Expansion of Limited Applicability of Water and River Management Technologies

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ABSTRACT: This paper elaborates on difficulties when ones tried to apply domestically developed technology to other countries from both technical and sociological aspects. Next, the author proposes possible solutions to expand the applicability of domestic technology. The main one is breaking down a technology to smaller components so that anybody can clarify the applicability of each component. The author presents an example of this methodology to flood hazard mapping.

1 INTRODUCTION

Water problems are extremely localized and region-specific, and their resolutions need to be sought according to the unique natural and social conditions in each river basin. Accordingly, solutions in certain river basins cannot necessarily contribute directly to resolving problems in other river basins. Applicability is even further limited in differing countries which have very different social systems. Nevertheless, the reason why scientific and technical research of water problem solutions targeting overseas river basins is conducted is because one can anticipate domestic benefits that can be obtained only from international contribution activities. The technical aspects of feedback of overseas research to one's own country are described here.

First, through applying domestic technologies to overseas countries, the said technologies can be expected to become more sophisticated and more universal. Through taking water management experience and know-how that is only applicable to individual countries and river basins and applying and upgrading it under a variety of differing natural and social conditions, the technology can be improved.

Examples of domestically developed technology being applied to other countries are frequently seen in technical development aid projects targeting developing countries. However, this work entails a lot of difficulties and experience shows that transfer of technology is not easy.

2 TECHNICAL ASPECT OF TECHNOLOGY TRANSFER DIFFICULTIES

The flood control setup in Japan is constructed around rivers. River management areas and river managers are clearly defined under the river law, and basic plans for each river system have been prepared and various technologies and systems for realizing these plans have been formulated based on this legislation. The representative example of such standards is the "Manual for river works in Japan," and numerous attempts have so far been made to translate this into English and implement it in developing countries. The first problem that confronts such an approach is the lack of basic data. Many countries do not possess enough rainfall or discharge data to conduct runoff analysis, and neither do they possess enough surveying data to examine river channel plans. Such countries are troubled by a total information shortage on a different dimension from the data shortages seen in the advanced countries. Data shortages should really be overcome through conducting observations; however, utilizing state-of-the-art science and technology makes it

possible to partially make up for missing data, and confronting data shortages in overseas countries acts as a good motive for conducting research and development.

Even assuming that data are available, the next hurdle is that differing natural conditions prevent the direct application of technology generally used in Japan. For example, the storage function method, which is the hydrological model developed primarily with the purpose of enhancing the accuracy of reproducing via calculation a flood that occurs in a short time, is not suitable for reproducing long-term runoff or floods in arid regions. This is because the predominant hydrological processes differ between rainy, arid and semi-arid regions and wet regions, and the aspects of the hydrological process that can be intensively reproduced by the

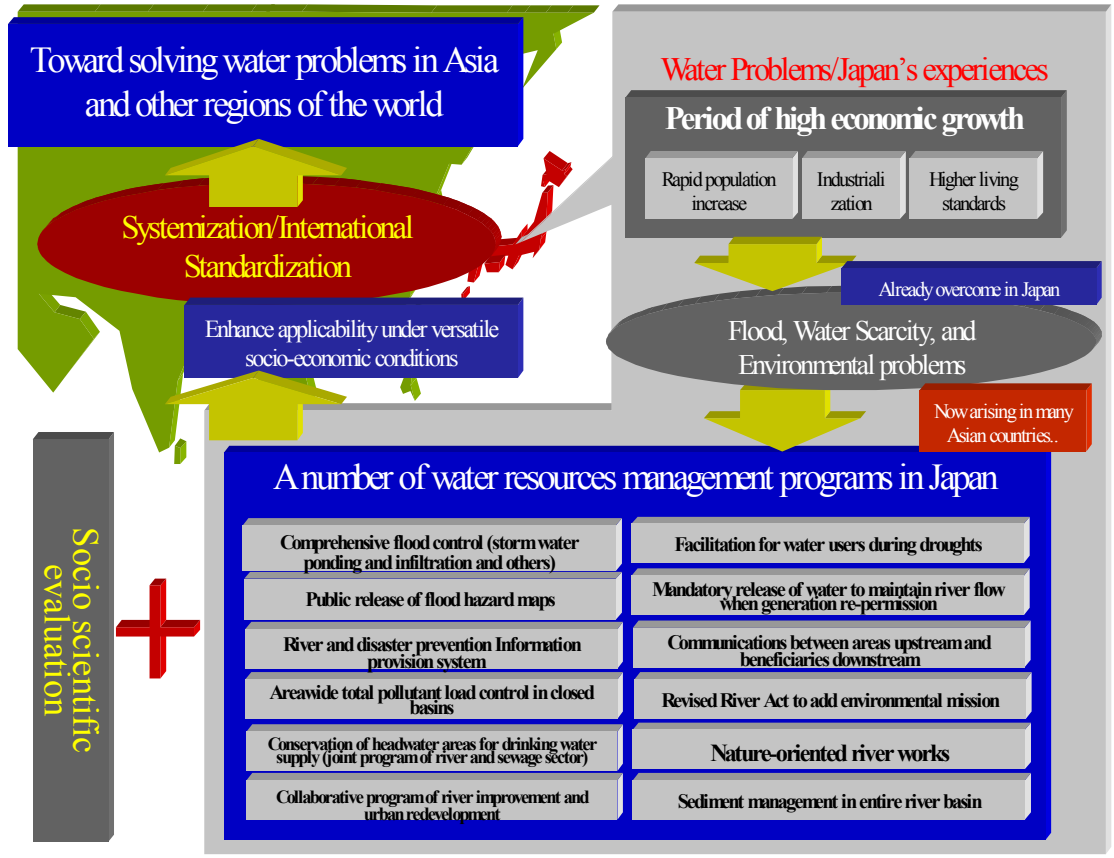

Fig. 1 Conceptual drawing of past experiences in water problem solving and its application to other regions after Musiaki (2000) and Yoshitani (2002)

hydrological model are different. On the other hand, the tank model, which was developed in Japan around the same time as the storage function method, has been made more widely applicable following application in various river basins of the type not seen in Japan under the Project for Mutual Comparison of Hydrological Forecasting Conceptual Models by the World Meteorological Organization (1968 to 1974). Application of models to overseas river basins offers a good opportunity to expand and develop the applicability of the models, and this upgrading of technology is also beneficial to the original country of development.

3 SOCIAL ASPECT OF TECHNOLOGY TRANSFER DIFFICULTIES

The next hurdle concerns the inability to apply technical systems such as planning techniques due to differing social conditions. For example, the Japanese planning method of setting the flood safety level (development target) as the return period and establishing the unregulated peak discharge for entire river systems is not required in countries where it isn't necessary to examine the priority of flood control investment and countries that possess no concepts or legal systems concerning river management. The maintenance flow setting method, nature-oriented river works, river disaster prevention information system including radar rainfall gauges, storm water storage and infiltration facilities, comprehensive flood control measures, super embankments and other technologies that have been developed for practical application in Japan as shown in Fig. 1 have been established as symptomatic responses under the uniquely Japanese social situation and legal system (Musiake, 2000). When considering such technologies in the domestic environment, there is no need to analyze the social background to them. However, when considering their application to foreign countries, the need arises to examine social conditions necessary for them to function. Taking the example of flood hazard map disclosure, in many countries, even if such maps can be prepared, many people believe they cannot be disclosed because of political concern over the impact on land prices. In Japan, due to similar thinking, such work was started from the disclosure of past inundation maps and these were gradually modified to flooding area projection maps. Contrary to the original concern, they received nobody's attention and had no effect on land prices. Flood hazard maps are currently disclosed in numerous municipalities. Since only a handful of administrators possess this experience and social-scientific analysis is not conducted at academic level, it is not possible to convey such experience to other countries and this prevents technologies from being disseminated even though the willingness to do so exists. If this type of social-scientific assessment can be conducted with a view to promoting dissemination in other countries, technologies can be given the applicability to respond to possible social upheavals that Japan has not experienced in the past.

4 METHODOLOGIES OF APPLICABILITY EXPANSION

The methodology of expanding applicability and universality entails finely breaking down certain technologies and measures into component elements including the measures down to utilization and dissemination. If technologies can be broken down to clarify the applicability of each component, it will be possible to offer clear responses to vague questions about whether or not flood hazard maps common in Japan can be applied to other countries. Fig. 2 shows an example of the breakdown of flood analysis technology, which is a flood hazard map preparation method (presented by Yoshitani at the First Southeast Asia Water Forum held in Chiang Mai, Thailand in November 2002). This makes it possible to appropriately assess applicability through breaking the technology down into the empirical rule with low applicability and the physical side with high applicability.

Another method is to analyze the past developments of why the technology in question came to be developed and what methods were used before the technology became available. This is an effective method for selecting and applying technologies suited to the financial situation, the level and number of engineers and the needs of different countries. Traditional flood control technologies that were used when financial and other resources were scarce may be effective for developing countries today, although actual examples such as the fascine mattress that was applied to counter riverbank erosion along the Mekong in Laos are very limited.

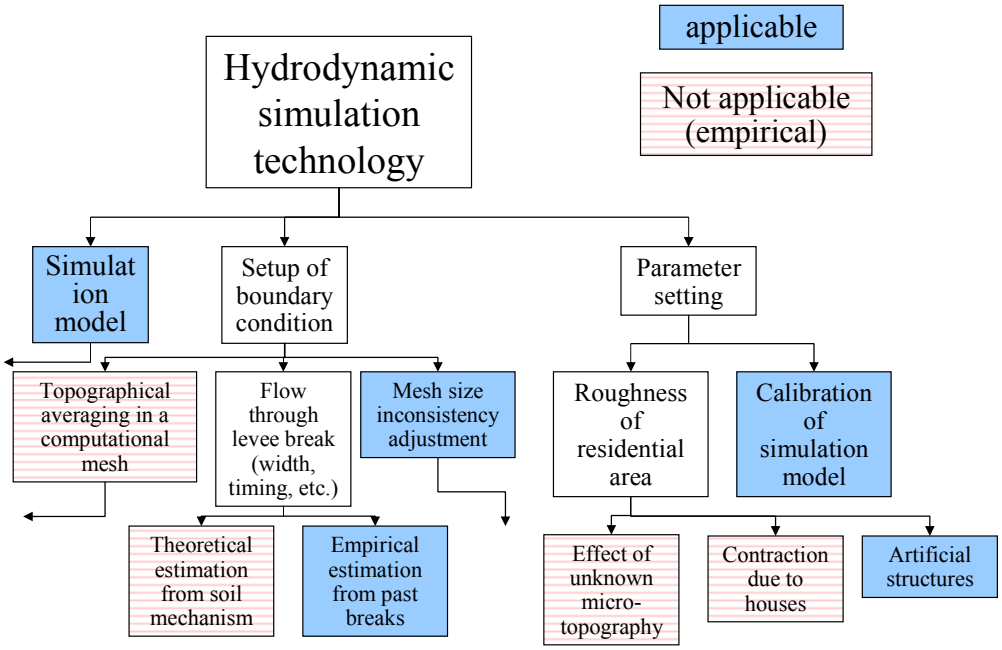

Fig. 2 Decomposition of Hydrodynamic Simulation Technology to Assess Applicability

5 SIGNIFICANCE OF INTERNATIONAL EXCHANGE

One aspect of feedback of overseas research to the domestic environment is that social experimental experiences and working advanced technologies that are unproven to function can be introduced and applied at home. For example, dispatching survey teams and conducting investigations when major disasters occur overseas is done with the objective of acquiring information on the results in a social experimental sense of introducing crisis management systems that have so far been untried in Japan, or analyzing reasons for why certain systems did not functions and applying the lessons in measures at home. In fact, river and disaster prevention information provision systems and nature-oriented river works have been expanded throughout Japan after first closely surveying the United States, Germany and other countries and conducting social-scientific analysis of these advanced cases.

Considering the more general objective of international exchange, it is frequently intended to acquire new ideas based on enhancing the diversity of thinking through coming into contact with differing cultures and values. Just like the need to conduct social-scientific assessment of technologies through applying for the first time in overseas countries, it is effective to become immersed in societies with differing values and cultures in order to realize that things one took for granted before are not always the case. Successful international corporations have systems for utilizing experience and know-how gained from international markets in future product development in order to provide better services; in other words, they have systems for internalizing diversity without distinguishing between home and overseas. Concerning water problems too, the ultimate objective of scientific and technical research targeting overseas may be to build a similar system on the global scale.

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7 REFERENCES

Katsumi Musiake (2000). "資源マネジメントと水環境－原理・規制・事例(Nei1S.Grigg 著,浅野孝監訳、池淵周一・虫明功臣・山岸俊之翻訳)の訳者まえがき(Introduction to translated book of Water Resources Management by Neil S. Grigg", 技報堂出版 (in Japanese)

Junichi Yoshitani (2002). "国際水管理に向けた技術開発の課題(Issues on technology development for international water management", 独立行政法人土木研究所 平成 13 年度土木研究所講演会講演集, 土木研究所資料, 第 3844 号, 2002.1 (in Japanese)