
The Roles of NILIM and Perspectives for the Future

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1. Introduction: Roles and Stance of NILIM

The National Institute for Land and Infrastructure Management (NILIM) conducts research and development based on the philosophy that “as the only national research organization in the social infrastructure/housing field, our goal is to use technology as the driving force to create an attractive country and society that are safer, more secure, and more vigorous, both now and in the future.” This is the first item in NILIM’s “Research Policy,” and it is our basic role and “Mission.”

The objects of research and development by NILIM include a diverse range of fields related to social infrastructure and housing. Our organization, as a system, consists of 10 research departments and 2 research centers, as well as 3 administrative departments. Our staff includes approximately 250 researchers and 100 administrative personnel who are involved in practical support business. The necessary themes that we are grappling with on a priority basis are Disaster Prevention and Mitigation, Maintenance, Green Society Realization and Digital Transformation (DX) of Infrastructure. We have set up committees to promote research in each of these 4 fields, and are conducting activities with the cooperation of related research departments and research divisions.

NILIM is currently studying about 300 research subjects. Based on some of those results, we provide technical support for the policies of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and, in turn, the government, for example, reflecting our research outcomes in technical standards. In activities other than research, to support recovery efforts when a disaster occurs, we dispatch experts with advanced technical capabilities at the request of the disaster-stricken area after the disaster, and provide recommendations on recovery and reconstruction and other assistance.

In 2023, a revision of the Basic Act for National Resilience and the establishment of a Fundamental Plan

for National Resilience were decided. Although NILIM has also carried out research and activities contributing to national resilience until now, we have taken a hard look at the effects caused by the recent 2024 Noto Peninsula Earthquake, and intend to further strengthen this particular role of NILIM.

2. Perspectives for Fulfilling NILIM’s Roles

Next, the perspectives that I think are important for fulfilling the roles of NILIM are as follows.

(1) Continuing efforts

- Digital transformation of infrastructure: Example of “digital twins” –

For national resilience and disaster prevention and mitigation, research on maintenance and upkeep of specific facilities, structures, etc. continues to be important. At the same time, I think it is necessary to carefully consider methods of use based on social conditions including the future, also including existing facilities. As we advance toward the realization of digital twins through the creation of the MLIT Data Platform, Plateau and other initiatives, it is necessary to analyze data in connection with facility use and make predictions based on the results. In digital twins, data analysis is performed in a digital world, and predictions are made with simulation technologies (analytical techniques).

Although this was some time ago, at an international conference in the dam field, I made a presentation on 3-dimensional nonlinear analysis techniques and examples of Japanese dams. However, at the time, there was little response from the world’s experts. This suggests that, while the advanced level of analytical techniques as such is recognized, it is difficult to gather all input data suitable to support their accuracy. Information on the external shapes of structures, ground and the like has been converted to data with high accuracy by the latest surveying technologies, but, for example, the accuracy and resolution of information on the physical properties of the foundation ground is

comparatively low at present. Thus, depending on the object of analysis, high uncertainty is still unavoidable in some simulations.

Therefore, in light of the increasing “new” role of improving the foundation of data that can contribute to digital twins, a renewed recognition of the importance of the roles that “we have carried out until now” is needed. Those roles include studying advanced analytical techniques, that is, collecting and organizing data, improving their performance and making appropriate selections of analytical techniques, evaluation of analytical results, and careful consideration of how we should proceed in the future.

(2) Understanding the direction and utilization of new technologies

- Digital transformation of infrastructure:

Example of satellite technology use –

“BRIDGE” refers to various programs for Bridging the gap between R&D and the IDEal society (Society 5.0) and Generating Economic and social value, which the Cabinet Office launched in April 2023. As part of that initiative, NILIM is implementing a policy called “Social implementation of remote monitoring technology in the social infrastructure/housing fields using satellites.” With the rapid progress of satellite observation technology in recent years, the need to use of satellite data, etc. has also increased. Among remote sensing technologies, in particular, SAR satellites (radar satellites), which enable observation at night and in any kind of weather, and technologies employing constellations of small satellites, which support high frequency observation, are expected to be used in various fields.

To return to my own specialty of dams, NILIM began research on techniques for measuring dam displacement by using a SAR satellite in FY 2014. This was shortly after the launch of the ALOS-2 (Daichi No. 2) satellite, but from among the many satellites available in the world, we constructed the dam displacement measurement technique centering on the use of ALOS-2 data. This was because we judged that ALOS-2 was the optimum choice at the time, considering the observation frequency, accuracy and measurability conditions necessary for operation and maintenance (O&M) of dams. However, rapid changes occur in dams and other facilities during an earthquake or other disaster. In order to understand those changes, a different perspective from routine O&M of facilities is needed. This includes, for example, full utilization of multiple satellites that can be used immediately

whenever a disaster strikes. Remarkable progress is occurring in the development of satellite technology, and by grasping that progress, we can also ensure progress in the development of our own technologies.

Although this is an example of satellite technology, here, in order to accurately understand information from other fields and reflect it in our research, it is necessary to create and continue the systems necessary for cooperation with external organizations so as to grasp that information.

(3) Integrity of laboratories

- Example of the Green Society Realization Research Promotion Committee –

In 2023, NILIM launched the Green Society Realization Research Promotion Committee in a form that integrates and expands the previous Climate Change Response Research Committee and Environment Research Committee. Although the Climate Change Response Research Committee had led NILIM’s internal research on “climate change response,” the importance of responding to “climate change mitigation measures” such as carbon neutrality has also increased. Since it is necessary to promote climate change responses from both directions, the new Green Society Committee was organized to broadly include perspectives such as “a society that coexists with nature” and “a recycling (circular) society.” The aims of this move were to invigorate research by encouraging closer information sharing in NILIM, and to ensure a response without delay in all fields of research at this institute.

In the future as well, it will be necessary to accurately understand conditions (changes) related to important issues, both inside and outside NILIM, to actively use the systems of the coordinating departments and others, and to stimulate activities by NILIM as a whole.

3. Conclusion

In order to fulfill the roles of NILIM, I believe we need to have a stance of continuing to “reflect” on how to use developed technologies, guidelines and the like in the field, how they will influence the country and society, and their connections with the goals of our “Mission,” which I mentioned at the outset. Moreover, in the future, I hope to carry out research in close cooperation with the field, while striving for foresight based on an accurate understanding of both internal and external technical information and social conditions.