues related to the structure of R&D which will contribute new movement to the market.

6.1.1 Market Dynamics

As discussed in the preceding chapter, the market dynamics of the telecom field have changed dramatically in the past two decades following the strong penetration of IP and wireless services into the market. Whereas communication services used to exist separately in each of the media—voice, data, and wireless—and network protocols were standardized to facilitate interoperability between switches made by different manufacturers, now both data and voice are transmitted on IP networks, and seamless service between fixed networks and cellphone networks is a requirement for all suppliers of commercial services. This has resulted in convergence among multiple network services such as VoIP and FMC (Fixed and Mobile Convergence).

IP and wireless are two major innovations in communication networks. As they became widely accepted, the focus of innovation shifted from networks to service as these two innovations became commoditized. Telecom companies

previously focused on speeding up data transmission and improving network failure recovery because their income depended on the number of customers who used their networks. Today, with the popularity of flat rate charges, companies are focusing on services that differentiate them from the rest of the field and new security methods that increase customer confidence in those services. Such technologies are progressing quickly, which has resulted in rapid acceleration of the clock speed in this industry.

6.1.2 Competitive Strategies and R&D Objectives

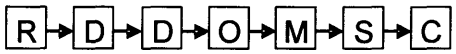
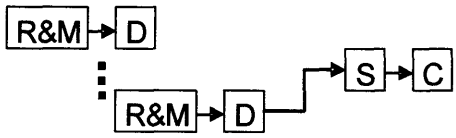
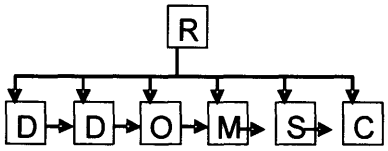
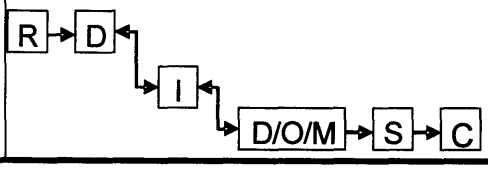
As the environment surrounding telecom companies' changes, R&D objectives are also changing. In the past, a long-term R&D objective was to develop network architecture and equipment for constructing the company's own high-volume networks. However, in today's circumstances, the competitive strategies of telecom companies are much more short term, including cost leadership, differentiated services that attract new customers, and risk management for customers and themselves. Consequently, R&D objectives today have shifted to supporting these new competitive strategies and to realizing faster development that attracts more customers with appealing commoditized services. In the older, legacy organization structure, it would be difficult to realize this type of innovation. So it is necessary to rethink R&D structure in telecom companies.

6.2 Models for Transitioning from R&D to Business

I would like to propose an R&D structure for telecom companies that would enable them to realize the competitive strategies that are part of the R&D objectives.

6.2.1 Types of Transition Models

There are several types of transition models that move a company from R&D to business. Five major models are shown in Figure 6-1.

	Structure	Skeleton
Linear model		Research, Development, Deployment, Operations, Marketing, Sales, and Customers are linked linearly.
Flow model		In linear model, some people shift to the next phase with service or product that they relate.
Iterative model		Research with Marketing team for specs and to make prototype. After repeating this cycle, products move to sales phase.
Circular model		Research team contributes to all phases of the transition from the technological view.
Intermediary model		Intermediary is composed of tech and marketing people who create strategies for Development and Marketing.

Notes: R: research, D: development, D: deployment, O: operations, M: marketing, S: sales, C: customers

Fig. 6-1 Transition models

6.2.2 Characteristics of Transition Models

Each model is described below.

(1) Linear model

The roles of each phase are clearly distinguished. It is necessary to arrange specifications, content, and job schedules only with the next-phase people. In other words, research people seldom have opportunities to talk with marketing people and customers. A certain amount of time is required before moving to the next phase, so this model often uses long-term rather than short-term plans.

(2) Flow model

The basic structure is the same as the linear model. The difference is that the flow model involves shifting resources, including human resources, to an ongoing product or service. In this model, people who are shifted are usually key people from earlier phases who bring all of their accumulated technologies and know-how with them. Compared to the linear model, the flow model has stronger relationships between phases. Often key people have prior experience with all phases. In this model, as well as the linear model, the duration through all phases is quite long.

(3) Iterative model

In this model, research and marketing people cooperate at the beginning of the project to determine product specifications. Once specifications are tentatively fixed, the development team can quickly make a prototype. By repeating this cycle

several times, final specifications are determined and the product or service can be brought to the commercial phase. This model is suitable for products that have considerable uncertainty or that are expected to have relatively shorter life cycles.

In the iterative model, the relationships between technology and marketing people are very close due to the collaboration required to quickly create the prototype. Moreover, depending on the kind of product, the prototype can be shown to customers during the early stage. The feedback at an early point in the development helps to shorten development time and strengthens customer satisfaction.

(4) Circular model

The basic structure is the same as the linear model from development to customers. The difference is that the research team contributes to all phases of the transition flow from a technological viewpoint. Therefore, the research team must have relationships with the entire organization, sometimes with customers as well. This is helpful for each phase because the team can obtain needed information and technical skills directly from the relevant researchers.

On the other hand, researchers are required to possess a variety of skills and experience. This model is helpful for shortening development duration and strengthening customer satisfaction.

Compared with the iterative model, this model would shorten each phase but repetitive prototyping would not be done. It is most suitable for products that are made under restricted conditions.

(5) Intermediary model

The basic structure is the same as the linear model, but the intermediary team exists between R&D and the commercial business side and includes deployment, operations, and sales. This team is composed of technical people from the labs and marketing people from the business side. It manages both development and marketing strategies. The purpose of this model is to reduce the gap between R&D and business and maximize the value of R&D products.

Compared with the linear model, R&D in this model needs closer relationships with the business side. Development duration in this model depends on the strategies decided on by the intermediary team.

6.2.3 Segmentation Factors

There are a number of factors that help a company decide which transition model is appropriate. These factors include:

- life cycle of products or services (clock speed: fast/slow)
- competitiveness (the amount of competitors: many/few)
- types of customers (market capacity: many/few)
- types of technologies (integral/modular)

"Market capacity" denotes the volume of users buying a product. Customized product has few market capacities. These factors are corresponding to the dimensions used for "make versus buy" decision making.[1] Therefore, it is possible to show these factors on a single distribution map and then place companies in major industries where they fit. Before doing this, I will briefly describe the companies first.

(1) IBM[2]

IBM is in the process of closing business units that have no potential for growth to find ways to get away from legacy big firm's constitution. Consequently, it decided to create an Engineering and Technology Service business unit (E&TS) which will offer design services for developing electronic devices; also an on-demand e-solution business unit that includes use of an IT platform from the customers' viewpoint.

As for R&D, IBM has eight fundamental research laboratories worldwide with 3,000 researchers. From the beginning, IBM has focused on integration—from parts and product-based integration for commoditization, to system and solution-based integrations for the creation of new values.[3] On this process, researchers deliver technical assistance for business activities. It can be said IBM adopts circular model.

(2) Sony[4]

Sony aims to stabilize its ratio of overseas production at 35% due to its policy of manufacturing near its marketplace. Sony has one world headquarters in Tokyo and three operational headquarters in Germany, the U.S., and Singapore, which include sales, manufacturing, R&D, and engineering. Sony's organization structure is very autonomous and flexible. To accomplish purpose of business, each section including R&D gets involved with each other (circular model).

(3) DELL[5]

Dell emphasizes customer satisfaction by offering a wide range of choices, keeping costs low, and improving product and process interoperability. Their R&D

model enables Dell to partner with industry-leading suppliers to integrate "best-of-breed" technologies, services, and industry-standard components to give customers some of the latest relevant technology at an aggressive price. In this point, Dell's structure is circular model. Dell's participation in the Standards Body will help establish standards that benefit both the vendor and customer communities.

(4) Siemens [6 7]

Siemens maintains a Technology-To-Business Center (TTB) that is unique to Siemens. It converts nascent technologies into profitable businesses. The process is composed of finding nascent technologies from all over the world that have potential, using Siemens' technicians to quickly make prototypes, improve them repeatedly (iterative model), and then sell the product through Siemens' worldwide sales channel. As for R&D strategy, Siemens is trying to be a "trendsetter," that is, a company that succeeds in establishing a new technology, a *de facto* standard, or an indispensable feature in as many fields of business as possible. IBM, Microsoft, and Intel are similar trendsetters.

(5) BMW [8]

Automobile development in the 1990s entailed a process that took five years from design concepts to finalizing. The basic process involves repeated prototyping. However, BMW has reduced its development time to 30 months with the introduction of simulations, digital mock-ups, and digital assembly. In the old design process, time per iteration was about 12 weeks, and four or five iterations were possible.

Using the new computer-aided-styling (CAS) technology, time per iteration has been shortened to 7-10 days and more than ten iterations can be done. They use iterative structure model.

(6) IDEO [9]

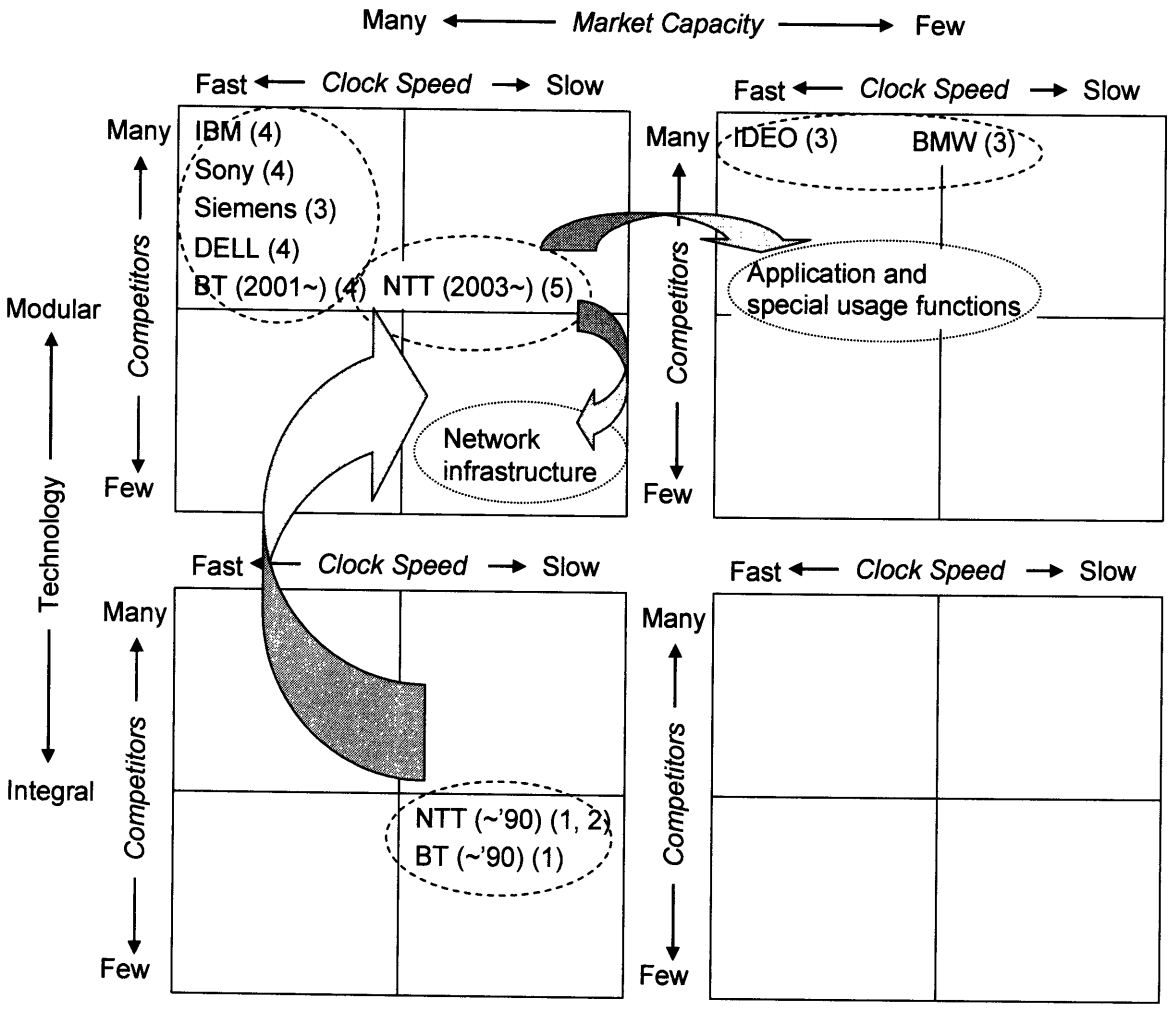
IDEO emphasizes both design and engineering equally. Frequent prototyping (iterative model) is the best way for the company to communicate with its clients, marketers, experts, and end users. Rapid prototyping follows a strategy of "rough, rapid, and right." The company accepts failure as part of its culture.

Here is a segmentation matrix which maps the major companies, as well as BT and NTT (see Figure 6-2). The matrix denotes the relationship between segmentation factors and transition model. Transition model number, (1) Linear model, (2) Flow model, (3) Iterative model, (4) Circular model and (5) Intermediary model are in parentheses.

As the figure shows, with fast clock time, the competitive companies in each industry tend to adopt the iterative model and the circular model as their R&D transitions to business. If they use the iterative model, the number of repetitions trades off with production cost. So these companies try to make very robust prototypes quickly and introduce computer-aided digital processing as soon as they can.

Companies that use the circular model generally identify new technologies and products from outside the company and around the world. Then they integrate,

arrange, and sell products using their full sales power. Therefore, the main task for R&D is to integrate and provide technical support for deployment and sales, while fundamental research is another alternative.



Source: Author, 2005

Fig. 6-2 Segmentation Matrix

BT and NTT used to be "integral technology" segmentation, because they were monopoly in each country's telecom industry and they could make every system by themselves in long span. But they changed to "modular technology" after their reforms. To keep abreast of changes in the market, they tried to use external

technologies efficiently. BT adopted the circular model, and it has unbundled services in order to integrate them more easily to meet customer needs. NTT adopted the intermediary model as one way to transition from a linear model to a circular model. In the future, it will be possible to be split into two parts: one for developing network infrastructure, and the other for applications and special-use functions. The reason why I think so is these two parts have totally different characteristics. It would be one possibility to strengthen engineering and technology service section for improving clock speed to comply with customers' requests quickly.

In this scenario, it is unnecessary to make everything inside the company. More important is to identify customer needs and incorporate those into the new product faster than competitors. To do this, capabilities such as mining in companies or universities that may have useful technologies that can shorten the development time is of key importance.

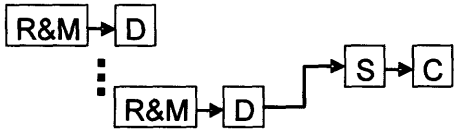
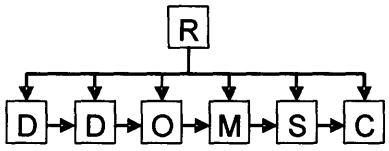
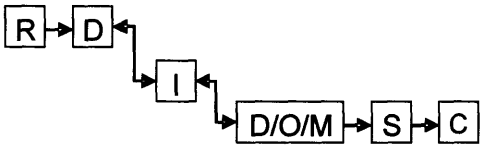
6.2.4 Assessment of a Possible Transition Model

Here I focus on which model corresponds best with each scenario (see Figure 6-3). The scenario numbers relate to those previously described in Table 5-2.

The linear model and flow model take a long time to transit from R&D to business, and R&D seldom has opportunities to learn about market needs. Therefore these models are deemed not appropriate for either current or future conditions.

The iterative model is basically adequate in all conditions. But when an industry is undergoing consolidation, it may be difficult for team members from both

sides to understand the others on the project team, and such cooperation and understanding is critical to quick executing prototypes.

Model	Structure	Scenario		
		1	2	3
		Slow	Rapid commoditization	
		Progressed consolidation		Not progressed
Linear model		Low	Low	Low
Flow model		Low	Low	Low
Iterative model		Middle	Middle	**High**
Circular model		Middle	**High**	**High**
Intermediary model		**High**	Middle	Middle

Source: Author, 2005

Fig. 6-3 Adequacy of transition model to handle possible scenarios

The circular model is the best solution for transitioning from R&D to business in an environment of proactive commoditization, no matter what the future scenario

will be expected to be. This model can respond to kaleidoscopic changes in the market as well as to external factors. This model does require a range of capabilities and knowledge, from research to marketing, and sales and extremely high performance are required of researchers working in this model. The difference between success and failure depends on their personal and team quality.

The intermediary model corresponds to every scenario. However, under rapid growth of proactive commoditization, it would be concerned with corresponding speed to external changes because all burdens would be concentrated on the intermediary team. Even in the case of slow growth, it is necessary to assign the right people to this team who has sufficient knowledge and experience with technologies and marketing.

Depending on the organization structure, many changes may be required, including defining the role of R&D, identifying the requisite capabilities, allocating R&D resources including expenses and human resources, clarifying the mindset of team members and employees, establishing indicators of evaluation, building relationships with customers, and shortening the time for development.

The telecom market has been changing dramatically in recent years, but the corporate structure remains a typical one – vertically integrated with linear relationship that can no longer adapt to change. It is absolutely imperative that companies wish to grow and prosper become willing to adapt structures that will create flexibility, and ability to diversity, and a willingness to change now.

Endnotes for Chapter Six

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[1] Charles H. Fine, *Clock Speed.* New York: Basic Books, 1998.

[2] Special report of Fuji-Keizai USA.< http://www.fuji-keizai.com/j/report/ibm_us_j.html>.

[3] IBM News: <http://ascii24.com/news/i/keyp/article/2004/07/30/650861-000.html?geta>.

[4] Sony history: <http://www.sony.co.jp/Fun/SH/2-18/h4.html>.

[5] Dell website: <http://www1.us.dell.com/content/topics/global.aspx/corp/standards/en/index?c=us&l=en&s=corp>.

[6] Siemens website: <http://www.ttb.siemens.com/arch_6.html>.

[7] Siemens Technology To Business (TTB) Center: <http://www.ttb.siemens.com/index.html>.

[8] Stefan Thomke, "BMW AG: The Digital Car Project," Harvard Business School Case Study No. 9-699-044, November 1, 2001

[9] Stefan Thomke and Ashok Nimgade, "IDEO Product Development", Harvard Business School Case Study No. 9-600-143, October 4, 2000.

Chapter Seven

Future Strategies

7.1 Possible Strategies

As discussed earlier, many world telecom carriers were privatized in the 1980s. Since that time, AT&T, BT, and NTT have taken steps to change their strategies to meet current demands and to respond to external changes, such as the introduction of IP and the widespread penetration of wireless communications.

AT&T has gone through repeated purchases and sales of companies to survive heavy competition in the U.S.

BT went through a dramatic reformation in 2001, including reshuffling zones of management. It also announced innovative strategies, such as all-IP replacement of its legacy telephone networks and its Bluephone project, real examples of fixed and mobile convergence (FMC). BT's reform was customer-oriented as a result of that they thought customers wanted in the company. On the other hand, after the internal reform, BT decided to buy the technologies it needed from external companies. R&D has been required to contribute to all phases of the business including deployment, operations, and sales.

NTT was divided into a holding company and five subsidiaries in 1999. NTT's strategies fell in the middle between those of AT&T and BT, largely because NTT was affected by U.S. and Japanese government policies and also because of the

crisis atmosphere owing to current economic conditions. At the same time, NTT decided to pursue advances in IP networks and begin to move from legacy telephone networks, similar to BT. Regarding R&D, NTT is focused on internal development for the long term, similar to AT&T.

Telecom companies used to execute R&D via long-range plans because the major issues requiring research were about network infrastructure which had been in use for several decades. However, given the current commoditization of network services, the most important factor for telecom companies' strategies has changed to ***how to innovate new services or products quickly in order to respond to rapid changes in markets and technologies.***

As shown in the preceding chapter, the ***R&D structure*** needs to be changed, and the circular model is appropriate in any future scenarios in which commoditization is progressing or where industry consolidation is advanced. In addition, innovation must be considered from the standpoint of ***resource assignment, corporate culture, and the mindset of employees***.

I will describe these issues to clarify possible strategies for NTT.

7.2 Organization and Processes

7.2.1 Strengthening the flexibility of R&D's role and structure

In Chapter 5, I discussed five models that can be used to move from R&D to business. The circular model, which was adopted by BT, is well suited for situations involving kaleidoscopic changes of market and other external factors. Legacy R&D structures, such as the linear model and the flow model, in which research was

executed only for the next-step development or deployment, cannot deal with the frequent and dynamic change needed today. These models are effective only for long-term research. The intermediary model, currently used by NTT, works well at the mid-term stage from the linear model to the circular model, as it enables technology people to get involved not only with R&D but also with business strategy. In the intermediary model, the interface between R&D and business is concentrated. However, sufficient intermediaries are needed in order to balance both researchers and marketing people if the model is to function well. If these are missing, it could result in a bottleneck.

To relieve the burden on specific people and alleviate anxiety about bottlenecks, I believe NTT should shift to the circular model in the near future. This change would help researchers move more quickly up the learning curve so they become more knowledgeable about markets and customers.

The steps needed in order to adopt a new model are the following.

(1) Select research issues carefully

Unnecessary research should be completed immediately. If any product or service already exists, use it in a positive way. Identifying the quality of external technologies is key for this step. Siemens' Technology-To-Business center and BT's liaison person could take on this role. Human resources and expenses should be focused on selecting an important research issue. When selecting them, it is helpful to gather opinions from the business side as well. This step should be repeated at regular intervals.

(2) Communicate research issues to the relevant business sections

Each research group should execute effective research. In this step, the essential capability of each group leader is communication with the related business section and with external companies and/or universities. Another requirement is strong project management skills because in the circular model each leader assumes responsibility as an intermediary between the R&D and business side.

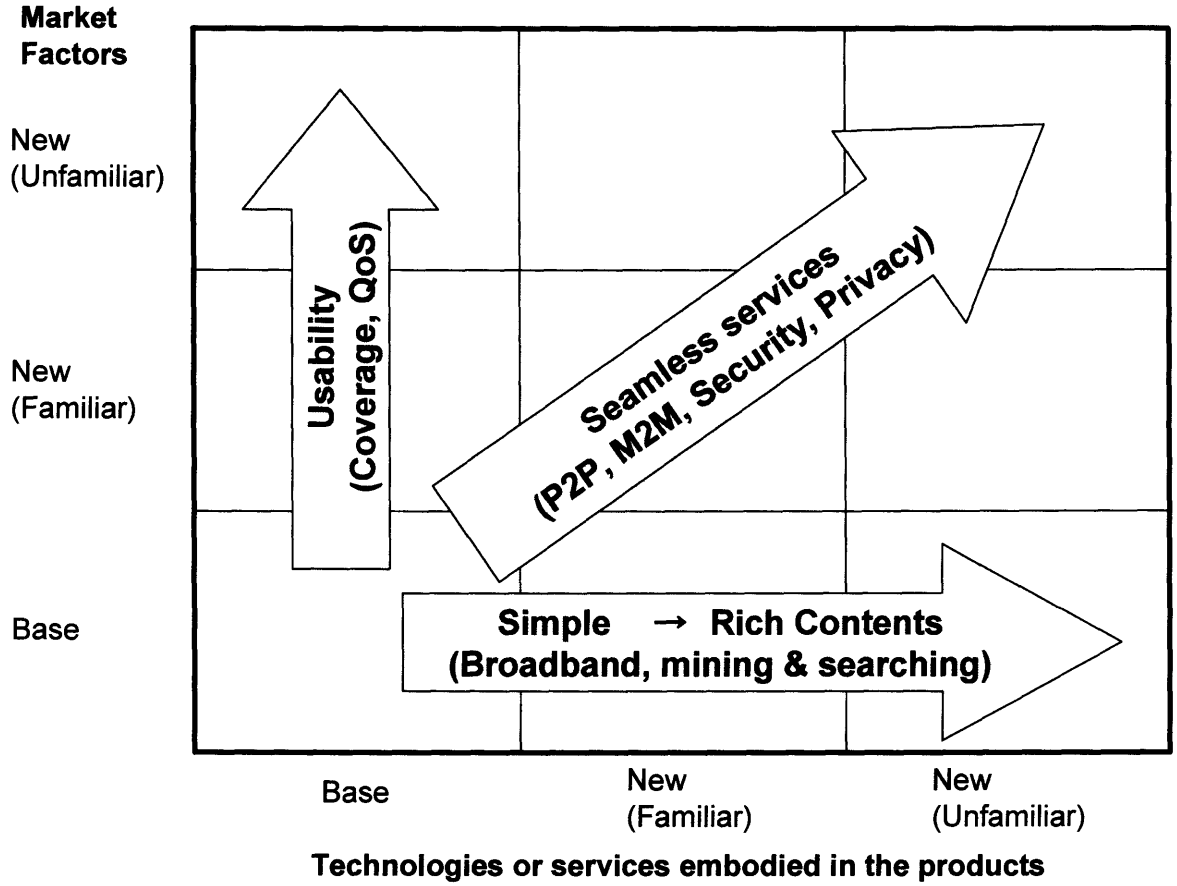
7.2.2 Collaboration with external partners

The first step is to decide what will be researched in-house and what can be purchased from external companies. To clarify this decision, a familiarity matrix[1] is useful. In the matrix, products or services are categorized as "base" (existing services), "familiar," or "not familiar" to the company from the stand point of technology.

Figure 7-1 is a matrix in which major marketing and technological trends are shown. In the figure, network services have already become commoditized. Therefore, the trends focus on usability and advanced services rather than performance and reliability. Most telecom companies, including NTT, used to focus on research regarding network switches and optical fiber uses. Now that the companies have considerable technology and experience in these areas, they have fallen behind in application software and content, which are needed now.

NTT has researched and developed almost all its products through internal development and cooperation with major manufacturers in the Japanese telecom industry. However, even when resorting to other manufacturers, NTT R&D has

usually mandated the specifications it wanted and monitored the manufacturing process.



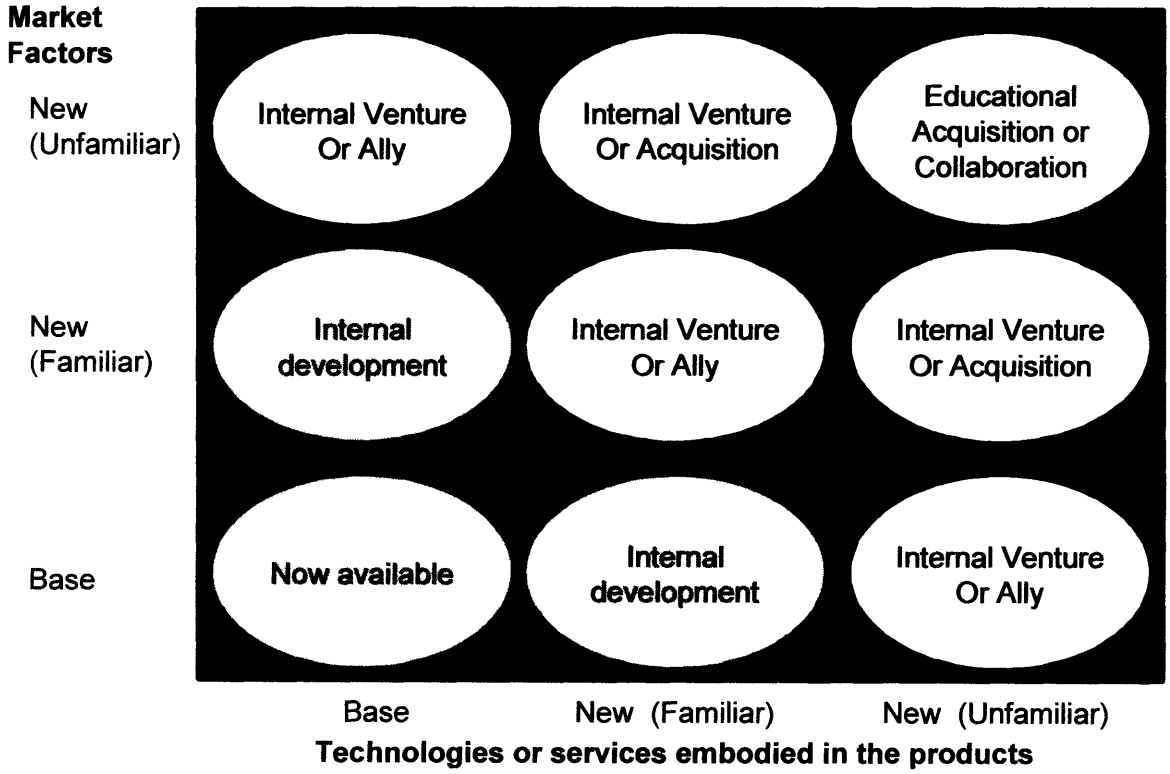
Source: Author, 2005

Fig. 7-1 Familiarity Matrix (Trend)

When NTT R&D covered the entire range of technologies, this scenario worked well. However, the situation has changed today, and it has become difficult for large telecom companies to continue supplying attractive services to customers without using some external resources. To cover the gaps between their own capabilities and new marketing trends, companies should learn to effectively use external technologies and products.

As shown in Figure 7-2, internal development is suitable only when a company is familiar with the technology or market. If the service or product they wish to supply includes unfamiliar technology or will require market experience they do not have or are unfamiliar with, it would be better to ally with other experienced companies or acquire the necessary technology and market drivers to build value through relationships.

In the past, NTT Group tried to invest in several companies that supply web hosting, managed hosting, Internet access, and global IP networking services. Unfortunately, these investments were not successful. There is an urgent need to strengthen NTT's ability to identify quality technology and make good decisions about external relationships.



Source: Edward B. Roberts, "Entering New Businesses", 1985 (modified by author, 2005)

Fig. 7-2 Entry Strategies

7.2.3 Effective partnerships in NTT Group

NTT has five major subsidiaries, including NTT East and West (local access networks), NTT Communications (long-distance networks), NTT DoCoMo (Wireless networks), and NTT Data (data communications and system integration) and over 150 group companies.

Major telecom business is executed by the five subsidiaries, and new, small business is conducted by subsidiaries that have been established for that purpose. A company like NTT, with a proven track record can be innovative, but only when it establishes small organizations that can develop innovations and remain independent. The new companies also play an active role with new customers who request new technology.[2]

These small companies were generated from inside NTT Group. This means their independence is sometimes uncertain, and indeed, they seem to reflect the mindset of the large parent company. This situation is totally different from companies such as P&G, which has expanded its business by repeated acquisitions.

In addition, duplication of targeted markets and products often happens in NTT Group. As a result, competition between group companies sometimes occurs. Managing these companies effectively is a fundamental issue for NTT in order to improve their competitiveness.

7.3 R&D Contribution to the Company's Strategy

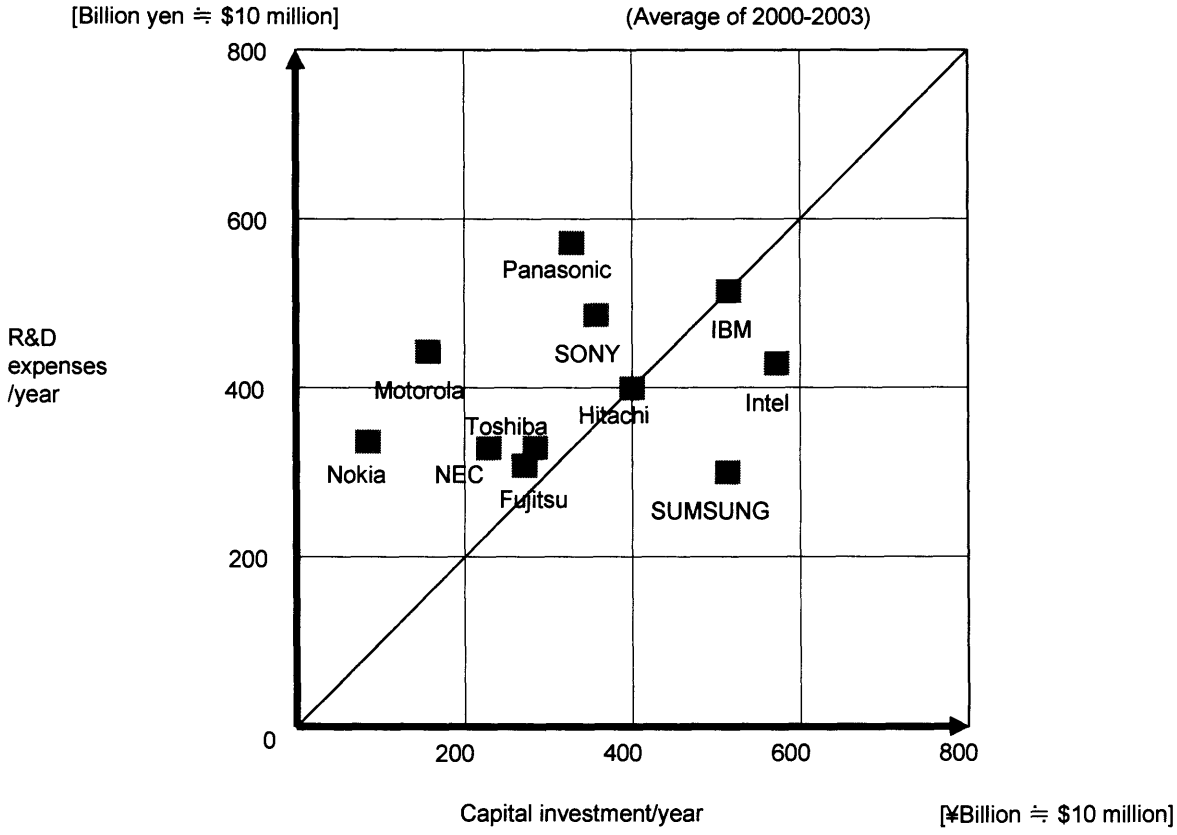
It is difficult to evaluate R&D activities because the effect of R&D is usually delayed and it is difficult to accurately ascertain what portion of the end product or

service can be attributed to R&D. Nevertheless, evaluation is necessary in order to assign appropriate resources such as personnel and funding. Possible parameters for evaluating R&D from the point of view of business would be revenue over R&D expenses and number of patents.

As shown in Chapter 5, the contribution of R&D to revenue (calculated as operating profits divided by the last five years' R&D expenses) has been decreasing for over two decades. This has happened for several reasons. One is that in-house development by the R&D section has not caught up with marketing trends. Second, partnerships with external companies were established, and more technologies and products were purchased from outside than ever before. However, the expectation still exists that R&D will continue to produce something that will earn a profit. As a result, every company keeps its R&D expenses in revenue, and the contribution rate declines. This is not necessarily wrong; the point is how to use the R&D resources effectively.

As market characteristics change, the assignment of resources should be changed accordingly. For example, consumer electronics companies spend huge amounts of money on R&D expenses even if they are in a commoditized industry (see Figure 7-3). NTT has the same level of R&D expenses as Motorola and SONY. The difference is that other companies are very sensitive to market trends but NTT tends to lack sensitivity to market trends due to limited contact between NTT developers and customers. In addition, NTT still spends huge amounts of money on infrastructure research and capital investment for building network infrastructure.

Further thought should be given to strategies that will improve the business from its early stages of development.



Source: Nikkei Business, 5/10/2004

Fig. 7-3 Consumer electronics companies' annual expenses

Patents and intellectual property rights are becoming important issues in the software and content-focused environment. As industry consolidation continues in the near future, it would be accelerated more to improve competitiveness.

In legacy companies in the past, R&D contributed only in the development and deployment phases in a linear-type organization. Such a strategy worked well while telecom companies had a supply of new technologies and their life cycles were long. But competitive advantage has shifted from company technologies to a focus

on customers and external technologies as the gradual commoditization of telecom technologies has proceeded. As a result, NTT's organization structure must be changed in order to meet rapidly changing external circumstances. Once the organization is changed to include innovations that function after the circular model, R&D will have an impact on all phases of a NTT's business.

There are many researchers who have highly technical capabilities in the R&D laboratories. While it may be possible to add marketing and business capabilities to those researchers, the reverse—adding technical know-how to business people—would be a lengthy and difficult task. The more likely possibility is to give researchers a better sense of business by working with people on the business side and helping researchers to focus on customer needs.

NTT announced that it would replace its legacy telephone networks with IP networks, which was disruptive decision. Such a market does not exist yet and cannot be analyzed based on the existing market. Therefore it is necessary to develop a plan for discover what will be needed in every phase. Fortunately, R&D researchers think in that manner all the time, and such a methodology is relatively simpler for them.

The problems associated with the commercialization of a disruptive technology are not technological but primarily marketing. Therefore, R&D people should be asked to change their mindset to include more focus on marketing, and to find or cultivate markets where the results of their R&D can compete advantageously.

The primary focus for market analysis is not the customers but their changing needs. Customizing may be needed, although it will be very costly, but over the long

term, greater success will be achieved by focusing on customers.[3] It is time to appeal to all R&D personnel to use their capabilities to benefit the entire company and the industry in the face of this disruptive innovation scenario.

Endnotes for Chapter Seven

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[1] Edward B. Roberts, Charles A. Berry, "Entering New Businesses: Selecting Strategies for Success," *Sloan Management Review,* Spring 1985.

[2] Clayton M. Christensen, *The Innovator's Dilemma*, Cambridge: Harvard Business School Press, 2001.

[3] Clayton M. Christensen, *The Innovator's Solution,* Cambridge: Harvard Business School Press, 2003.

Chapter Eight

Conclusion

In this thesis, I discussed the current situation of the telecom industry, compared three major world carriers—AT&T, BT and NTT—and described the organizational structures of telecom companies in general to determine where there already exist—or if there is a requirement to improve—the smooth transition from R&D to business as one way to enhance the competitiveness of telecom companies. I discussed the following considerations:

- **What are the key factors for successfully transitioning from R&D to business?**
  - *Technological change*: more focus on IP over broadband networks and wireless networks.
  - *Market change*: more progress with proactive commoditization.
  - *Organization change*: an organization structure that is more flexible. Industry consolidation should be accelerated.

- **How can an organization be changed to incorporate these factors?**
  - *Strategic design*: The structure of R&D should be changed from the old linear model of the legacy company to a circular model that produced faster clock speed. Develop relationships with external companies and universities to purchase appropriate technologies and products quickly and efficiently.
  - *Political issues*: A major focus on IP over broadcast and wireless networks. Assign leaders and resources adequately. Effective management of NTT Group is another key issue to be executed.
  - *Cultural issues*: All employees, but especially R&D people, should change their mindset to market-oriented thinking.

Today, the external conditions surrounding telecom companies are changing dramatically, far more than most companies anticipated. However, if telecom companies can turn these changes into opportunities instead of perceiving them as hardships, then the companies can transform themselves to be "IP communication service companies" that use their huge technical resources to successfully market their products and services.