
For Continuing to Product Research Results Responding to Social Demand

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key words: mission of NILIM, social demand, index, recognition

1. Introduction

The mission of the National Institute for Land and Infrastructure Management (NILIM) is, as stated in its Research Policy (revised in Nov. 2017), "to realize, as the sole national research institution in the field of housing and public capital, a safe, secure, active, and attractive land and society for present and future generations by using technologies as a driving force". NILIM is developing research activities in order to achieve this mission in pursuit of the maintenance and improvement of service provision to society concerning housing and public capital. This paper first describes how NILIM considers service for society concerning housing and public capital to achieve research results that lead to maintenance and improvement of the service. Then, it looks at matters necessary for conducting research at NILIM.

2. Understanding social demands with indexes

As an example of social service in the housing and public capital sector, let us discuss road traffic. Society demands that people and goods can move smoothly. If the traffic volume (needs) that embodies the movement of people and goods exceeds the traffic capacity of the supplied road, traffic congestion occurs. If both supply and demand of the whole road network could be adjusted in various ways to avoid such problems and still enable supply to reasonably meet demand, service would be adequately provided and social demand would also be met.

As described above, NILIM views social demands as needs that can be indexed, and evaluates technologies, measures, etc. (provision of service) to meet such needs with an index comparable with those needs. Then, using such indexes of supply and demand, NILIM conducts examination of response policy, which is a type of technological policy, and technological development required for execution of the policy in combination of various researches. As the above-mentioned example suggests, introducing traffic volume as an index makes it possible to quantify needs. Furthermore, the present level of service provided can be identified by measuring the level of service that fulfills demand with the index for traffic capacity and comparing it quantitatively against demand. Then, if cost required for supply is separately calculated, it is possible to indicate the economic rationality of project, which is an act of providing service, which will lead to social

agreement to determine the reasonable level of service to be provided.

Since the purpose of service provision to society concerning housing and public capital is huge, it is necessary to take actions for achievement of this purpose by forming layers each of which represents the purpose and procedures to achieve it for each service field so that achievement of procedures of a certain layer will be the purpose of the layer immediately below that layer, with the top layer constituting the huge purpose above. Normally, for individual research themes at NILIM, indexes determined in a layer of the above structure are evaluated with models obtained from theoretical analysis, statistics, simulations, physical experiments, etc. and the purpose of research is to take those models to new depths. However, many of such models are continuously examined and tend to focus on more detailed model development or improvement as research proceeds and the position of research may be lost if too much focus is placed on indexes or models directly handled in individual research themes.

In order to conduct research that corresponds to social demand, it is necessary to go deep with individual research themes and attentively position those themes in the aforementioned hierarchical structure. Moreover, though it is effective to quantify social demand with indexes or models, we should always ask ourselves whether we misinterpret such indexes or models as real when they could inherently be biased.

3. Response to changes in social demand

New issues (needs) that are not easy to address in a deteriorating economic situation, such as maintaining the level housing and public capital services in depopulated areas faced with particularly severe situations, have arisen. Unlike the conventional way, new response, such as "Compact plus Network." is needed in the circumstances where degeneracy cannot be avoided. For such issues, it is required to study in the reverse way, i.e. to request changes in social structure, considering the restriction on the service supply side.

For utilization of new technologies represented by ICT and AI, to which prompt response is required and for which knowledge is not sufficiently accumulated in NILIM, it should be studied in both needs and supply by taking social demand in advance. In the field of public capital as well, advent of an age is predicted

where services specialized even to the level of individuals using ICT is called for. If society demands real-time provision of services at the level of individuals in the field of public capital, it will be necessary to recognize needs with indexes different from existing ones and new approach will be required. Whatever form is taken in service provision, we would be urged to obtain a lot of data and establish data-driven services. In many fields, it is required to prepare for the new services in the age of Society 5.0 by clarifying the position and roles of the public sector.

4. Response to uncertainty

Many of the research themes at NILIM contain some uncertainty. The solid red line in the following conceptual drawing represents the distribution of occurrence probability of the simulated needs indexes (external forces such as flood flow, traffic volume, and load) and the solid blue line simulates supply indexes (functions such as discharge capacity, traffic capacity, and intensity). Supposing that the index value of a supply that is met at present represents ① on the scale, a problem (flood, traffic congestion, destruction) will arise if external force exceeds ①. Taking as an example climate change, which is considered to cause an increase in flood flow, distribution of the occurrence probability of flood flow expected in the future is likely to move to the right as shown with the broken red line, but it is uncertain to what extent it will move and how the form of distribution will be. When themes entertain an external force with an inconsistent distribution of occurrence probability, as in the case of an impact assessment of climate change, the uncertainty of the external force assessment will create problems. In such fields, an attempt to reduce the uncertainty has been made by drastically increasing the amount of information through improvements in weather forecast calculation technologies, accumulation of observational data such as radar rainfall, etc.

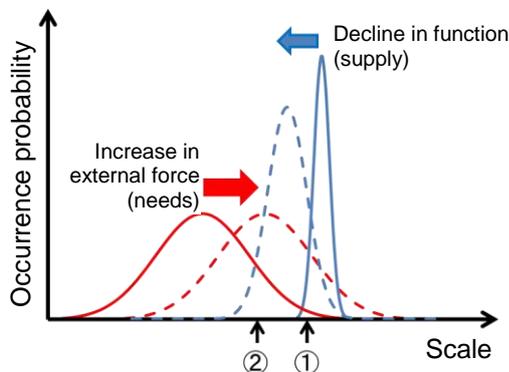


Fig.: Uncertainty in index assessment

As the solid blue line shows, the distribution of occurrence probability in the index value of function (supply) also varies. If the value of the supply index

lowers and reaches ② on the scale as the distribution of the broken blue lines is due to insufficient management of facilities, it will lead to frequent problems, so it is essential to assess and maintain the functions of facilities, etc. Uncertainty can expectedly be controlled by increasing the amount of information about the functions of facilities, etc. such as acquisition of continuous monitoring data on the behavior or displacement of facilities, etc. by applying new technologies. The importance of status monitoring technology for facilities, etc. is high. Since housing and the provision of public capital have been developed to a certain extent, the importance of the response to uncertainty has been increasing from the viewpoint of risk management. Assessment based on the accumulation of accurate data is becoming more necessary than ever before, and utilization of housing and public capital data is one of the utmost important issues.

5. Conclusion

It is possible to say that many of the researches conducted at NILIM assess land, society, systems, facilities, etc. with indexes or models and study how to steer new technical policies towards social demand. Accordingly, taking individual research projects to new depths and constant reviews of the purpose and positioning of research would lead to achievement of research results that contribute to society. Let's move forward to a new frontier, without falling into inertia.