

# The Role of High-technology Diffusion for Sustainable Urban Development

January 2019

Hiroki HONDA

# The Role of High-technology Diffusion for Sustainable Urban Development

A Dissertation Submitted to  
the Graduate School of Life and Environmental Sciences,  
the University of Tsukuba  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy in Science  
(Doctoral Program in Geoenvironmental Sciences)

Hiroki HONDA

## Abstract

This study aimed to elucidate the role of high technology diffusion in sustainable urban development from the perspectives of different users. The author set three axes; spatial scale (national, prefectural, and municipal), user (government, private firms, organization, and resident) and diffusion process (adoption, promotion, and utilization). Then, the author combined these axes for analysis. The study areas were Saitama city and Yokohama city, corresponding to two origins of Smart City; Origin I (creating an ideal city) and Origin II (enhancing the utilization of ICT). Thus, the author considered how the diffusion of high technology influenced sustainable urban development.

At first, the author analyzed six policies for sustainable urban development in Japan. As a result, the smallest scale where policy for sustainable development enforced were a municipal scale, and especially policies enforced after later 2000s regarded resident users as important.

Secondly, the author conducted a survey for 36 next-generation vehicle users and asked their reasons of adoption, contents of promotion, and ways of utilization of next-generation vehicle in the case of Saitama city. As a result, next-generation vehicle diffusion was boosted by an original policy enforced by government of Saitama city. In addition, private firms and residents in Saitama city who utilized next-generation vehicle in different ways compared with policy of government of Saitama city, contributed next-generation vehicle diffusion in later period.

Thirdly, the author conducted a survey for 39 HEMS and/or PV users and asked their reasons of adoption, contents of promotion, and ways of utilization of each high technology in the case of Yokohama city. As a result, high technology diffusion in Yokohama city also was boosted by its government policy. In this diffusion process, chain relationships, like governments to private firms, and private firms to residents, contributed to an increase in users. Moreover, after the Smart City

policy ended, high technology was diffused by users on a municipal scale to a higher scale, specifically prefectural and national scales. There were case in which private firms that got to know HEMS for the first time through YSCP, diffused it to other municipalities in Kanagawa prefecture in another way of government of Yokohama city. Both Saitama city and Yokohama city had various types of users when the Smart City policy began. Then, users' interrelationships filled four elements of sustainable development through various ways of high technology utilization by each user. As a result, entire city became more sustainable.

High technology utilization had a top down structure that users on a national scale greatly affected users on a municipal scale. However, after Smart City policy began, users on a municipal scale invented new ways of utilization, which were difference with government', and promoted high technology diffusion to other areas. In other words, users on a municipal scale started bottom up actions instead of being affected by top down actions.

Consequently, the role of high technology diffusion for sustainable urban development were three points below. The first role is stimulating the participation of each user and in building relationships among users. The second role is gaining four elements of sustainable development through high technology utilization by each user. Then, the final role is converting top down into bottom up.

Previous studies about sustainable development elucidated contribution of governments and international companies and suggested that top down actions can ignore local users (Hollands 2008, 2015: Söderström et al. 2014). However, these studies showed significance of local users only in suggesting the importance or case study of ICT utilization. This study conducted empirical study from the perspectives of all high technology users in order to fill in the gap of previous studies. As a result, high technology utilizations of each user were important for high technology diffusion according to the

Smart City policy. These results also showed a new focus point and method for analyzing Smart City.

Furthermore, this study dealt with Smart City as a kind of sustainable urban development. Actions for sustainable urban development were not limited in high technology utilization. Thus, a methodology that analyzing sustainable urban development through high technology diffusion is not efficient for all cases. However, this study attached greater importance for focusing on local users through high technology diffusion. Hollands (2008), which focusing on governments and international company for aiming Smart City, suggested mismatching statement of making Smart City and actual actions. Governments and some private firms could not fill in all elements of sustainable development in the case of this study. However, local users, including private firms, organizations and residents, participated forming Smart City through high technology diffusion, then, each user complemented each element of sustainable development. In other words, the mismatch between the statement of making a Smart City and the final goals in achieving sustainable development were filled by local users.

Although users in this study had a part of special case, this study suggests that the potential of sustainable development of other areas through high technology utilization, considered the study areas of this study, were advanced cases of Japan. Moreover, the most important part of this study is high technology utilization not only by governments through its policy but also by local users. Ways of utilization of high technology can be customized suitable for users' daily life by each user. Thus, encouraging local users to invent new ways of utilization of high technology in its diffusion process can make other areas more sustainable.

Key words: Sustainable development, Smart city, High-technology,  
Next-generation vehicle, User, Saitama city, Yokohama city