

Development of a Smart City and its Adoption and Acceptance: the Case of New Songdo (*)

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Abstract: South Korea's new Songdo city provides a spectacular example of a smart city, which is developed as an aerotropolis, and a ubiquitous city (U-City). An intriguing aspect of the development of the new Songdo city is that supportive formal and informal institutions are the primary reason why the U.S.-developed smart city technologies have been first implemented in Korea rather than anywhere else. Nonetheless, these institutions also pose challenges that are yet to overcome. This article aims to provide new insights into how formal and informal institutions have shaped the development of the new Songdo city and its adoption and acceptance by the targeted end users.

Key words: smart city, new Songdo city, South Korea, formal and informal institutions, ubiquitous city, aerotropolis.

The development of smart and sustainable cities has been a global trend in an early phase. For instance, South Korea announced its plan to build about 15 ubiquitous cities (U-Cities) (JE-HAE, 2009) that apply "ubiquitous computing" to integrate information systems and social systems. However, South Korea is not the only country in which this has become a trend. Singapore, Hong Kong, Dubai, and a number of European countries have been putting efforts and initiatives to introduce digital city cities or wireless city cities which utilize the state of the art technology in the development of urban systems. Likewise, Japan has put in place a strategy to build a u-Japan since 2004 (MYUNG-JE, 2009).

(*) Acknowledgement: The authors would like to acknowledge the research support from Ritsumeikan Asia Pacific University. An anonymous reviewer's helpful remarks helped to improve the paper drastically.

While most smart city initiatives involve "smartization" of existing cities, so far, the New Songdo or Songdo International Business District is the only smart city in the world, which has been built from scratch. It is thus described as the world's first greenfield smart city. New Songdo city is built in 1,500 acres of land reclaimed from the Yellow Sea in Incheon and is described as the largest private real estate venture in history, costing US\$ 35 billion (WOYKE, 2009). An Economist article described New Songdo as "the most ambitious smart-city project so far" (economist.com, 2010). However, an intriguing aspect of the development of the new Songdo city is that most of the core technologies were developed in the U.S. rather than in Korea. Supportive formal and informal institutions are the primary reason why the U.S.-developed smart city technologies were first implemented in Korea rather than anywhere else. Anthony Townsend, a research director from Palo Alto, noted:

"Much of this [smart city] technology was developed in U.S. research labs, but there are fewer social and regulatory obstacles to implementing them in Korea" (Regine, 2005).

Korea thus has an institutional advantage compared to other countries in this domain. The Persuasive Technology Lab's B. J. Fogg argued:

"This [social and regulatory friendliness] is a competitive advantage for the Koreans" (REGINE, 2005).

In light of the above observations, in this paper, we argue that various components of formal and informal institutions have played critical roles, both as facilitators and inhibitors, in the development of the new Songdo city and its adoption and acceptance by the targeted end users. There are also various institutional obstacles and barriers that have to be overcome to take advantage of the opportunities that smart city-related initiatives may bring. For instance, whereas the city was initially expected to be completed by 2014, as of May 2014, the developer has postponed the completion date of the project until 2020. An executive of Gale International noted that the introduction of eco-friendly buses needed to be postponed due to the tight financial climate following the 2008 global financial crisis (GFC) (OLIVER, 2009).

The objective of this article is to provide new insights into how formal and informal institutions shape the development of a smart city and its adoption and acceptance by the targeted end users. The paper is structured as follows. We proceed by first examining the development of the new Songdo city. Next, we discuss institutional influence on the development of a smart

city and its adoption and acceptance by the targeted end users. It is followed by a section on discussion and implications. The final section provides concluding comments.

■ The development of the new Songdo city

Table 1 provides a timeline of the events related to the development of the new Songdo city, which is a US\$35 billion, 100 million square-foot project (VISER, 2014). It is built as an aerotropolis, around the Incheon international airport. The idea here is that a city built around an airport would allow for a quicker movement of goods and people (DINARDO, 2013). The new Songdo city is developed as a U-City, where all devices, components, and services in the city are linked to an information network, mainly through wireless networks (CHOHAN, 2014). A key objective of a U-city is to provide an integrated environment, in which citizens have access to all types of services, everywhere and any time through ICT devices (MURGANTE & BORRUSO, 2013).

Mike An, chief project manager of the Incheon Free Economic Zone Authority, the government agency overseeing the project noted:

"New Songdo will be the first to fully adopt the U-city concept, not only in Korea but in the world" (O'CONNELL, 2005).

New Songdo is expected to be one of the first cities in which residential, medical and business information systems are integrated (*The Age*, 2007). Fixed-line fiber optics and high-speed wireless will be provided to every home. Each resident in the city will have a smartcard, which will serve as her/his personal key to everything. The Vice President for Strategy at new Songdo city Development noted that the key "can be used to get on the subway, pay a parking meter, see a movie, borrow a free public bicycle, and so on. It will be anonymous, won't be linked to your identity, and if lost you can quickly cancel the card and reset your door lock" (O'CONNELL, 2005). The 'U-protection' service aims to use 'mobile health-sensor' technologies to manage health conditions of senior citizens, especially those living alone. To take an example, location-based technologies will identify elderly citizens with Alzheimer's in case they are lost or face problems (KEETON, 2013). Songdo has also formed partnerships with local retailers such as Lotte and Megabox cinemas and foreign retailers such as Tesco in order to develop retail facilities.

Table 1 - Development of the new Songdo city: a timeline

2001	After opening the airport in Incheon, the South Korean government approached Gale International about developing a city (aerotropolis) that would attract multinationals due to its proximity to the airport. The goal was to turn the region into the world's gateway to northeast Asia.
November 2007	Received a syndicated loan of US\$ 2.7 billion, which was led by Korea's Shinhan Bank.
2008	The construction of the Songdo Convensia Center was completed.
August 2009	The first phase of the project opened. There were about 8,000 residents and some businesses operating from Songdo.
August 2009	The 100-acre Central Park was completed.
2009	Cisco Systems joined the Songdo project. It is making an investment of US\$ 47 million to wire Songdo (STRICKLAND, 2011).
2009	After the Incheon Fair & Festival, the IFEZ Authority signed MOUs with several foreign firms such as Boeing, Samsung, TESCO and McCaffery for development projects (JE-HAE, 2009).
2010	The Songdo Convensia Center qualified for Leadership in Energy and Environmental Design (LEED). It is the first LEED-certified convention facility in Asia.
2011	The personal information protection bill revised previous laws enacted in 1999, 2001, and 2008 (KEETON, 2013).
October 2012	Songdo was selected as the headquarters of the secretariat of the UN Green Climate Fund.
October 2012	Total investment crossed US\$ 24 billion of which slightly over US\$ 1 billion was foreign investment (airrang.co.kr, 2012)
November 2012	Songdo's population was 60,377 with 927 foreign residents (KIM, 2012)
December 2013	The World Bank Group opened its office in Songdo.
December 2013	Songdo is estimated to be about half finished (citiscopes.org, 2013).
May 2014	The project was over 50% done. New completion date is expected 2020 (VISER, 2014).

The construction started in 2004. The U.S. developer Gale International has a 70% stake and Korea's Posco Engineering & Construction holds the remaining 30% (OLIVER, 2009). It is located about 64 km west of Seoul and 11 km from Incheon International airport. The city is given the status of free economic zone. This means that foreigners can legally own land and run schools and hospitals in Songdo, and companies are not required to pay taxes (CORTESE, 2007). During the construction phase, 6,000-10,000 people have been employed on the sites (OLIVER, 2009). As of 2009, the project attracted US\$ 9 billion in foreign investment (independent.co.uk, 2009).

As noted above, the city was initially expected to be completed by 2014. After the completion, it was expected to have 80,000 apartments, 50 million

square feet of office space for about 300,000 workers and 10 million square feet of retail space (independent.co.uk, 2009). The city's master plan also includes 600 acres of open space. The city imports important architectural features from around the world such as New York's Central Park and Venice's canals. Central Park is located at the middle of the city. Despite the support from the public sector, the project is less successful than had been hoped. For instance, as of September 2013, the city was less than half full and less than 20% of the commercial offices were occupied. The streets, cafes and shopping centers have been largely empty (WILLIAMSON, 2013).

■ Institutional influence on the development of a smart city and its adoption and acceptance by the end users

At the broadest level, the concept of social "co-evolving" system (MITLETON-KELLY, 2003, p. 29) can be used to analyze how formal and informal institutions are likely to affect the development of a smart city and its acceptance by end users. An organization influences and is influenced by the social ecosystem. Institutions can be considered as a conceptual subset of the social ecosystem. An economic system, on the other hand, is a – coordinated set of formal and informal institutions influencing economic agents' behavior (DALLAGO, 2002; MATUTINOVIAE, 2005). The idea here is that all economic phenomena have institutional components and implications (PARTO, 2005).

Institutional theory deals with the issue of seeking legitimacy, approval and support from various actors in the environment (DICKSON, BESHES & GUPTA, 2004; CAMPBELL, 2004). Institutional influence in the development of a smart city becomes an admittedly complex process when the developers and users are required to derive legitimacy from multiple sources. Institutions are the "rules of the game" (NORTH, 1990, p. 27) and include "formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self-imposed codes of conduct), and their enforcement characteristics" (NORTH, 1996, p. 344). We use SCOTT's (1995, 2001) three institutional pillars – regulative, normative and cognitive – to examine the development of the new Songdo city. These pillars relate to "legally sanctioned", "morally governed" and "recognizable, taken-for-granted" behaviors respectively (SCOTT, RUEF, MENDEL, & CARONNA, 2000, p. 238). Whereas regulative institutions are also known as formal institutions, normative and cognitive institutions are informal institutions.

Table 2 - Institutional influence on the development of a smart city and its adoption and acceptance by the targeted end users

<i>Institutions</i>	<i>Development of infrastructure and physical facilities</i>	<i>Development of technologies, services and applications</i>	<i>End users' adoption process</i>
Regulative	<p>Gale complained about the alleged red tape of the Korean government bureaucracy. Gale reported that it finished work on the international school to open it to fee-paying students. In July 2009, South Korea's Ministry of Education rejected the school's application arguing that it did not meet nine of the 10 criteria for running a school. One of them is that a Korean rule required 70% of students to be foreign. The rule was subsequently relaxed. Parents who moved to Songdo were required to make alternative arrangements for their children's school for 2009 (McNEILL, 2009).</p> <p>While the government provided incentives for foreign companies, there was a lack of such incentive for domestic companies. Songdo was unable to attract companies providing legal, accounting and other services, which are needed for foreign companies (NAM, 2013).</p>	<p>The personal information protection bill of 2011 revised previous laws enacted in 1999, 2001, and 2008 (KEETON, 2013).</p>	<p>The government allowed the developer to temporarily build more residential units than office space. The demand for offices had been stagnant. Due to a price-capping scheme intended to stop the "overheating" of the housing market, in 2009, some of the flats were required to be sold at 2005 rates (OLIVER, 2009).</p> <p>Strict recycling regulations enforcement mechanisms.</p> <p>South Korea is planning to use 2% of GDP in its green initiatives (MUELLER, 2013).</p>
Normative	<p><i>The norms of the Korean banking industry are against</i> financing a shopping center (OLIVER, 2009).</p>	<p>Korean cultural norms: present fewer barriers to the implementation of ubiquitous technology.</p> <p>Industry associations resist the change in the development of products and delivery of services.</p>	<p>High technologies such as Smartphones or an apartment in a smart city is also a status symbol (LANE, 2012).</p>
Cognitive	<p>The cultural system is increasingly supportive of and expects industrialization and economic growth (KU, 2004).</p>	<p>Technology is tightly linked to Korea's culture, history, education, and music (LANE, 2012).</p> <p>Broadband culture: Domestic Internet contents: moving pictures /graphics: high preference for: "pali, pali" (quickly, quickly).</p>	<p>A well-travelled population with a high level of education: affinity for the Western brands (OLIVER, 2009).</p> <p>The old South Korean slogan: "Hongik-Ingan" ("Devotion to the welfare of all mankind") leads to minimization of litter by citizens (MUELLER, 2013).</p> <p>While the use of RFID to automate tracking and monitoring the movements of people is a concern in the West, privacy concerns are less prominent in Asia (ROZEK, 2007).</p>

Specifically, we analyze how these three pillars are related to: a) development of infrastructure and physical facilities, b) development of

technologies, services and applications, and c) end users' adoption process of smart cities. Table 2 presents some important aspects of each of the institutional pillars from the standpoint of the development of a smart city and its adoption and acceptance by the targeted end users. We elaborate some of the key effects in this section.

Regulative institutions' effects on the development of a smart city and its adoption and acceptance by the end users

Regulative institutions consist of "explicit regulative processes: rule setting, monitoring, and sanctioning activities" (SCOTT, 1995, 35). They are related to regulatory bodies and the existing laws and rules that influence development of a smart city and its adoption and acceptance by end users. These institutions focus on pragmatic legitimacy concerns in managing the demands of regulators and governments (KELMAN, 1987). Individuals and organizations adhere to them so that they would not suffer the penalty for noncompliance (HOFFMAN, 1999).

Indeed, the central and local governments play a crucial role in the development of Songdo. Incheon city and the South Korean Government committed US\$ 10 billion in the development of required infrastructure, including highways and a subway link (HISCOCK, 2009).

As of 2011, the government had invested US\$ 10 billion in Songdo, and has a plan to spend an additional US\$ 4.3 billion by 2020 (YAP, 2011). As reported by KOO *et al.* (2009), the "Act of ubiquitous city construction and etc." was enacted in 2008 in order to put forward the development of U-cities. This Act sets the process for initiating and mobilizing resources for U-city projects. In addition, the government has taken some measures to address the pressing concern of data privacy, which has been a top concern due to the digitization and increasing information access. For instance, the personal information protection bill of 2011 revised previous laws enacted in 1999, 2001, and 2008 (KEETON, 2013).

From the developer's perspective, looking from an entrepreneurial angle, government policies and actions affect the costs, risks and barriers to competition faced by entrepreneurial firms and hence the range of opportunities that are potentially profitable (AHMAD & HOFFMANN, 2008). In this regard, on the plus side, Songdo has the financial backing of the Korean government. The central government underwrote a 12.3 km bridge to connect Songdo to Incheon airport and a high-speed rail link to Seoul (economist.com, 2010). It is, however, worth noting that Gale had

disagreements with the Korean government on a number of critical issues including design of the city, the combination of residential and commercial space and the amount of incentives the government would provide. An ex-chief executive of Gale noted that he stepped down from the company in 2010 due to the environment of "turbulence" between Gale and the Korean government (NAM, 2013). Likewise, in 2009, investors were concerned that the government's revised policy regulating condominium sales would have a severe negative impact on buyer interest in the top 30 floors of the Northeast Asia Trade Tower (NEATT), which was supposed to become South Korea's tallest building. Consequently construction of the NEATT was temporarily stopped after key investors, which included Morgan Stanley, Kookmin and Woori banks, withdrew from the project. A spokesman of Gale International put the issue this way: "Applying a new law to a building that broke ground three years ago is frustrating " (HAN, 2009).

Moreover, the use of ICT in delivering health services is rather restricted in South Korea. The existing national Medical Law does not allow telemedicine, . medical Medical advices and diagnoses should be provided to patients on face-to-face basis (CHO, 2013). This limits the adoption and diffusion of ubiquitous health (U-health) programs, which is based on telemedicine that provides medical services to patients at a distance through the use of ICT.

Normative institutions' effects on the development of a smart city and its adoption and acceptance by the end users

While regulative rules are parts of regulative institutions, social rules are components of normative institutions. Normative components introduce "a prescriptive, evaluative, and obligatory dimension into social life" (SCOTT, 1995, 37). Practices that are consistent with and take into account different assumptions and value systems of national cultures are likely to be successful (SCHNEIDER, 1999). An aspect of informal institutions that deserves mention relates to Korean societal norms. KEETON (2013) argued that societal norms in Korea present fewer barriers to the implementation of ubiquitous technology, because Koreans are more likely to associate U-cities with growth, innovation, and competitiveness.

Elements of normative institutions also include trade associations or professional associations (e.g., the Korean Medical Association) that can use social obligation as a tool to induce certain behavior within the smart city industry. The basis of compliance in this case derives from social and professional obligations and non-compliance can result in societal and

professional sanctions (GREWAL & DHARWADKAR, 2002). To put things in context, at the industry level, the development of ubiquitous products for and services in New Songdo is facing normative pressures. As reported by HODGKINSON (2011), U-city initiatives may clash with existing ICT leadership, clusters, and literacy. To take an example, the Korean Medical Association announced its objection to telemedicine, which is considered to undermine the fundamentals of medical services and sustainability of local clinics, favoring large hospitals that can afford the cost of telemedicine (CHO, 2013).

Cognitive institutions' effects on the development of a smart city and its adoption and acceptance by the end users

SCOTT (1995, 40) suggests that "cognitive elements constitute the nature of reality and the frames through which meaning is made". Although carried by individuals, cognitive programs are elements of the social environment (BERGER & LUCKMANN, 1967). Although all components of institutions are intertwined with culture, cognitive institutions are arguably most closely associated with culture (JEPPERSON, 1991; NEALE, 1994). These components represent culturally supported habits that influence the development and growth of smart cities. In most cases, they are associated with cognitive legitimacy concerns that are based on subconsciously accepted rules and customs as well as some taken-for-granted cultural account related to smart cities. To take an example, it was reported that Koreans typically prefer large, multilane thoroughfares as well as big buildings on small land units. Such preferences are against the idea of a vibrant street life. Due to this cultural preference, the Songdo team and Korean officials were required to engage in significant debate before completing the plans (CORTESE, 2007).

There are also different dimensions of culture that play an important role in the development of a U-city such as the New Songdo. For instance, a main reason why the u-city initiatives are effective in South Korea is the wide adoption of ICT among residents. According to OECD, South Korea ranks 6th for the total number of fixed broadband subscriptions, 18.01 million, and 3rd for that of wireless broadband subscriptions, 51.89 million, in 2012. When measured per 100 inhabitants, South Korea had more wireless broadband subscriptions than inhabitants (104.2). One successful case of using ICT in delivering service and information is the online site School Information Disclosure System in Elementary & Secondary Schools. About 20,000 users visit this site per day (SEVERIN & CAPOTA, 2011).

Finally, some argue that the residents of Songdo may find that digital lifestyle in a U-city may have significant privacy costs. The new Songdo city makes an extensive use of RFID technology. For instance, using RFID, public recycling bins credit every time an individual recycles a bottle (REGINE, 2005). Nonetheless, while the use of RFID to automate tracking and monitoring people is becoming a serious concern in the West, privacy concerns are less prominent in Asia (ROZEK, 2007). Anthony Townsend, a research director of Palo Alto, put the issue this way:

"There is an historical expectation of less privacy. Korea is willing to put off the hard questions to take the early lead and set standards" (REGINE, 2005).

■ Discussion and implications

The experience of the development of the new Songdo city indicates that many unexpected outcomes are likely to emerge in mega-projects such as those associated with a smart city. Specifically, various institutional factors facilitate as well as hinder the initiatives to develop a smart city. In the case of the New Songdo city, whereas the financial backing by the central government for the bridge to connect Songdo with Incheon airport and a high-speed rail link to Seoul facilitated entrepreneurial activities of local and foreign players, the disagreements of the developers with the Korean government on key issues such as design, the combination of residential and commercial space and the amount of incentives hindered entrepreneurial initiatives. Informal institutions (normative and cognitive components) in Korea have largely positive effects on initiatives to build smart and sustainable cities. These include Korea's highly technology-oriented culture, Korean cultural norms' compatibility with the implementation of ubiquitous technology, adoption of high technologies and owning an apartment in a smart city as a status symbol, cultural preference for "pali, pali" and the Korean culture which centers around "Hongik-Ingan". Nonetheless, it is also crucial to acknowledge and manage the resistance of informal institutions, which are likely to occur in the development of smart cities.

In order to gain further insights and understandings into the institutional aspect of the development of the New Songdo city, we need to look at South Korea's broader institutional contexts. In this regard, prior research indicates that despite South Korea's success in poverty reduction, its developmental

model is less pro-poor and pro-SMEs compared to some other members of the Organisation for Economic Co-operation and Development (OECD) (KSHETRI, 2014). In particular, South Korea has arguably neglected the broader welfare and social support needs of older persons (KSHETRI, 2014). Mega-projects such as the New Songdo city, targetting wealthy businesspeople, who value convenience, thus enjoy broad legitimacy in the country. For instance, an average apartment in the city costs US\$ 500,000 and some cost as much as US\$ 1.5 million. The average annual fees at the International School is over US\$ 25,000. Likewise, shopping at the Taubaum Shopping Center is beyond the reach of most Koreans (independent.co.uk 2009). Looking from an entrepreneurial angle, the value creation activities are primarily undertaken to enhance the quality of life and convenience of wealthy business people. Initiatives such as the New Songdo thus have a little impact on the welfare of a large majority of the population.

While the economic and social benefits of the new Songdo city are yet to realize, Gale International and the Korean government have to work together to overcome the inherent uncertainties and risks of the venture. As noted earlier, the new Songdo city is the world's first large-scale new city planned as an international business district and the first ever U.S.-South Korean real estate joint venture. Due to its newness, there is a lack of a template to guide policy development and implementation in the field of smart city. Thus, the smart city industry suffers from underdeveloped regulatory and legal systems. For instance, critics have argued that the government has failed to properly define what it meant by a free economic zone. Investors are also concerned about the lack of clarity regarding tax incentives (OLIVER, 2009). Whether tax incentives should be extended to local enterprises to proliferate businesses in the city still remains a debate. Moreover, the current development of more residential spaces than commercial spaces seems to depart from the original plan of building the city as a business district.

In addition to regulatory and legal issues, the disagreements over issues such as planning and design could be a result of significant cultural differences. Previous studies have reported cultural differences between the U.S. and South Korea in negotiations and other issues (MORDEN & BOWLES, 1998). One key difference is that South Koreans, just like most Asians, tend to focus more on building trust and personal relationships than their U.S. counterparts. The slow pace of business proliferation in the city could also be attributed to the heavy stigma of business failure in South Korea (KSHETRI, 2014). The newness of the city, its system and technology increases the perceived risk of failure by business developers in South Korea.

In sum, the institutional differences between the U.S. and South Korea are potential reasons of the uneasy and turbulent relationship of Gale International with the Korean government. While some of the disagreements between the Korean government and Gale have been resolved, there is still a growing rift in the development of policy and strategy related to the development of the new Songdo city. A key lesson from the development of the new Songdo city is that the policy makers need to be willing to make legal-institutional adjustments and become more clearer about incentives, and operational requirements in order to deal with various uncertainties.

As noted earlier, the main reason why the U.S.-developed smart city technologies were first implemented in South Korea concerned the expected formal and informal legitimacy in the country. The ongoing disagreement between Gale International and the South Korean government over key details suggests that South Korea's regulatory responses to smart city development have not been what Gale International had anticipated. That is, Gale's approach in the development of the new Songdo city enjoyed a lower degree of formal legitimacy in South Korea than it had anticipated. Various components of normative and cognitive institutions discussed above, on the other hand, are more persistent, durable and stable, which have contributed to the success of the new Songdo city project. An analysis of South Korean consumers' cultural norms and mental maps with respect to other technologies could help Gale predict their response to smart cities. Such a prediction has been less accurate for the regulative institutions.

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