



## Disruptive innovation for social change: how technology innovation can be best managed in social context

Dong-Hee Shin <sup>a,\*</sup>, Chul-Woo Lee <sup>b</sup>

<sup>a</sup> Department of Interaction Science, Sungkyunkwan University, B307 International Hall, 53 Myeongnyun-dong 3-ga, Jongno-gu, Seoul 110-745, South Korea

<sup>b</sup> Department of Journalism and Mass Communications, Sungkyunkwan University, B307 International Hall, 53 Myeongnyun-dong 3-ga, Jongno-gu, Seoul 110-745, South Korea

### ARTICLE INFO

#### Article history:

Received 11 January 2010

Received in revised form 3 August 2010

Accepted 19 August 2010

#### Keywords:

Ubiquitous computing

Actor-network theory

Korea

Socio-technical innovation

### ABSTRACT

This paper describes a research approach based on the Actor-Network Theory (ANT) to interpret and understand the Korea's strategy for the development of the ubiquitous city (u-city). Analyzing empirical materials from u-city development, this study traces and unpacks the interaction occurring around the u-city innovation and also identifies patterns of innovation, concentrating on negotiation and translation implementation. The findings imply that Korean approach has marginalized key issues relating to the development potential inherent in the combination of knowledge and technology and thus conflicts with broader development suggestions of participative design. Korean case reveals the essential role of participatory design in u-city development. U-city as a public utility should draw users' perspectives, its design should be heavily grounded in users' needs, and its design decisions should be based on a community consensus.

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### 1. Introduction

Since Weiser (1991) raised the concept of ubiquitous computing, the idea has seen speedy realization with the rapid and far-reaching advancement of information communication technology (ICT). Recently, the idea has received more attention as it combines ever-present computing technologies, a current application of which is ubiquitous city projects. The *ubiquitous city*, or u-city, refers to a region with omnipresent ICT where all information systems are linked, and virtually everyone is connected to an information system through technologies such as wireless networking and radio-frequency identification (RFID) tags. The concept has received most attention in Korea, which has actively developed 15 ubiquitous cities since 2003. The Korean government and industry together have combined efforts for a national urban development project focused on integrating advanced ICT infrastructure to support sustainable development of futuristic cities. The u-city project aims at creating environments in cities where residents can enjoy access to high-speed networks and advanced information services regardless of location through a ubiquitous computing network. This will be achieved by integrating into urban space the latest ICT infrastructures and information services, such as broadband convergence networks, RFIDs, ubiquitous sensor networks, home networking, wireless broadband, digital multimedia broadcasting, telematics, geographic information systems, location-based systems, and smart-card systems. Korea has considered the u-city development a strategic and promising area in which to realize cutting-edge pervasive computing technologies. Aware of the magnitude and scope of its impact, the Korean government has fully supported u-city implementation. Extensive financial investment has been committed to various u-city projects and substantial regulatory support has gone to industry involved in the project.

\* Corresponding author. Tel.: +02 740 1864; fax: +02 740 1856.

E-mail addresses: [dshin@skku.edu](mailto:dshin@skku.edu), [dshin1030@gmail.com](mailto:dshin1030@gmail.com) (D.-H. Shin), [catarina@skku.edu](mailto:catarina@skku.edu) (C.-W. Lee).

Despite progressive innovations for u-city development, questions about the design of the u-city still linger: What ultimate vision does Korea have for a city where the real and the digital merge and where all people and things connect in a network? What opportunities and challenges exist in the u-city for communities and individuals? What macro-strategies are available to enter this network society? What is the effective system development methodology tailored to the specific needs of the ubiquitous environment?

In response to these rising questions, some have argued that the implementation and reception of large-scale ICT is not merely a technological change, but also a political, institutional, and social innovation directly affecting the way we plan and design national system environments (Farias and Bender, 2009; Shin, 2009; Constantinides and Barrett, 2006). The development of a vast array of pervasive media and techniques such as mobile communications, automated positioning technologies, geographic information systems, and geographic tagging, have given new tools to urbanists and communities. Similarly, Castells (2000) argues that the “informational city... is not a form but a process” organized around networks (p. 398). That is, these cities are defined by interactions occurring within their networks, not by physical or geographical boundaries. He defines space as “the material support of time-sharing social practices” (p. 411). Modern society is constructed around the “space of flows”; he defines *flows* as “purposeful, repetitive, programmable sequences of exchange and interaction” between actors (p. 412). This idea parallels what Tuomi (2002) defines as *social practice*; network innovation occurs when social practice changes among actors.

These arguments effectively relate to the current Korean u-city case, given the country’s previous technology trajectory. Previous Korean innovative attempts at digital cities and a national information infrastructure have consistently shown that such innovations – given their ineffective system development methods and processes – had undesirable results. The u-cities in the present study tend to be designed and implemented primarily through misguided, ineffective top-down driven strategies (Hwang et al., 2008). The primary driving force to develop the u-cities has been the arrangement or outlay of technological equipment to increase technical capability. It has been noted that the progressive and linear models of innovations are not sufficient to explain large-scale ICT development on innovation development (Olla et al., 2003; Tuomi, 2002; Van de Ven et al., 1999). This calls for new system development methodologies tailored to the specific needs of new ICT environments. In response, the following questions lead this study:

RQ1: To what extent are the social values reflecting the design of the u-city projects?

RQ2: How was Korea’s strategic u-city innovation concept initiated and how has it evolved? How do actors build relationships with other industry actors, with artifacts, and with the development of u-city innovations?

RQ3: How do differing strategies play out in the development of strategic policies and in the transformation of the industry and services?

The inquiries explain why the national strategy of the u-city has been posited as a strategic initiative and how to interpret the nature of the u-city in the context of the Korean IT environment. How actors interpret the nature of the u-city project is crucial for understanding the meaning of the u-city because of its multifarious, nonlinear, and complicated nature. The process of building the u-city invites envisaging points toward which actors tend, wish, or are pressured to move. Therefore, this study focuses on focal actors crafting a common understanding of u-city principles around an actor-network by following focal actors’ activities to enroll and control the social and technical components interacting during the initiation, production, and diffusion of innovations. The reassembling and stabilizing of such components is the challenging goal of the focal actors involved in these processes. After all, the findings of this study recognize the complexity of innovation as a socio-technical process where both knowledge networks and networks of influence are central to success in a continuous transformation process.

This article is structured as follows: Section 2 describes study design; Section 3 then provides a literature review on Actor-Network Theory (ANT) and its perspective on innovation. Section 4 surveys the history of Korean information infrastructure innovation. Section 5 discusses Korean u-city development in reference to the ANT framework. Section 6 presents critical socio-technical insights. Section 7 draws on suggestions for a Korean u-city model. Section 8 presents theoretical implications, followed by practical contributions in Section 9. Finally, Section 10 concludes the study.

## 2. Study design

### 2.1. Data collection

Qualitative data collection techniques are important tools of investigation for ANT research. Particularly, content analysis and interviews allow researchers to explore the formation and development of networks and examine the alliances built along the way. In this particular research project, interviews allowed feedback in clarifying questions, allowed the interviewer to probe for a clearer response, allowed a lengthier period of questioning, and generally afforded a much higher response rate. Interviews are now a well-established means of qualitative data collection in the information systems field.

A variety of data collection methods were used in developing the case study. Qualitative and factual data were collected using multiple data collection methods – surveys, in-depth and face-to-face interviews, telephone interviews, and e-mail exchanges – with people (government administrators, regulators, industry players, professors, and researchers) associated

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