

Advisory Opinion

Towards Cross-Border Infrastructure Governance



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**Subcommittee on Advanced Infrastructure
Committee on Civil Engineering and Architecture**

This advisory opinion summarizes and publishes the results of the deliberations of Subcommittee on Advanced Infrastructure, Committee on Civil Engineering and Architecture, Science Council of Japan.

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Executive Summary

1 Background

As the mechanisms of disaster occurrence has changed due to climate change, societies has changed due to declining population, aging population with fewer children, and interpretation of well-being has changed over times, the demands on infrastructure have been changed. Strategies for infrastructure development and renewal that incorporate the results of the latest technological innovations, such as digitalization, will play a leading role in the regeneration and development of national land, cities and communities. Here we summarize our views on 'cross-border infrastructure governance', which should be promoted to enhance and upgrade the value of infrastructure.

2 Current Status and Challenges

With the development of science and technology in civil engineering and architecture, elemental technical methodologies for infrastructure have developed to a considerable extent, and autonomous management systems have been established for infrastructure for each individual function. In addition, financial constraints associated with social change and increasing sophistication of technology required to manage infrastructure facilities have necessitated the participation of more and more stakeholders, including the private sector.

In conventional infrastructure development, various discussions have been developed with “ensuring the safety and security of the people” as the outcome. However, when looking at current infrastructure with the outcome of “building a society that realize well-being” in addition to “ensuring the safety and security of the people”, serious gaps exist between infrastructure planning and design theories and various management theories. Considering that the functions provided by various infrastructures are complementary to each other, while many stakeholders’ participation in infrastructure management, and more seamless planning and design theories are progressed, it is required to cross the boundaries of individual infrastructures with each other for an autonomous and decentralized infrastructure system (System of Systems). In addition, there is a need for consideration to include the discussion on services derived from a well-being perspective and the discussion on performance derived as a result of scientific and technological considerations. To this end, , infrastructure governance is demanded that enables discussion of coordination principles such as integration and coordination across traditionally established authorities, more effective increase in value of infrastructure and progressive improvement of

society's ability to achieve well-being.

3 Contents of the Advisory Opinion

This Advisory Opinion is aimed at researchers and engineers involved in infrastructure, as well as government and business actors involved in the development and operation of infrastructure and can be summarized as the following five points.

(1) Coordination between design and planning theories based on infrastructure performance

The discussion on infrastructure services derived from the perspective of wellbeing in society and the discussion on infrastructure structural performance derived as a result of natural science and technological considerations are loosely connected but divided by the qualitative concept of function. By defining structural performance as structural infrastructure performance and service level as social infrastructure performance, and by introducing the concept of infrastructure performance that integrates these two types of performance, it is possible to link structural performance and service, and to coordinate the discussion between design and planning theory.

(2) Coordination of Management via infrastructure performance

In order to increase the value of infrastructure, asset management has a hierarchical structure with different targeted management scopes and time horizons, such as long-term, medium-term and short-term planning, but it is also desirable to incorporate the concept of risk management. The linkage between final outcomes (outcomes) in infrastructure and intermediate, specific outcomes (outputs) to realize them, which are linked by infrastructure performance and based on a common engineering basis, can also facilitate the coordination of management at different levels of hierarchy throughout the life cycle.

(3) Development of coordination principles for cross-border infrastructure governance

In order to expand management areas beyond each other's boundaries to the extent that existing service levels are not degraded, and to achieve more efficient and sustainable management as a whole, a coordination principle must be developed with infrastructure performance at its core, based on the premise that the value of individual function-specific infrastructures is increased in each of them, it is necessary to coordinate areas that cannot be covered by a single infrastructure, and to move towards a system of governance that

can cross borders to ensure reliability and fairness. To this end, it is necessary to collect data and evidence for the analysis of their effectiveness, and to develop institutional frameworks and structures to enable cross-border service provision.

(4) Technologies for cross-border infrastructure governance

It is necessary to promote development of soft infrastructure through monitoring technologies using information and communication technologies such as IoT, and fundamental technologies such as data. The challenge is to establish correlations that interconnect quantitative indicators of structural and social infrastructure performance, but as the relationships are social science information, data science is a powerful technology. Furthermore, large-scale simulations based on big data accumulated in the infrastructure DX are effective for deductively inferring measures to deal with cases where performance guarantees are not always possible, such as unexpected, remedial measures and exceptional responses.

(5) Human resource development for cross-border infrastructure governance

What is required for human resources in the era of infrastructure digital transformation (DX) is the ability to extract information necessary for value creation and problem solving in society, to understand the principles of various disciplines, and to understand society from a bird's eye view and structurally, and thus practical education is needed to acquire these abilities. In addition, in order to cross borders in infrastructure governance, it is necessary to have not only those who can demonstrate leadership that takes risks and transcends existing authority in a progressive manner, but also those who can act as facilitators to be close to the whole from the side, increase the satisfaction of participating in activities and support personnel who should cross the border. In order to achieve this, it is necessary to foster an organizational culture and social climate that enables a correct evaluation for each human resource.