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Developing and validating a citizen-centric typology for smart city services

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ABSTRACT

This study proposes a new typological framework for classifying smart city services. Intentionally focused on citizen-centricity, away from bureaucratic perspectives that most typologies have taken, this typology is derived from marketing and service science literature. The proposed typology consists of four dimensions: mode of technology (automate–informative–transformative), purpose of service (hedonic–utilitarian), service authority (voluntary–mandatory), and delivery mode (passive–interactive). This typological framework is validated with a qualitative exercise of classifying inventories of actual smart city services in practice into the framework. Exercise results revealed that the categories provided are mutually exclusive and comprehensively exhaustive in general, and useful in further conceptualization of new services by identifying gaps in reality. In practice, this typology would be useful in positioning specific smart city service under development in terms of citizen-centricity. Urban planners and administrators may use this framework in understanding the pattern of their service development. Also, this framework may provide a useful guideline for service designer pinpointing the design characteristics of old and new smart city services from the perspective of users and customers of city services: citizens.

1. Introduction

Cities, used to be considered as part of local government, are now attract attentions as centers of governmental innovations as the number increases and the boundary expands worldwide. Urban population accounted for more than half of total global population as of 2009 and will be more than 60% by 2030, according to the global health observatory. Two trends are evident in city and urban management. First, urban areas worldwide are rapidly increasing in scope and city population is growing in a fast pace. Second, with rapid advance and utilization of smart information and communication technologies (ICT), smart city services are becoming a norm rather than exception in developing and managing city services for citizens (Layne & Lee, 2001; Lee, 2010; Lee, Baik, & Lee, 2011). On top of a variety of city services developed throughout the industrialization in the last centuries, new services are being conceptualized, developed, and implemented over the last decades across the globe in cities. Many cities are expanding their efforts to make their cities more competitive by becoming 'more digitalized,' 'more intelligent,' and 'smarter.'

In this context, the concept of smart city attracts strong attentions from academics as well as practitioners, these days. The focus of this newly coined term of smart city seems to be on the role of ICT played, but the definition is still not clear yet (Caragliu, Del Bo, & Nijkamp, 2011). Although smart city is a quite fuzzy concept, there are several descriptions of smart city. Hollands (2008) collected several examples of smart city definitions, and concludes that the smart city is a city that maximizes the "utilization of networked infrastructure to improve economic and political efficiency and enable social, cultural, and urban development." Caragliu et al. (2011) took this definition and enhanced into "a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance." For a city to be smart, it is required to develop and manage a variety of innovative services that provide information to all citizens about all aspects of city life via interactive and internet-based applications (Kuk & Janssen, 2011).

As cities are managed by city government, these smart city services are the very basis of the smarter government movements. Citizenship implies relations between citizens and their government and these relations can be conceived in several ways. For example, Michel (2005) defined four different modes of 'electronic' citizenship management in cities: e-administration, e-government, e-governance, and the learning city. In the e-administration mode, citizens should be considered as interactive consumers and users of personalized services needed for administration of the public, while e-government refers to the policy instrumentation aspect of city government. In the e-governance mode, citizens are active political agents participating in policy formulation and other political agenda in city governance. As an ideal and future

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mode of local government, they suggested a city government involved in double loop learning adopting the concept of learning organization, in which citizens are allowed to trigger complex cybernetic mechanism of learning and feedback.

When it comes to smart city services, it was found that, with the advent of ubiquitous computing technologies, local governments in the Republic of Korea had conceptualized and implemented a variety of smart city services (ETRI, 2010; Gil-Castineira et al., 2011; Lee et al., 2011). In 2009, a national survey was conducted to inventory the smart city services, and came up with 228 smart city services, nationwide. Some are still being used while some are becoming obsolete as they are not used anymore. The 228 smart city services identified in this survey are now listed as an appendix to 'The Business Management Guidelines for the Construction of Ubiquitous Cities' published by the Korean Ministry of Land, Transport and Maritime Affairs. In the guidelines, 228 smart city services are classified and presented in eleven categories of administration; transportation; public health, medical care & welfare; environment; crime & disaster prevention; facilities management; education; culture, tourism, & sports; distribution; work & employment. This typology of eleven administrative categories is stipulated in the 'Ubiquitous City Construction Act' and is accepted as a standard typology for smart city service classification (Jeong, Moon, & Heo, 2009; Shin, Lee, Lee, & Kim, 2009).

Interestingly, a number of frameworks have been proposed as typologies of the smart city services, but none seems to have yet become prevalent in academics or in practice (Batty et al., 2012; Caragliu et al., 2011; Kuk & Janssen, 2011; Michel, 2005). This is because the proposed typologies primarily employ and maintain the provider's perspective rather than the user's. In smart city services, providers are predominantly the city administrators who can easily become bureaucratic.

In this regard, efforts are concerted, in this study, to develop and validate a usable and acceptable typology of smart city services from the users' and/or citizens' perspective via a systematic literature review and qualitative exercises. Four dimensions are identified as important in the typology of smart city services: mode of technology, service purpose, service authority and delivery mode. As ICT, by definition, is geared towards increasing the ease of use as well as efficiency of services, this citizen-centric typology would be helpful in developing as well as managing a variety of smart city services. Gaps among services can be identified through this typological lens, or new converged services can be developed by combining different characteristics of services in different categories, leading urban planners to think out of the box.

2. Literature review

2.1. Smart city services

The concept of smart city has many historical predecessors or synonyms, such as intelligent city, information city, knowledge city, digital city and ubiquitous city. Despite differences in wording and definitions, all of these terms imply the utilization of ICT in urban management and serving citizens. Differences in these terms originated from different perspectives taken and different foci changed over time reflecting advances of related technologies. For example, while the term ubiquitous city – fashioned about a decade ago – implies ubiquity of sensors and data, the most recently coined term of smart city reflects the recent and rapid infiltration of smart devices and intelligence pushed down to the edge layers of networks.

There are some similar terms to smart city in Korea; u-city and u-eco city. A u-city (ubiquitous city) can be defined as a city in which a variety of city services are provided through ubiquitous information and communication technologies, such as built-in sensor networks that collect and disseminate information and instructions (Lee et al., 2011). A u-eco city (ubiquitous ecological city) combines core u-city technologies such as integrated city management/operations and citizen services with green technologies to increase convenience, safety, and quality of life while reducing carbon emissions—in short, a place where people, technology, and the environment coexist in harmony. IBM defines smart cities as (1) interconnected, (2) instrumented, and (3) intelligent (Greisinger, 2009) while some academic literature defines the smart city as a city well performing in a forward-looking way in six characteristics as follows: smart economy, smart people, smart governance, smart mobility, smart environment and smart living (Giffinger et al., 2007). In this sense, the smart city is a broader concept that may include other factors such as human capital and education as drivers of change, than the use of ICT itself.

In sum, the smart city is a city in which the city dwellers may access smart services regardless of time or place. City managers may enhance the city's competitiveness and citizens' quality of life via providing these smart city services. A smart city provides its citizens with services via its infrastructure based on ICT technologies. City governments are increasingly exploiting smart technologies, changing the ways to interact with citizens and providing novel and interactive services. In this regard, a smart city requires innovative services that provide information, knowledge and transaction capabilities to citizens about all aspects of their life in the city. In this regard, any services that used to be employed in a city can become smart city services. To avoid confusion, this paper uses 'smart city services' as referring to innovative services using ICT in city planning and management. From time to time, 'u-service' is used.

2.2. Various typologies of smart city services

A city is a complex entity that plays multiple roles in serving various aspects of citizens' lives. Various services are developed for cities since the industrialization of our society, as people gather around cities. City administrators are only now getting grips on issues concerning problems that cities are facing worldwide as the number grows exponentially with increasing population. Developing and managing city services requires political and managerial skills as well as the imaginations and willingness to adapt to the changes. Fairly little attention has been devoted to the typology of city services.

In most cases, city services are classified following administrative functions, such as transportation, facility management and medical care. This typology is developed as a functional decomposition structure for administrative conveniences by grouping functionally related services together. For example, traffic monitoring and toll collection handled by transportation department of city administration are classified as transportation services though one is related to financials while the other to pattern recognition.

As can be seen in Table 1, typical classifications of city services follow typical governmental functional structure. However, when it comes to smart city services in which ICT is actively utilized to enhance the service performance, different typologies are beginning to surface mostly in academic and consulting literature. Giffinger et al. (2007) suggested six categories for smart city services; people, governance, mobility, environment and living, while Kuk and Janssen (2011) adopted and applied e-business model framework of eight categories of service providers. Walravens and Ballon (2011) proposed four different types of service platforms.

Traditional typologies identified above maintain their bureaucratic perspectives following the administrative classification of functions. Though these functional classifications might be historically developed with citizens in mind, current classifications are the opportunistic outcome of administrative history. New typologies reviewed seem to be a little different from traditional ones deviating from functional specifications of government. However, these new typologies still maintain providers' perspective. In this regard, these typologies may not provide interesting and insightful classification of smart city services reflecting service characteristics or users' views (ETRI, 2010; Lee, Kim, & Lee, 2012; Shin et al., 2009).