

Research into what infrastructure development should be in Japan

Noboru NISHIFUJI

Member of JSCE, President, Japan Research Institute

SCOPE OF INFRASTRUCTURE DEVELOPMENT PROBLEMS

In looking for the kind of infrastructure development best-suited to Japan in the 21st century, the first need is to recognize that infrastructure development does not simply mean physical and spatial improvements. Rather, it also has a strong bearing on administrative, financial, land-use, and environmental conservation systems. As a result, the scope of problems to be addressed is broadening.

In discussing this issue, I would like to first introduce the concept of *common social capital*, as proposed by Professor Hirofumi Uzawa, et al. It is defined as capital that subsumes natural capital, institutional capital, and infrastructure (social capital), three elements that together have an external effect, form a common basis, and interact with each other. Infrastructure is positioned as one element of this framework (Fig. 1), and research into infrastructure development should take place with close regard for natural and institutional capital.

In addressing global environmental issues, for example, the directing of development efforts toward, say, an energy-saving and low carbon dioxide infrastructure

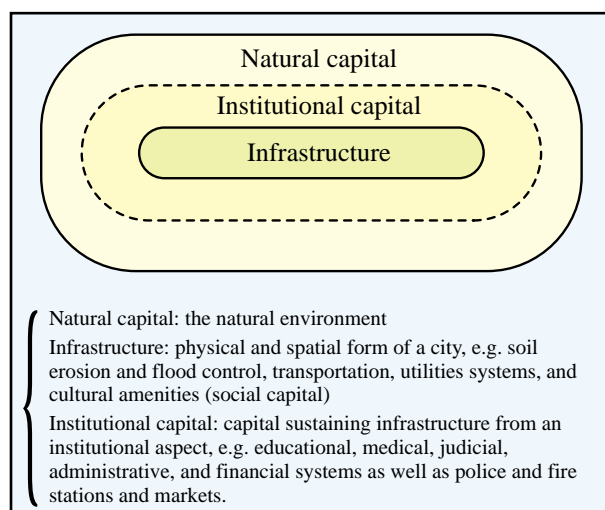


Fig. 1 Concept of common social capital

Source: Hirofumi Uzawa, "Concept of common social capital" (Prepared with reference to "Infrastructure Development — Commons and Cities: Economic Affairs-4, Institute of Capital Investment of Japan Development Bank, Publishing Section of the University of Tokyo, 1994)

should be studied by setting goals for natural capital — such as a target carbon dioxide reduction — and considering the form of institutional capital, such as the market mechanism, administrative, financial, and tax systems, and national policies or schemes for cooperation. (Table 1)

As another example, to take remedial action with respect to the poor housing situation that exists in major cities, consideration should not be limited to residential investment (social capital), but should also extend to

Table 1 Correlation between three elements of common social capital

Source: Economic Research Institute, Economic Planning Agency, "Toward structural reform of infrastructure," Printing Bureau, Ministry of Finance, 1997

Super ordinate concept / Sub-ordinate concept	Natural capital	Infrastructure	Institutional capital
Natural capital		Infrastructure development with attention to the environment	<ul style="list-style-type: none"> Bringing natural capital preservation and infrastructure development into balance (harmony between the environment and development) Medium- and long-term positioning of the three elements of common social capital in triangular form (harmony between fairness and efficiency)
Infrastructure	Dealing with global environmental issues (control of development and restoration of natural capital)		
Institutional capital	Dealing with global environmental issues (introduction of a carbon tax system and a new international institutional system)	Improving institutional capital (such as through an administrative system) for infrastructure development	

Notes: For the sake of convenience, this table indicates how the subordinate concepts (the other elements of common social capital) should be treated when adopting the super ordinate concept (one particular element of common social capital). When natural capital is taken as the super ordinate concept, the question is how the subordinate concepts, i.e. infrastructure and institutional capital, should adjust to global environmental issues. When infrastructure and institutional capital are taken as super ordinate concepts, on the other hand, the subject of the subordinate concept becomes different. Any final adjustments, however, should be made by institutional capital.

introduction of fixed term tenancy and improving land administration (institutional capital).

As this makes clear, the study of infrastructure development for the 21st century must be pursued from a broader spectrum of angles related to common social capital.

From this viewpoint, the next major set of challenges to be addressed in exploring infrastructure development includes appropriate allocation of social capital by sector, implementing socioeconomic evaluations of infrastructure development projects, introduction of the idea of the Private Finance Initiative (PFI)¹⁾, and planning of a strategic development methodologies based on the external effect of infrastructure. In the context of the close linkage between social capital and institutional capital, these challenges are discussed below.

For appropriate allocation of social capital

One criticism that arises in discussing an ideal infrastructure development is inappropriately directed investment since the sectoral allocation of public investment is unchanged recently. When we observe sectoral allocation as a ratio in the national general account budget (initial budget), there was considerable fluctuation until fiscal 1980, but the ratios have remained unchanged since then. We can clearly observe "inflexi-

ble allocation". (Table 2)

[Reasons for inflexible allocation]

Up until 1980 or so, the allocation of public investment by sector was made according to the government's economic plans, and five-year schemes of road, sewerage, port, and harbor development were drawn up on the basis of these plans. However, this method of allocation was excluded from plans after the New Seven-Year Socioeconomic Plan of 1979.

In preparing plans prior to that time, open discussions had been held among people of learning and experience at the Social Capital Working Group and the Public Investment Sub-Committee of the Economic Deliberation Council to discuss the allocation of resources. At such meetings, issues such as the importance of various needs and direction of higher allocation so as to lead future economic and social development were discussed. This results in considerable influence on allocation decisions.

In more specific terms, government departments competed with each other for bigger pieces of the pie, and the committee was a kind of contest that resulted in variations in the ratio of public investment by sector.

As already noted, this system of open discussion and competition for public investment was discontinued in

Table 2 Changes of the sectoral ratios in public investment (on a budget basis) (Source: "National budget")

(unit: %)

Sector	Fiscal year	1960	1965	1970	1975	1980	1985	1990	1995	1996
Soil erosion and flood control		27.31	19.55	17.91	16.98	17.51	17.56	18.10	17.55	17.44
Flood control		17.38	14.87	14.07	13.15	13.66	13.67	14.12	13.75	13.66
Soil erosion control		2.61	2.81	2.30	2.35	2.57	2.62	2.71	2.57	2.56
Coastal conservation		7.32	1.87	1.54	1.48	1.28	1.28	1.28	1.23	1.22
Road improvement		41.02	51.31	44.40	36.04	30.29	29.62	28.96	28.86	28.79
Harbor, fishing port, and airport development		9.38	8.96	8.89	9.04	8.38	8.30	8.33	7.87	7.77
Harbor development		6.44	6.41	5.85	5.15	4.23	4.17	4.27	3.98	3.90
Fishing port development		2.09	1.60	1.73	2.32	2.60	2.62	2.63	2.42	2.35
Airport development		0.85	0.95	1.31	1.56	1.54	1.50	1.42	1.47	1.52
Housing development		N.A.	N.A.	7.22	11.10	11.96	12.29	11.68	12.35	12.45
Sewage system development, environmental and sanitation works		N.A.	N.A.	N.A.	10.67	15.32	15.74	16.53	17.87	18.22
Sewage system development		N.A.	N.A.	3.98	6.75	10.80	11.00	11.43	12.39	12.57
Environmental and sanitation works		N.A.	N.A.	0.78	2.68	3.02	3.08	3.09	3.73	3.87
Urban development and parks		0.66	1.98	N.A.	1.24	1.50	1.66	2.01	1.75	1.78
Agricultural infrastructure work		17.93	14.90	14.31	13.54	14.23	14.26	14.22	13.35	13.17
Tree planting, forestry road construction, and industrial water supply development		3.69	3.29	2.52	2.63	2.32	2.22	2.17	2.15	2.16
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Notes:

1. Investment in each sub-sector is expressed as a percentage of total investment in the respective sector.
2. N/A: data unavailable due to differences in data classification.

economic plans after the 1980s, and this is what led to today's inflexible allocation.

[For optimum allocation by sector]

Experience tells us that, for a proper allocation by sector in response to public investment need, the first requirement is to reinstate the mechanism of allocating public investment in accordance with economic plans. Further, it is necessary to introduce such methodologies as cost-benefit analysis and optimization techniques to sectoral and regional allocations.

Moreover, with future administrative reform in view, there is a need to set up arrangements for studying the optimum scale and sectoral allocation of public funds from an objective standpoint, and this should take the form of a social capital committee within the Economic and Public Finance Advisory Council of the Cabinet Office comprising experts from universities and private enterprise.

SOCIOECONOMIC EVALUATION OF INFRASTRUCTURE DEVELOPMENT PROJECTS

In the 21st century, with the days of continuous growth and profligate energy use behind us, tighter constraints will lead to a growing need for a rational choice of individual public works projects as well as an optimum allocation of public investments by sector. Choices will be based on socioeconomic evaluations using cost-benefit analysis.

The Road Bureau of the Ministry of Construction has recently decided to make socioeconomic evaluations a prerequisite to the implementation of major road development projects. A flow chart of the evaluation process is shown in Fig. 2. The cost-benefit analysis that forms the core of this evaluation method takes into account not only the direct benefits to road users, such as time savings, but also those due to reduction of traffic accidents and noise and air pollution improvements. Further, a financial assessment is carried out for toll roads. One issue left for future study, however, is the development of a suitable methodology for objectively evaluating the effects of road projects on amenities, the landscape, the safety of the road network, and regional disparities.

This evaluation procedure is now in actual use for road development projects, and a study is being carried out on its extension to development projects of other areas of transportation, such as railway, and port and harbor.

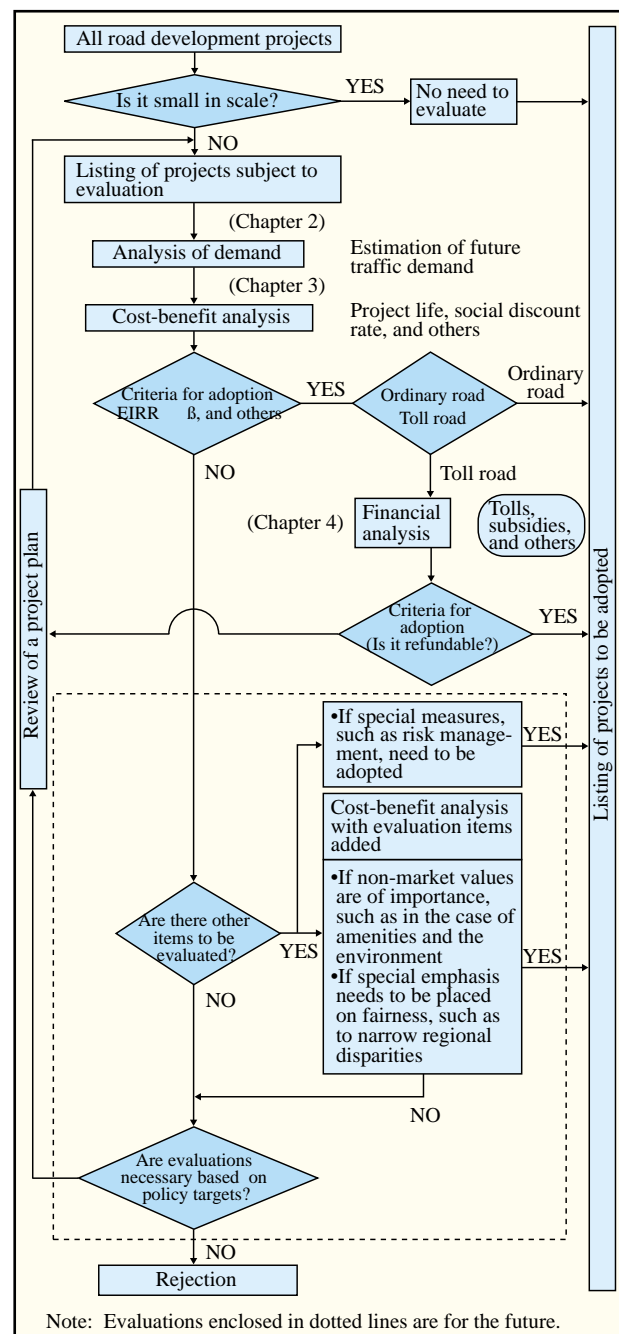


Fig. 2 Socioeconomic evaluation of road investment (analysis procedure)

Source: Study Committee on Guidelines for Evaluation of Road Investment, "Guidelines for Evaluation of Road Investment (Draft)," 1998

As regards the evaluation of infrastructure development in other sectors, such as parks, sewage systems, schools, soil erosion, flood control, and agricultural development, the stage has been reached at which methodologies such as the Hedonic approach²⁾ and the Contingent Valuation Method (CVM)²⁾ need to be studied, while testing should be carried out through practical implementations that will lead to improvements.

Ideally, public works in all sectors should be subjected to such socioeconomic evaluations, and there is a need for comparative studies of all types of projects. With the growing importance of informing and obtaining consent from the public, it will be crucial to disclose information to demonstrate that projects have been selected based on objective criteria will be crucial.

In addition to these pre-evaluations that are performed during the project planning phase, post-completion evaluations should also be carried out. Such post-evaluations are highly significant as regards measuring actual costs and benefits. They also play an important role if there is considerable difference between the two results; allowing for analysis of the major factors responsible for the difference, and providing information useful in the review and improvement of data processing and project evaluation methodologies.

INTRODUCTION OF PFI INTO INFRASTRUCTURE DEVELOPMENT

To bring greater efficiency to infrastructure development, it is of course necessary to correct high-cost structures and make effective use of stock. In the

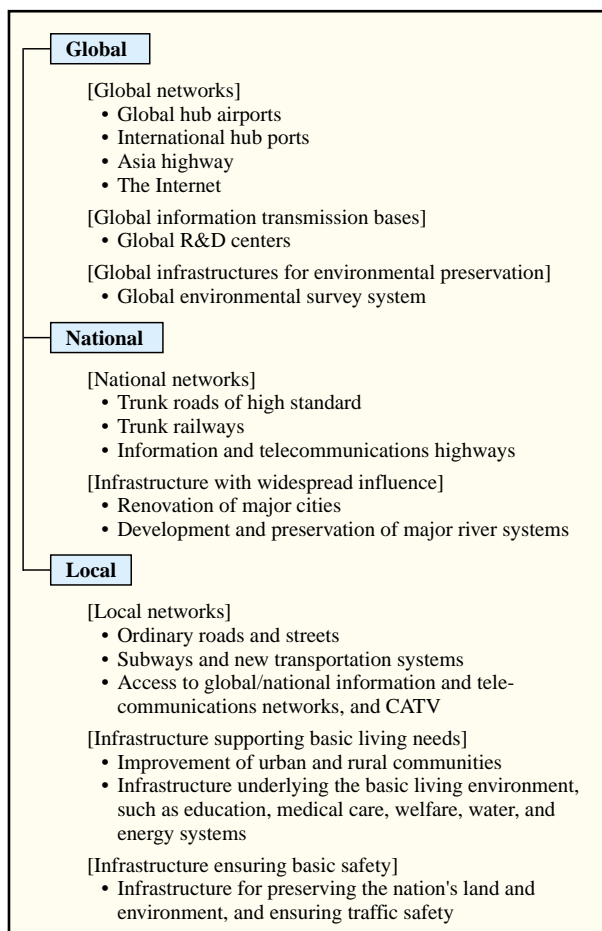


Fig. 3 Infrastructure ordered by external effect

long term, though, the introduction of PFI will have the most comprehensive effect. Based on the U.K.'s experience, it can be concluded that PFI should be introduced into Japan for the following purposes:

(1) To make the most of the strengths of private enterprise

Not merely private funds, but also the capabilities of private enterprise in such areas as management skills, ability to respond to market competition, and engineering expertise should be leveraged.

(2) To reflect the importance of cost performance

The challenge is to use PFI to provide the public with services through infrastructure rather than simply by constructing it. In providing these services, the aim should be to provide public services of consistent quality at low cost, as espoused by the Value for Money³⁾ concept for maximizing cost effectiveness in the U.K.

(3) To ensure transparency and market competition

To encourage private enterprise to take the initiative, the public sector must disclose all project information, including objectives, basic rules, evaluation criteria, and forms of contract. To further improve the VFM and other performance indices, it is important to encourage competition between the public and private sectors and between individual private enterprises, while also securing transparency in the process of selecting enterprises for projects.

(4) To clarify the risk burden

It is important to clarify the division of risk between the public sector and private enterprises in raising funds, planning, constructing, and running infrastructural projects. The general rule should be that risk is to be borne by the entity most able to manage risk efficiently.

The introduction of PFI into infrastructure development in Japan will begin in the near future when the institutional framework is established by the PFI bill, a bill for the promotion of infrastructure development with private funds submitted to the Diet for consideration in May 1998. A PFI Promotion Committee will then be established, and basic policies and implementation schemes will be formulated.

Whether or not the efficiency of infrastructure development improves markedly after Japanese PFI is introduced depends largely on whether the central government emphasizes the above aims of PFI and respond actively to them.

STRATEGIC SYSTEM FOR INFRASTRUCTURE DEVELOPMENT

The development of infrastructure in the 21st century will depend on re-formulating infrastructural projects in accordance with their external effects, and developing a strategic system to improve infrastructure. One particularly important challenge is to shift from the conventional approach by which infrastructure is planned, constructed, and administered under a centralized administration to a new system responsive to localization. That is, development should fall under a decentralized administrative structure while remaining open to globalization, i.e. development through the global market mechanism. (Fig. 3)

[Localization of infrastructure developments]

Decentralization has been ongoing for some time, with emphasis on autonomy and respect for local characteristics, while at the same time motorization has been expanding spheres of activity and hence the scope of infrastructure planning, construction, operation, and administration by local communities. That is, spheres of living comprising cities, towns, and villages have been growing considerably wider.

Under these circumstances, infrastructure needs to be planned and operated under the auspices of local communities, with central government intervention minimized. This in turn requires discussion of how a re-allocation of revenues may be achieved, such as through reform of the existing consumption tax into a local tax.

In developing local infrastructure for the communities of the 21st century, in which demographics and the closeness of families are likely to see rapid change, there will be a desire to grasp people's needs in the face of increasing diversity in terms of age, sex, residential location, nationality, sense of values, and life styles, thus enabling infrastructure to be developed that allows them to live together.

Thus, participation and full information disclosure, in addition to decentralization and PFI, will become keywords in the planning, construction, and administration of such local infrastructure. For instance, the disclosure of project information beginning at the planning phase will be more important, and citizens (including NPOs and local community members) will begin to participate in the process of preparing project plans that meet their needs. (Photo 1) In the coming century, we will see new systems by which administrations disclose, disseminate,



Photo 1 Street improvement project with citizen participation (Source: Kochi Prefectural Office)

and exchange information with citizens through polls, web pages, and direct voting from personal computers.

[Globalization of infrastructure development]

As the economy becomes more global, infrastructure systems that support global exchange, such as transportation, information and telecommunications networks, R&D centers, universities, and scientific societies, will come to play an increasingly important role. The integration of these global structures with national/local ones, and the links between them, will have an influence on the quality of infrastructural services in all nations and regions, and also on the development potential of each nation and region in the mega-competition of the global economy.

Japan lags in the planning and operation of these global infrastructure systems. The reason why such global concepts as the Internet and the Iridium Project were never conceived by the Japanese is that telecommunications providers offered services through a vertically segmented structure, in which local, long-haul, international, and mobile telecommunication services are all independent. Consequently, no business was able to come up with the idea of services that crossed its own boundaries. Clearly, the barriers that separate these segments should be taken down.

Another example of Japan's lag in development is the international hub airport. In the 21st century, when super-jetliners become the norm on intercontinental air routes, this nation will require a global air hub that operates 24 hours a day if it is to remain a center of international exchange. Such an airport would have to cover an area of 4,000 hectares and offer five runways. (Fig. 4)



Fig. 4 Conceptual drawing of a global hub airport
(Source: Global Hub Airport Working Group)

It will be an important challenge for Japan in the coming century to develop a system suitable for the conceptualization, planning, and operation of such global infrastructure systems.

Notes:

1) A method by which infrastructure, which is traditionally built and operated by the government and public sectors, can be developed using private funds and expertise. In the U.K. and Australia, a new method by which the public sector pays the private sector for services by usage, as measured by traffic volume or the number of prisoners, for example, has been

adopted. This is in addition to the Build, Operate, Transfer (BOT) method by which infrastructure such as railways and highways is built and operated with private funds, and then transferred to the public sector once the initial investment has been recovered through fares and tolls.

2) Infrastructure cannot be valued using market prices since no market exists for the services they offer. The Hedonic approach and CVM are techniques for measuring the monetary value of infrastructure by alternative means. The former assumes that the state of infrastructure development is reflected in land prices, and measures its value through factor analysis, including a multiple regression analysis, on land prices in many locations with different levels of development. The latter is based on the assumption that the living environment is improved by the development of infrastructure, and it measures the value of this change by determining how much consumers would pay for such infrastructure-related improvements.

3) The concept of measuring how much public funding, including taxes (Money), is necessary to develop infrastructure (Value). In the U.K., the decision as to whether PFI will be introduced into a particular infrastructure development is often made by comparing the value of the flow of public funds (at current values) between the two cases of public and private sector development.