Naples Forum 2009
Category of Theme: Service innovation

New Roles of Inter-firm Relationships in Service Developments: The Case of the Japanese ICT Industry

Kenichi Nishioka
Kanai University and The University of Edinburgh

Faculty of Commerce, Kansai University, Japan
3-3-35 yamate-cho, Suita-shi, Osaka, 564-8680, Japan

Chieko Minami
Kobe University
Graduate School of Business Administration, Kobe University, Japan
2-1, Nada-ku, Kobe City, Japan

New Roles of Inter-firm Relationships in Service Developments: The Case of the Japanese ICT Industry

Abstract

This paper examines R&D activities in ICT (Information Communication Technology) and aims to identify the key factors that lead to innovative change in service development. Software for major business applications has normally been run on users' corporate servers, but several IT vendor companies now provide it as an on-demand service (Software as a Service) through their own network. This trend is apparent in areas such as infrastructure (Cloud computing) and service delivery platform (Platform as a Service). As a result, developers' tasks are mainly focused on selecting and integrating software components with configuration tasks to meet customer demand. Consequently, service providers are required to integrate and manage these services in cooperation with other service providing companies.

Services have been analysed within the theoretical perspective of provider-customer interactions, which are regarded as inseparable activities. Through this interaction, providers are expected to activate the process of creating value for the user. S-D logic defined 'service' as the application of knowledge and skills for other parties. Companies' resources should be used to provide 'service' in the collaborative interaction with customers.

This study examines recent service developments in the Japanese telecom industry using case methodology. The findings of the research are as follows: 1) As developments within web technology have led to standardised interfaces and platform functions, services are now being offered by integrating modularized service components; 2) Additionally, there is a new emphasis on the role of inter-firm relationships in integrating external resources from the supply side.

The results imply that the characteristics of provider-user interactions have changed due to the modularisation of services. Service providers are expected to develop higher integration abilities to create value for the user companies.

Keywords: Service Development, ICT, Information and Communication Technology, Inter-firm –relationships, Japan

1. Introduction

Enterprises have benefitted from advanced ICT (Information and Communication Technology) in terms of communication, data transfer, and dealings in a business-to-business setting. World Wide Web (WWW) related technologies have strongly affected the communication and information industries, by providing both the standard interfaces for data communication and the development methods per se for data communication.

The methodology of service development in ICT has evolved because of appreciation of the standardised interfaces. IT vendor companies used to integrate the hardware, software, and networks into the system for their clients in a customised way to suit the client's environment. Software for major business applications has normally been run on users' corporate servers. However, several IT vendor companies now provide it as an on-demand service (Software as a Service) through their own network. This trend is apparent in areas such as infrastructure (Cloud Computing) and service delivery platform (Platform as a Service).

The standardised ICT platform-based web-related technology made the services into the sets of service modules. As a result, ICT service developers' tasks are mainly focused on selecting and integrating software components as service modules with configuration tasks to meet customer demand, instead of integrating physical goods. Delivery of business application software such as CRM or ERP through the Web as an on-demand service is providing business customers with value in terms of improvement of business operation, cost cutting and speed of introduction.

In the advanced processes of the service development of ICT, service providers are required to integrate and manage these services in cooperation with other service providing companies. In the ICT industry, changes in collaborative patterns among firms have been observed in new technological circumstances. Value is co-created in the process of interaction between service providers and customers (Vargo and Lusch 2004). The co-creation process of value is expected to change if the nature of interaction (i.e. availability of platform) is changed.

This study examines recent service developments in the Japanese telecom industry using case methodology. The emergence of WWW and high-speed networks drastically changed the nature of the telecommunication service market. The number of actors involved in the telecom market dramatically increased, and the market is now segmented into areas such as middleware products and software, consisting of many specialized actors within each layered stack. These movements are closely related to developing Web-based technologies. Telecom operators are changing their managerial mode from telephone provider to that of service provider, integrating the layered services and offering them as a package.

Using the case of the Japanese telecom industry, this article clarifies the following: 1) As developments within web technology have led to standardised interfaces and platform functions, services are now being offered by integrating modularized service components; 2) Additionally, there is a new emphasis on the role of inter-firm relationships in integrating external resources from the supply side.

2. Theoretical Background

2.1 Exchange of resources and relationships

Recent debate on 'Service-dominant logic' (S-D logic) raised by Vargo and Lusch (2004) proposed the idea that the application of specialized skill and knowledge is the fundamental unit of exchange as the first premise in the context of evolving dominant logic for marketing theory. Here, application of knowledge and skills for the benefit of another party is regarded as 'operant resources', which is identical to the concept of 'service' (in the singular). In S-D logic, 'service', i.e. the use of resources for another party's benefit, is positioned as a fundamental function of marketing (Vargo and Lusch 2008a, 2008b). Furthermore, this exchange process is characterised by its collaborative nature between service provider and customer.

'Resource' was originally conceptualised by Penrose (1959) to explain the factors involved in the growth of firms. Resources are defined to include physical things that a firm acquires for its own use and people hired. Services are here considered to be yielded by resources and regarded as a function of the way in which resources are used.

Departing from the traditional marketing thought that products should be delivered to fulfil customer's needs, S-D logic regards marketing as a more interactive and co-operative activity among actors. Although selling companies should apply their knowledge and skills to their customers, the process is not unilateral but collaborative to create value. A service-centred view sees service as inherently customer oriented and relational because it is defined in terms of customer-determined benefit and is co-created (Vargo and Lusch 2008).

Resources have been discussed in relation to inter-firm relationships (Ford et al. 1998, Anderson, Hakansson and Johanson 1994, Pfeffer and Salansik 1978, Parvatiyar and Sheth 2000, Varadarajan and Cunningham1995). Pfeffer and Salancik (1978) indicated that organizations are embedded in social environments consisting of other organizations, and that these organizations must inevitably interact with their environments to acquire resources. In this view, called 'resource dependence theory', resources were regarded as the objects for which firms interact.

In industrial marketing, interactive behaviour was observed between firms (e.g. Hakansson 1982) and exchanges of technological and social content directed researchers' attention to the embedded context of business relationships (Ford et al. 1998; Hakansson and Snehota 2000; Anderson, Hakansson, and Johanson 1994). They analysed the business networks in relation to accessibility of resources, i.e. anticipated resource transferability and anticipated resource particularity through networking of other firms.

Resources can be explained as the motivation for firms building relationships with others (Parvatiyar and Sheth 2000, Varadarajan and Cunningham1995), while Hunt and Morgan (1995) regard relationships as strategic resources. Kogut and Zander (1992) focus on the element of the inter-firm transfer of resources, especially knowledge.

In summary, new dominant logic for marketing thought is focused on the process in which companies apply their resources, such as knowledge and skills, to their customers. The resources should be activated and developed through interactions among actors. Exchanges of resources are inherently relational. How to develop marketing functions, i.e. activating resources for customers, should be analysed in the context of inter-firm and firm-consumer relationships.

2.2 Integrating functions of services

It has been argued that services are inherently relational (Berry 1983, Gummesson 1987, Gronroos 2002, Sheth and Parvatiyar 2000). This inseparability as a feature of services has been identified as well as others, such as intangibility, heterogeneity, and perishability, in the debate surrounding goods/service distinctions (Lovelock and Gummesson 2004, Zeithaml, Parasuraman and Berry 1985). Due to the inseparability of production and consumption, service providers and customers have to interact. The interactive feature of services contributes as a basis for the idea that services are inherently relational. In the context of the relationship approach, Sheth and Parvatiyar (2000) pointed out that products have been delivered with services as a system.

There has been a recent trend to sell products as an integrated service in the business market (e.g. Davies et al. 2007). This trend emphasises the importance of providing solutions rather than selling products (Davies 2004, Shepherd and Ahmed 2000, Wise and Baumgartner 1999). Developing services and integrated solutions is gaining importance. In terms of 'solutions', services for customers connote the idea of something valuable, rather than the mere bundling of products. Companies are expected to apply their knowledge and skills to work for their customers in recent business circumstances. Each solution can be tailored to a customer's needs by using standardised, reusable and easy-to deploy modules based on product platforms and service portfolios (Davies et al. 2007).

Wise and Baumgartner (1999) argued the changes of business models for manufacturers and suggested that they go 'downstream' in the value chain of business, by taking a direction toward providing services required to operate and maintain products rather than focusing on manufacturing per se to improve profitability. Their four strategically suggested models for downstream are as follows: embedded services, comprehensive services, integrated solutions and distribution control.

On the other hand, going upstream also attracted attention (Davies 2004, Ervelles and Stevenson 2006). Davies (2004), in his analysis of multiple business cases, pointed out the importance of developing novel combinations of service capabilities, such as operations, business consultancies, and finance, rather than going downstream to complete solutions. Erevelles and Stevenson (2006) investigated the stream on the supply side and developed a conceptual model which partitioned the functions of suppliers such as solution providers, technology developers, outsourcers, in alignment with industrial buyers, i.e. manufacturers.

Shifting toward servicing for manufacturers brings up the argument of how to develop services. Capabilities to identify, design and integrate resources should be developed. Researches on upstream and downstream among value chain actors tend to refer only to vertical inter-firm relationships. However, the partnering type of relationships is also expected to develop services by using the other parties' resources.

2.3 Service development in communication industry

Recent business circumstances have led to another role for inter-firm relationships. In the communication industry, the trend towards modularity and open standards has increased opportunities for firms to specialize in component supply or system integration (Davies et al. 2007).

Many smaller specialized firms existing within each layer supply modular hardware and software components. As well as these downstream activities (Wise and Baumgartner 1999), the focus shifts to upstream activities where service providers manage the supply side (Hobday et al.2005, Ervelles and Stevenson 2006). Firms cannot store all of their necessary technology in-house, requiring external actors in order to combine internal and external technology.

The recent phenomena bring up the following issues for discussion. When a standardised interface is given, in what way is the development of services expected to change? Are companies supposed to be more focused on integration, coordination, and specialisation? Are inter-firm relationship becoming arm's length or more intricate? How can resources applied to other parties be changed by service modulization? How do companies initiate inter-acting with each other?

This paper assumes the existence of a 'facilitator', who is able to understand and analyse the attributes of the demand side, seeking and selecting potential technology from suppliers, and integrating it. Finally, the facilitator provides these integrated solutions to the demand side. These activities are linked together by partnerships and alliances, often working in temporary consortiums for the duration of a project. In summary, the role of inter-firm relationships should be focused on developing capabilities that can integrate external and internal resources from the supply side to match demand.

3. Methodology

This paper examines R&D activities in ICT (Information Communication Technology) and aims to identify the key factors that lead to innovative change in service development. Focusing especially on the relationships between developing resources and inter-firm relationships, the study attempts to investigate the emphasis of inter-firm relationships in service development. Therefore, the study attempts to show (1) how an inter-firm relationship has worked in R&D activities, and (2) how inter-firm relationships have had to change along with developing technologies.

R&D departments aim to accumulate technological resources, to be used not only for temporary but also future projects. In addition, these resources are expected to be used for other purposes. Based on these features, R&D activities should be investigated by not focusing on a single project but on multiple R&D projects over a long period of time.

Studies of R&D activities include many variables: technology trends, business circumstances, the diversity of actor behaviour and policies or regulations. Therefore, a study of causal links and the effects of one factor on another is difficult. Given this challenge, case study is regarded as a suitable method to explain how events interactively occur over time (e.g. Yin 1994) and in particular describes the 'contexts' of events.

This study uses the Japanese telecom industry and in particular, the company NTT as a research case, focusing especially on switching systems projects after World War II. A switching system is one of the most important pieces of telecom equipment, used for connecting telephone calls. The system is required to perform a huge amount of telephone call exchange accurately and within a very short space of time. Therefore, reliability, scalability and performance need to be very high compared to other equipment. Their required areas of technology for development

are very wide, and most advanced technology was accepted at any given time. Additionally, these features necessitate long term development periods of between five and ten years.

The data used are published documents: annual reports, company histories and other relevant material. Informal interviews are used to understand the context of recent events. Information about R&D activities is confidential for firms. Therefore, information gained from formal interviews is of limited value, being circumscribed by confidentiality restrictions and an 'official' version of events.

3. Case Study

3.1 NTT and *Family companies*[1]

NTT (Nippon Telegram and Telephone Corporation) is the biggest Japanese telecom operator, running the whole Japanese communication business from telecom and mobile to data communication and system integration services. NTT was established as a public corporation in 1952. After NTT became incorporated as a private company in 1985, it split off from its data communication and mobile businesses in 1988 and 1992 respectively. After NTT's operations reorganized into a holding company structure in 1999, today, NTT has five main companies[2] and 258 subsidiaries. The five firms are still leading companies in each business area despite dealing in very competitive environments.

NTT laboratory belongs directly to NTT holding company. The lab consists of twelve laboratories, dealing with basic and applied research. Three thousand researchers work in the lab and the annual research fee is almost $12.5 hundred million[3], co-funded by subsidiaries. The lab has been involved in most of the big projects NTT has carried out in its history. NTT lab initiated these projects with other business departments and manufacturing companies. One interesting feature is that NTT does not have manufacturing departments. Therefore, manufacturing activities have been carried out in collaboration with other companies.

One characteristic of the Japanese telecom industry was that a limited number of firms took part in R&D activities post-1945. NTT in particular had collaborated with only four big companies, consisting of NEC, Hitachi, Fujitsu and Oki, in all of its main projects. NEC and Fujitsu are the leading companies in the computer, system integration, and communication businesses. Their annual revenues in 2007 were $46.2 and $55.7 billion with NEC and Fujitsu. Hitachi Ltd is a famous Japanese general electronic manufacturer, whose business covers a variety of areas from nuclear plants and rail systems to general appliances. Their revenue in 2007 was $95 billion. Oki is a relatively smaller company compared with the three others, but it produces the relevant components for computer and communications industries with its revenue of $ 7.2 billion in 2007.

[1] The history of NTT are described based on NTT (2006) and their corporate web site (http://www.ntt.co.jp/index_e.html).

[2] The five companies are two regional telephone companies (NTT-east, NTT west), a long distance telephone company (NTT Communications), mobile (NTT-DoCoMo) and system integration company (NTT-Data).

[3] In 2006 (http://www.ntt.co.jp/RD/OFIS/active/2007pdfe/rd/data.html)

NTT and these four companies have kept mutual relationships in NTT's procurement, personal exchanges and R&D activities without any capital ties. In addition, because NTT has no manufacturing department, these companies fulfilled that role. NTT's strong purchasing power in Japan contributed to these companies' management. These special relationships can be called '*family companies*'.

There are several reasons why this collaboration system was maintained for a long time [4]. Firstly, a telecommunications system consists of millions of interconnected components. As a result, standardization is extremely important. All processes, from design to manufacturing, aim to equalize the quality of products, Attributes and performance have to be standardized. An exchange with limited members is easier for quality management. Secondly, for NTT to receive their requested products, they consulted closely with manufacturing companies. Thirdly, NTT purchased every prototype, so when they decided to introduce a system, the manufacturing companies benefitted immensely from manufacturing the system. As a result, the family companies were able to concentrate on studying problems without entailing any risk.

Furthermore, by using technologies created by the collaboration, family companies were able to develop derived systems for civil use and export. This could be realized in that family companies were able to use and exchange patents made by the collaboration and accumulate technological capabilities. The results of collaboration were stored as the patents and specifications belonged to NTT. These specifications did not consist of manufacturing technologies that each company had accumulated through the collaboration. Companies were use others' technologies by paying a patent fee or exchanging patents. The aforementioned manufacturing companies were exempt from paying NTT's patents[5].

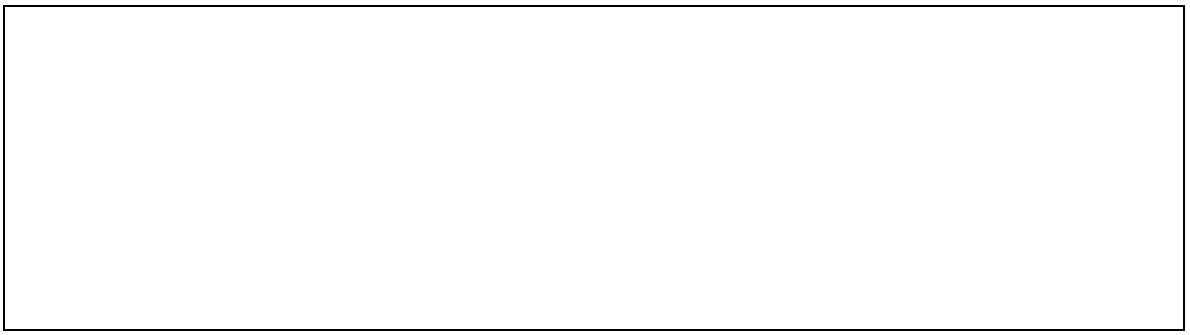

Figure1 The relationship between NTT and the *family companies*

3.2 Developing technological resources and the collaboration system

3.2.1 Establishing the collaboration system[6]

In the immediate post-war period telecom conditions were poor due to the disruption of the network during the war. In order to recover and improve this

[4] These are based on Nakagawa (1990), Shindo (1982). Shindo was the last president of NTT public Corporation and the first president of NTT Corporation.
[5] Hiramatsu (1980)
[6] These are described based on Nakagawa (1990), NTT (1976), NEC (2001), Oki (2001) and study of files at NTT

quickly, NTT decided to develop a new type of switching system, the crossbar switching system. This development was executed by importing and modifying foreign technologies and rationalizing components to fit Japanese telecom conditions. NTT made a thorough study of the imported crossbar switching systems in collaboration with NEC. They disassembled and assembled a Western Electric crossbar system many times, remodelling and improving it for companies to manufacture easily. Naturally, the system NTT developed was completely similar to that of Western Electric's. However, this trial was very important, especially for a late player, in developing R&D capabilities. These methods are termed 'reverse-engineering'. According to Fujimoto and Ge (2004), we should distinguish between reverse engineering and exact copy. Both activities are similar, imitating the products of a front runner or competitor, but with a greater effect on a firm's accumulating R&D activities from a long-term perspective. By disassembling and assembling a WE system, they had studied the its design as well as how to connect physical components using structural and functional design. By using the experience gained from these studies, they understood the nature of developing switching systems. Consequently, these gained technologies were transferred to other companies. The results of the collaboration between NTT and NEC were made available to OKI, Hitachi and Fujitsu under the terms of the contract. The systems were manufactured by four companies independently and, as a result, their technological level was improved and standardized by sharing gained technological capabilities.

In 1962, Bell Labs released the news that it had succeeded in developing a prototype of an electric switching system. This was a kind of computer, using electric devices to replace physical switches. This news triggered NTT's decision to develop an electric switching system for commercial use. However, they did not have enough experience and information to develop such a system.. The necessary technological areas were more varied than those involved in the development of the crossbar switching system. Consequently, NTT tried to make a contract with Bell Labs directly. This resulted in a cross licence agreement, although NTT paid a large amount for it. NTT also drafted a technical assistance contract with Western Electric. This contract provided NTT with substantial information about electric switching systems. At the same time, the most important thing was to evaluate Bell's electric switching systems in detail. By using this information, NTT developed a prototype system in 1966, based on the Bell system, in order to study the stored program system and its applicability for the switching system. On the other hand, family companies contracted with foreign companies in the semiconductor and computer business areas. They were able to obtain technological information and new trends from their original sources.

In 1966, the first prototype was developed based on the Bell system in order to study a stored program system and its applicability for a switching system. At the same time, another prototype was developed in collaboration with NEC. It was a unique and very advanced system using new technology. It aimed to evaluate a time division system which was closely related to PCM (pulse code modification) systems. Evaluating results from two systems, NTT and manufacturing companies launched the development of a new system through their ongoing collaboration in 1967. The design was their original concept. This system used their unique technology, in particular the latest semiconductors. Their original IC, which was

developed in collaboration with NEC, was adapted for the CPU devices. In this way, they achieved economization and footprint downsizing.

These two cases show how the collaboration between NTT and its family companies became established and deepened (**Figure2**). In both projects, studying new technologies and how to manage a large scale project were the main issues. Four companies were able to accumulate technological resources through the collaboration. Therefore, each company developed small civil switching systems by using accumulated technologies. As a result, they were able to penetrate the domestic market and succeeded in exporting their systems. Consequently, these technologies were used for NTT's systems and the family companies' products. As a result, the family companies grew dramatically. This reusability of gained technologies became a feature of the collaboration system. In addition, they were able to learn how to collaborate with each other, ways of establishing a development plan, as well as project management methods. By studying the contents of the collaboration in detail, we can see that their relationships greatly contributed to the development of their technological capabilities.

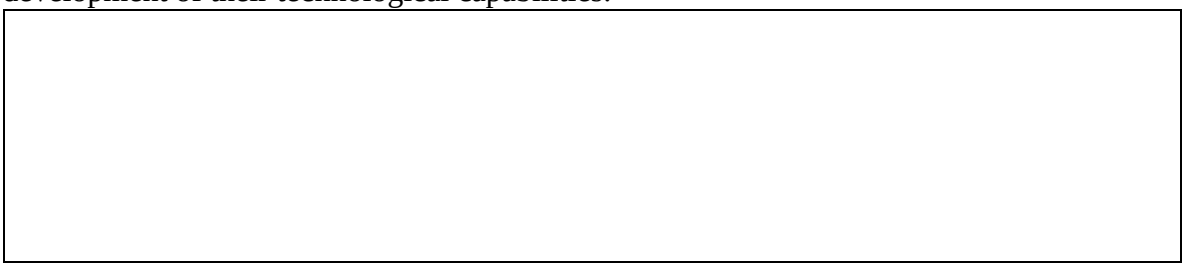

Figure2 The collaboration system in the development of crossbar and electronic switching systems

3.2.2 Developing technologies and the collaboration system

In the 1990's, the 'open system' and 'networking' changed the computer business. This was accompanied by the emergence of the UNIX workstation and the development of personal computers connected to the network through Ethernet The UNIX operation system instigated the development of a variety of applications, for example data base and storage systems. These things were done much more cheaply and therefore customers preferred to construct their systems based on these open system components.

Another significant factor was that workstations were designed to be networked. This was achieved using Ethernet protocol. Clusters of small networking computers, such as workstations and PCs, replaced the legacy computer world of a large central system. Consequently, the most important thing for users connecting to LAN was access to the internet using routers. These 'downsizing' trends gave new impetus to the development of relevant technologies. For example, microprocessor technologies underwent significant development, including the introduction of RISC processors. Their performance was almost equal to that of mainframes. These developments were damaging for IBM, who were consequently forced to change their mainframe-oriented approach to one of service central management.

NTT believed that optical fibres and ISDN protocols would open a new telecom market. ISDN has two main types based on bandwidth: Narrowband (N-ISDN) and Broadband (B-ISDN). N-ISDN had already been commercialized with the development of digital switching systems in 1986. On the other hand, B-ISDN

was realized using ATM (Asynchronous Transfer Mode) protocols and optical fibres. NTT aimed to expand their businesses by connecting with premises through optical fibres and realizing broadband services. In order to do this, NTT decided to follow three steps[7]. The first step was to develop and expand existing telephone services by adding information technologies. The second step was based on internet services. By accepting N-ISDN for the introduction of the internet, NTT tried to stimulate and expand the demand for network use in businesses and consumer markets. The final stage would be when optical fibres and B-ISDN would drive VOD (Video on Demand) services. Specifically, they regarded the Internet as a mere service menu.

Following this plan, NTT started to develop new types of system in 1994, aiming at reducing the cost of N-ISDN and integrating N and B-ISDN. The four family companies also participated in the project. The development involved open architecture and Internet technologies as well as existing telephony technologies. For example, SPARC (developed by Sun micro systems) and MIPS (a product of MIPS Corporation) processors were used as their main processors and other communication control units. In addition, OS was developed based on TRON, and C programming language was used for their software development. Workstations were also introduced for their service management systems and development support systems. In order to integrate with their original communication technologies, these technologies were introduced not by direct exchange but by mediation among the family companies. The project, called MHN (Multi handling Node), released its first version in 1996, consisting of N-ISDN and ATM switching systems. It continued to improve and add functions until the beginning of the 2000's.

In the MHN project, the relationship between NTT and its family companies still seemed strong, but it had changed slightly. The pressure of cost reduction and the speeding up of development time meant that this project used many internet-relevant technologies for its developments, and these technologies came from US vendors. NTT needed its family companies as mediators in the integration of telephony and new technologies, improving their quality and reliability. In other words, the family companies were indispensable players whenever NTT carried out a project.

In contrast, the family companies had more power in the collaboration system because of their superior technologies, accumulated over a long period. Their wide variety of business areas helped to accumulate the relevant technologies. Therefore, it can be argued that the family companies' technology enabled them to escape from NTT's dominance. In this regard, the relationship between NTT and its family companies was weakening.

In summary, the relationship between NTT and other companies has changed in that the number of new joint firms has increased, while the structure of the industrial network has changed. Previously, the telecom industry was completely dominated by NTT. A limited number of companies were allowed to exchange. Also, each relationship and mutual dependency was very strong. The structure was hierarchical because NTT were extremely powerful in every aspect - technology, finance and human resources.

However, this trend has changed due to the penetration of internet technology into the telecom industry. New actors exchange through existing companies, and new

[7] NTT (1999)

technologies have been introduced through helping existing companies (**Figure3**). Each relationship and mutual dependency in the collaboration system has become weaker, with the structure consisting of direct and indirect exchanges.

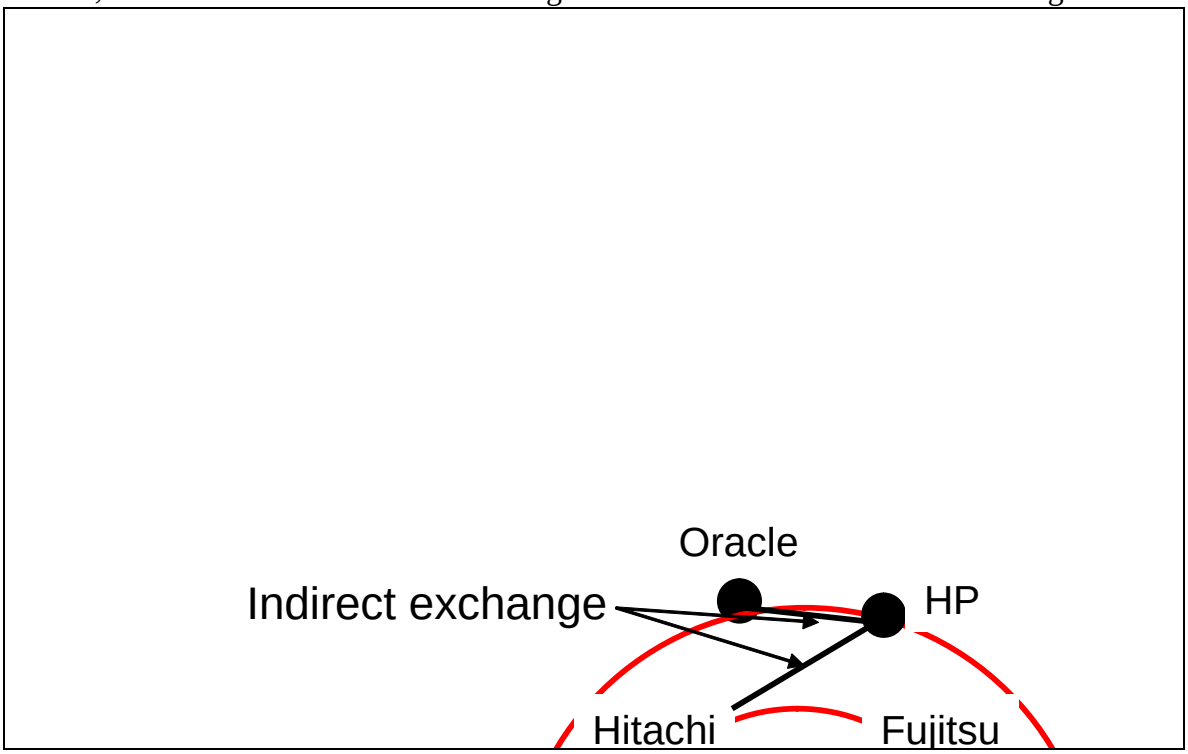

Figure3 Exchanges with external companies in the MHN projects

3.3 Towards Service-oriented activities

3.3.1 Segmenting communication businesses

The emergence of WWW and high-speed networks changed the nature of the telecom market. The number of actors involved in the telecom market dramatically increased, and the market is now segmented, consisting of many specialized actors within each layered stack. These movements are closely related to the development of Web-based technologies.

The World Wide Web provides standard interfaces for data communication, leading to unified development methods for communication and information systems. At the same time, these technologies strongly affect the communication and information industries.

Along with web-relevant technologies becoming standardised, developers eventually used it to design software products, while companies set up web-based businesses. At the same time, as well as providing standard interfaces between users, web-relevant technology also provided common interfaces between information systems. These standard interfaces were established in open communities, such as IETF and W3C, making them available to the public. This meant that one company would not be able to produce all of its technologies in-house. IBM had dominated the computer market with their secret interfaces, which connected their facilities to their software products. However, new enterprising companies could now enter the market if they developed their original products based on these standard interfaces and specifications.

Object-oriented programming methods enabled software as components. Each software component is linked to API interfaces, enabling them to cooperate. Java helped to make this modular trend more widely accepted and methods of application software development were unified by Java-based programming. Furthermore, web service technologies (SOAP and other XML related technologies) provided inter-operational functions between software components that existed in other computers. These technologies led to a unified environment for system development. In addition, web technology gave rise to a new software category as well as new services such as middleware products and application services.

As a result, the web's high inter-operability, added to the acceptance of standard interfaces and modularised software, affected both the information and communication industry. Web-relevant technologies were accepted for large-scale systems, and their applicability expanded into communication areas. As a result, both markets became integrated.

The development and improvement of web-related technologies helped to make this integrated market segmented. Due to poor interoperability, major computer companies like IBM had previously managed all functions vertically in-house. However, the standardisation of interfaces and unified development environments enabled technologies to work together easily. Companies could now concentrate on developing their specialised technologies without considering infrastructure. They simply had to design and create their products based on the standardised interfaces and specifications. At the same time, the area of competition moved to upper layer businesses. In middleware and applications businesses, there are many players, each of whom have specialised technologies and services. Companies were able to compete in each specialised software category, or sometimes cooperate with other players. These circumstances had been brought about by the technological ability of the web to enable a high standard of interoperability. Moreover, these technologies helped lead to greater cooperation among companies.

3.3.2 Changes in the Japanese telecom industry and the collaboration system

Therefore, telecom operators are changing their managerial mode from telephone provider to that of service provider, integrating the layered services and offering them as a package. As a result, NTT lab shifted its policy to IP-based developments. They began offering telephone services on IP-based technologies, aiming to develop an integration network for providing both IP and telephone services.

Consequently, NTT lab began to develop their NGN system after announcing that NTT begin the NGN experimental project in December 2006.

The four family companies participated in the development by integrating their existing data communication and vendor technologies. As an example, although NTT purchased core routers of the system from CISCO and Juniper Networks[8], both were affiliated with Fujitsu and NEC for each. NEC and Fujitsu played the role of integrators at NTT's request. The edge routers were procured from a Japanese company, Alaxaia Corporation, a joint company established by Hitachi and NEC in

[8] Nikkei IT-pro "vendors of NTT NGN experimental network", 2006-12-04, http://itpro.nikkeibp.co.jp/article/COLUMN/20061204/255755/

2004. This company aims to enter the high-end router markets dominated by US companies like CISCO and Jupiter Networks, and they focused especially on using the NGN system[9]. As was pointed out before, in the NGN system, an edge router has many functions and performs complex tasks using session controls to allocate bandwidth for each session dynamically. At the same time, a large amount of data has to be transacted. Furthermore, high reliability is required. Products that can fulfil these requirements were beyond the capacity of existing routers. Telecom companies had accumulated these technologies through their experiences of developing ATM and ISDN. Therefore, in the experimental phases of the NGN, the family companies had an advantage over other router makers when it came to developing such routers. Consequently, NTT procured their SIP servers from NEC and Oki[10].

The above facts show that the collaboration system between NTT and the family companies is still going strong. NTT accepted their hardware components from router makers Cisco and Jupiter Networks, along with servers for their systems. Based on these vendors' products, NTT developed its own original communication technologies by collaborating with its family companies. Their work added special functions or tuned these products to satisfy NTT's needs. These activities were similar to those of general information systems. In addition, the development required a variety of relevant technologies, from software and server, to semiconductors and processors as well as communication technologies. NEC and the other family companies have organized full line-ups of these technologies. These managerial methods contributed to the development of the NGN for the family companies.

However, the nature of the collaboration had changed. This change came from the open standard and integration trends between telecom and information systems. Most of the NGN system specifications rely on open standard technologies established in international organisations such as ITU-T, IETF and W3C. Telecom technologies were also standardized in ITU-T and were open to the public. However, these technologies were very unique and complex, and could only be used on telecom equipment. Therefore, only a limited number of actors could deal with these technologies. With the development of computer and Internet-relevant technologies, telecom and information system technologies gradually became integrated. As a result, information-relevant technologies can be used for telecom equipment. If the specifications have been established by open standard technologies, new players can easily develop telecom equipment. In fact, router-makers can be involved in the commercial systems of NGN by adapting their superior technologies, high-speed routing, and their network management functions to NGN specifications. For example, Cisco recently announced that their latest router product has been accepted by NTT, and Juniper networks have also released their edge router for NTT's networks[11].

These events have changed the role of inter-firm relationships. In the development of NGN, the family companies also maintained their strong position in NTT's R&D activities because they had accumulated communication and computer

[9] http://www.atmarkit.co.jp/news/200410/05/alaxala.html

[10] Nikkei IT-pro "vendors of NTT NGN experimental network", 2006-12-04, http://itpro.nikkeibp.co.jp/article/COLUMN/20061204/255755/

[11] CISCO "Telepresence of CISCO is accepted for NGN network both in NTT-east and West.", news release, 2008-10-01 <http://www.cisco.com/web/JP/news/pr/2008/038.html>

technologies. One family company acted as mediator, integrating the new IP-based technology with their superior telecom-based technology. However, it should be emphasised that the focus of telecom carriers has shifted from the network to offering upper layer services. In other words, the leverage of communication industry has apparently shifted to services. NTT developed affiliations with new actors for its service development. They ran experimental projects, through which they were attempting to understand market demand and analyze the required network functions for providing services.

Previously, the family companies benefitted significantly by NTT purchasing hardware products, as software developments were yielding little reward. However, along with NTT fully accepting vendors' products for their systems, NTT's business for family companies was no longer such a juicy source of profit. Therefore, the family companies were gradually placed at a distance compared to their previous position under the collaboration system. Meanwhile, NTT worked directly with other companies on their R&D activities. Their increased need for computer and Internet technologies meant that they needed to expand into new areas of technology. Therefore, NTT lab had to deal with a variety of technology. In order to adapt to these circumstances, NTT lab would either engage with companies who have competitive or de facto standard technologies within specific areas or simply purchase these technologies. These activities took place not under the comprehensive remit of the company, but within small units, such as departments or project teams. Family companies have also engaged in NTT's R&D activities. However, this time they acted as me a kind of vendor to NTT.

3.3.3 The emphasis of inter-firm relationships and integration abilities

Recently, NTT has been considering B-to-B businesses, especially SaaS and Cloud Computing businesses, as the main focus of NGN services. A business system requires high security and a reliable network. These systems were therefore constructed not on the Internet, but using dedicated lines to connect each area. However, this method leads to high cost and a lack of flexibility when the system is changed. Consequently, VPN (Virtual Private Network) technologies are used to replace dedicated lines. VPN provides a single private network in which the link-layer protocols are tunnelled through the larger network (e.g. the Internet). It can reserve secure and constant communication by defining the SLA (Service Level Agreement). However, the low level of security and reliability of the Internet creates difficulties for a company constructing Internet-based VPN. The NGN network is considered an appropriate method for constructing a business network because of its higher security and reliability compared to the Internet. More mission critical[12] users will be expected to use NGN as part of their system, as they reduce costs while maintaining security and reliability.

NTT are also paying close attention to the Cloud and SaaS businesses. In general, these services are provided through the Internet. However, this raises questions about privacy, security, and reliability (Hayes 2008). Enterprise systems

[12] The term 'mission critical' means when any setback (equipment, process, procedure, software, etc.) immediately makes crucial the successful completion of an entire project.

require an extremely high level of operational reliability. Cloud providers agree SLAs (Service Level Agreements) with each customer. They are not satisfied with current levels of operational capacity, and are trying hard to improve the reliability of their systems, but are still having trouble with Internet-related problems. NGN can provide secure and highly reliable network functions for providers, and is therefore welcome among these providers. In addition, providers can offer security, charging, authentication and other network functions, or can combine their original functions with them. There are modularized service components, called 'Enablers'. These are segmented communication functions, and a business process is created by the integration of these components using the function ESB (Enterprise Service Bus). Service developers can use and integrate these components to develop application products, or create new services by combining other application programs. Finally, an integrated application system operates network functions through SIP servers.

In order to provide these systems, an enormous number of infrastructure functions - such as charging, authentication and security, as well as application components such as Streaming, CRM and ERP - are needed to mount the NGN system. In addition, recent service developments have been provided by a combination of modularised software components segmented on layered stacks. These software modules are compliant with API and other interfaces between network functions. These functions are based on middleware, called application servers or SIP servers, and are provided by Oracle, IBM and other software makers, including the family companies. In order to provide services on the network, it is critical that these products or software modules are combined and integrated to match customer demand. NTT uses SaaS (Software as a Service) as a key component of their NGN system. They have collaborated with Salesforce.com[13] and Microsoft[14] to develop SaaS services for NGN. Hanazawa, Director and Senior Vice President, and Director of Research and Development Planning Department, mentioned that the next step of their R&D activities after NGN will focus on Cloud-related technologies and the management of computer resources' cooperative technologies. These technologies are dominated by service providers such as Amazon and Google and other computer makers, and Hanazawa[15] mentioned that NTT will try to develop these technologies by collaborating with other external companies as well as making positive use of open source technologies. NTT aims to develop its platform of providing services by integrating external resources.

Previously, R&D activities in NTT concentrated on physical functions such as switching, routing and line controls. Technological resources were used to connect and integrate technological components, and were limited to telephone services. However, as telecom businesses have expanded into upper layer businesses and have become more focused on services, there has been in a change in the type of goods arising from R&D activities. The R&D department aims to offer network services; not specified services like telephone and data communication functions, but more customized technology services that each service provider wants. In other words, a

[13] News release from NTT, NTT communications and Salesfoce.com, 2008.05.06, <http://www.ntt.co.jp/news/news08/0805/080526a.html>

[14] NTT "NTT and Microsoft Collaborate on SaaS Over NGN", 2008-12-10, <http://www.ntt.co.jp/news/news08e/0812/081210a.html>

[15] From his speech in NTT R&D forum held in 2009-02-19. Takashi Hanazawa is Director and Senior Vice President, and Director of Research and Development Planning Department.

change of ‘goods’ provided by R&D activities initiates a change in roles of R&D activities, influencing their inter-firm relationships. Now, NTT is looking for potential players to integrate external resources from the supply side (upstream activities) while scanning market demand (downstream activities). This case shows the importance of these upstream activities in coordinating inter-firm relationships in a service-oriented approach, and assumes the existence of a facilitator who can bridge both upstream and downstream activities. R&D will act as a ‘technology service provider’ that offers technological solutions and integration abilities based on individual customer demand.

The emergence of Cloud Computing and SaaS businesses would emphasize the role of inter-firm relationships, especially when it came to the integration of functions. The trend seems to be towards service providers offering everything as a service, from infrastructure and platforms to applications. In these circumstances, integration abilities are more important for developers when constructing systems or creating application services, as Cloud and SaaS offer every component in the network. This allows developers to use or integrate these components to suit their purpose. Aside from integration ability, the management of inter-firm relationships is more focused. Cloud computing services are based on a variety of technologies. A company cannot build these services on its own, and collaboration with other players becomes indispensable for developing services. In other words, in order to develop a service, a company has to select the available technologies and partners from the supply side. Therefore, there is an emphasis on the importance of how a company manages inter-firm relationships in the supply-side as well as its integration abilities.

4. Discussions

Considering the relationship between developing technology and its influence on the market, it can be argued that technological development brought about changes in the market. In other words, developing the technology expanded its domain of applicability. As a result, the existing market was forced to undergo change. Internet-relevant technology expanded its domain of applicability from local networks in offices to international communications through Internet. Finally, these technologies supplanted telecom-oriented technologies. Telecom companies were forced to construct a network based on internet protocols. As a result, the nature of the telecom market changed to that of an internet-based market. Telecom operators changed their managerial mode from telephone provider to one where they offered an integration of layered services as a package. Consequently, a number of new actors began to appear in the telecom market. The Web’s high inter-operability, acceptance of standard interfaces and modularizing software affected information and communication industry, leading to integrating both. Furthermore, the standardizing of interfaces, along with the unifying of development environments, provides a common platform of service delivery enabling service components to work together easily. As a result, the integrated market is segmented consisting of many specialized actors in each layered stack.

These results emphasize the following two points: firstly, with the increasing integration of the market, the number of participants in the market has increased (**Figure 4-(1)**). Additionally, these participants tend to concentrate on specific

businesses with specialized skills **(Figure 4-(2))**. In the early telecom market, the NTT's business field was limited to telephony services: line controls and network operations. By expanding their business areas to computers, NTT began to deal with upper layer firms. These new business areas involved many firms in computer businesses and system integration companies. Consequently, as NTT became involved in internet services, many more firms were involved in telecom markets. These firms exist in each layer, according to the communication protocol stack. They have the power to dominate each layered market by having special technologies or developed de facto standard technologies in specific business areas.

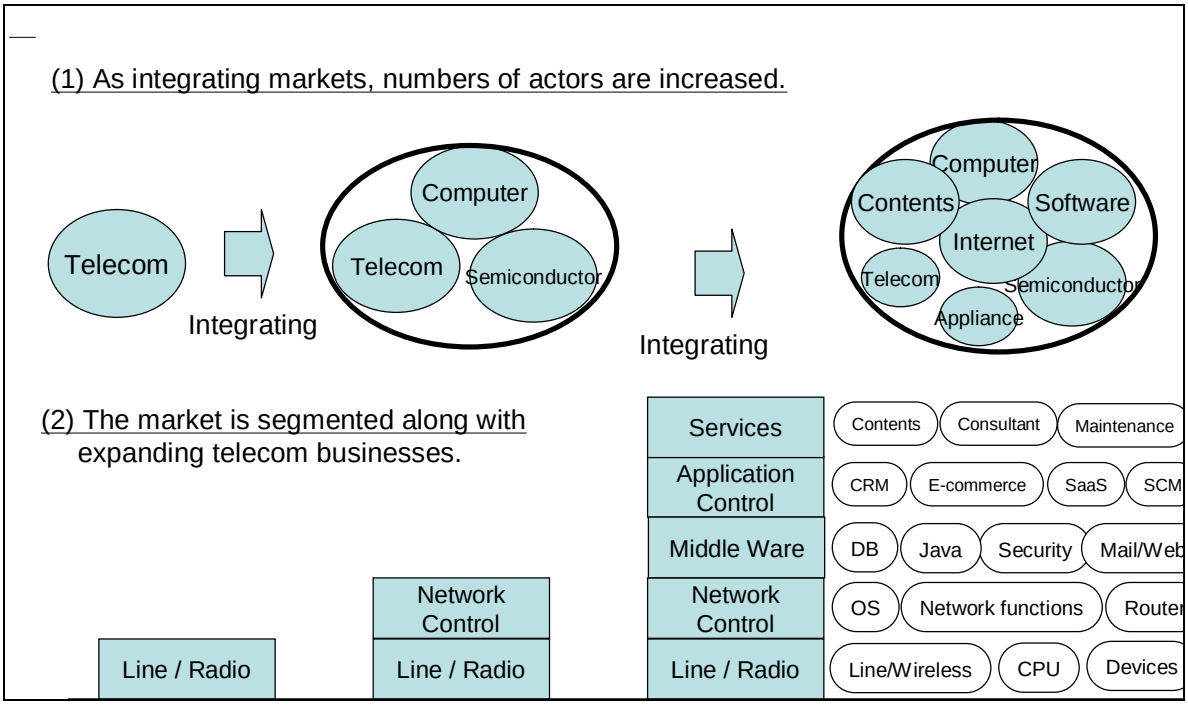

Figure 4The changes of the Japanese telecom market

Findings indicate that the collaboration system played two roles: collecting advantageous technologies from others and mediating in the introduction of new technologies. NTT and its family companies tried to collect technological information through affiliating with each unique partner. The advanced information they obtained was amended and refined through the development of experimental products within the collaboration, which then became their advanced technologies. As a result, these technologies can be used not only for current projects but also in future ones. The family companies also use them for their own products. In addition, the collaboration system plays the role of mediator in integrating new and existing technologies, allowing for new services which accept the new technological trends.

This has led to the creation of a new role for inter-firm relationships: coordinating external suppliers, and integrating external and internal resources to meet customer demand. Developing the technology expanded its domain of applicability, bringing about changes in the market. As a result, the role of inter-firm relationships in R&D activities has changed. The emergence of WWW and high speed networks changed the nature of the telecom market, leading to it becoming

segmented. Therefore, telecom operators are changing their managerial mode from telephone provider to that of service provider, integrating the layered services and offering them as a package. In service development, NTT is looking for potential players to integrate external resources from the supply side (upstream activities) while scanning market demand (downstream activities) **(Fugure5)**. These findings assume an emphasis on the importance of these upstream activities in coordinating inter-firm relationships in a service-oriented approach. At the same time, the findings suggest that the concept of 'market' should be broadened to include not only existing customers and competitors but also other stakeholders who have the potential to contribute towards creating future customer value and develop competitive advantage in future markets.

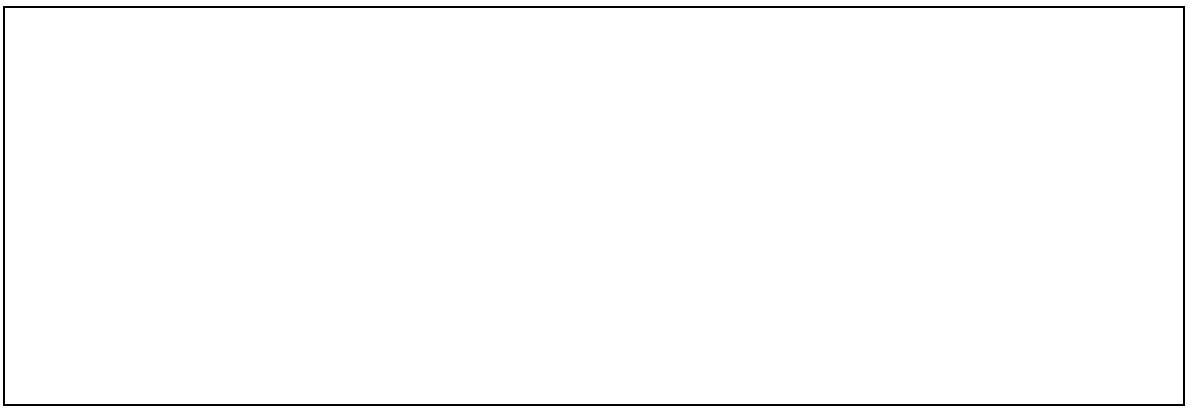

Figure 5 The roles of NTT in service developments of the NGN project

References

Anderson, James C., Hakan Hakansson, and Jan Johanson (1994) , "Dyadic Business Relationships Within a Business Network Context" , *Journal of Marketing*, 58 (October), pp.1-15

Berry, Leonard L.(1983), "Relationship Marketing," in Berry, L.L., Shostack, G.L. and Upah, G.D.(eds), *Emerging Perspectives on Services Marketing*, *American Marketing Association*, Chicago, pp.25-28

Ceruzzi, Paul E. (1998) *A History of Modern Computing*, Cambridge: The MIT Press.

Constantin, J. A. & Lusch, R. F. (1994). *Understanding Resource Management*, Irwin Professional Pub.

Cusumano, Michael A. (2004) *The Business of Software*, New York: Free Press.

Davies, Andrew (2004), "Moving base into high-value integrated solutions: a value stream approach", *Industrial and Corporate Change*, Vol.13 (5), pp.727-756.

Davies, Andrew, Tim Brady, Michael Hobday (2007), "Organizing for solutions: systems seller vs. Systems integrator," *Industrial Marketing Management*, 36, pp.183-193.

Ervelles, Sunil, and Thoman H. Stevenson (2006), "Enhancing the business-to-business supply chain: Insights from portioning the supply-side", *Industrial Marketing Management*, 35, pp.481-292.

Ezaki, Shouji, Akira Kurokawa and Kimihide Matsumoto (2007) " NGN no Gairyaku [in Japanese]" [Overview of NGN], NTT technology Journal, 19(4), pp.32-37.

Ford, David, Lars-Erik Gadde, Hakan Hakansson, Aders Lundgren, Ivan Snehota, Peter Turnbull, and David Wilson (1998), *Managing Business Relationships*, John Wiley & Sons Ltd., West Sussex, UK.

Fujimoto, Takahiro and Dongsheng Ge (2004) "Gijji Akitekucha to Gijyutu Rokkuin" (in Japanese) [Quasi-open architecture and technological lock-in. The case of Chinese motorbike industry] *Discussion Paper No.5*, The University of Tokyo, Manufacturing Management Research Center.

Fujishima et al. (2008) " Jisedai Nettowa-ku Kibangijyutu kakuritu ni muketa end to end Gijyutu Kensho [in Japanese]",[The trial test of per-to-peer technology for developing fundamental technologies in NGN], NTT technology Journal, 20(7) pp.34-35.

Gronroos, Chrstian (2000), "Relationship Marketing: The Nordic School Perspective", in *Handbook of Relationship Marketing*, Jagdish N. Sheth and Atul Parvatiyar eds. Sage Publications, Inc.

Gummesson, Evert (1987), "The New Marketing – Developing Long-term Interactive Relationships," *Long Range Planning*, Vol.20, No.4, pp. 10-20.

Hakansson, Hakan, (1982), "An Interaction Approach," in Hakansson, H. ed. *International Marketing and Purchasing of Indsutrial Goods*, John Wiley and Sons, pp.10-27

Hakansson, H. & Snehota, I.J. (2000). The IMP Perspective: Assets and Liabilities of Business Relationships. in *Handbook of Relationship Marketing* ,Jagdish N. Sheth and Atul Parvatiyar, eds. Sage Publications, Inc.: 69-93.

Hiramatsu, Hitoshi (1980). Denwa no Mukouha Donnakao (in Japanese) [The backyard of telecom industry], Tokyo: Saimaru publishing.

Hobday, Michael, Andrew Davies, and Andrea Prencipe (2005), "Systems integration: a core capability of the modern corporation", *Industrial & Corporate Change*, Vol.14(6), pp.1109-1143.

Hunt, Shelby D. and Robert M. Morgan(1995), "The Comparative Advantage Theory of Competition" ,*Journal of Marketing*, Vol.59(April), pp.1-15

Johanson, Jan and Lars-Gunnar Mattsson,(1987) "Interorganizational Relations in Industrial Systmes: A Network Approach Compared with the Transaction-Cost Approach", *International Studies of Management and Organisation*, Vol. XVII. No.1, 34-48

Kasahara et al. (2007) " Jisedai Nettowa-ku wo Sasaeru Nettowa-ku Kibangijyutu (in Japanese)" [Critical technology of Next Generation Network], NTT technology Journal, 19(4), pp38-43.

Kogut, Bruce and Udo Zander(1992),"Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology", *Organization Science*, 3, pp.383-97

Lovelock, Christopher and Evert Gummesson (2004), "Whither Services Marketing?: In Search of a New Paradigm and Fresh Perspectives", *Journal of Service Research*, Vol. 7(1), pp.20-41.

Miyasaka, Masahiro, Noritaka Harigome and Kouji Kishida (2008). "NGN no Taiiki Seigyo Gijyutu (in Japanese)" [Band width control technologies of NGN], NTT technology Journal, 20(10), pp.22-23.

Morita, Naokta and Yukio Hiramatsu "ITU-T Riri-su1 no Kansei (in Japanese)" [The release1 of ITU-T version of NGN], NTT technology Journal, 20(8), pp.24-25.

-------- and Hideo Imanaka “NGN Kanrengijyutu no Hyoujyunnkadoukou (in Japanese)” [Current movement of standardization activities in NGN related technologies]”, NTT technology Journal, 20(9), pp.64-65.
Muraoka, Yoichi (1985), *Nippon Denshin Denwa* (in Japanese) [NTT telegraph and telephone Corporation]. In: Nippon no Konpyu-ta no Rekishi (in Japanese) [The history of Japanese computers]. Aiiso et al(eds.), Tokyo: Omusha, pp. 177-202.
Nakagawa, Yasuzo (1990), *NTT Gijyutu Suimyaku* (in Japanese) [Technology resources of NTT] Tokyo: Toyo-Keizai Shinposha.
Nakayama, Mikimasa (2009) “ NTT communications niokeru SaaS over NGN no Torikumi (in Japanese)” [SaaS over NGN in NTT communications], NTT technology Journal, 21(2) pp24-247.
NEC (2001), *NihonDenki KabushikiKaisha 100nen shi* (in Japanese) [The 100 years’ history of NEC Corporation], Tokyo: NEC Corporation.
Nisase, Masami (2008) “NGN niokeru Sekyuriteti Kannrenn Gijyutu (in Japanese)” [Security of NGN”, NTT technology], NTT technology Journal, 20(9) pp.22-23.
NTT (1976) *Denki Tsushin Jishugijyutu Kaihatushi* (in Japanese) [The history of NTT’s developments of telecommunication technologies] Tokyo: Denki Tsushin Kyokai.
------- (1999) *R&D no Keifu* (in Japanese) [The genealogy of R&D], Tokyo, NTT Corporation.
------- (1999) *NTT no 10 nen* (in Japanese) [The 10 years’ history of NTT Corporation], Tokyo, NTT Corporation.
------- (2006) *NTT Guru-pu Shashi* [1995-2005] (in Japanese) [The history of NTT Group [1995-2005]], Tokyo, NTT Corporation.
Oki (2001) *Shishu no Seishin -Okidenki 120nen no Ayumi* (in Japanese) [Enterprising spirits: the 120 years’ history of Oki Electric Corporation] Tokyo: Oki Electric Corporation
Parvatiyar, Atul and Jagdish N. Sheth (2000). “The Domain and Conceptual Foundations of Relationship Marketing", *in Handbook of Relationship Marketing*, Jagdish N. Sheth and Atul Parvatiyar.
Penrose, Edith (1959). *The Theory of the Growth of the Firm*. Oxford Press.
Pfeffer, Jeffrey, and Gerald R. Salancik, (1978), *The External Control of Organizations: A Resource Dependence Perspective*, Harper and Row, Publishers.
Shepherd, Charles and Pervaiz K. Ahmed (2000), “From product innovation to solutions innovation: a new paradigm for competitive advantage”, *European Journal of Innovation Management*, Vol.3 (2), pp. 100-106.
Shimoda, Hirotsugu (1981) *Tsushin Kakumei to Dendenkousha* (in Japanese) [Communication revolutions and NTT Public Corporation], Tokyo: Mainichi Shinbun.
Shindo, Hisashi (1982) *Denden Zakkubaran* (in Japanese) [Frankly talking about NTT], Tokyo, Toyokeizai Shinposha.
Southwick, Karen (1999) *HIGH MOON: The inside story of Scott McNealy and the Rise of Sun Microsystems*, John Wiley and Sons, Inc.
Tuchiya, Toshiaki (2008). “NGN ni okeru Hinshitukanri Gijyutu (in Japanese)” [Quality control of NGN], NTT technology Journal, 20(6) pp.30-31.

Varadarajan, R. and Cunningham, M. (1995) , "Strategic Alliances: a synthesis of conceptual foundations, *Journal of Academy of Marketing Science*, 23(4), pp.282-296.

Vargo, S. & Lusch,R. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, 68(January), pp.1-17.

Vargo, S. & Lusch. R (2006).Service-Dominant Logic: What It Is, What It Is, What It Is Not, What It Might Be. in *The Service-Dominant Logic of Marketing: Dialog, Debate, and Directions*, R.F. Lusch and S.L.Vargo, eds. M.E.Sharpe, Inc.

Vargo and Lusch 2008a, "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, 36, pp.1-10.

Vargo and Lusch 2008b "Why 'service'?" *Journal of the Academy of Marketing Science*, 36,pp.25-38.

Weber, Steven (2004). *The Success of Open Source*, Cambridge, Massachusetts, and London, England: Harvard University Press.

Wise, Richard and Peter Baumgartner (1999), "Go Downstream; The New Profit Imperative in Manufacturing," *Harvard Business Review*, September-October, pp.133-141.

Yin, Robert K. (2003) *Case Study Research: Design and Methods Third Edition*, Sage Publications.

Yost, Jeffrey R. (2005) *The Computer Industry*, Green Wood Press

Zeithaml, Valarie A. A. Parasuraman and Leonard L. Berry(1985),"Problems and Strategies in Services Marketing", *Journal of Marketing*,Vol.49,33-46.