JAPAN'S EXPERIENCE IN INFRASTRUCTURE DEVELOPMENT AND DEVELOPMENT COOPERATION[1]

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SUMMARY

This paper examines Japan's experience in infrastructure development and roles in development cooperation. First, patterns of demand in the transportation and electricity sectors, which are key infrastructure in national progress are analyzed at each phase of economic development in Japan over the past century. This analysis identifies the distinguished characteristics inherent in that process. Second, the linkage between infrastructure demand patterns and phases of economic development are discussed by comparison of those in Japan and South Korea. Third, Japan's experience in institutional and financial arrangements for infrastructure development is broadly examined. Fourth, Japan's experience in infrastructure investment aiming at correction of regional disparities is reviewed, followed by a comparison of Japan and the US for regional disparities in infrastructure service charges. Fifth, based on these experiences in Japan, it should be stressed that analyzing and reporting on the Japan's experience from the viewpoint of developing countries gives Japan a comparative advantage in providing international cooperation. Finally, strategic viewpoints on future cooperation for infrastructure development are presented, and some recommendations are proposed.

1. INTRODUCTION

Infrastructure development is essential for attainment of the main development targets of developing countries, namely improved human development index, participation in development with equitable distribution of benefits, sustainable economic development, and preservation of land and environment. Therefore infrastructure development is the most integral part of the public policies in developing countries. Support for infrastructure development is an extremely important field not only for ODA, but also in the activities of private businesses and citizens' groups such as NGOs. However, little research has been conducted on linkages between development targets and infrastructure development. Particularly it is more than so in such development and phases of economic development, and correction of regional income disparities from the viewpoint of current tasks facing developing countries. In general, the overall qualitative evaluation is applied to each project individually in the infrastructure development plans, in addition to quantitative cost-benefit analysis. This method is the most effective when demand is already evident. However, the cost-benefit analysis method is constrained as a means of decision-makings concerning core infrastructure development which frames future national economies. This is because synergies with other sectors, external economies and production effects on regional economies are beyond the control of the authorities involved in the planning and execution of the projects. Even if it can be controlled by the planning and execution agencies, it is difficult to predict and quantify external economies. Demand prediction and investment allocation, which are the key factors of infrastructure development planning, must be based on a long-term economic development trend and land use planning, which predicts the country's temporal and spatial demographics and economic structure. Therefore, this paper is aimed to acquire lessons contributing to infrastructure development in developing countries based on the macro-scopic empirical analysis of infrastructure development in Japan.

First, this paper will extract the distinguished phases of Japan's economic development process from early Meiji to present, and the patterns of infrastructure development in conjunction with these development phases are presented, focusing on demand and investment in the core

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1 This paper is a substantial revision and reorganization of the portions of the following works which were the responsibility of the author: "The Path of Infrastructure Development and Economic Development", Transport and Economy (January - February 2000 edition), Transport Survey Office, and "International Development Theory: Chapter 18" Toyo Keizai Shinposha, 2000.

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infrastructure sectors (energy, electricity, transportation). The interrelations of economic growth, infrastructure demand and investment are particularly analyzed here. Comparative analysis of Japan's patterns with South Korea's case will reveal the remarkable similarities imilarities. The role of public and private sectors in infrastructure development are also reviewed briefly, with a view to the current tasks burdened on developing countries. In addition, Japan's investment in infrastructure to overcome regional income disparities will be discussed, and its validity and limitations will be preliminarily viewed with observations drawn from comparison with the United States. Then, based on the Japan's infrastructure development experience over more than a century, implications for developing countries are considered. Finally some recommendations concerning Japan's role in infrastructure development in developing countries will be presented.

2. JAPAN'S PHASES OF ECONOMIC DEVELOPMENT AND ITS DEMAND FOR INFRASTRUCTURE

2.1 RECENT ISSUES CONCERNING DEFINITIONS OF INFRASTRUCTURE

The most appropriate discussion for understanding the definition of infrastructure is Hirschman's argument[2]. Hirschman proposes the concept of social overhead capital, which supplements direct productive capital, and comments the relationship between the direct productive capital of the private sector (factories, machinery etc.) and social overhead capital (abbreviated below to social capital), which is mainly built by public bodies. His hypothesis is that if the social capital is once invested, quantity of public service which can be supplied by social capital often exceeds the quantity of demand, since social capital possesses economies of scale in most cases.[3] It then provides less expensive services and intermediate goods to private sector capital, thereby raising the productivity of private-sector capital.

The social capital acts as a pump priming for expanded private sector investment, and in contrast social capital relatively becomes lacking along with the expansion of private capital and productive activities. When that happens, the private sector's indirect production costs gradually increase and private sector capital input declines. At that stage, demand for social capital investment recurs and such investment is expanded. Thus the two types of investments by public and private sectors expand in a zigzag pattern as they overcome imbalances. Hirschman's hypothesis is an experiential phenomenon seen in many cases[4]. If the social capital defined by Hirschman is equated as infrastructure, six attributes of infrastructure can be shown in the following:

a) In many cases the beneficiaries are non-exclusive.
b) As a technical characteristic, the facilities and services are indivisible.
c) Having regional monopolies due to economies of scale.
d) As a social, economic and environmental characteristic, having external economies and diseconomies.
e) Having geographical, inter-temporal and interpersonal redistributive effects on incomes.
f) When investment and operation are purely based on market principles, there is the risk of harming the public interest in the long run by emerging oversupply or shortage[5].

Within the scope of infrastructure, ports, industrial water supply, airports, expressways, communications and electric power are often used as the services and intermediate goods that are essential for the productive processes of private-sector. As such, it is known as "economic infrastructure." Since it is possible to collect tolls directly from beneficiaries depending upon their usage amount, there is a growing global trend towards private sector investment and operation for such infrastructure within adequate institutional frameworks to protect the public interest.

Besides economic infrastructure, there are also the terms "disaster prevention and environmental infrastructure," "social infrastructure" and "living-related infrastructure." These types of infrastructure to protect the public

2 Hirschman, A.O. (1958). *The Strategy of Economic Development.*

3 Demand in the infrastructure sector means demand that is revealed once it becomes available. Therefore the demand described in this paper does not include potential demand. For example, the potential demand for a road between points A and B is revealed only when the road is usable.

4 One familiar example is the relationship between investment in road construction and volumes of traffic using the road, which shows a leapfrog each other during a period of high economic growth.

5 The range and definition of infrastructure is discussed in detail in "Japan's Social Capital" by the Economic Planning Agency (1998).

safety and improve living standards provide facilities and services that go beyond the pursuit of economic efficiency. The projects such as land conservation, disaster prevention, environmental preservation in the border areas of natural and human activities, and provision of parks and urban settlements are included. It is difficult to collect tolls from the beneficiaries of such services, if not impossible. These types also include works and services such as the following:

- Basic services such as national defense, police, firefighting and quarantine, which are covered by taxes.
- Public education, public health, maternal health and waste disposal, which rely generally on subsidies.
- Water supply and sewerage, for which charges are usually levied.

Many countries in the world are currently faced with the issues of who should supply such infrastructure services, how the costs should be shared, and how maintenance should be conducted. The methods of sharing the supply of infrastructure services differ between countries, and they change over time. Thus the proper division of the burden between the public and the private depends on changing value judgements among the people.

Furthermore, the concepts of "institutional infrastructure" and "intellectual infrastructure" have come to the fore in recent years. These terms refer to the rules and regulations, organizations, institutions and other elements which support the ability of national and local authorities to stimulate the economic activities of the private sector in the market. Based on these concepts, the infrastructure can be defined as follows.

Infrastructure contributes to enhancing productivity and, under democratic governance, assists in the realization of the potential ability of human capital, and creates situations in which that potential can fully function. It also contributes directly and indirectly to improving the safety and quality of people's lives. By delivering its functions (services) efficiently, it provides suitable and sustainable effects for industry (the economy) and the public (society). The term "infrastructure" encompasses facilities, services and management which are intended to accomplish such objectives.

The aforementioned multi-dimensional concept of infrastructure reflects more or less the bitter experiences in developing countries over five decades since the end of World War II.

The rebuilding of economic infrastructure was the key factor in the remarkable recoveries achieved by Europe under the US Marshall Plan and Japan under aid from the US and the World Bank immediately after the end of the War. After that, the developed countries, involved in East - West aid competition, strove to apply the lessons learned from the revival of Europe and Japan to developing countries. However, with the exception of the Newly-Industrializing Economies (NIES) of East Asia, most of these efforts ended in failure. In most developing countries the development of human resources, the transfer of appropriate technologies and the establishment of institutional infrastructure and other elements were prerequisite before the establishment of economic infrastructure. Furthermore, from the beginning of the 1980s the most poverty-stricken countries began to have doubts about their ability of governance and their receiving capacity of aid.

Various aspects related to organizations, institutions and the importance of role played by social norms were strongly recognized. The ideas of institutional (intellectual) infrastructure and governance to strengthen these aspects became major issues in the aid community, along with environmental protection, poverty reduction and women's participation in development.

More recently, the UNDP has put forward the idea of "Global Public Goods," which are goods and services that transcend national borders[6]. It is an essential concept to overcome a wide range of global-scale problems which are emerging together with innovations in technologies and institutions, including IT. As the global crises (environment, poverty, safety, terrorism, infectious diseases and drugs) occur in the areas beyond control by states, the countermeasures are beginning to become a common interest facing global citizenship. It is recognized that the grave shortage of global public goods is now precipitating international crises. As described later in this paper, infrastructure networks across national boundaries are obviously regarded as one of the global public goods.

In Japan, infrastructure investment (development) is practically synonymous with public or government investment; however, they are, strictly speaking, different things. For example, in national account, public investment means government capital formation, and does not include spending on land. However, government investment means ex-

6 UNDP (1999), *Global Public Goods*, Oxford University Press. Japanese translation: FASID (International Development Research Center, 1999), "Global Public Goods", Nihon Keizai Shimbun.

penditure items in the public sector, which includes expenditure on land. In section one of this paper, infrastructure investment means public investment. On the other hand, it should be noted that in section four, infrastructure investment means government investment. However, even if these are regarded as the same thing, the arguments and conclusions in this paper can retain their significance.

2.2 PHASES IN JAPAN'S ECONOMIC DEVELOPMENT

A country's economic development is the process of change in its socio-economic structures. It is also the process of metamorphosis in people's values. It is certainly the objective of infrastructure development to promote and regulate the metamorphosis. The path of a country's long-term economic growth is examined in terms of the gross national product; one common characteristic is that it resembles in shape with growth curve (the S-shaped logistics curve). If a common pattern can be seen in the path of a country's economic growth, it is reasonable to hypothesize that there should also be a common pattern in the development of the infrastructure that supports the country's growth. With this view in mind, it would be worth carrying out an analysis of infrastructure development with reference to the path of economic growth in Japan and South Korea, which started their nation building as developing countries from a viewpoint of Western countries. Such analysis would be also highly significant for the preparation of long-term strategic policies for the infrastructure development in the contemporary developing countries. These will be carried out in this and later sections.

First, drawing on the work of K. Ohkawa and H. Kohama[7], the analysis of Japan's phases of economic development will be explained, including an overview of the characteristics of the economic structures and macroeconomic indicators for each phase. As shown in Table 1, the process of Japan's economic development over approximately one century to 1975 can be divided into five phases with major characteristics explained below.

Import substitution phase for light industrial goods (1887 ~ 1904)

In this phase, traditional sectors developed on the basis of past accumulations, and the manufacturing sector expanded gradually, with the beginning of infrastructure development to support it. Encouragement for exports of traditional products began to be combined with the import substitution of non-durable consumer goods (foodstuffs, light industrial manufactured goods and consumption goods began to be manufactured in Japan and replaced imports). During this phase, the population working in the agriculture sector began to decline slightly.

Export phase for light industrial goods (1904 - 1919)

In this phase, the productivity of the traditional agricultural sector began to rise due to the introduction of new agricultural practices. At the same time, the labor-intensive light industrial sector began to expand, and exports of light industrial manufactured goods began (after domestic markets were filled, exports to foreign markets began as product quality improved). The manufacturing sector continued to expand. Capital accumulation in the private sector was still sluggish, but the accumulation of capital in the infrastructure sector expanded rapidly. As labor demand in the industrial sector increased, real wages for labor began to rise.

Import substitution phase for durable consumer and capital goods (1919 ~ 1938)

In this phase, the proportion of GNP in the agricultural sector declined and the manufacturing and service sectors expanded sustainedly. In international trade, the import substitution of durable consumer and capital goods (machinery, heavy industrial manufactured and intermediate goods) began. It should be noted that the transition to this phase from the preceding phase was accompanied by three significant phenomena:

- First, labor demand exceeds supply and real wages rise.
- Second, accumulation of technical ability as well as improvement of human resources, and operational, managerial and organizational abilities enabling technology transfer, acquisition, improvement and development.
- Third, a vigorous private sector emerges, and the policies, regulations and legal environment are being put in place to promote its growth.

Import substitution phase for durable consumer and capital goods (1954 ~ 1965)

This was the phase in which import substitution of capital goods matured, and it had basically the same characteristics with the preceding phase. It was also the

7 K. Ohkawa & H. Kohama (1989), *Lectures on Developing Economies: Japan's Experience and Its Relevance*, University of Tokyo Press.

Table 1 The Phases of Japan's Economic Development and Annual Growth Rates in Demand for Infrastructure

Major indices \ Period (years)	1887~1904 Import substitution phase for light industrial goods	1904~1919 Export phase for light industrial goods	1919~1938 Import substitution phase for durable consumer and capital goods	1954~1965 Import substitution phase for durable consumer and capital goods	1965~1975 Export phase for durable consumer and capital goods
Growth rate in per-capita GNP (%)	1.5	2.1	3.5	8.6	5.1
Proportion of GDP generated by manufacturing (%)	10-23	17-23	23-24	23-24	24-36
Total investment as a percentage of GDP (%)	9.7	14.8	18.4	27.0	33.4
Incremental Capital Output Ratio (ICOR)	3.7	4.2	3.8	2.8	5.4
Proportion of total workforce engaged in the agricultural sector (%)	Approx. 70-62	62-55	55-45	45-24	24-13
Urban population as a proportion of total national population (%)	12-14	14-18	18-36	52-68	68-76
Annual growth rate in total cargo traffic (%)	10.1	5.1	9.7	8.9	5.6
Annual growth rate in total demand for electricity (%)	–	15.3	16.5	11.3	7.5
Annual growth rate in total energy supply (%)	3.9	3.6	5.8	10.5	6.7

phase when the discontinuity of the war period had been restored.

Export phase for durable consumer and capital goods (1965 ~ 1975)

In this phase, the import substitution of durable consumer goods was complete, and durable consumer goods, capital goods and intermediate goods became internationally competitive, resulting in export of such goods. Conversely, Japanese non-durable consumer goods (light industrial manufactured goods) such as textiles became uncompetitive and imports began to increase.

The development phases described above are presented in Figure 1, together with major economic indicators (cumulative values of annual growth rates in GDP, gross domestic capital formation, and manufacturing sector value added) for those periods. As Figure 1 clearly shows, the process of economic growth is one in which the growth rates in capital formation and manufacturing sector production are higher than the growth rate for GDP. In short, the graph shows that abundant capital formation (saving) and the vitality of the manufacturing sector were the driving forces behind sustained economic growth. However, since 1990 there has been a clear tendency for the growth rate of the manufacturing sector to lag behind that of GDP. This means that the structure of the Japanese economy is shifting to centering on service industries.

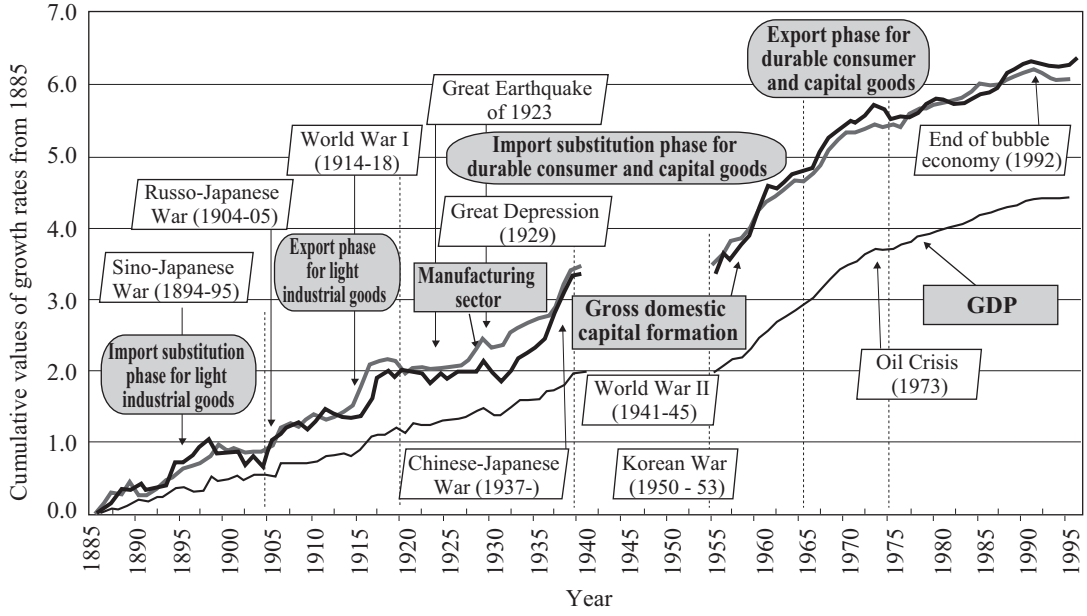
2.3 CHANGES IN ENERGY DEMAND AND SUPPLY SOURCES

Figure 2 illustrates the relationships between Japan's GDP and primary energy supply, CO2 emission quantity and SO2 density in air (measured from sample locations) for the past century. The boundaries between development phases are indicated in the graph by vertical dotted lines. Over the 110 years between 1885 (population 38.3 million) and 1995 (population 125.6 million), total energy supply rose approximately 100 times and real GDP rose approximately 80 times. In terms of per-capita, the increases were 30 times and 25 times respectively. Figure 3 also shows the performance of some of Japan's efforts to address environmental problems. It can be inferred from the figure that CO2 emission volume rose somewhat less than total energy supply volume. Dramatic changes in SO2 density can also be seen. In the second half of the period of high economic growth in the '60s, pollution problems worsened severely. Efforts to deal with the pollution began in the mid-'60s, and cut atmospheric SO2 density to one sixth over 20 years. The reduction of CO2 emission is an issue to be addressed in future. The correlation between economic growth and energy supply in Japan, and the experience of overcoming environmental problems can serve as a model to provide numerous implications to developing countries.

Figure 3 shows the proportions of primary energy sources. It also plots the proportion of primary energy supplied from biomass (mainly firewood and charcoal) in Indonesia, Thailand and Malaysia in 1994.

The long-term analysis of primary energy supply reveals that the interrelation between GDP and energy supply (demand) is different at each development phase. In the prewar light industrial goods export phase, and in the durable consumer goods export phase, the growth rate in energy consumption far exceeded the growth rate in GDP. Furthermore, the graph shows that the shift from traditional energy (firewood and charcoal) to commercial energy (coal, oil etc.) was accomplished very rapidly over a period of 30

Figure 1 Phases of Economic Development and the Cumulative Values of Major Economic Indicators Growth Rates



years in the early phases of industrialization. Many developing countries are now facing this phase. It is obvious that the economic growth in the 1950s and 1960s was achieved along with the shift of energy sources from coal to oil.

2.4 ENERGY SUPPLY AND LAND CONSERVATION

In the 1880s Japan's population density was 100 people per square kilometer, which was extremely high in the world. Nevertheless, approximately 75% of the country's land was forest. In recent years (nearly 120 years later) the population density has approximately tripled to 334 people/km^2 (with the 1997 population of 126.2 million) but, amazingly, the forest land still accounts for 67% of Japan's land area, having declined only by 8% point. Situated in a monsoon climate with steep and rugged topography, Japan's modernization process saw a rapid accumulation of population and productive assets in the alluvial plains. The risks of natural disasters were aggravated by this accumulation. As a result, a high priority has been given to preserving forest resources and managing rivers for reasons of disaster prevention. It is a rare example in the world that Japan experienced of achieving economic growth through rapid industrialization without depleting forest resources.

In many developing countries, whether they are stagnating or growing, their forests are dwindling rapidly. Destruction of forests caused by poverty and economic growth proceeded simultaneously. The combined impact is widely recognized as a critical environmental problem. For example, the wooded land in the total national land area of Thailand was approximately 70% in the 1950s, but now, (half a century later), the figure has fallen to approximately 30%.

As Figure 3 shows, if energy supply sources were not switched smoothly along the progress of development phase, deforestation and land degradation would have been progressed even in Japan, which is seen today in densely-populated developing countries. Appropriate management of nature in conjunction with changes of industrial structures fulfills the long-term development objectives. Healthy forests have increased water retention capacity, suppressed soil erosion and enhanced the productivity of agriculture, which centers on rice production on the alluvial land. It should not be ignored that the protection of forests in mountainous areas and the management of rivers and seacoasts have played an important role in protecting people's lives and productive asset from natural disasters. These anti-natural disasters infrastructures were provided to protect 80% of Japan's total population accumulated on the alluvial plains and majority of industrial assets accumulated on the coasts. It seemed that the pace of Japan's prewar industrialization was rather slow, which left an adequate margin to make adjustment well with environmental problems. The experiences in pollution control in cities and industrial areas during the rapid postwar growth period can provide valuable lessons that can be

Figure 2 GNP, Total Energy Supply, CO2 Emission and SO2 Density

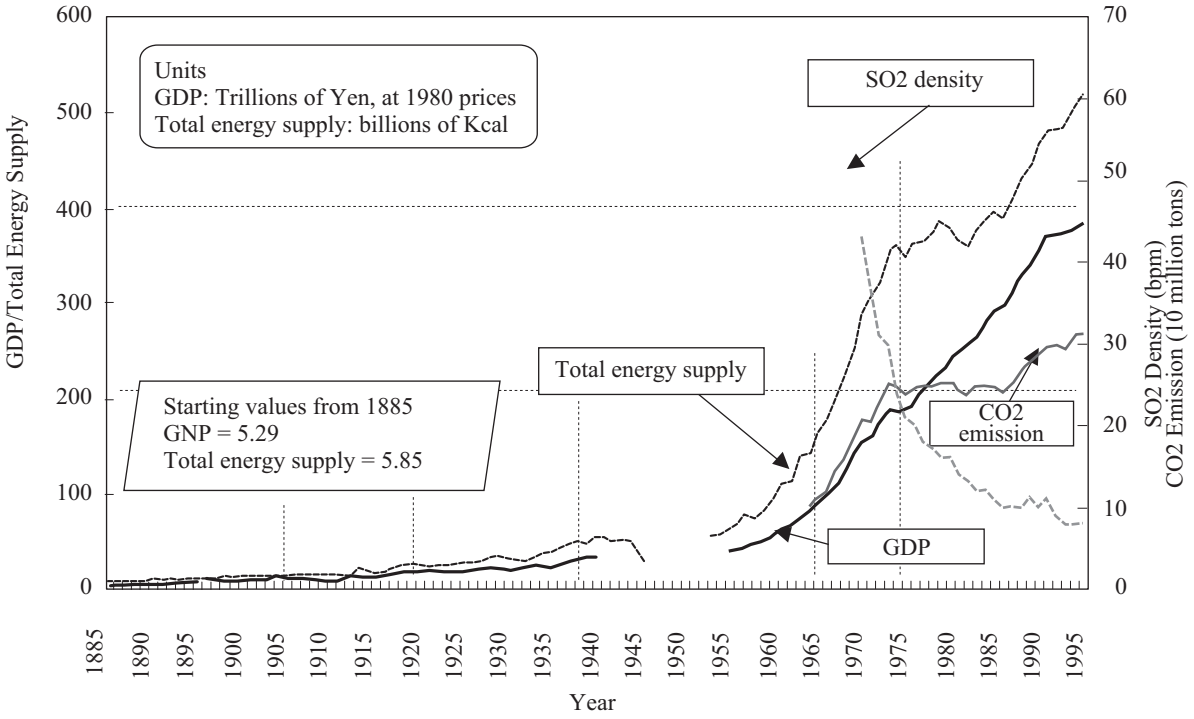
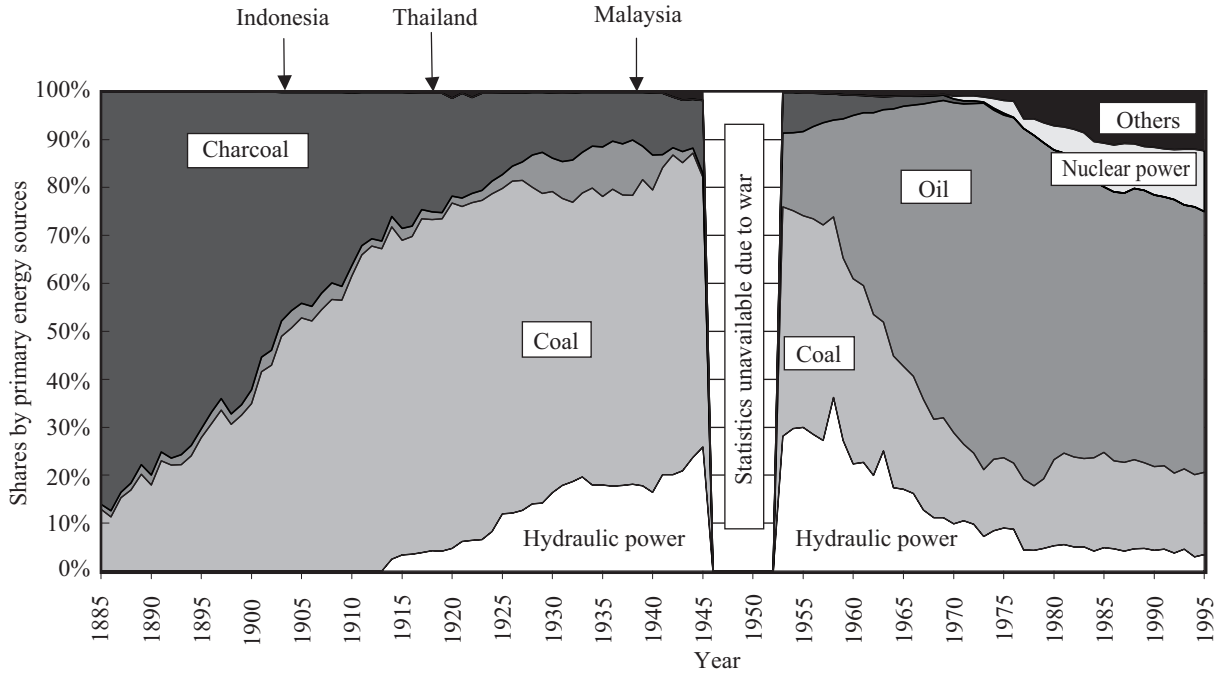


Figure 3 Shares by Primary Energy Sources



Note Also includes coke, geothermal energy, liquefied natural gas and renewable energy.

passed on to developing countries. In the modernization process of Japan which is situated in monsoon Asia, the experience of infrastructure development, particularly the experience of land conservation, water resource management and disaster prevention is an intellectual asset which is readily transferable to other Asian developing countries suffering from natural disasters in the monsoon climate. This Japan's experience is a unique one that is little seen in the Western industrialized countries.

2.5 DEVELOPMENT PHASES AND ELECTRIC POWER SUPPLY

The first electricity enterprise in Japan was commenced in 1886, only nine years after the first commercial electricity service started in the USA in 1878. In that year, the Tokyo Electric Light Co. started direct current electricity generation (125V x 200A = 25kw) using a 30hp steam engine, and provided distribution lines around the station. In 1889 the Osaka Electric Light Co. started distributing electricity from AC generators. In 1892 the Keage Power Station, Japan's first public hydroelectric power station, went into operation. It had 19 small generators powered by water from Lake Biwa which produced 1,785kw of 60Hz AC. In 1895 the Tokyo Electric Light Co. installed 50Hz generators manufactured by AFG of Germany in its Asakusa thermal power station. On the other hand, the Osaka Electric Light Co. installed 60Hz American generators manufactured by Thomson Houston (the forerunner of GE). This was the beginning of the two frequency systems that have coexisted in different regions of Japan until the present[8].

Through the early stages of electricity development led by private sector, it was the period (1890 ~ 1920) known as the era of Japan's industrial revolution during which demand for electric power grew rapidly. The power revolution brought by electricity development complemented labor-intensive manufacturing industries (particularly textiles), and light industry sectors shifted from import substitution to export orientation. This enabled a further growth of the economy through capital accumulation, and absorbed surplus labor in rural areas, as well as raising the real wage rates of laborers. This period is recognized as the take-off stage in the Japanese economy. In terms of the development phases described above, it was the transition from the second phase (export of labor-intensive light industrial products) to the third phase (domestic production of durable consumer and capital goods). Figure 4 shows electrical demand (for energy in terms of kWh and peak output in terms of kW), together with investment and stock in the electricity sector. As Figure 4 shows, in the phases of prewar economic development, demand for electric power was growing at a far higher rate than that of real GDP. After the war, demand for electric power grew in parallel with GDP. This demonstrates that the growth rate in electricity demand is extremely high in the early phases of development.

2.6 CHANGES IN DEMAND FOR CARGO TRAFFIC AND SHARES BETWEEN MODES OF TRANSPORTATION

Figures 5 shows movements in the total domestic cargo traffic (ton - kilometers) for the period between 1885 and 1995, and Figure 6 shows the shares for each mode of transportation (modal share ratios) over the same period. The total cargo traffic increased by an average annual rate of 8% for approximately 50 years before the war. This is compared with the higher growth rate of 10% over the 30 postwar years to 1975. Then, the slowed economic growth and major shifts of economic structures which followed the 1974 oil crisis reduced the rate of growth in total cargo traffic. The main shifts were the relative decline of heavy industry, the "evacuation" of manufacturing industry out of Japan and rapid demographic changes. In case of the demographic shift, the labor force percentage in total population in Japan increased from 60% to 70% over the period between 1950 and 1970, but it remained almost unchanged since 1970 to the recent. Over the corresponding years from 1970s to 1990s, the average annual growth rate in total cargo traffic was only 2.2%. This pattern indicates that shifts in demographics and economic structures have extremely strong effects on infrastructure demand. The Figure 6 shows that there were dramatic changes in modal share ratios. Before the war there was a sharp shift from coastal shipping to railways, while the postwar era has seen a rapid shift from rails to roads. The main factors behind these shifts were the relative differentials in unit shipping prices for each mode of transport due to technical innovations and economies of scale, and changes in the economic values of time.

2.7 DEVELOPMENT PHASES AND INFRASTRUCTURE DEMAND AND INVESTMENT

The relationships have been discussed so far between Japan's phases of economic development and the demand for the infrastructure will be summarized hereunder. Figure

8 Kamekichi Takahashi (1973) "History of Japan's Modern Economic Progress, Volume Three", Toyo Keizai.

Figure 4 Investment, Stock and Installed Capacity (kW) and Generated Energy (kWh)

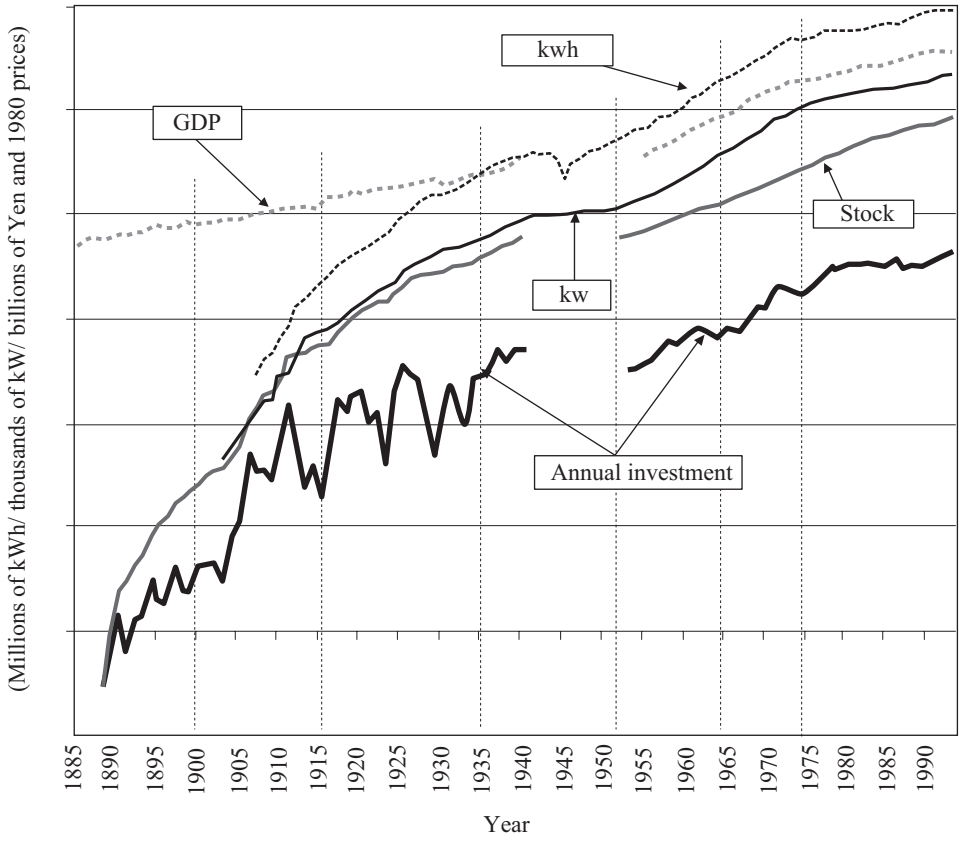


Figure 5 Cargo Traffic Gworth by Mode

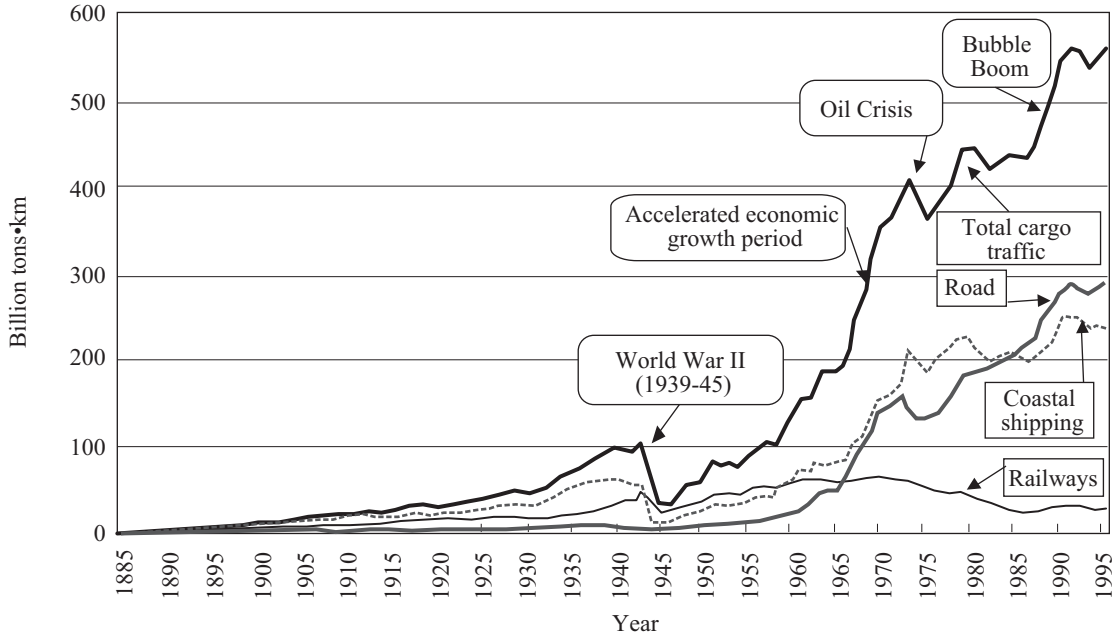


Figure 6 Cargo Traffic Share by Mode

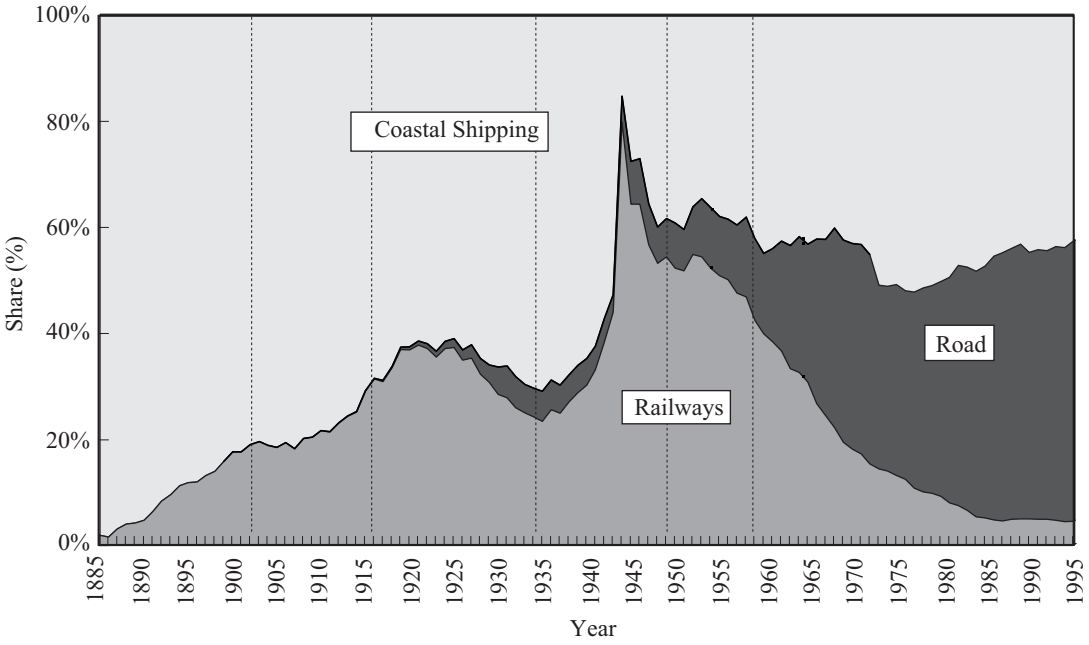
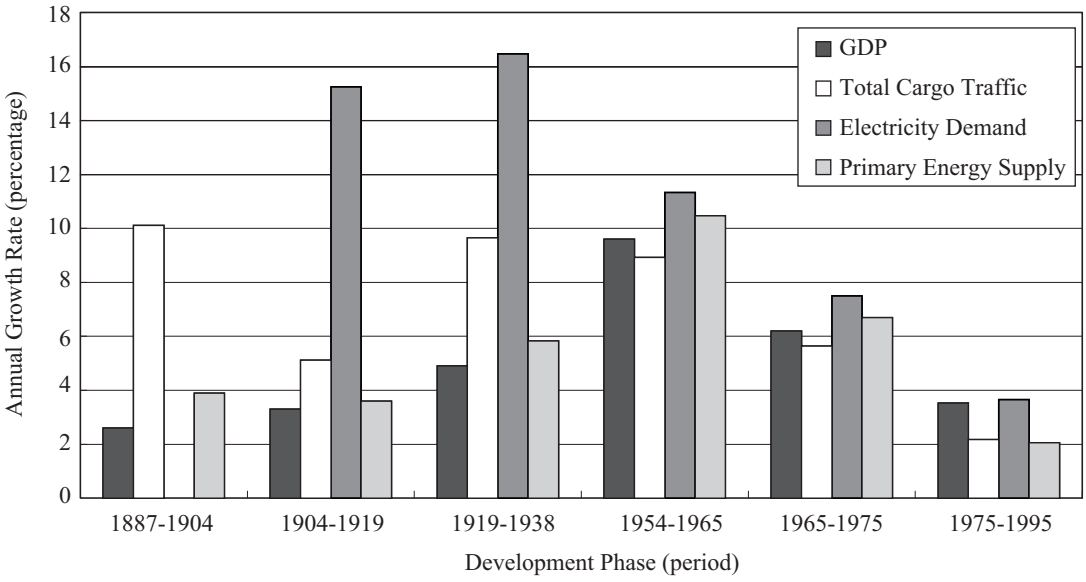


Figure 7 Growth Rates of GDP and Infrastructure Demand in Japan's Development Phases



7 shows GDP in each economic development phase and average annual growth rates in demand for major infrastructure sectors. Clearly, the GDP growth rate forms a bell curve when looking at as a time series, reflecting what is known as a growth "S" curve. On the other hand, infrastructure demand shows an interesting growth rate in relation to the GDP growth rate. The high growth rate appeared first in the transportation sector, followed by the electricity sector, and growth in demand for these sectors preceded accelerated economic growth. To put it another way, there is a phase lag in growth rates between the infrastructure demand and the GDP. It is worth noting that growth rates in total cargo traffic since 1965 and primary energy demand since 1975 have been lower than the corresponding growth rates in GDP. These phenomena appear to reflect the way the structure of the Japanese economy has been shifting from a high resource intensive structure, which requires relatively high amounts of materials and energy, to an intellectual industrial structure which asks for knowledge based services and information.

Figure 8 Investment in Major Infrastructure as Share of GDP

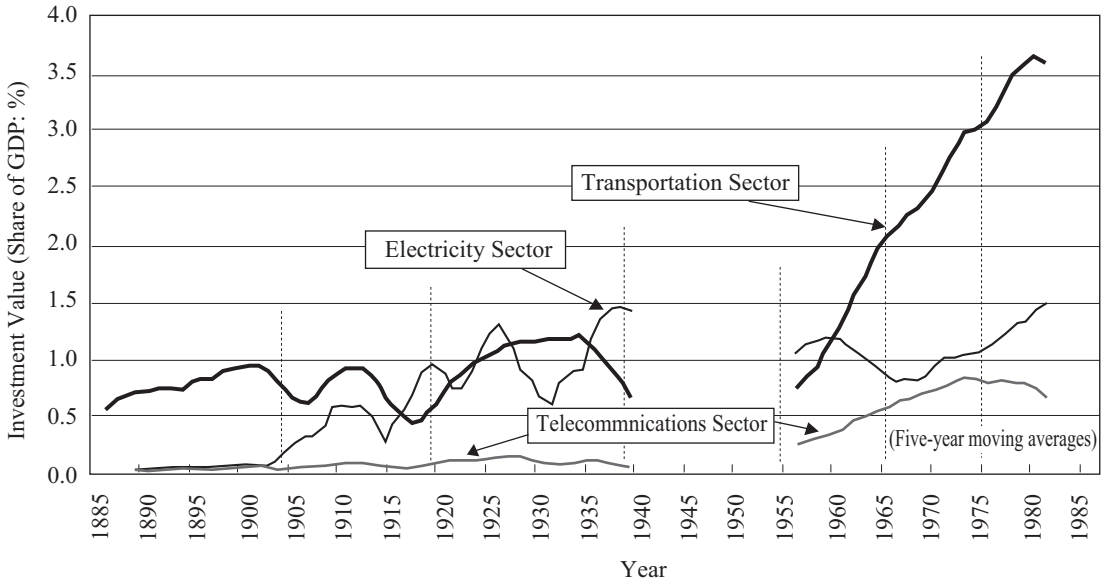
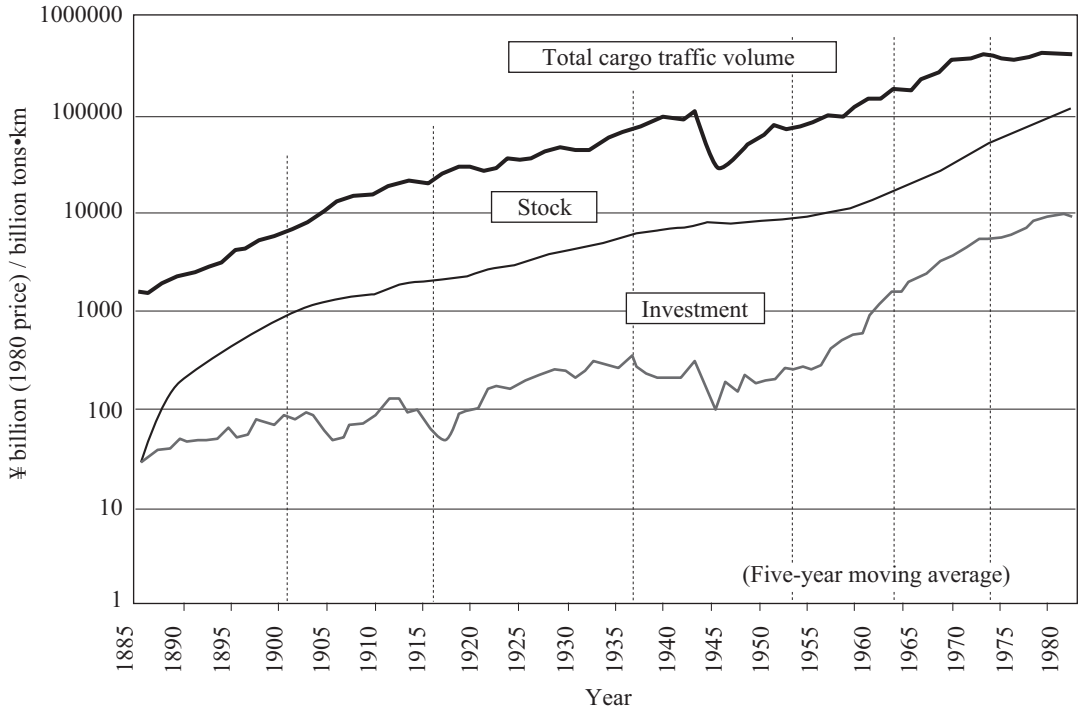


Figure 9 Total Cargo Traffic Volume and Stock in the Transportation Sector



The above evidence suggests that the priority fields for infrastructure investment must accommodate shifts in socioeconomic structures in a flexible manner.

Following the above discussions, the investment in major infrastructure sectors is reviewed here. The share of investment in GDP are compared in each year for transportation, electricity and telecommunications sectors. Figure 8 shows these shares together with the phases of Japan's economic development (divided by vertical dotted lines for this figure). The investment in major economic infrastructure sectors, totaling these three sectors, ranged between 1% and 2.5% of GDP before the war, in concert with a modest pace of the overall economic growth. After the war, with the spread of the automobile that coincided with the period of accelerated economic growth, the total investment in the three main infrastructure sectors reached 5~6% of GDP. This level of investment is extremely close to those seen in Asian countries today, and particularly in

those developing countries which are achieving higher economic growth. It appears that these values expressed in terms of percentage of GDP can be of reference in predicting the demand for infrastructure investment in developing countries.

Figure 9 plots investment and stock (real cumulative investment value) in the transportation sector, as well as total cargo traffic volume. The key point to notice is that the two curves for stock and total cargo traffic volume are not parallel. The rapid increase of stock between the late 1880s and 1904 was clearly related to the rapid growth in traffic volume in that period, and to the subsequent sustained growth of the total cargo traffic volume. Calculating the volume of cargo traffic per unit of stock, the results were highest in the periods 1923~1939 and 1954~1965, which indicates that the investment preceding those periods was being highly utilized. Thus the pattern of investment in the pre-war period is characterized as advance investment or demand inductive investment. On the other hand, as can be discerned from the figure, the prewar peak of total traffic volume was not reached again until 1955. Between the end of the war and 1955, stock was built up very slightly. Investment in the transportation sector made a spurt again only after 1955. Thus, in the decade after the end of the war, the rapidly recovering demand for cargo traffic was somehow met under the prewar stock. According to the report on the war damage, the rates of damage to the railways and electricity sectors, which were very important for postwar economic and social recovery, were below 10%[9]. The rate of damage to the whole infrastructure was approximately 10%. In contrast, damage to the industrial sector was enormous, with the rates of 25%, 30% and 20% suffered by the mechanical, chemistry and textiles industries respectively[10]. Once the Japan's economy entered into the period of hyper economic growth from 1955 to 1975, as can be seen on the figure, the pattern of the investment and stock clearly shifted to an attempt to keep up with the emerging demand.

After 1975, the slackening growth of the Japanese economy and the corresponding changes in its structure brought about a noticeable change in infrastructure demand. As seen in Figure 7, the pattern of demand for infrastructure after 1975 differed from those seen in previous development phases, both in its relationship to GDP and in its growth rate.

As seen above, the impact of a country's infrastructure investment requires a long time before its effect on private sector production sectors (productive effects of stock) is fully manifested. Therefore when an investment is contemplated, it is vitally important to distinguish whether it is intended to keep up with the current demand or to stimulate future demand. When the aim is to promote productive effects of investment, long-term insight into the coming phases of economic development becomes critically important, as the analysis of development phases provides a long-term prediction of comparative advantages of factors of production in the region in which the infrastructure will be constructed. To put it another way, the accurate projection of comparative advantages in the private sector which demands for infrastructure services is really essential for infrastructure investment, particularly those advanced investment for regional development.

3. SOUTH KOREA'S PHASES OF ECONOMIC DEVELOPMENT AND ITS DEMAND FOR INFRASTRUCTURE

It is not easy to prove whether Japan's experience of development phases and infrastructure demand patterns is unique or whether it is of generalization. However, by comparison with other countries, it should be possible to build a persuasive argument. A comparative analysis of the case in South Korea will be carried out hereunder, to examine factors of similarity and disparity with Japan's experience.

3.1 CHARACTERISTICS OF SOUTH KOREA'S DEVELOPMENT PHASES

Table 2 presents the phases of South Korea's economic development together with the average annual growth rates in total cargo traffic volume and electric power demand.

The analysis of South Korea's development phases presented here is quoted from Ohkawa and Kohama[11]. The most interesting point is that Japan's phase of import substitution of light industrial goods took 18 years between 1886 and 1904, while South Korea went through the similar phase in only ten years, between 1954 and 1964. Furthermore, the light industrial goods export phase took

9 Damage rate = (Amount of damage caused directly and indirectly by the war)/ (estimate value of assets at the time of the war's end, had the war not occurred).

10 Economic Stability Working Group (1949), "General Report on Damage Suffered by Japan in the Pacific War".

11 K. Ohkawa & H. Kohama (1993), *Economic Development Theory: Japan's Experience and Developing Countries*, Toyo Keizai Shimposha.

Japan 15 years, between 1904 and 1919, while South Korea passed through the similar phase in only eight years, between 1964 and 1972. Likemise, the durable consumer and capital goods import substitution phase took Japan ten years between 1955 and 1965, while South Korea passed through the same phase more quickly, between 1972 and 1979. The subsequent durable consumer and capital goods export phase began in Japan in 1965, and South Korea entered the similar phase in 1979. These shortened periods of phases in South Korea, known as "compressed development phases" due to the "late comers' advantage", is observed in most of newly-industrializing nations.

3.2 DEVELOPMENT PHASES AND INFRASTRUCTURE DEMAND BELL CURVE

The annual growth rates (%) stated above for cargo and electric power demand in South Korea's development phases are plotted in Figure 10. Comparing Figure 10 with the equivalent graph for Japan in Figure 7, they are startlingly similar. The growth trends of cargo traffic and electric power demand in the respective development phase and their correlation to GDP growth rates are extremely similar.

Figure 11 shows the patterns of demand growth for both South Korea and Japan. The horizontal axis, which shows the development phases for both countries, represented by the average values of the manufacturing sector's share (%) of GDP, and the share (%) of GDP used for gross domestic fixed capital formation. As Figure 11 shows, the similarity between the two countries is clear. One characteristic point is that South Korea's annual growth rates exceed those of Japan. This indicates the enormous investment in South Korea's infrastructure sector to meet the demand for the infrastructure needed to support the compressed development phases, which can also be described as higher economic growth rates. As it was stated previously, the infrastructure development patterns, as experienced by both Japan and South Korea, who have striven for economic development as late comers, are described by a bell curve against the indices representing development phases. This may be named as an infrastructure bell curve. The empirical evidence of the bell curve for infrastructure investment and demand, proven for Japan and South Korea, can provide important implications for infrastructure development in developing countries.

4. JAPAN'S INFRASTRUCTURE DEVELOPMENT: INSTITUTIONAL AND FINANCING ARRANGEMENTS[12]

It is no simple matter to describe laws, systems and regulations evolved in the infrastructure sector as well as technology transfer and its self-reliance, plus financing arrangements in the modernization process of Japan. There have been few instances of systematic research on these topics from a viewpoint of developing countries. In this section, the aspects such as institutions and funding arrangements will be summarized in order to gain valuable implications for developing countries.

4.1 TELECOMMUNICATIONS SECTOR

It was in 1838 when an open experiment (16 km) of telecommunications took place by Morse. In Japan, transmis-

Table 2 South Korea's Phases of Economic Development and Average Annual Growth Rates in Infrastructure Demand

	1954~1964 Phase of import substitution of light industrial goods	1964~1972 Export phase of light industrial goods	1972~1979 Phase of import substitution of durable consumer and capital goods	1979~1989 Export phase of durable consumer and capital goods
Annual GDP growth rate (%)	4.8	9.6	9.5	9.0
Annual growth rate of manufacturing sector (%)	11.3	22.3	15.7	12.4
Manufacturing sector's share of GDP (%)	5 ~ 10	10 ~ 19	19 ~ 37	37 ~ 49
Gross investment as a percentage of GDP (%)	11 ~ 12	12 ~ 25	25 ~ 32	32 ~34
Annual growth rate of total cargo traffic volume (%)	5.3	15.3	8.4	7.2
Annual growth rate of demand for electric power (%)	11.1	21.6	14.8	10.8

12 Most of the content of this section is drawn from "Systems for Developing Social Infrastructure" Civil Engineering Council (1995), Economic Survey Association.

Figure 10 Growth Rates of GDP and Infrastructure Demand in South Korea's Dvelopment Phases

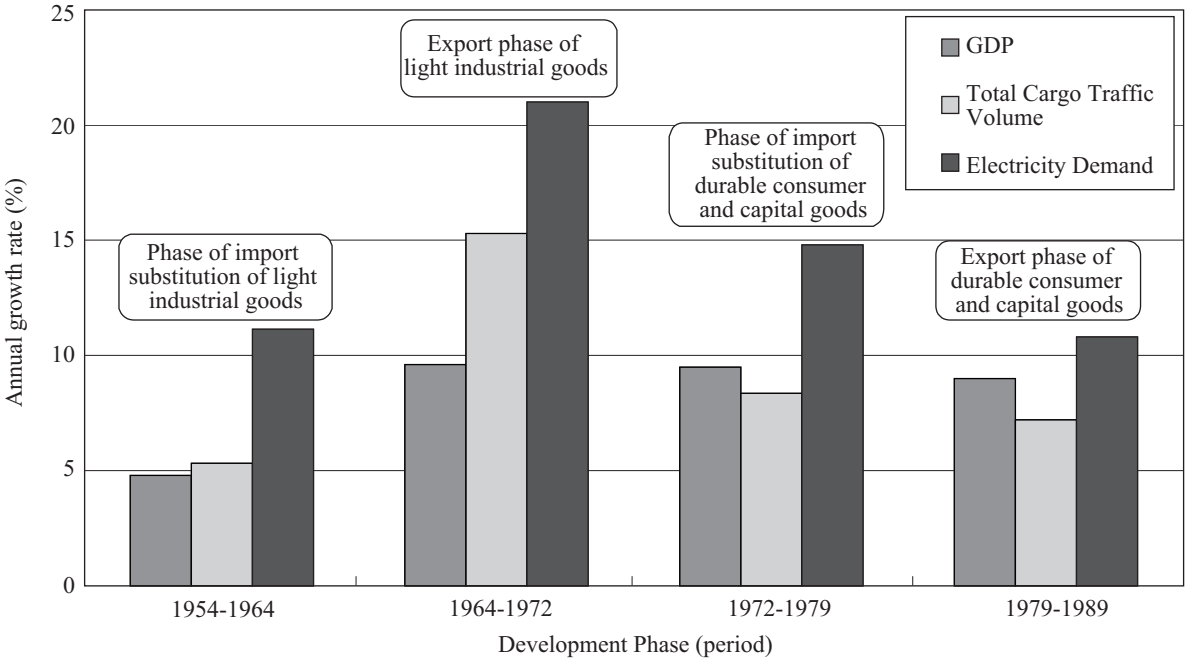
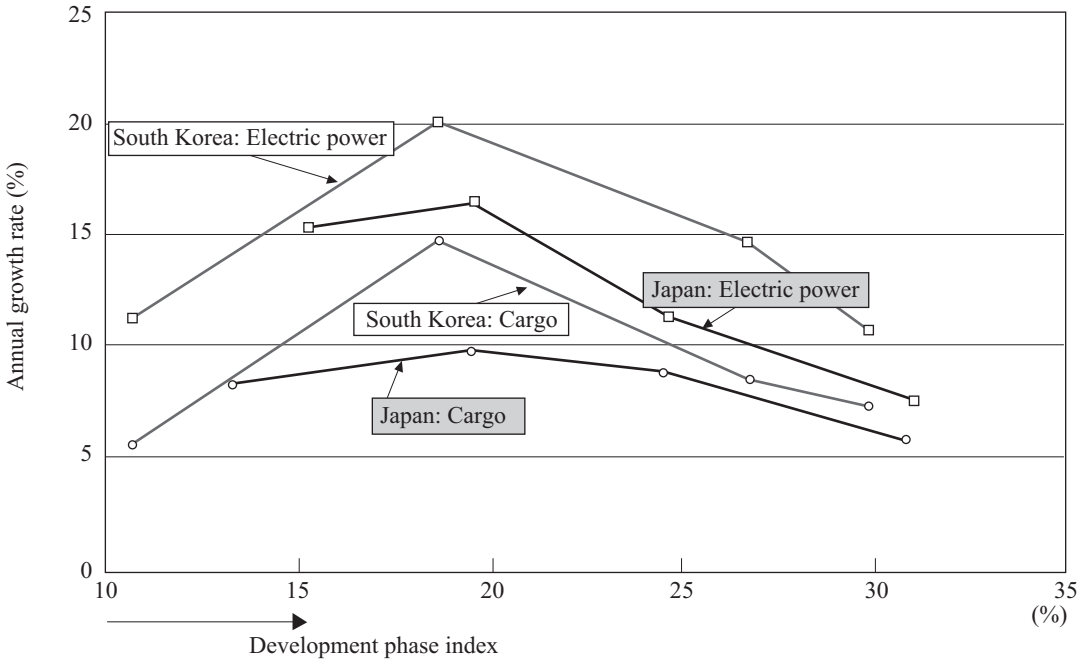


Figure 11 Development Phases and Annual Growth Rates of Cargo Traffic and Electric Power in Japan and South Korea



(Average values of manufacturing industry output and fixed capital formation as shares of GDP).

sion of telegrams between Tokyo and Yokohama began in 1869. By the end of 1875 (year 7 of the Meiji era), the telegram network extended to 1,710 km, and by the end of 1882 it had reached 7,250 km. This indicates that the government after the Meiji restoration placed a top priority on the development of telegram network to facilitate public order and national defense as well as to establish a centralized state authority. Fourteen years after Bell invented the telephone in 1876, telephone exchanges were installed under official management between Tokyo and Yokohama in 1890. Before the war the main source of funding was the government, which mobilized from general fiscal revenue. Therefore, investment in the telecommunications sector was buffeted by the uncertainties of the government's financial situation, and investment was often intermittent. After 1917, when the Telephone Projects Bonds Act was promulgated, it became possible to procure funds by issuing bonds. As telephone services were under direct government authority, they were unable to respond flexibly to market conditions (demand) and supply fell short of demand for a long period. The reason was the inefficiency peculiar to official businesses. Of course, after the Meiji Restoration, debates about privatization of telephone services arose from time to time. The main reasons why they were not privatized are the concerns over abuses of regional monopolies, privacy, and national security. After the war, it was converted to a public corporation. And the main sources of funding were issues of public corporation bonds and low-interest borrowing from government. The Telephone and Telegraph Corporation was equitized in 1985 (initially, all shares were owned by the government before being put on the market in 1987) to put it under private management. After that, all the unmet demand was cleared, and the efficiency of the business improved rapidly as a whole[13]. The privatization of the telegraph and telephone services took a whole century from the time when the operation started under the government's business management.

4.2 RAILWAYS SECTOR

The development of Japan's railways exhibits an extremely interesting process. The Meiji government quickly realized the importance of railways, based on their value as a symbol of modernization and their efficiency as a means of transport. The Meiji government received technical support from a number of engineers, particularly an English engineer Edmond Morel, and issued bonds in the Londom market based on a contract with the Oriental Bank of London (the contract was signed in 1870, the value of the issue was 300,000 pounds, and the interest was 9 % p.a.). In 1872 (the fifth year of the Meiji era) the first railway opened under government management between Shimbashi and Yokohama. In 1876 the government provided a loan of ¥8.4 million for the construction of ports, mines and railways. The Southwestern Rebellion of 1877 caused large expenditures, putting the government in a difficult financial position and setting back the implementation of many projects. In response to the situation, the Japan Railway Company was founded in 1881 (Meiji 14) with private capital, and a boom in private-sector railway development ensued. The main government measures to encourage the private sector were:

(i) Government subsidy to interest payments during the construction period.
(ii) A guaranteed net profit of 8% for investors for ten years after the opening of the railway.
(iii) Free sales of government owned land for railways facilities.
(iv) Privately-owned land was purchased by the government under the Purchase of Land for Public Projects Act and sold to the railways companies at the purchase price.
(v) Exemption from all national taxes.
(vi) Construction of the railways by the government's Department of Railways Construction (due to special circumstances by which the Department was left underemployed by lack of funds).

The government promotion policies were later applied on a case by case basis to each individual line. The first two measures were only applied to trunk routes, while (iii)~(vi) are generally applied to branch lines[14]. Infrastructure development by private sector's financial initiatives (PFI) was already flourishing 120 years ago, in the 1880s.

The selection of main rail routes was: (a) linking traditional industrial zones with ports, in order to nurture and develop traditional industries and link them with export markets; and (b) linking divisional bases with a view to national defense.

Most lines were consistently well managed, and the private sector railway investment boom continued for

13 Sun Yan (2000), "Economic Efficiency Measurement: A Case Study on NTT", Master's Thesis of Waseda University, Asia-Pacific Research Dept.

14 Kamekichi Takahashi (1973) "History of Japan's Modern Economic Progress, Volume Three", Toyo Keizai Shinposha.

decades. By 1900, 28 years after the opening of Japan's first railway, the total length of railways in operation had reached 5,880km (an average of 280km of railways opened per year).

However, the Sino-Japanese War of 1894~1895 and the Russo-Japanese War of 1904~1905 caused economic turmoils which depressed the business turnovers of railway operators. Government intervention into the railways operations was debated as a way of unifying standards and management, and the National Railway Ownership Act was enacted in 1906 (Meiji 39). Of the 38 private railway companies then in existence, the 17 largest were purchased by the government. The lines throughout the country, apart from some small urban zones, were nationalized. According to the government statement, the major reasons for nationalization were as follows:

(a) Unified management under state ownership would enhance efficiency, thereby promoting industry.
(b) Preventing the participation of foreigners in business.
(c) Unified management and streamlining by the state would help in improving the fiscal situation following the end of the Russo-Japanese War.

After World War II in 1945, the funding source was a special account set up within the Government general accounts. The postwar operation of the National Railway was at the mercy of political intervention and labor-management problems. Furthermore, it had been in serious deficit and there were times when labor-management relations reached breaking point. To overcome the situation, and being influenced by the privatization of public enterprises in Europe, the National Railway was split into seven companies and privatized in 1987, 81 years after nationalization. At the time of the privatization, Japan National Railways had liabilities totaling ¥37 trillion. The Japan National Railways Settlement Foundation was established to take on ¥26 trillion of the liabilities, a sum which has not been reduced, over a decade later to present. The history of Japan's railways offers many lessons on the strengths and weaknesses of government and private control over infrastructure development and management. One notable point in the government-managed period is technological innovation of "Shinkansen," which is about to leave for Asia beyond the national boundaries. It should not be forgotten how the earnest passion of railway engineers created Japan's world-beating Shinkansen with a long-term vision.

4.3 ELECTRICITY SECTOR

The development of electric power has centered on the private sector ever since its introduction, with a hiatus during World War II. As mentioned earlier, the first electric power company in Japan was the Tokyo Electric Light Co. established in 1886. After that, the electric power development had been promoted with public and private companies coexisting, although the private sector has always been dominant. In 1923 the Tokyo Electric Light Co. issued Pound-denominated bonds worth three million pounds. The State Management of Electric Power Act was passed in 1938. The facilities and businesses of five large electric power companies and over 400 electricity businesses were formed into the Japan Electricity Generation and Transmission Company and nine distribution companies, beginning a stage of total state control. In 1951 the Electricity Businesses Act was enacted, dividing the industry into nine electric power companies nationwide under private management. The government role was limited to the exercise of regulatory authority to protect the public interest. Funds were obtained through borrowing from the government at low interest rates, or from issuing bonds on domestic or foreign markets, share issues and other means. In recent years, deregulation policies have made it easier to move into the electricity industry, and the introduction of competitive principles is expected to promote greater efficiency and cost reduction[15].

4.4 ROADS SECTOR

The construction and maintenance of roads have been mainly responsible for the public sector since the Meiji restoration. However, Cabinet Proclamation No.648 of 1871 permitted toll roads. Famous projects using the toll system include the Oigawa toll bridge, built in 1875, and the toll road over the Tokaido Nakayama Pass (between Kanayama and Hisaka) in 1880. A number of other toll roads and bridges were also constructed by the private sector. This Act was succeeded by the Old Roads Act in 1919 and the Road Building Special Measures Act in 1952. The construction of the postwar toll expressway system began with the Meishin (Nagoya - Kobe) Expressway, which opened in 1965. This project was partially funded by a World Bank loan. The toll expressways are mainly under the jurisdiction of the Japan Highways Corporation, which was established in 1956. The expressway network

15 Japans electricity charges are two or three times higher than US levels, as of 1999.

continued to grow rapidly, with the total length of toll expressways reaching 6,500km by the end of 1995. Toll roads in the metropolitan region are managed by the Metropolitan Expressways Corporation, and those in the Hanshin (Osaka - Kobe) region are managed by the Hanshin Expressways Corporation. In contrast to Western and developing countries, Japan does not yet have any unified road systems by which a private-sector body handles all aspects of road construction, maintenance, management and operation. That is a major task to be considered for the future.

5. JAPAN'S INFRASTRUCTURE DEVELOPMENT AND CORRECTION OF REGIONAL INCOME DISPARITIES

The preceding sections discussed patterns of economic growth and infrastructure demand for the country as a whole, including comparison with South Korea. This section will broadly examine Japan's experience of the correction of regional income disparities, which is another role expected of infrastructure development. The infrastructure service charges, with reference to a comparison between Japanese and US charges will be analyzed, and the significance of the results for developing countries will be discussed.

5.1 INFRASTRUCTURE INVESTMENT IN EACH REGION AND THE CORRECTION OF REGIONAL INCOME DISPARITIES

As described above, infrastructure demand immediately after World War II, and up until the phase where the economy reached its prewar scale, was greatly met by the stock accumulated before the war. After that, the investment for breaking through infrastructure bottlenecks took priority place to maximize the economic growth as a prime concern. This was evidenced by the way in which infrastructure investment was focused on the major metropolitan areas, which were economically dynamic. This biased allocation of resources was completely appropriate, given the need to emphasize economic efficiency above other concerns at a time when financial resources for investment was extremely scarce. For local area development, the first priority in infrastructure investment was given to the conservation and development of natural resources, such as the prevention of natural disasters, increased staple food production and the development of electric power sources. Following the above, infrastructure investment continued for the improvement of urban and industrial areas and for managing water resources. These priorities were matched with the extremely rapid industrialization and urbanization. The Income Doubling Plan, which was passed by the cabinet in 1960, advocated development of the major metropolitan areas and their surrounding areas, and focused on infrastructure development to achieve its goals. Infrastructure development for rural areas were regarded as complementary.

From the start of the 1960s, the problems of regional income disparities and excessive centralization emerged as political issues. In 1962 the Nationwide Comprehensive Development Plan was approved by the Cabinet, and up until now the infrastructure investment (public works) has been recognized as an important tool to achieve balanced development of the national land, namely correcting regional income disparities[16].

The relationship between regional incomes and infrastructure investment since the War[17] will be examined hereunder referring to the distribution of infrastructure investment in eight regions. The regions are Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku and Kyushu. Figure 12 shows per-capita GDP and the Theil inequality index, which indicates the degree of income inequality between the eight regions from 1955 to 1985. When each region's share of the national population equals its share of GDP, the inequality among the regions is nill. When the shares differ, the index increases. Theil index, I, is defined by the following formula:

16 In this discussion, infrastructure investment is equated with government investment, including the following types:
- Living infrastructure (municipal roads, streets, urban planning, housing, water supply, sewerage, health and welfare facilities [including projects to build hospitals, national health insurance, hospitals affiliated with public universities], and educational facilities).
- Industrial infrastructure (national and prefectural roads, ports [including port construction projects], airports, industrial water supply).
- Farming, forestry and fisheries (infrastructure related to the farming, forestry and fisheries industries).
- Land conservation (mountains and water management, coastline conservation)
- Others (unemployment countermeasures, disaster recovery, building and repair of government offices, railways, subways, electricity, gas etc.).

17 The discussion here is based on data from "Surya R.A. (1999), Infrastructure Investment Policy and Mechanism of Regional Disparity in Developing Countries, Doctoral Thesis of the University of Tokyo, the School of Engineering.

$I = \sum_{i=1}^{n} Y_i \ln \frac{Y_i}{P_i}$, where i names the region concerned (regions are numbered 1, 2, 3, ... n), Yi is the share of GNP produced by region i, and Pi is the share of the national population living in region i.

As Figure 12 shows, the regional income disparity (inequality index) peaked in 1960 and then declined, before rising again from 1985. Under the Income Doubling Plan announced in 1960, the purpose was "to maximize economic growth and distribute industrial locations fairly among the regions." Furthermore, the Economic and Social Development Plan which was announced in 1970 called for "balanced economic growth." To understand infrastructure investment actually taken towards achieving these national goals, Figure 13 shows trends in the per-capita infrastructure investment (at current price) for each of the eight regions between 1960 and 1990.

As Figure 13 shows clearly, the per-capita infrastructure investment is larger in the Hokkaido, Tohoku, Chugoku, Shikoku and Kyushu regions, with the lesser in the major metropolitan areas of Kanto, Chubu and Kinki. For example, in 1980 the annual per-capita infrastructure investment was 80% higher in Hokkaido than it was in the Kinki region. This tendency was most prominent in the 1970s and '80s. This indicates that the infrastructure investment was centered on local areas as a means of achieving the "inter-regional balanced development" in the "Nationwide Comprehensive Development Plan" that was decided upon by the Cabinet in 1962. After 1985, it has a tendency that difference of per-capita infrastructure investment by region has been decreased.

But what was the effect of inter-regional distribution for infrastructure investment like? There has been not a few studies analyzing the quantitative relationships between infrastructure investment and the economic growth by region[18]. The trends of per-capita gross domestic production in terms of value added by region are shown in Figure 14. This chart shows that in 1960 the ratio between the highest and lowest per-capita income (maximum per-capita regional income divided by minimum per-capita regional income) was 1.83. As Figure 13 indicates, per-capita infrastructure investment in the low-income areas is much higher than in the high income areas. In Figure 14, the level of per-capita income in the low-income areas is considerably below the 1.83 line which represents the maximum disparity level reached in 1960. Thus it can be inferred that more infrastructure investment in the less-developed regions has made a positive contribution to achieving the policy objective of correcting income disparities among the regions.

The economic effects of infrastructure investment can be broadly divided into two types. One is the demand creation effect in other economic activities which is induced by investment (construction) itself. This is called as "flow effect". The construction of infrastructure increases local demand in other sectors (so-called multiplier effects), creating jobs and stimulating the economy in the region, and thereby increasing total regional production (income) there. On the other hand, the infrastructure investment brings about effects as a stock. These are the effects that, through the improved services provided by infrastructure stock, indirect production costs of the private sector will be reduced and their productivity will increase, thereby production (income) in the areas will be raised. This is called the production effect (stock effect) of the infrastructure investment. The strong correlation between investment and regional income as shown in Figures 13 and 14 is the combined effect of the flow effects and stock effects of infrastructure investment.

Examination of the flow effects of infrastructure investment by government is important in order to evaluate the validity of such investment as a means of short-term economic stimulus. Recent research based on econometric models has indicated that the value of multiplier effect is declining gradually, from 2.1 in 1967~75, to 1.8 in 1975~84 and 1.7 in 1983~92[19]. The principal aim of infrastructure investment is to realize the stock effects. Namely, the built facilities should function as intended, and yield social and economic effects, thereby contribute to sustainable private-sector growth. Therefore it is not always appropriate, from a long-term point of view, to make decisions on infrastructure investment on the basis of the multiplier effect. Above all, infrastructure investment as a means of addressing a long-term regional income disparities should be combined with other complementary and synergistic policy measures to stimulate the private sector towards structural changes in regions.

The stock and production effects of infrastructure investment (in other words, marginal productivity: amount of additional production per incremental unit of investment) from a macroeconomic viewpoint[20] are briefly examined

18 For example, "Public Finance and the Productivity of Infrastructure" by Kiyoshi Mitsui (1995), Nihon Hyoronsha.

19 "Public Investment Report", Construction Economic Research Institute (1997)

20 Calculation results for production effects are from the following sources: Yasuhiro Kimura "Basic Research Into the Impact on Production and Human Activity due to Changes in Infrastructure Stock Allocation", master's thesis of the University of Tokyo, Department of Engineering, Social Infrastructure Engineering, March 1999

Figure 12 Per-capita GDP and Theil Inequality Index of Regional Income

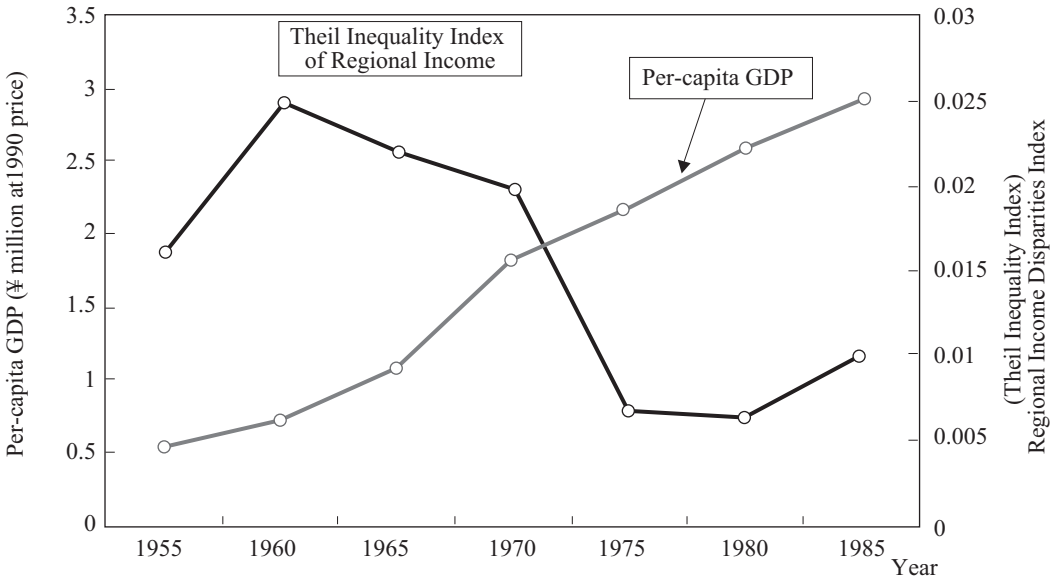
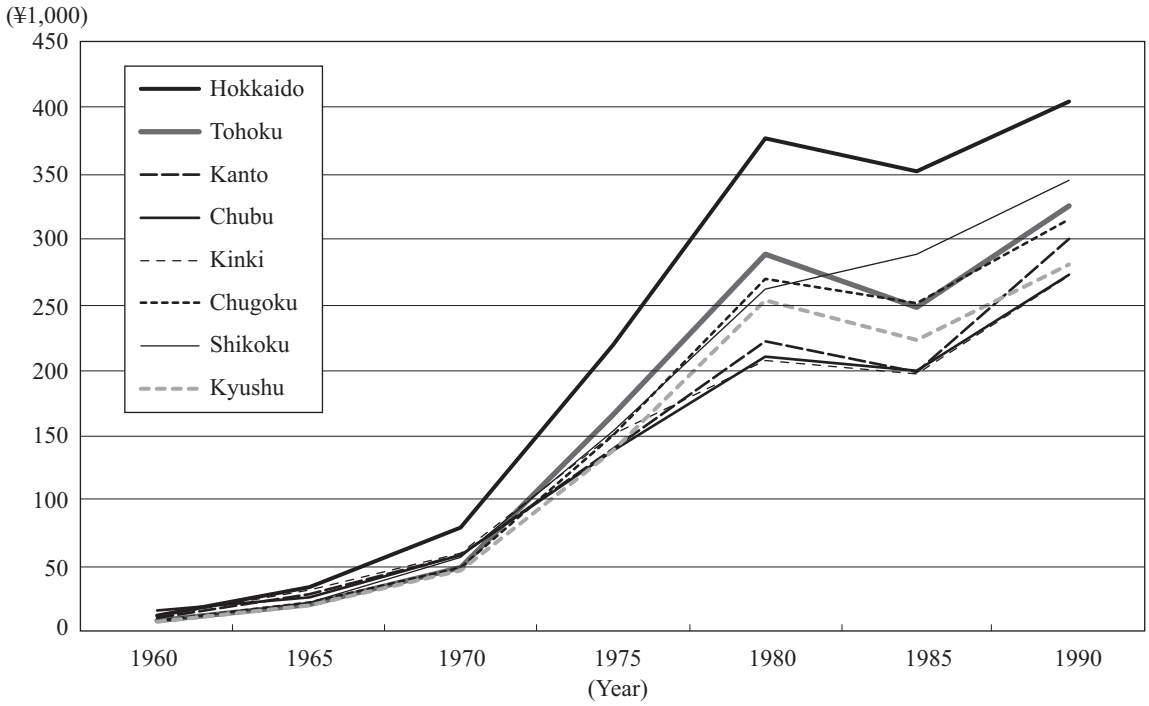


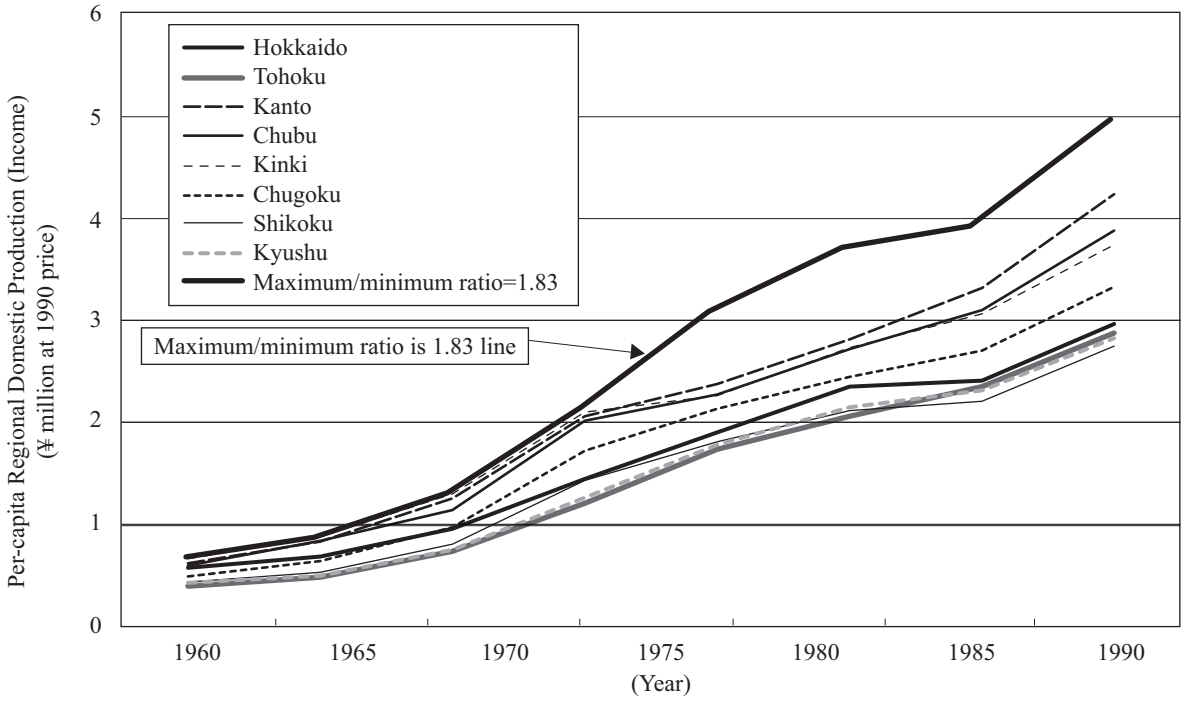
Figure 13 Per-capita Infrastructure Investment by Region (¥1,000/year at current price)



hereunder. Figure 15 categorizes the eight regions of Japan into the major urban areas (Kanto, Chubu, Kansai) and the rural regions (the other five regions) and plots the changes over time of their marginal productivity of infrastructure investments made in each group. The chart reveals two characteristics. One is that the marginal productivity of investments in the urban areas is higher than that in the rural regions. The other is that marginal productivity in both groups is declining. These findings are consistent with other research results[21]. These characteristics indicate the

21 Naoyuki Yoshino and Takanobu Nakajima (1999), "Economic Effects of Public Investment", Nihon Hyoronsha

Figure 14 Transition in Per-capita Regional Domestic Production and the Maximum/Minimum Ratio = 1.83 Line



possibility that infrastructure investment is also following the law of diminishing returns. To put it another way, the value for each incremental unit of infrastructure investment becomes relatively lesser. Another reason of the diminishing return is a doubt that the recent distribution of infrastructure investment by sector has not been appropriate, and investment is not being allocated to needed infrastructure where it can yield high marginal productivity. In short, there is a suspicion that necessary investments are not being made, and unnecessary investments are being made out of "bureaucratic inertia" to satisfy the institutionalized demand of the rested interest groups.

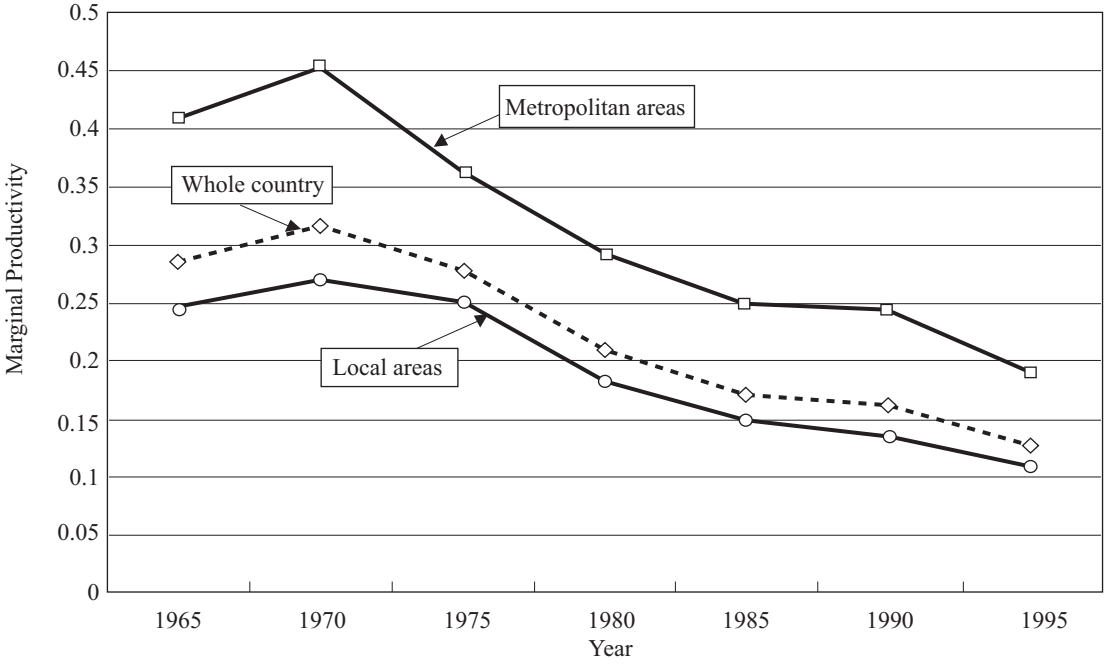
A few remarks on this point will be supplemented here. If economic and social evaluation on each project of Japan's infrastructure investment is strictly conducted, it is possible to estimate more precisely the marginal productivity of investment in the infrastructure sector. Because the economic internal rate of return as a selection criteria for project evaluation means the marginal productivity (rate of return) of a project from a viewpoint of national economy. The pre- and post-evaluations for each project have not been made strictly in many public works in Japan, and therefore it becomes difficult to verify the marginal productivity of each infrastructure sector. This is a very strong reason for reforming the decision-making systems and evaluation methods used in public works in Japan.

5.2 REGIONAL DISPARITIES IN INFRASTRUCTURE SERVICE CHARGES

Infrastructure investment creates facilities, and services are provided to beneficiaries when it functions properly. In this section a comparison of regional disparities in infrastructure service charges between Japan and the US will be discussed. From documentation on household expenditures in each country, which is relatively easy to obtain, it is possible to compare charges for electricity, gas and water (light, heat and water) in Japan and the US. Furthermore, for Japan it is possible to obtain a price index which combines transport and telecommunications charges, and for the US it is possible to obtain a transport charge index. For the US data, the Bureau of the Census selects 66 points nationwide, and for Japan the data is available from 47 prefectures nationwide[22]. In addition, data on per-capita incomes for each of 47 Japanese prefectures, and for 51 of the 66 US

22 The data in the US is from "11 th Edition Statistical Abstract of the United States", 1996, Bureau of the Census, and the data in Japan from "National Price Statistical Research Report, Consumers' Price Regional Disparity Index Edition", Management and Coordination Agency of Japan, Statistics Bureau, Statistical Survey Department, Consumer Statistics Division.

Figure 15 Marginal Productivity of Infrastructure Investment



data points are available. In Figure 16 a comparison of the two countries was conducted by ranking the points in each country according to their indices, in a descending order.

As Figure 16 clearly indicates, it is a characteristic of Japan that the disparities between regions in infrastructure service charges are extremely small. The standard deviation of 47 samples in light, heat and water charges in Japan is 5.5, and for transport and communications charges it is a mere 3.2. Oßf the US samples the equivalent values are very large, at 21.1 and 9.1 respectively. The most interesting point is that the regional disparity in per-capita income is somewhat smaller in Japan, but there is no significant disparity between Japan and the US as shown in Figure 16. In Japan the standard deviation for regional disparities in income is 12.3, compared to 16.0 in the US[23].

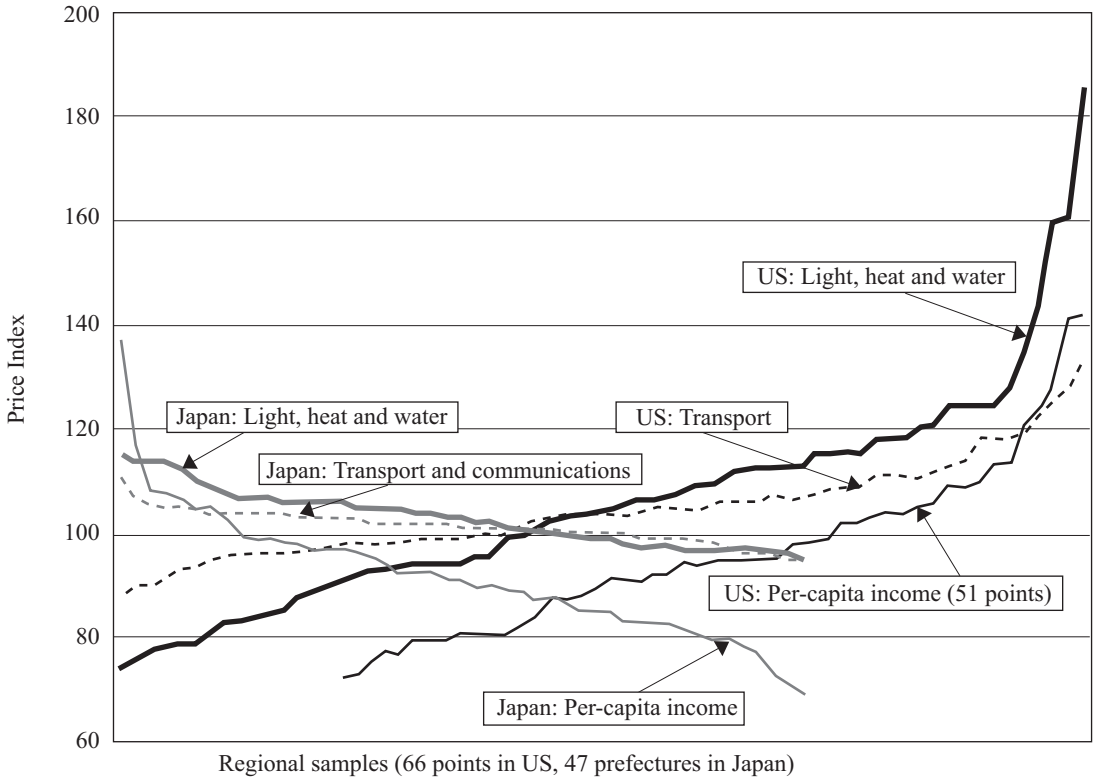
Considering the difference in land area between Japan and the US, the regional disparities in infrastructure services charges in Japan appear small, compared to the US. However, the situation in Japan should be judged from the national policy objective that "social services should be provided equally to all citizens" is strongly reflected. In 23 cities chosen by the Bureau of the Census of the US[24], the correlation between household expenditure index for infrastructure services and the overall household expenditure (cost of living) was shown in Figure 17. The infrastructure services referred to light, heat and water costs (utilities), and transport costs. The share of total cost of living by these infrastructure service costs is 18%, largely the same as in Japan. Incidentally, the two extreme points in Figure 17 are New York (total cost of living index 222) and San Francisco (174). Figure 18 shows the correlation between per-capita income indices and living cost indices for the same 23 cities. Clearly, there is a strong positive correlation between per-capita income indices and living cost indices. In other words, there is a strong correlation with high living costs in parts of the US where the level of per-capita income is also high.

How should this difference between Japan and the US be interpreted? And what is the implications for developing countries? In its initial phases of a country's economic development, if the following cases are applicable, it could be justifiable, with a view to meeting people's basic needs for infrastructure services, to provide financial assistance or cross-subsidies between income strata. The reasons are, firstly, level of income is low and access to infrastructure services is very limited to all

23 As for a detailed analysis of regional cost of living indices in both countries, refer to "A Comparison of Japan and US Concerning Regional Price Disparity" by Jiro Kano, Osaka City, Ports and Harbors Bureau, Theses of Projects, March 2000.

24 The ranking of the 23 cities in order of total cost of living index, from the highest, is New York, San Francisco, Boston, Philadelphia, Washington DC, Los Angels, Miami, Portland, Chicago, Denver, Milwaukee, Cleveland, Columbus, Cincinnati, Phoenix, Dallas, Atlanta, Norfolk, Salt Lake City, Houston, Indianapolis, Oklahoma City and Nashville

Figure 16 Income and Infrastructure Charge Indices by Region for the US and Japan



* National average is 100 both in Japan and the US.

citizens. Secondly, nationwide infrastructure is essential if people are to develop their latent potential. Thirdly, the proportion of household expenditure spent on infrastructure services is significantly larger in poorer regions and/or among specific segments of the citizens.

Infrastructure service charges in developing countries are extremely expensive, from a viewpoint of their household income relative to those in developed countries. For example, the fares on the light tram systems which have recently opened in Bangkok and Manila are around $0.40 (40 yen), which appears at first glance cheaper than that in Japan. However, considering that the average disposable income of those living in Bangkok and Manila is around one tenth that of Japanese people, it is extremely expensive for them. Thus, it is vitally important for developing countries to take into account this fact when the development of infrastructure and its service charges is considered.

However, it should be recognized that it is not always appropriate to use infrastructure service charges and related subsidies as income redistributive measures. Alternative policy means having income distribution effects should be carefully considered. Once a country's economy progresses along with increase in national income levels, when people reach the level at which they can choose the benefits of alternative infrastructure services, and the price of infrastructure services become relatively cheaper than other living costs, efforts should be paid to eliminate subsidies and to let infrastructure charge systems adjust competitive market principles. In short, infrastructure service charges should be set to reflect regional comparative advantages according to market principles. This means that the efficient allocation of regional resources are encouraged by leaving infrastructure service charges of the region to market principles. The local industries which can be expected to bring long-term sustainable development should be encouraged based on market principles. Decentralization or regional development policies including infrastructure development for sustainable growth should be based on the comparative advantages of each region. The different forms of infrastructure service charges in Japan and the US give two extreme alternatives in providing infrastructure in developing countries.

In the long-lasting Cold War which followed World War II, the governments of capitalist economies, strongly aware of the competition with communist economies, promised to deliver excessive public services to their people. In many cases, infrastructure development was

Figure 17 Correlation between Infrastructure Service Charge Indices and Cost of Living Indices in Major US Cities

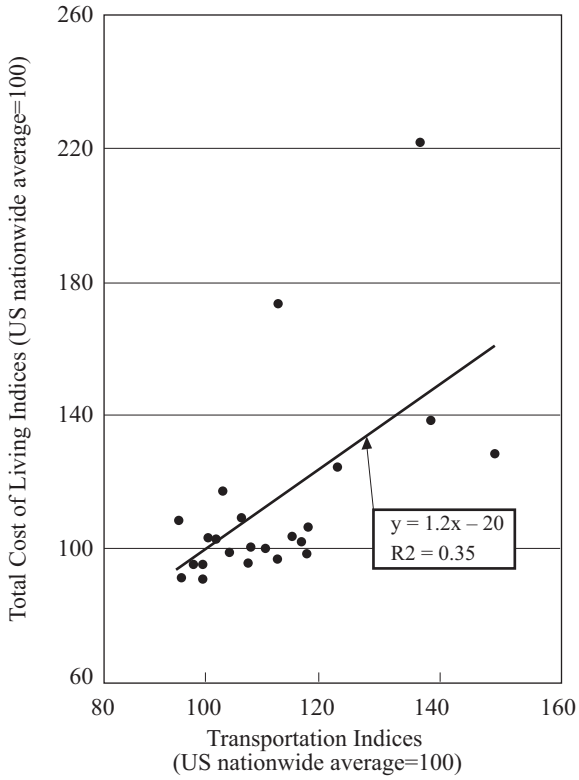
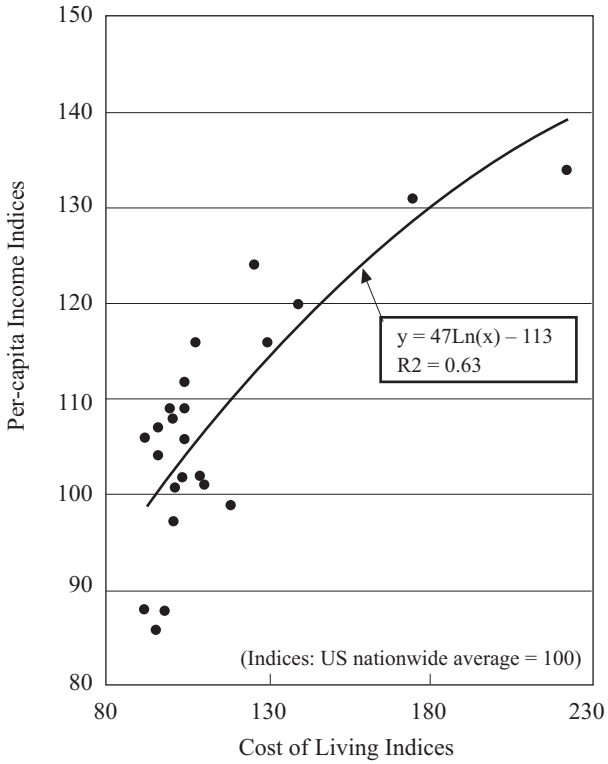


Figure 18 Cost of Living Indices and Per-capita Income Indices in Major US Cities



Source: Statistical Abstract of the United States (11th Edition)

dominated by the public sector with excessive protections and regulations which frequently obstructed the provision of creative and high-quality services. Competitive and efficient management of public infrastructure services were often prevented. The result in Japan was that infrastructure service charges were, even across the country, very expensive by international standards. For example, compared to France and Italy, which have also adopted the toll expressway system, Japan's tolls are almost three times as high. Charges for the use of ports and container terminals are twice as high as those in Singapore and Pusan and 50% higher than New York. Airport usage charges (for a Boeing 747-300, as an example) are ¥900,000 at Narita, compared to ¥250,000 at Kennedy, ¥560,000 at Frankfurt and ¥450,000 at De Gaulle Airports[25].

Expensive infrastructure service charges reduce the international competitiveness of industries which use those services as intermediate services. When US state governments try to attract Japanese factories to invest in their lands, their selling points are cheap infrastructure service charges, cheap housing, high-quality educational and medical services and, above all, low levels of taxes. In this global age, international competitiveness in industrial locations necessitates a re-consideration of how infrastructure services should be provided in Japan. However, very little consideration has been given to infrastructure management and taxation for the promotion of regional development with a view to international competitiveness. Even in non-manufacturing fields which had previously been considered non-tradable, an evaluation from Japan has begun to appear. It is a time when the comparative advantages of industrial location by region should be seriously considered with a view of comparative advantages of factor of production including infrastructure charges and taxation. Of course, these lessons from the Japanese experience should be applied flexibly in developing countries according to the country's stage of development, from a viewpoint of international competitiveness[26].

25 Economic Planning Agency (1997), "Toward the Structural Reform of Social Capital"

26 The evaluation methods generally used for infrastructure projects in developing countries are principally based on the point of view of international competitiveness, and cost and benefit measurement are based on border prices.

6. IMPLICATIONS OF THE JAPAN'S EXPERIENCE TO DEVELOPING COUNTRIES

On the basis of the Japan's experience of infrastructure development over the last century, as reviewed so far, what lessons can be shared with developing countries? This question will be discussed hereunder, including some issues to be addressed.

6.1 THE IMPORTANCE OF THE CONCEPT OF DEVELOPMENT PHASE IN PREDICTING INFRASTRUCTURE DEMAND

First, as shown by a bell-curve relationship between economic development phase and infrastructure demand in Chapter II-2, a highly similar relationship has been observed in both Japan and South Korea. Growth rates in demand for cargo traffic and electric power were higher in the development phase before the accelerated growth in GDP took place. South Korea's experience in achieving higher economic growth than Japan can be interpreted as "compressed phase of development" making the best use of the latecomer's advantages. At that time, South Korea's annual growth rate in infrastructure demand was higher than that in Japan, which indicates that the higher level of infrastructure investment had been earlier made to meet the increasing demand as a precondition for sustained economic growth. It is very important to take into account of the bell curve for the prediction of infrastructure demand in the long run. For the development of infrastructure in developing countries, it is essential to understand what development phase the country stands at, including changing directions of demographics, structured shifts of the economy, and the law of diminishing returns. To put it another way, it must be noted that infrastructure demand depends largely on changes in demographics (including concentration of population in cities), changes in economic structures and changes in people's values.

6.2 ROLES OF PUBLIC AND PRIVATE SECTORS

There are many lessons to be learned from the Japan's experience in the demarcation of roles between the public and private sectors in development and management of infrastructure. The basic viewpoint is a flexible division of roles between the two which fully recognizes the significance of development phases of economy. As mentioned earlier, the trunk networks of the national railways were established primarily by private sector capital under government's strong support measures. This approach is suggestive of infrastructure development by private sector in contemporary developing countries. However, the experience of Japan, which transferred the ownership and management of railways from private sector to state, offers an important lesson on the roles of the state and private sectors in building and managing infrastructure in developing countries. The telecommunications and railway sectors were kept under state control for a long time. In both sectors it is undeniable that there was managerial inefficiency, and quality of service was deteriorated. However, both sectors tried to provide universal services to give all the citizen equal access to these services, and they certainly made a great contribution to raising the latent capacity of the people all over the country. Both sectors were privatized very recently, in the 1980s. It is well understood by the public that each privatization has brought about improvement in management efficiency and in quality of services. The treatment of redundant personnel with a minimum of labor friction and introduction of innovative technology were the biggest achievements in both sectors.

The excessive government interventions and restrictions before the recent introduction of deregulation policies were a good example of how not to follow the experience of Japan. For example, the undue regulations in the electricity and transportation sectors have been criticized on many occasions in Japan. The recent deregulation in these sectors revitalized the mobilization of private sector resources, and the introduction of competitive principles and consumer-oriented policies have witnessed improved services, lowered prices and strengthened international competitiveness. The appropriate division of roles between the government and private sectors, and policy measures for government interventions, are not uniform, depending on such factors as the respective country's development phase, managing ability of the bureaucracy and the private sector. Rigidity in infrastructure development and management systems triggers spoiling efficiency, raising service charges, reducing service quality and degrading the competitiveness of the whole economy. Of course the government has an obligation to fulfill an important role in planning and supervising the infrastructure systems that work well to protect the public interest in general. It would be extremely useful to make an empirical analysis of Japan's institutional evolution process from the viewpoint of developing countries so that the lessons from system design of infrastructure sectors in Japan's diversified experiences (policies, institutions, mechanism) can be learned for the developing countries.

A review of the Japan's past experiences indicates that the infrastructure development by the private sector in

developing countries should be considered carefully. Developing countries are not uniform. A wide range of experiences gained in the development of Japan's infrastructure since the Meiji Restoration suggests that the policies and approaches in infrastructure development in developing countries should be duly of varieties.

Developing countries are very diverse in many aspects such as economic development phase, strength of governance, assimilation capacity, and ability to mobilize private-sector resources, as well as culture, tradition, and social norms. If a market is immatured with little hope of the efficient participation of private sector resources, and when availability of infrastructure services are very limited, public interventions and subsidies can be justifiable. In this occasion, the social benefits or contribution to social justice played by infrastructure services must be clearly spelled out, and the public interventions must be transparent and predictable for the public. For example, infrastructure investment to meet national goals of balanced land development for the correction of regional income disparities (particularly the development of infrastructure to correct urban - rural disparities in income and quality of life) is a very important role that should be filled by the public sector. On the other hand, infrastructure investment to meet the revealed demand can be implemented with the initiatives of private sectors, and creative means of cooperation with the private sector should be actively pursued. The issue of infrastructure development by the private sector does not relate to who owns the infrastructure, but to whether or not it is possible to create a capable system in which efficient and transparent management of infrastructure services can be realized.

6.3 LESSONS ON THE DISTRIBUTION OF PUBLIC INVESTMENT AMONG SECTORS

From the Meiji Restoration until the beginning of the accelerated economic growth in 1960s, the allocation of public investment among sectors was extremely flexible in Japan. Since then, however, there has been almost no change in the shares of infrastructure budgets allocated to each ministry and agency. This has been particularly true between 1980 and the present[27]. Considering the fact that, over the last 20 years, Japan has experienced dramatic changes in economic structures, and major shifts in demographics and in people's values, it was natural that allocation of investment among infrastructure sectors would have been changed. In case of infrastructure aid to developing countries, the distribution of aid fund among sectors is an unavoidable exercise, in which the decision-making process and evaluation criteria for the distribution must be made transparent. At the same time it should not be forgotten that it is extremely important to apply appropriate methodologies in investment fund allocations.

6.4 INFRASTRUCTURE DEVELOPMENT AND THE CORRECTION OF REGIONAL INCOME DISPARITIES

Infrastructure development has been pursued as a means of correcting the regional income disparities which arose during the postwar period of the accelerated economic growth, and has achieved a certain degree of success. However, it should not be concluded that these projects yield adequate productive effects, which are the ultimate purpose of infrastructure development. The most probable result from the infrastructure investment in low-income regions was an increase in non-sustainable regional incomes through multiplier effects. For sustainable growth in regional economies, there must be linkage between infrastructure development and other regional economic stimulus measures that are intended to complement the infrastructure investment and generate synergistic effects. That means that the infrastructure development would create an opportunity to attract private-sector investment and production based on the comparative advantages of the region, and the infrastructure would yield indirect production effects through provision of adequate infrastructure services as intermediate inputs. From this point of view, as for aid for infrastructure development in developing countries, the comprehensive approach should be contemplated to yield synergistic effects with the investment mainly from the private sector.

6.5 REGIONAL DISPARITIES IN INFRASTRUCTURE SERVICE CHARGES

The comparison of regional disparities in infrastructure service charges between Japan and the US revealed that the regional disparities were extremely small in Japan. While in the US, the disparities were much larger, with a positive correlation with per-capita income disparities. In the US, the regional differences in the cost of living (household expenses) were compensated out by disparities in per-capita income. In Japan the disparities between regions in costs of living were far smaller than disparities in per-capita income.

27 Takayoshi Igarashi and Akio Ogawa (1999), "Explanatory Diagram: Mechanism of Public Works", Toyokeizai Shinposha

What are the implications for developing countries of this major difference between Japan and the US? Which policy direction should developing countries choose? The criteria for making the choice depends on how the people of the country perceive the purpose of infrastructure development. This perception relies on a value judgement by the people of the country. If a certain infrastructure service is needed in a development process by which the potential capability of the people can be drawn out, and if the service being priority demand, then the access to that infrastructure service should be regarded as a basic human need. In that case, it is appropriate for public bodies to intervene to provide equal access to the service for all citizens. In short, the first priority should be given to minimizing regional disparities and providing a universal service through government interventions. However, when the country comes into a phase where human and other resources are reasonably developed to materialize their potential, the price of infrastructure services should be set close to the actual cost in each region. That is, subsidies and public interventions should be gradually removed. The activation of regional economies should not be based on long-term subsidy from central government to infrastructure development, but based on industrial development making the best use of comparative advantages in the regions. In Japan, in order to promote the electric power development huge subsidies are provided to the local government in which jurisdiction electric power plants are located. And electricity tariff is almost uniform nationwide. If, instead of subsidies, lower electricity tariff is applied in the region, then electricity consuming-type of industries would be settling in the region, laying the foundations for promoting other related industries. This would lead to a desirable allocation of resources from the viewpoint of the national economy. As seen in the US, regional comparative advantages rooted in their disparities are starting points for stimulating regional economies. This US type of infrastructure development from a viewpoint of regional comparative advantages gives another implications for developing countries. The different policies adopted in the US and Japan represent two extremely different alternatives of policy choices available to developing countries.

6.6 SUPPORT FOR CROSS-BORDER AND LONG-TERM VISIONED INFRASTRUCTURE

The planning, investment and operation of core infrastructure in the early stages of Japan's economic development made the maximum use of private-sector resources, as seen in the cases of the railway and electric power sectors. It should be remembered that the long-term vision of national development and land use were well taken into account in those days.

The managerial expertise, possessed by electric power companies and various different railways companies is valuable for much needed cross-bordering infrastructure that extends beyond the national boundaries of developing countries as the companies jointly operate and manage their services beyond their geographical jurisdictions. The infrastructure development in developing countries, particularly the infrastructure networks beyond national borders in sectors such as transport, energy, water resources and the environment should be further promoted on the basis of economic rationality. As seen in the European Union (EU), the development of integrated international infrastructure systems that go beyond national territories encourages mutual growth in economies and contributes to inter-state security. A major role of cross-border infrastructure development is to help establish a common system of coexistence and mutual prosperity. This must be one of the central tasks for Japan's official development assistance (ODA) in the 21st century.

Most multilateral aid agencies tend to limit their assistance to individual loan projects and it is rare for them to prepare infrastructure projects from the point of view of inter-state development. Japan's ODA has a comparative advantage on this point, in the form of technical assistance (development planning and dispatch of experts) from JICA, which is the most appropriate form of assistance in preparing infrastructure master plans based on a long-term perspective for a country. Priority projects justified in master plans may be worthy to be financed by JBIC. As mentioned earlier, infrastructure investment for the correction of regional disparities and the reduction of poverty needs to be initiated by the Government. Furthermore, it is important to provide complementary policies along with the infrastructure investment for the relevant industries which create demand for the infrastructure. It should not be forgotten that sustainable development in the low-income region can be achieved only when infrastructure development and industrial promotion based on the regional comparative advantages go together.

6.7 THE IMPORTANCE OF TRANSFER AND SELF-RELIANCE OF INFRASTRUCTURE TECHNOLOGIES

In Japan's modernization process since the Meiji era, the introduction of technology was not always consistent during the early period of technology transfer and development,

as seen in the electricity and railway sectors. As mentioned in the problem of two frequency systems in Japan, the unification of technical standards during the introduction and transfer of technology is a critical role of the government. Similarly, in the railway sector a variety of design standards and specifications were transferred from different countries. This inconsistency of technical standards was a major reason behind the nationalization of the railways in 1906. Since then, the issues involved in technical standards was highlighted, and they were occasionally debated even in parliament[28].

It is desirable to achieve as much consistency as possible in design standards and specifications. Japan had an opportunity to introduce technology at its own choice with rather decentralized decision-making process, but that system brought about negative results of inconsistency in technical standards. However, the various types of infrastructure technology introduced from Western Europe were modified one way or another to Japan's natural conditions and monsoon climate. The evolutional process of the development of design standards and specifications, followed by the construction of the highest quality of infrastructure is exactly what Japan can be proud of. As a late comer, Japan's experience in technology transfer and self-reliance is very useful for developing countries. However, research into Japan's experience of technology transfer and development in the infrastructure sector is not well advanced. Particularly the area of technology policies research is a task that has yet to be addressed. Based on Japan's experiences, future support for infrastructure development in developing countries should emphasize more proper package between software and hardware aspects, taking into consideration of global standards (ISO). It should include intellectual support for software fields, such as design standards, specifications and certification of qualified engineers.

7. JAPAN'S ROLE: CONTRIBUTION TO INFRASTRUCTURE DEVELOPMENT IN ASIA

Based on the above discussions about Japan's experience and its implications to developing countries, this section will discuss the foreign aid that Japan had once received and propose some suggestions on Japan's role in developing infrastructure systems in developing countries.

7.1 THE NEED FOR POSITIVE ANALYSIS OF PROJECT AID RECEIVED BY JAPAN

After the end of World War II in 1945 till 1952, Japan was under the U.S. occupation. The total amount of US aid to Japan in that period is said to be around $2 billion. In 1952, Japan and Germany joined the World Bank, and Japan received its first World Bank loan in 1953, which financed a power development project (Kansai Electric Power Co.). Japan was able to repay its all pre-war debts from abroad as stipulated largely owing to World Bank's mediation. Since then, the World Bank loans were mainly utilized to finance projects in the power and steel industries, through the Japan Development Bank. It is interesting to note that Toyota Motors received a loan of $2.35 million for its bus and truck factory in 1956. Over the eight years between 1953 and 1960, Japan borrowed a total foreign exchange of $850 million from abroad, with 43% provided by the World Bank (for reference, the Japan's exports amounted to $2.9 billion in 1958)[29]. In those eight years, loans were also extended to the Aichi Water Corporation in 1957, the Electric Power Development Co., Ltd. in 1959 and the Japan Highways Corporation (for the Meishin Expressway Project) in 1960. In 1959, Japanese bonds were successfully issued in the New York market for the first time after the war. This was an epoch-making event indicating that Japan gained its credibility in the global financial market. Between 1960 and 1966 the Japanese public bodies receiving loans from the World Bank include Japan National Railways, Japan Highways Corporation (second loan), the Metropolitan Expressway Corporation and the Hanshin Expressway Corporation. The last loan was to the Japan Highways Corporation for the Tomei Expressway project (Tokyo to Shizuoka) in 1966. Japan had received a total of $862 million for 31 projects. During this period, Japan was one of the World Bank's largest borrowers. The last repayment to the World Bank was completed in 1990[30].

Thus the infrastructure development which supported the accelerated economic growth in the postwar era was

28 For example, there was the famous debate over rail gauges (1,067mm narrow gauge and 1,435mm standard gauge). The issue of which should be adopted was debated in the parliament a number of times from 1896 onwards. In 1918 the government adopted the guidelines stipulated in "Construction comes first and reform later: costly improvements to standard gauge will be postponed and construction, mainly of narrow gauge, will proceed to the regions which await the commencement of railway services". Standard gauge lines began with the opening of Shinkansen in 1964.

29 World Bank (1995), *The Evolving Role of the World Bank.*

30 World Bank Tokyo Office(1998), "World Bank and Japan"

greatly assisted by aid from the international community, particularly from the World Bank. This valuable experience of receiving aid has not been well researched and there has been little analysis allowing Japan to convey the lessons to contemporary developing countries. Japan's experience as an aid recipient during its accelerated economic development process must be very valuable when Japan, in turn, provides development assistance to developing countries. The lessons learned in the process of being an aid recipient provide important perceptions and knowledge that would help Japan to understand the position of the developing countries. The lessons would also provide Japan persuasive power, thus giving Japan a comparative advantage in development assistance. This is one of the research themes that should be addressed under an organized and systemic framework as an ODA project.

7.2 JAPAN'S COMPARATIVE ADVANTAGE IN DEVELOPMENT COOPERATION

As mentioned above, as a latecomer, Japan has a valuable experience in infrastructure development which differs from those of other Western countries. Taking into account of the current issues in developing countries, it is worth recognizing that an analysis of Japan's experiences in infrastructure development and the release of its results to developing countries will be an important international contribution. Japan's experiences include such areas as the transfer of infrastructure technologies and its development and self-reliance, related policy measures, organizations, systems and regulations, allocation of investment by sector, and infrastructure project management systems. For example, over 2,000 dams have been constructed in Japan since the end of the War. They are intended to protect the lives of the people concentrated on the alluvial plains from the threat of flooding, as well as providing water for households and industry. They also serve to increasing agricultural production and provide a stable supply of electricity. Many developing countries around Asia are facing the same problems that Japan experienced. Dam construction, which was pivotal in Japan's management of water resources, had been the bitter and painful experiences as Japan pursued a coexistence of human and environment. That experience has yielded sufficient knowledge that can be shared with developing countries, particularly in monsoon regions. One mission is to help work together in creating ways of symbiosis for people, dams and environment. The task facing the government, private sector and NGOs is to pool their wisdom, together with the participation of the local people, to find creative solutions. By understanding each other's dilemmas and sharing each other's problems, they should look for ways they can work together for development. In this way, intellectual assets based on the experience of Japan's modernization process can give Japan a comparative advantage in the ODA community, which should be duly recognized.

7.3 A STRATEGIC VIEWS ON INFRASTRUCTURE DEVELOPMENT ASSISTANCE

Assistance for construction of trans-national infrastructure network systems: Asian economic crisis occurred suddenly in 1997, and this consequently strengthened the feeling of solidarity within the region. It is a "testimony" to the "multi-layered relationships of interdependence" which have grown up at an accelerating speed over the last 30 years in Asia. The world's trade volume has been growing along with the increased trade within Asia. Over 40% of Japan's exports are already directed to other Asian countries. Asia will continue to grow further in the 21st century, or at least first half of the century. As was seen in the 1997 currency crisis, people in Asia wanted Japan to take a leadership role in the region. That fact can be viewed as the historic achievement for the comprehensive national security accomplished by Japanese people in five decades after the War. In the last few decades in Asia, the role played by ODA in establishing Japan's status in Asia was extremely large. Above all, support for infrastructure development, which has been pivotal in ODA, has underpinned the rapid economic growth and thereby social stability of Asian countries. If Asian countries continue to place economic growth, the reduction of poverty, introduction of market economics and privatization as their development objectives, Japan should maintain or over strive to contribute to the development of infrastructure in developing countries, particularly those in Asia. It is important to recognize trans-national infrastructure as regional public goods, that is to say, as common assets for the regional security[31]. The more assets are shared within a region, the more deterrent it is expected to suppress strife in the region. Thus the investment in trans-national infrastructure creates regional public goods which encourage regional peace, coexistence, and mutual prosperity through closer intra-regional links. Support for this kind of infrastructure should be one of the important components of Japan's ODA strategy.

It is recommended to implement "Asian Trans-

31 One good example is policy agreed at the General Assembly of the Asian Development Bank in May 2000 for strengthening linkages among ASEAN nations to stabilize financial systems.

national Infrastructure Research Projects" including researchers from developing countries within the framework of ODA. This research should make full use of IT, satellites and other modern technology in an organized and systemic effort towards the following two major objectives: first, to prioritize cross-border infrastructure projects to link the emerging economically active zones covering multiple Asian countries, and second, to help establish the protocols (agreements between all parties concerned over institutional arrangements), common plans and technical standards concerned with trans-national infrastructure to overcome the related legal, institutional and technical problems inherent to cross-boarder movement of resources.

Recently, most multilateral agencies have become not so positive toward infrastructure development. However, assistance for trans-national infrastructure systems corresponds to the common vision of Asian countries in the 21st century. In the financial sector and in the fields of health and education, respective organizations already exist in Asia[32]. However, there is little research on planning, coordination, monitoring and support for the development of trans-national infrastructure in Asia[33]. This recommendation appears timely, as Asia expects to enter into an age of self-governance in the 21st century by strengthening cooperation and integration within the region. Japan is capable of helping establish trans-national infrastructure systems in Asian developing countries, and helping research and implement policies, systems, technology transfer and development of human resources. Japan is also ready to help incorporate the private sector to develop infrastructure in a "coordinated, complementary and synergistic" manner. Therefore the Asian Trans-National Infrastructure Research Project is expected to become the core of element in the infrastructure development assistance in Japan's ODA.

Coordination and cooperation with Japan's domestic infrastructure development: The necessity of linking infrastructure development between Asian developing countries and Japan is coming to afore with an emergence of localized economic sphere across national borders within Asia regions. The promotion of international infrastructure linkage based on transport and energy will yield social and economic stimulus for Japan's regions. On the other hand, it raises the efficacy of international development cooperation with neighboring countries. For example, the integration of energy between Hokkaido and Sakhalin has enabled the supply of low-cost energy and electricity, giving a comparative advantage to electricity consuming industries in Hokkaido. In the economic zone of the Sea of Japan, the infrastructure development for creating an interdependent system must proceed simultaneously both in Japan and neighboring nations with the best use of mutual comparative advantages and interdependency in the economic zones including Russia, China, North Korea and South Korea. It is clear that Kyushu should pursue its regional advantages by developing infrastructure that promotes linkages with the Huang Hai region and the south coast of China. The axes of economic integration which have been established in Japan to date will be reintegrated with the encouragement of stronger developmental linkages with neighboring countries, based on the principles of comparative economic advantages. Such linkaged developments will be possible by a combination of the IT revolution and the institutional revolution. The latter is the revolution in the movement of resources brought about by the removal of tariff and non-tariff barriers through bilateral agreements and the WTO. Based on this perception, one objective of trans-national infrastructure development in neighboring Asian countries by means of ODA should be well coordinated with Japanese infrastructure development.

The need of expanding intellectual aid: As described earlier in this paper, Japan and South Korea's experiences of success and failure in designing systems for infrastructure building can clearly provide important lessons for developing countries. This awareness can be the key to infrastructure development for developing countries. Therefore the experience and expertises who have been involved in infrastructure development in Japan are expected to be utilized in a more strategic manner in ODA. Intellectual support should be expanded in many ODA fields, and it is also expected to promote the productive use of the rather redundant human resources in infrastructure sectors in Japan.

Reinforcement of private-sector competitiveness: ODA should be made available to activate Japan's private sector in developing countries. The US, which has once criticized the commercialization of Japanese aid in the past, is now pursuing the linkage of aid with commercial business more actively than Japan. In the end, the sustainable development of an economy depends on the activity of its private sector. Therefore it is extremely important to support

32 There are activities including IMF, WHO, UNESCO etc.

33 As for Asia Highway, ESCAP is active by the support from Japan's Infrastructure Development Institute.

the linkage of private-sector activities with ODA measures. However, if ODA measures and policies reduce the international competitiveness of the private sector, it will do more harm than good. Thus, this linkage must be creative enough to strengthen the international competitiveness of its private sector in the long run.

The case of the Meishin Expressway in 1960, which was partly funded by the World Bank, is highly instructive for future assistance to infrastructure, and particularly core infrastructure, in developing countries. It seemed that this case contained diversified innovations such as organization (highways corporation), financing modality and transfer of technology. What is really needed for future infrastructure development in Asia is the creation of various innovations. A range of innovative models (such as expansion of JBIC operations that guarantee private-sector infrastructure investment projects) for linking ODA with private sector resources must be devised in the fields of funding, technology, personnel development, management and operation. In short, the introduction of various aid models integrated with the private sector is highly expected.

8. CONCLUSION

This paper presented a positive analysis from various angles of the correlations between Japan's economic growth and the core infrastructure (the energy, electricity and transportation sectors) over the last century, in order to derive lessons that can be useful to developing countries. As a country's economic development is basically a part of its unique historical process, there is little way to generalize its experience. Nevertheless, the evidence from many developed countries show a certain degree of similarities. It can be presumed that the experience of Japan as a late-comer country contains some relevant lessons for developing countries.

Most developing countries have come to a point where they are able to picture their visions they should be in the future. This means that their development activities are no wait to be allowed. However, there is neither entirely reliable theory for development, nor the best practice applicable across the time and space. In such a situation, the experiences of advanced countries, in which it is possible to draw the empirical lessons and results of their actions, serving as valuable reference for developing countries.

The experience in the field of development assistance tells an imperative conception of "no time to wait". In the front line of development, the time available to work together with development partners and devise creative solutions to development problems are very limited. There are few standard prescriptions for solving the problems. At such cases, a solid trustworthy relationship among the development stakeholders become extremely important. When making an effort to find a solution from limitless choices, the knowledge and lessons learned from experiences by the advanced countries is essential for establishing mutual trust with partners. Whether or not the recipients listen to the advice of the donors depends wholly upon how much the donors have accumulated their wisdom from their hands-on experience in the past.

The lessons learned from Japan's development experience are a major intellectual asset that should be passed on to developing countries. This intellectual asset gives Japan a comparative advantage in development assistance. A considerable number of developing countries feel uncomfortable with the development strategies prepared by the Western advanced countries. Naturally, they expect Japan and South Korea, former developing countries, to take reasonable leadership in international aid. Therefore, Japan and South Korea are expected to show persuasive development strategies and models from their own development experiences. The role of ODA will become increasingly important toward the 21st century in order for Japan to be able to realize its constitutional mandate: We desire to occupy an honored place in an international society striving for the preservation of peace, and the banishment of tyranny and slavery, oppression and intolerance for all time from the earth (an excerpt from Preamble to the Constitution of Japan). In closing this paper, it should be reaffirmed that the ultimate goal of assisting infrastructure development in developing countries is exactly the same with the spirit of Constitution above.

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