Part I. Japan Team : 6. Infrastructure Building in the Japanese Telecommunications Sector: From Public-Public Partnership to Public-Private Partnership

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Infrastructure Building in the Japanese Telecommunications Sector: From Public-Public Partnership to Public-Private Partnership

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1. INTRODUCTION

Telecommunications infrastructure is fundamental to the information society in the 21st century. Telecommunications technology has seen remarkable developments since the late 1980s. One of the most important advancements has been made in the field of multimedia, which involves the transmission of a huge volume of data including images, voice, and words through optical fibers. The development of technology such as computers, ISDN, and ATM switches has made multimedia a reality. Multimedia has made the real world small enough to transmit face-to-face information in real time.

In addition, telecommunications infrastructure such as the optical fiber network has been installed extensively in many countries, and enables the transmission of a huge volume of information at high speed. Based on this infrastructure, the above-mentioned applications such as

multimedia and the Internet have become possible. Both infrastructure and application together, in other words, both hardware and software are essential to the information society, and one without the other is meaningless.

In this paper, we discuss the current situation of telecommunications infrastructure and the application of multimedia based on it, providing examples in the fields of medicine and education. As an example of telecommunications infrastructure, the traditional fixed telephone network comes to mind. Regarding the fixed telephone, the Japanese penetration ratio is almost 100% and so-called universal service has been discussed. This issue in Japan lies not in promoting telephone service to low-income families, who cannot afford to own a telephone, but in achieving fairness in the level of charges and the content of services in the differing regions such as metropolitan and depopulated areas.[1]

On the other hand, the optical fiber network has been constructed as a part of telecommunications infrastructure, and its construction is mainly the responsibility of telecommunications carriers such as NTT, and other NCCs. They have their own schedule for installing optical fibers according to their business strategy, and as a result of competition the optical fiber network is expanding throughout the economy.

The current areas covered by their network are, however, not satisfactory for fully utilizing multimedia in every region. Therefore, local governments and agencies, which are financially supported by the central government, have been constructing their own networks for their own policy purposes. This paper explains this situation, presents the Japanese way of building telecommunications infrastructure, and discusses its characteristics and issues.

This paper consists of the following sections. In section 1, we focus on the optical fiber network as an example of telecommunications infrastructure and show the current situation, and discuss the frameworks of infrastructure building: namely, competitive and non-competitive. In sections 2 and 3, we examine how telecommunications infrastructure has been constructed in both a competitive and non-competitive framework, respectively. Local governments all over the world are now constructing their own optical fiber network, and the example of Kobe City is presented in section 4, as to how the different agents in the city collaborated to construct the network. In section 5, we analyze the Japanese way of constructing telecommunications infrastructure which differs from those of other economies, namely, 'public-public partnership,' and the necessity

for the Private Finance Initiative (PFI) or 'public-private partnership' is discussed. Conditions for further applications of multimedia in the fields of medicine and education based on telecommunications infrastructure are proposed in the final section.

2. TELECOMMUNICATIONS INFRASTRUCTURE

Here, the definition of telecommunication infrastructure used in this paper is clarified, and the frameworks for constructing optical fiber networks are presented.

2.1. Construction of Optical Fiber Networks in a Competitive Framework

In this paper, we mainly focus on optical fiber networks as telecommunications infrastructure, and discuss schemes to install optical fiber networks all over Japan. To begin with, let us discuss agents which install optical fibers for the purpose of telecommunications. They are as follows: (1) long distance telecommunications carriers such as NTT Communications, KDD, and other long distance NCCs; (2) local telecommunications carriers including East NTT and West NTT, which are divested from former giant NTT, and TTNet, CTK, OMP and Qnet, which were established mainly by electric companies and are called local NCCs; (3) CATV companies; and (4) cellular phone and mobile phone companies. Those agents have been competing with each other, and they have been constructing optical fiber networks according to their business strategies.

Telecommunications infrastructure is, in general, classified into two categories: trunk lines and subscriber lines. As for trunk lines, long distance carriers have already established their fiber networks among all their nodes (branches) throughout Japan. NTT has, for example, established about 180,000 km of trunk fiber cables including a high speed network by late 1999, and KDD has installed 100Gbps in a water network called "Japan Information Highway" which surrounds Japan, which started operations in April 1999. With the expectation of increased demand for the Internet and electric commerce, they have all been attempting to expand gigabit capacity. This is exactly the aftermath of market competition.

On the other hand, the situation of subscriber lines is quite different.[2]

Telecommunications carriers, both long distance and local, do not have any intention of installing optical fibers for individual homes, that is, 'fiber to the home' (FTTH). The main reason is that it is costly and less demand for high speed and large volume communications are expected from households. Telecommunications carriers are, instead, planning 'fiber to the curve' (FTTC). CATV companies, however, have networks for individual families, even though their network situated near households are still mainly based on capper lines and coax, rather than optical fibers. Since CATV, and cellular phone and mobile phone companies have their own network, they are considered to be an important segment of the telecommunications infrastructure.

2.2. Construction of Optical Fiber Networks in a Non-Competitive Environment

In a competitive environment, only profitable services are provided to high demand users or areas. High cost areas such as depopulated regions or isolated islands, for example, cannot receive such services. To cope with this situation, the concept of universal service is thought to be required. That is, telecommunications carriers bear universal service obligation to install infrastructure and provide services, and the cost of universal service is borne by all telecommunications carriers.

There is another scheme to construct telecommunications infrastructure other than through the market mechanism; that is, local governments can install telecommunications infrastructure by themselves using their tax money. Depopulated areas are last on the list for telecommunications carriers to install optical fibers, and they should not be expected to wait for such service. According to economic theory, public intervention is one solution to market failure. In the age of an information society, however, this has much more significant meaning. Telecommunications infrastructure provides the basis of the regional information policy that is implemented by local governments. The development of information technology makes it possible for even small regions to pursue their policy goals such as promoting economic activities as well as increasing amenities and welfare services.

There are many examples of large regions as well as small-sized cities constructing a fiber optics system inside a region, not only for administrative purposes but also for attracting factories, business offices, and big commercial complexes (Longcore and Rees [1996], Grant and

Berquist [1998], Sharon and Berquist [1999]). Examples of large networks are the North Carolina Information Super Highway (NCIH) and the Iowa Communications Network (ICN). The former was constructed through the collaboration of telecommunications carriers and the state government, and the latter by the State of Iowa. These networks provide the basis for their regional information policies, and interconnect administrative offices, schools, educational institutions, libraries, and medical facilities.[3]

2.3. Technological Progress and Telecommunications Infrastructure

So far in all countries, fixed telephone telecommunications networks were constructed by either government enterprises or a regulated monopoly, since in this industry it was widely believed that the theory of natural monopoly held. But technological development, including digitalization and multimedia in the info-telecommunications field, has been most rapid compared to other industries. Traditional telecommunications infrastructure such as capper lines and coax has been replaced with optical fibers, which allow the transmission of a huge volume of information at high speed. Because of the digitalization and development of computer technology, the cost of equipment and devices have been remarkably reduced and quality improved. This technological development lowered the barriers for other firms to enter the telecommunications industry, and thus competition for services and for the construction of infrastructure began.

Due to competition among carriers, all trunk cables were replaced with optical fibers, as will be explained later in more detail. Subscriber lines, on the other hand, are still owned by NTT, since the cost to install those subscriber lines are thought to be high. Again due to technological development, new networks such as those of CATV, and cellular and mobile phones are expected to reach more users. Moreover, a wireless local loop is also expected to be introduced in the near future. In sum, the definition of telecommunications infrastructure is not set, but rather changes according to technological development.

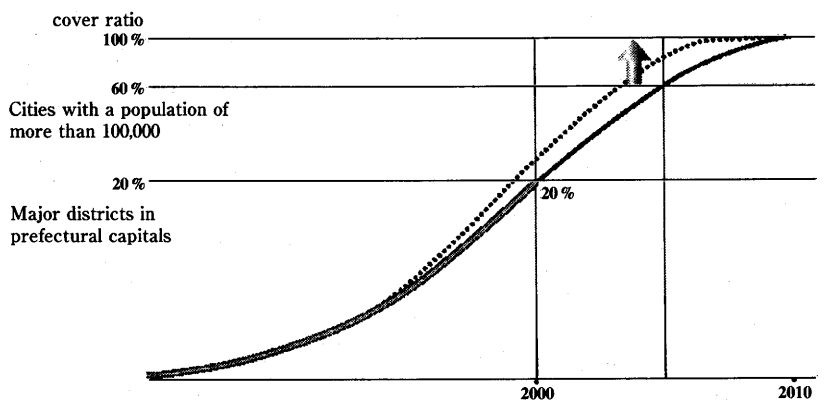
3. TELECOMMUNICATIONS INFRASTRUCTURE CONSTRUCTION IN A COMPETITIVE ENVIRONMENT

Here, the current situation of the construction of telecommunications infrastructure is presented, and according to each agent installing optical fibers, we discuss particular business strategies for infrastructure construction in a competitive framework.

3.1. Overall Situation

Figure 6.1 indicates the schedule of optical fiber installment in Japan. In 1994, the government set up a schedule such that by the year 2010, 100% of the nation would be covered by optical fibers. In 1997, it was decided to speed up the schedule, with the aim of completing it by the year 2005 with the help of the private sector. At this time, special loans were prepared for the was installment of optical fiber to subscriber lines, and the amount increased year by year. As a result, the ratio of regions covered by optical fibers are as follows: 10% (1994), 13% (1995), 16% (1996), 19%(1997), 27% (1998), and 30% (1999).

Figure 6.1: Schedule of Construction of the Optical Fiber Network



Source: MPT.

3.2. NTT

Although NTT was divested into four companies, they each are still big in size and play important roles in the Japanese telecommunications market. The most important characteristics of the NTT group is that local NTTs such as West NTT and East NTT own subscriber lines. All NCCs have to interconnect with subscriber lines in order to provide services to each consumer. In 1997, NTT completed the digitalization of trunk cables and local switches. Based on this digitalization, NTT started diversified new services such as a monthly discount for long distance calls, and a fixed monthly rate for a specific time zone, ISDN services, and Internet services.

NTT has also been engaging in replacing existing capper networks with those of optical fibers, and currently the ratio of optical fibers in the network is about 30%. In more detail, business districts in prefectural capitals as well as big cities with a population more than 100,000 have completed the replacement of optical fibers. NTT plans to complete all replacement by the year 2010.[4] NTT's strategy of promoting optical fibers places high priority on metropolitan and business areas by aiming at leased circuits for business users. NTT does not have any plan to FTTH, but rather FTTC. All capper lines to houses will be replaced with optical fibers, but for individual subscribers, NTT has a project named 'π system'. The π system is a hybrid of optical fibers and capper lines. Optical network units (ONUs) are installed on the telephone poles. ONU exchanges optical signals for electric, and it connects optical fibers to existing capper lines. One ONU can handle 10 lines (houses), and provide INS64 as well as low speed OCN (Internet connection).

Another new technology supporting FTTC utilizing existing metallic lines is called x Digital Subscriber Line (xDSL). This is also called SDSL, HDSL, ADSL, etc., according to the different transmission methods, and enables high-speed transmission such as 50 Mbps and is expected to promote multimedia.[5]

3.3. Local Telecommunications Carriers

Local telecommunications carriers base their systems on the networks of electric companies. Electric companies own power plants, distribution networks, and other facilities, and the aim of the networks is to control and operate their systems related to generation, transmission, and distrib-

ution of electric power, and securing a stable supply. In addition to these, the network is used for automatic gauging of electric usage. Since these networks have to meet the above-mentioned specific purposes and require a certain level of quality and reliability, it can be utilized as the public switched network of telecommunications carriers. The characteristic of this network is that it can play the role of subscriber lines, and this is why electric companies have started providing telecommunications service.[6]

Tokyo Electric Company, for instance, currently owns 40,000 km of optical fiber network, and plans to extend this to 80,000 km in five years. The purpose of this expansion is not only to promote its telephone services operated by its affiliated company TTNet, but also to set up a new company with Softbank which will begin a new business this summer in providing Internet service at a fixed rate. The existing network is too small for starting a new business and expanding its network to the curve of the street, that is, FTTC. Tokyo Electric Company will install 8,000 km of optical fibers in metropolitan Tokyo, and will expand to cities with a population of more than 100,000 within its business areas by the end of the year 2004.

3.4. CATV

CATV has an optic fiber network, which also serves as the information infrastructure of the region, that has the characteristics of locality and interactivity. CATV is currently in the center of the so-called 'convergence of telecommunications and broadcasting,' and has expanded services to telephony and Internet connection. CATV in foreign countries has been playing an important role in telecommunications as well as broadcasting, but due to the deregulation of 1993 the number of subscribing households has been increasing in Japan. In April 1999, the number of households was 2.2 billion and its ratio to total households was 13.4%.

In order to promote its activities, as previously mentioned, deregulation in CATV started in 1993. The Ministry of Posts and Telecommunications (MPT) has been revising CATV regulations with the aim of making CATV the core of the info-communications infrastructure, particularly in the region. The following are the items covered by the deregulation: (1) abolition of local operator requirement for CATV operators; (2) lifting restriction on foreign capital investment; (3) simplification of the

application form for obtaining permission to install CATV facilities; (4) utilization of fiber-optic subscriber networks owned by telecommunications carriers (June 1998); and (5) utilization of wireless networks for complementing the CATV network (September 1998). By abolishing the local operator requirement, CATV operators have been able to expand their business over a wider area. Because of this, a variety of capital including trading companies is entering the CATV market. CATV businesses covering multiple administrative districts are on the rise, and multiple system operators (MSO) have started to launch their businesses. (4) implies that CATV operators are allowed to use the fiber-optic subscriber network owned by telecommunications carriers on the condition that fair and effective competition is secured.

Because of the above deregulation on CATV and technological development, CATV operators have been expanding their business activities such as CATV telephony services and Internet access, and preparing for digitalization and full service. CATV can access to the Internet much faster (eight to sixteen times) than ISDN (64 kbps) of telecommunications carriers, since the former has a broadband network with 750 MHz. In addition, CATV provides Internet service at a fixed rate, which is not yet provided by NTT. [7]

In spite of these characteristics, interconnections among different CATV networks remain quite unsatisfactory. Each CATV network is an important local information infrastructure, but they are still separated from the other, and have not reached the level of nationwide infrastructure.

4. TELECOMMUNICATIONS INFRASTRUCTURE CONSTRUCTION IN A NON-COMPETITIVE ENVIRONMENT

Some optical fiber networks are constructed in a non-competitive framework, that is, by local governments. Here, we introduce projects related to local information policy and present their characteristics.

4.1. NCIH and ICN in the US

The largest ATM network is found in the State of North Carolina in the US, which is called the North Carolina Information Super Highway (NCIH), and utilized for tele-education, tele-medicine and administrative

purposes. NCIH is the first broadband ISDN SONET/ATM network to be used in the world for practical use. The speed of transmission is 155Mbps.

NCIH was constructed and is owned by three major regional telecommunications carriers in the state including Bell South, GTE, and Sprint; that is, it is a commercial network, but the State of North Carolina is the largest user of the network. NCIH was thus constructed and has been operated with the collaboration of private and public organizations. The benefit for private companies in constructing huge infrastructure lies in their expectation of increased demand and new businesses from the private sector in future, although the current user is mainly the local government. In addition to the state government, regional banks such as Branch Banking & Trust, and Mercedes Benz are end users of the network. The latter is using the ATM network for training automobile mechanics specialists.

In the State of Iowa, the Iowa Communication Network (ICN) is in operation. The construction of ICN was begun in 1991, and the current total mileage of the network is 3,000 miles. ICN has been serving as the backbone for tele-education and tele-medicine, and is also leased to private companies such as Sprint and MCI. When the construction of ICN was being planned, private companies were asked to present their bids for the project, and since no bids were received, the state government decided to construct the network by itself. The end users of ICN are educational facilities, libraries, state government, the National Guard, clinics and hospitals, federal government, and post offices. The purposes of ICN use are tele-education, tele-medicine, and the legal field. The way of constructing infrastructure is in good contrast to that of the NCIH, and the difference rises from the density of population and economic strength of each state.[8]

4.2. Regional Optical Fiber Networks: Wide Area Network

Now in Japan, projects similar to the Information Super Highway have been discussed by prefectural governments such as those of Okayama, Oita, Mie, and Kochi. The objective is to construct a broadband optical fiber network, which serves as the backbone of the Wide Area Network (WAN) in the region. That is, all other networks in the region, both public and private, such as the Local Area Network (LAN) of local governments, regional Intranet, CATV, and telecommunications carriers are

interconnected with each other through WAN, and all agents such as firms, schools, Internet Providers (IP), and individuals can have access to this. The ultimate aim is for all households in the region to have access to this WAN at high speed such as several Mbps. The essential difference of NCIH and ICN lies in the fact that the Internet is the core factor.[9]

The regional information policies based on WAN are as follows: (a) tele-education, which interconnects all schools in the region, and provides study at home as well as life-long education; (b) tele-medicine, which provides tele-care at home for the elderly, and emergency services; (c) volunteer activities; and (d) smart administration which makes it possible to provide administrative services 24 hours a day.

4.3. Regional Information Policy and Telecommunications Infrastructure

Some small-sized local governments have already constructed their own network either by themselves or with the collaboration of the central government and private telecommunications carriers. Here are some examples.

(a) *Setouchi Town, Kagoshima Prefecture*

Setouchi Town is located at the southern tip of Amami-Oshima Island, Kagoshima Prefecture, and consists of 3 other isolated small islands, namely, Kakeroma, Koishima, and Yoro Island. The population of the town is 12,017, and this has been showing a decreasing trend since there is no big industry in the town, except for fishery.

The tele-education system of Setouchi Town interconnects three elementary schools of the town and the Education Research Center of Kagoshima Prefecture by ISDN (64Kbps and 1.5Mbps). They are Koniya School on the main island, Hyo School on Kakeroma Island, Ikeji School in Uke Island, and Yoro School on Yoro Island. The main aim of tele-education in this town is to unify the feeling of the teachers and pupils on the isolated islands. In this project, NTT constructed an optical fiber network in this isolated town for this purpose only.[10]

(b) *Kawai Village, Iwate Prefecture*

On the other hand, in Kawai Village, Iwate Prefecture, although the total length is about 1.5 km, the local authority built the optic fiber network (64 Kbps) at the cost of ¥7 million (US$

70,000) at their own expense. Kawai Village is located in a mountainous area with 4,300 inhabitants and has the second lowest income level in Iwate Prefecture. The network interconnects related offices such as those for administration, health, welfare, and medical services, and these offices share information. By sharing information, the efficient allocation of caretakers, visiting nurses, medical doctors, and equipment are achieved. This network for sharing information is essential for reducing the cost of medicine and care-at-home and promoting efficiency.[11]

4.4. Other Examples: Tele-care at Home System[12]

The construction of an optical fiber network is not the sole objective, and it becomes meaningful only when it is actually applied. Here we show some examples of local governments constructing telecommunication infrastructure and later implementing a regional information policy such as tele-medicine. This section is thus related to a non-competitive framework.

The tele-care at home system, in effect, connects patients at home and medical institutions through the telecommunications network, which includes public telephone lines of telecommunications carriers, leased circuits, ISDN, and the CATV network. In addition to these, among advanced university hospitals and medical institutions, cellular and mobile phones, the Internet, and even satellite communication are used.

The characteristics of the tele-care at home-type system are the real-time and two-way interactive transmission of motion pictures by using a videoconference system or videophone. This system makes the greatest possible use of the characteristics of multimedia, and is classified into three subcategories according to type of network: (a) CATV-broadcast type; (b) CATV-LAN type; and (c) ISDN type. The CATV network, utilized by (a) and (b), can transmit high definition motion picture of 30 cells per second by color digital (CCD) camera with 360,000 elements. As far as the system is concerned, (a) uses the network for broadcasting and (b) the network for LAN. As for working examples of (a), the systems of Goshiki Town in Hyogo Prefecture and Kamaishi City in Iwate Prefecture are two in operation. As for (b), there is the care-at-home support system called 'Anshin-netto' in Minami-Shinano Village in Nagano Prefecture which is the only working example of the LAN type.

In the context of construction of telecommunications infrastructure, CATV networks of (a) and (b) were constructed through the so-called 'third sector method,' which is a joint venture of local governments and local companies with the financial assistance of the central government.[13] On the other hand, the ISDN type (c) of tele-care at home utilizes INS64 of NTT's public telephone lines as its network, and image information is transmitted by the videophone system. As for quality of screen image of videophones, the motion picture is 10 to 25 cells per second, and it is inferior to that of the CATV type. This type of system is in operation in Bekkai Town in Hokkaido, Mogami Town in Yamagata Prefecture, Ogaki City in Gifu Prefecture, and Mitoyo region in Kagawa Prefecture.

Table 6.1 provides a comparison of the three systems. The three systems have both advantages and disadvantages in terms of quality of screen image, construction expenses, operating cost, and so on.

Table 6.1: Comparison of Systems

	CATV-Broadcasting Type	CATV-LAN Type	ISDN Type
Number in Operation and Name of Local Government	2 Kamaishi City Goshiki Town	1 Minami-Shinano Village	4 Mogami Town Ogaki City Bekkai Town Mihama District
Picture Quality	High	High	Low
Privacy	By scramble	Easy	Easy
Cost of Network Construction	¥1.5 billion	¥600 million	None (NTT constructed)
Cost of Equipment	¥170 million (Goshiki Town) ¥20 million (Kamaishi City)	¥100 million	¥27 million (Mogami Town)
Telephone Bills	None	None	¥1 million (Mogami Town)
Extension of System	Difficult	Easy	Easy and simple

Source: Tsuji et al. [1999b].

In those projects, most of the construction cost is financed by the ministries of the central government, and local governments bear those of maintenance and telecommunications charges. This is the secret as to how these small and depopulated regions can implement a tele-care at home system.

5. INFRASTRUCTURE CONSTRUCTION: CASE OF KOBE CITY[14]

Here, we select one particular region, Kobe City, and introduce how each agent collaborated in constructing the city's network. It has been widely reported that the killer earthquake of January 1995 devastated Kobe City and left more than 6,000 casualities. Since then, Kobe has had the unique opportunity of reconstructing the city by building telecommunications infrastructure aimed at preventing disasters and promoting the economic and social activities of the city. Here, we present how telecommunication infrastructure has been built by the different agents.

5.1. Optical Fiber Networks Constructed by TAO

The construction of optic fiber networks is mainly the responsibility of telecommunications carriers such as NTT and other NCCs. NTT has its own schedule for installing optical fibers according to its business strategy. Thus, local governments and agencies, which are financially supported by the central government, have been constructing their own networks for their own policy purposes.

In Kobe City, much effort has been made to construct the information infrastructure by different agents. First of all, there is an optical fiber network constructed by the Telecommunications Advancement Organization of Japan (TAO), which is an agency of the MPT, and this agency owns and operates this network in collaboration with the city office.[15] TAO is a research organization and develops telecommunications technology through experimental activities. TAO constructed the network in Kobe in order to conduct research on the application of the network for disaster prevention.[16]

This network consists of the following two sub-networks: (a) trunk optical cable with 622 Mbps; and (b) branch optical cable with 155Mbps. The total length of the network is about 53 km and this is the longest optic fiber network of a local government in Japan. Construction was

started in 1996, and it cost about US$100 million. It is an ATM network and there are seven ATM switches in the network. The network is installed along the subway lines (30 km), a new urban transportation system called Port-Liner, highways such as the Harbor Highway, roads, and underground shopping malls.

This network serves as the city's basic infrastructure, and interconnects the city office, its main branch offices, universities, schools, and major hospitals. In order to interconnect with the CATV network, which will be explained later, there are five CATV access points. Many projects of a regional information policy based on multimedia have been implemented on this infrastructure.

5.2. NTT's Optical Fiber Network

As mentioned earlier, NTT is the biggest agent for installing optic fibers, and it has its own policy for installation all over Japan. In order to support the reconstruction, NTT put a high priority on installing optic fibers inside Kobe City, and currently installment has been completed in the central business district. NTT aims to complete this work in other business districts by the year 2000, and as for areas other than those related to businesses which were heavily damaged by the earthquake, NTT plans to replace 40-50% of the telecommunications network with optic fibers. In other areas, 20-30% of the network will be replaced by optic fibers by 2000.

5.3. CATV

CATV was started in Kobe City in 1973, and five CATV companies are now in operation, covering almost all city areas. All CATV stations are established as a joint venture of the public and private sectors. Interconnection with CATV and the ATM network mentioned above was attempted by TAO as an experimental project after the earthquake. Yet, these networks are not interconnected with each other, nor have they started Internet connection. CATV in Kobe is mainly used only for broadcasting. Efforts have been made to expand the CATV network even wider, and to renovate its technology to proceed with new services such as Internet connection, TV shopping, Video on Demand (VOD), and telephony.

6. CHARACTERISTICS OF JAPANESE TELECOMMUNICATIONS INFRASTRUCTURE CONSTRUCTION

In the previous section, telecommunications infrastructure construction and application were presented in a non-competitive environment. Here, Japanese characteristics are discussed.

6.1. Public-Public Partnership (PPP)

The unique way of constructing infrastructure in Japan is found in the relationship between the central government and local governments. That is, central and local governments coordinate with each other in order to construct infrastructure and proceed with application. In the traditional Japanese jurisdiction, the central government has had ultimate power in all policy fields including budget allocation. The ministries set up their plans and strategies, and allocate tax money to realize those policy goals. Local governments, on the other hand, actually implement the policies.[17] In this paper, this relationship is referred to as Public-Public Partnership (PPP).

This relationship is explained by the principal-agent theory; that is, central government is the principal, and local governments are the agents. As to the fields of health, medical care, and education, local governments such as those of the city, town, and village are in charge, since these public services are closely related to the lives of all residents. In order for those services to be provided properly, local governments have to grasp the need and demand of the residents, and select the most suitable policies. Thus, local governments interested in those related matters proceed with their own policies. On the other hand, although the central government has power, it cannot gain access to information related to the regions. Then the asymmetry of information thus arises, and the central government selects a local government to proceed with its policy goals.

There is the following traditional basis on which PPP holds, that is, the Fiscal Investment and Loan Program (FILP).[18] The FILP is a general name for government activities related to the finance and investment of public funds. The total amount of funds related to this program is so huge, almost half the national budget, that this program is sometimes referred to as 'the second national budget'.

Local governments also require funding to improve their infrastruc-

ture such as roads, parks, and schools. For these purposes, they issue bonds to finance projects. The FILP also purchases those bonds. Nearly more than half the bonds issued by local governments is bought by the program. The particular objectives of investment by the FILP is classified into the following twelve categories; (1) housing, (2) maintaining national land and environment, (3) welfare, (4) education, (5) financing small businesses, (6) agriculture and fishery, (7) preventing natural disasters, (8) roads, (9) transportation and communication, (10) regional development, (11) industrial technology, and (12) trade and overseas cooperation.

The reason for government financial involvement is explained by market failure. In the financial market, imperfection occurs from various reasons, and the market fails to achieve the efficiency of allocation. The inefficiency of the market system comes from mainly the following two factors: imperfect information and imperfect competition. The former results in the lack of the market or the lack of complete contracts in the private sector, as suggested by Ide and Hayashi [1992]. This also leads to government provision of funds to risky areas, which has less incentive for the private sector to invest in (see Yoshino [1990]). The government and the private sector share the risk.

There is another reason why PPP is successful in the field of info-communication; that is, competition among government agencies. Bureaucrats are said to be eager to expand their power to related areas of their administration. This is what motivates the competitive atmosphere among government ministries. Now, targeting the information society of the 21st century, bureaucrats are announcing their own projects in the information industry. The Ministry of International Trade and Industry (MITI), the Ministries of Construction, Agriculture, Transportation, and the MPT have formulated ambitious projects for promoting regional information policies based on multimedia. Even the Ministry of Education has joined this race.[19] This attitude of claiming new territory has the same basis as the government's role in implementing an industrial policy for Japanese economic development.

6.2. The Third Sector Method

Another characteristic of regional information policy related to infrastructure construction is the third sector method; namely, projects are proceeded with through the joint venture of the public and private sec-

tors. Among the latter, interested private firms join in the project. The main reason for this is the size of the project. If the project requires a big amount of funds, local government cannot manage to undertake it by themselves, and regional firms are asked to join the project.

This scheme itself is quite reasonable, but, as Kagami [2000] argues, most projects based on this scheme tend to fail. The main reason for this is "coordination failure," due to the lack of leadership and responsibility. It is apparent that regional information policies carried out with the strong leadership and clear vision of the head of local government are successful.

7. CONCLUSION: FROM PPP TO PUBLIC-PRIVATE PARTNERSHIP

In the UK and other countries, PFI is utilized for information technology (IT), and this particular kind of PFI is called IT-PFI. Here, the possibility of IT-PFI in Japan is discussed.

7.1. IT-PFI

In the classification of PFI in the UK, there is a category related to IT. Specifically, it is called System Development and Service Provision, and this means that a private contractor designs, builds, and operates an IT system for a particular authority. This project includes the construction of a computer system and provision of public service through it. Examples of IT-PFI are found in the New Insurance Record System (NIRS2) and the Immigration and Nationality Directorate (IND) in the UK, and SmartTraveler System in Washington, DC in the US It is widely believed that IT-PFI is one of the most promising projects.[20] In Japan, on the other hand, PFI is generally referred to as investment for hardware, typically physical facilities such as buildings and roads, and it is less concerned with IT and software.

From the experience of our field research, in the fields of tele-medicine and tele-care at home, most of the projects had already been proceeded with, more or less, by public-private partnership, namely, with the collaboration of local governments and manufacturers of related industries such as those dealing with computers, electrical appliances, and cameras. Since tele-medicine is a new field, and there was no ready-made equipment or devices of mass-production, they had to develop

them by themselves. In the case of Goshiki Town and Kamaishi City, for instance, the private sector had already been participating in their telemedicine projects in this way. Household electric appliance companies manufactured a CATV system together with the staff of local governments. Computer makers and equipment manufacturers are quite eager to sell their hardware as well as software related to care-at-home, since the care-at-home insurance will be in effect as of April 2000. They have already started experimental projects to establish the network to exchange and share information related to care-at-home among the related sections of local governments. By accumulating these experiences, IT-PFI in this field might be successful.

7.2. Conditions for IT-PFI in the Construction of Telecommunications Infrastructure

As already mentioned, public and private sector collaboration is proceeding, but only in the technological field. In order to achieve real PPP, more private funds should be directed towards IT-PFI. Care should be given to the following issues related to IT-PFI: (a) the scope of the project; and (b) risks. Since IT-PFI in the field of tele-care at home, telemedicine, and tele-education, for example, includes various activities, assets on which the services are based include tangible and intangible, or hardware and software, and personnel or staff so it is rather difficult to determine the scope of the projects. Without a clear distinction of the business activities of PFI, its success cannot be secured.

The most important issue of PFI in general is how to share the risks among related agents. IT-PFI also has its own risks related to management and development. The former comes from the following sources: inefficient project management, vagueness of business objectives and scope of projects, and consistency of demand of local governments. The latter is related to the length between contract and operation, the period in which projects give riser to concrete effects. In addition, IT-PFI is related to newest technology, and risks come from reliability of technology and when it is completed.

From examples of actual projects related to telecommunications infrastructure implemented by local governments shown in sections 3 and 4, the following issues are related to IT-PFI. First, project size is rather small. From the viewpoint of business, small projects mean they are less attractive for private firms to participation. In order for projects

to be more profitable, several nearby local governments should join together and implement IT-PFI.

The second issue is as follows. If projects require big investment for infrastructure, they may not work out successfully, since the more amount of funds are required, the more risky projects become. In order for IT-PFI to be successful, the proper share must be agreed upon. The proper share of public-private partnership, for instance, is that the public takes responsibility for constructing infrastructure, and the private software, and this reduces the risks for the private sector. As shown by telecare at home, the central government takes care of infrastructure investment and the local government the costs of maintenance and telecommunications charges, and this provides some suggestions for cost sharing.

Notes

[1] As for the current discussion on universal service, see Sugaya [1997], and Tsuji [1999a].

[2] Issues related to the bottleneck monopoly of subscriber lines is discussed by Tsuji [1999a].

[3] See 3.1. for more details.

[4] The timetable for replacement can be viewed on NTT's homepage.

[5] By making use of this, it is reported that NTT has started Video on Demand (VOD) service. One shortcoming of this technology is the distance of transmission, and 7 km is said to be the limit.

[6] In addition to electric companies, gas companies also own networks for the same reason. No gas company operates a telecommunications business, but some provide services such as home security through their networks. An interesting service is found in the application of a tele-medicine network. One small gas company in Gifu Prefecture has been providing viral sensors to families and they send medical data through its network. This is an interesting service which is expected to have increased demand.

[7] In the case of Titus Communications, the ratio of households using CATV telephony is 3.3%, and that of Internet connection 1.7%, as of April 1999.

[8] As for NCIH and ICN, and their comparison with Japan, see Tsuji *et al.* [1999c].

[9] It is said that in the age of the Internet, huge and expensive networks such as NCIH and ICN are not necessarily essential, and they are products of the pre-Internet age.

[10] See Tsuji et al. [1999a] for more details.

[11] See Tsuji et al. [1999b] for more details.

[12] This section is based on Tsuji *et al.* [1999c].

[13] See also the discussion in 5.2.

[14] This section in based on Tsuji [1999b].

[15] The network will be transferred to Kobe City after a certain period.

[16] TAO also has a R&D branch institution in Kobe, and it engages in R&D activities.

[17] It is said that local governments have only so-called '30% autonomy' in terms of money and power, and most of the power is in the hands of the central government.

[18] The role and theoretical foundation of FILP was discussed extensively by Tsuji [1996].

[19] Another field of competition among government agencies is venture businesses. Most of the above ministries receive financial assistance for promoting venture businesses.

[20] See Hidaka [1999] for instance.

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