The Global Smart City Revolution

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ABSTRACT

The smart city concept—the integration of digital and information and communications technologies (ICT) in urban areas—is swiftly becoming a reality in municipalities throughout the world. Accordingly, the global trend towards smart cities has precipitated intense competition among major corporations and firms looking to serve this rapidly expanding market space—particularly the development and supply of the sensors, platforms and other critical technologies necessary to realize the vision of smart urban spaces. While smart cities promise theoretical benefits in terms of efficiency, sustainability and responsiveness they also elicit numerous concerns that will require government action—cyber security, invasion of privacy, technology standardization and regulation, etc. Effectively responding to these challenges and fostering innovation will thus, be crucial as nations race to modernize and digitalize their cities of the future.

SUMMARY

The smart city revolution is progressing worldwide, and people, societies, and governments have no choice but to adjust and adapt to its developments and consequences.

- In some sense, the emergence of the smart city concept could be considered the fourth industrial revolution, or have widespread ramifications equivalent to that of another industrial revolution.
- In brief, the smart city concept can also be considered the digitization of everything.
  - Cities and urban areas are naturally a testbed for these technologies given the inherent economic advantages of high population densities, existing infrastructure, etc.
- Large, multinational corporations and conglomerates are spearheading smart cities development worldwide, with smart electric grids being a major aspect of this overall revolution.
- So far, technical progress on smart cities has outpaced necessary developments in policy, regulation, social and ethical issues, etc.
  - Although technology development and deployment are ongoing, policy discussions and debates about social equity and ethics have lagged behind.
  - Automation and digitization must proceed in manner that is user-friendly and user-centric.
  - While smart cities seek to make an urban environment more efficient, whether efficiency gains are in energy use or traffic, it may be necessary to maintain some of the inefficiencies of life that humans enjoy--these and similar issues must be considered before progress on smart cities continues apace.

Smart city developments in the U.S. have tended to focus on the role of utilities in smart grids and power systems, rather than a broader vision of an integrated, digitized city system.

- A fully digitized and integrated urban environment will likely contain numerous features and characteristics, some of which may be difficult to envision at present.
- Although there are many uncertainties, transportation in future smart cities will witness revolutionary changes.
  - The shared economy (i.e. Uber, etc.) system that has emerged within the last few years represent the first signs of smart city development.
  - How smart city transportation will evolve is yet uncertain, although there are a number of possible trajectories.
- Smart direction of traffic will eliminate or at least mitigate slowdowns and delays, and will allow emergency responders (police cars, fire trucks, ambulances, etc.) to move to their destinations unimpeded.
  - Shared economy concepts will likely have symbiotic relationships with digitized urban infrastructures.
    - Digitization will allow for more effective use of automated vehicles, efficient use of available parking, more optimized navigation, etc.
  - Many large companies have already made significant investments into digitized systems.
    - These investments are not limited to vehicle road traffic alone, but also in areas related to the use of drones for monitoring, delivery, etc.

The potential market for greater digitization of cities is massive, although challenges remain with respect to needed infrastructure, enabling technologies, policies and regulations, and social/ethical issues.
- There are over 20,000 cities that are interested in pursuing some degree of digitization of urban management systems, and using smart technologies to enrich the life of their publics and citizens.
  - Washington, DC is seeking to achieve 100% renewable energy production and consumption; if these objectives are met, then the city could potentially be a model for smart city development.
- There are many variables in smart city development, and uncertainties are numerous-- challenges in the development of smart cities include innovation in prerequisite technologies.
  - According to some, universal WiFi will likely be necessary for progress in smart city development.
  - Advances in 5G technology may allow for more affordable smart city concepts, which were previously impossible with only 4G technology.
  - Given the central role that electricity will play in powering the sensors, devices, and infrastructure upon which a smart city is built, guaranteeing the security and integrity of the grid and power system will become increasingly vital.
  - Cybersecurity will also become increasingly important, as more of urban life is digitized and connected.

- There are also numerous policy and societal issues that will need to be addressed before or concurrent with developments in smart cities.
    - The existence of ubiquitous sensors and monitors in a smart city will elicit privacy concerns that will need to be addressed through technical, regulatory, and policy/ legal measures.
    - In general, there will be human resistance to significant changes; ultimately, education and adaptation will be key to overcoming barriers to the adoption of smart technologies.

Smart city development in Korea has accelerated under the current administration, which prioritizes increasing the proportion of clean and renewable energy that is generated and consumed.
- Smart city development has become more important under the broader government policies of Energy Transition and Energy Conversion.
    - Recent government energy policies prioritize the decentralization of energy production and distribution, higher rates of urbanization, and greater penetrations of clean and renewable energy sources--all of these require highly digitized and interconnected infrastructure, aligning with developments in smart cities.
- The connection between renewables and smart cities is apparent--greater renewable energy use will require more sophisticated and digitized grid and transmission/distribution systems that can communicate and coordinate multi-directional flows of electricity.
- South Korea's present target goal is that renewables represent 20% of South Korea's total electricity mix by 2030.
    - Smart cities with integrated renewable systems is a major component of this effort.
- South Korea is among the most interconnected societies in the world; this existing culture and infrastructure is advantageous with regards to the smart city revolution.

The U-City initiative in Korea was a precursor to the smart city which began in the 2000s, and now, smart city testbeds are emerging in Korea
- The "U" in U-City stands for ubiquitous--it means anytime, everywhere.
    - The goal of the U-City concept was to connect municipal governments to broader information on the city through digital sensors and monitors.
    - Within U-Cities, there have been significant build-outs of IT infrastructure to capture and digitize information on transportation, buildings, etc.
- In spite of the technological advancement that the concept represents, the U-City system was primarily a top-down method of information delivery.
    - As a result, much of the public and city residents were unaware that such a concept was in place.
    - In turn, civilians were less aware about how they could benefit and/or utilize such a system.
- Current smart cities in Korea, in contrast to the U-City model, employ open governance, and the public is fully integrated and considered in these arrangements.

- Hence, South Korea research advanced U-city model (Smart City) which is open governance.
  - There are two smart city testbed projects in South Korea: Sejong 5-1 and Busan EDC.
- Sejong 5-1 focuses on the development of a sustainable platform that aims to achieve a number of objectives: increasing civil happiness, creating new job opportunities, etc.
- Busan EDC focuses on becoming a test model of a global innovation city that can harmonize nature and technology--for instance, this smart district within the greater Busan metropolitan area contains flowing bodies of water, which can be utilized for renewable energy generation to power the project's smart monitors, sensors, devices, and infrastructure.
  - EU proceeds Urban Regeneration but UR is less technically involved and more likely reconstruction of old cities.

QUESTION & ANSWER

Q: *What is transportation innovation?*

A: Innovation in transportation can come about through various ways. Innovation is beyond just the vehicles themselves (whether automated, EV, hydrogen, or some combination of these), but also includes the infrastructure and network to fully realize the benefits and advantages of these various technological platforms. Creating a holistic system and network within a smart city to maximize these technologies should be considered an example of transportation innovation.

Q: *Are there any federal government smart city projects in the U.S.?*

A: There is no smart city program in the U.S. that is being financed by the federal government, but many private lenders, investors, and companies are presently interested in being involved or financing such projects. For example, utilities are looking at blockchain technology as one accounting mechanism for multi-directional energy flows and sales, and so they are investing heavily in this area.

A: There are significant legal issues with respect to funding smart city projects from the federal level, given that state laws differ significantly. Thus, federal mandates to create uniform regulations and policies on smart cities may create issues concerning constitutional law. Furthermore, there isn't sufficient public attention or demand for smart city projects for the federal government to get involved at this stage.

Q: *How sophisticated do humans/users need to be to adjust and adapt to smart city systems? There may be resistance or difficulty adjusting to new modes of life, particularly among older citizens.*

A: It is very important to present new technologies to the public. All things considered, technological advances in "smartness" and artificial intelligence will help people and benefit society. However, one uncertainty is in job creation effects--this 4th industrial revolution may actually reduce the number of jobs for people, especially as specific tasks become automated and digitized. This is a social issue that will need to wrestled with. Creating innovative new jobs will likely be necessary to get publics and societies on board with the smart city revolution.

Q: *How much do people need to be trained and educated in order to utilize the features of a smart city? Can it be possible for citizens to use these technologies when they don't understand them?*

A: People do not necessarily need to understand how and why certain technologies work in order to use them. For example, I have no idea how this smartphone works, and yet I use the technological platform to great effect. These technologies, while complicated, must be designed so that they are user-friendly and user-centric.

Q: *How would urban regeneration and retrofits differ from new build?*

A: Retrofitting smartness into existing building stock and infrastructure can be challenging. In Europe, where there are many historical buildings and cities, smart city development can thus be confronted with certain impediments. In Korea, where there are high rates of urban renewal (and considering that some of these smart cities/regions were built from scratch), this might be less of a barrier.