



SMART CITIES AROUND THE WORLD



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Smart Cities are much more than fast internet connection, big data, and interlinked applications. The key is to set the human – both as a user and a citizen – at the core of the smart solutions, and keep the local context firmly in mind in order to gain most from the technology.

In order to unleash the potential of Smart Cities in Denmark, it is obvious to learn from experiences from abroad in relation to what it means to be a smart and digital city, and where the synergies with Danish strongholds are to be found. The Innovation Centre Denmark is located in six of the biggest and most technology-oriented mega hubs in the world: Silicon Valley, Shanghai, Munich, Sao Paolo, New Delhi and Seoul. We have spent some time investigating how smart cities develop, which policies are implemented and who the major stakeholders are. This article outlines some trends and policies taking a point of departure in North American, South Korean and German projects and decisions.

Keywords: Smart City, Spatial Data, Innovation, ICT, Infrastructure, Energy Efficiency, Government, Policies, U-city

INTRODUCTION

Just like cities are not made up by the bricks but by its inhabitants, Smart Cities are much more than fast internet connection, big data, and interlinked applications. The key is to set the human – both as a user and citizen – at the core of the smart solutions, and keep the local context firmly in mind in order to gain most from the technology.

Smart Cities has been a buzzword for a number of years, and it is stated to contain endless opportunities for growth and welfare. Although full-scale Smart Cities and real market opportunities are only emerging slowly, it is an area that not only Denmark seeks to exploit and benefit from; it is also an area within which Denmark has better conditions for excelling than most other countries.

In order to unleash the Danish potential, develop, and capitalize from smart city technologies it is paramount that we understand how the rest of the world positions itself in relation to what it means to be a smart and digital city, and where the synergies with Danish strongholds are to be found.

The Innovation Centre Denmark is located in six of the biggest and most technology-oriented mega hubs in the world: Silicon Valley, Shanghai, Munich, Sao Paolo, New Delhi and Seoul. We have spent some time investigating how smart cities develop, which policies are implemented and who the major stakeholders are. This article will outline some trends and policies taking a point of departure in American, South Korean and German projects and decisions.

CASE 1: USA

In many ways the US is the absolute leader within the field of smart cities technologies. One of the most prominent trends is using Internet of Things (IoT) as the next level in smart cities development. According to IoT¹ Analytics seven of the top-10 Internet of Things (IoT) cities in the world are located in the US, with San Francisco as no. 1

hosting 325 headquarters of IoT companies, smaller start-ups as well as enormous tech companies such as Cisco, Google, Apple and Intel. Forecasts predict that no less than 75 billion IoT units will be connected in 2020, pushing the development of city² integration. The decreasing price of sensors as well as improved wireless and cloud-based solutions has let the technologies diffuse into people's everyday lives.

In terms of innovation capability and technological research, the U.S. is clearly the nation spearheading global R&D and innovation. The development is driven primarily by the private sector, which underlines the key characteristic behind the American leading position: Innovation has been achieved on the background of beneficial legislation enabling conducive public-private partnerships and a thriving entrepreneurial community. Nowhere is this more evident than in Silicon Valley.

At the same time, however, the greater San Francisco area is also the best example of the paradox that the US presents us with. New technologies, smart solutions, and innovative business models are abundant, but Smart City infrastructures are conspicuously few. In terms of the ICT infrastructure, only 7,7 % of the population in the US has optical fiber internet (the fastest and highest quality available), and San Francisco ranks a low number 208 out of 408 cities in terms of city³ connectivity.

The potential has been recognized by the Obama administration in the latest Smart Cities Initiative, released in September 2015, wherein “the opportunity to be a global leader” is acknowledged. In terms of federal spending, \$ 45 million is allocated to new grants and proposed investments to build a research infrastructure for Smart Cities by the National Science Foundation and National Institute of Standards and Technology, as well as an additional total of \$ 115 million to find new solutions to public policy challenges. Also,

¹ <http://iot-analytics.com/top-15-internet-of-things-cities/>

² <http://www.slideshare.net/GridPoint>

³ <http://onesanfrancisco.org/wp-content/uploads/Agenda-Item-4-DT-Connectivity-Presentation-Revised.pdf>

Top 15 Internet of Things cities

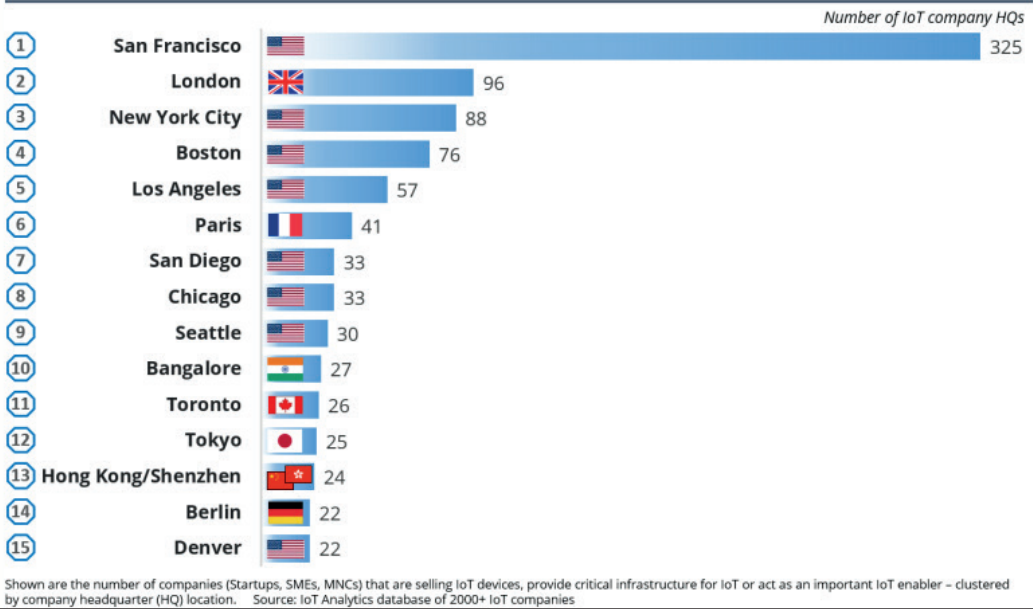


Figure 1. The World's Leading IoT hubs

initiatives and policies including investment grants dedicated to Smart Grid projects totaling \$ 3.4 billion have been launched by the current administration. The grants follow an industry matching model, meaning that every private investment made will be matched by federal grants. This is an unparalleled investment scheme and one that underlines the fact that the current government wishes to maintain and develop the American leading position within smart cities. As the U.S.-model represents the most market driven approach to smart cities, it will be of huge interest to see what solutions and business models will be developed in the coming years, both in large corporations as well as in small and medium sized companies. This will have a global impact on the perception and development of smart cities.

CASE 2: SOUTH KOREA

Since 2003, South Korea has retained its top spot in the United Nations E-Government Development Index, which among other things is due to its

impeccable ICT infrastructure. Ultra-fast LTE network (4G) is accessible in most of South Korea, making it the most connected country in the world. There is a 100 % LTE penetration rate in Seoul with 831 free wi-fi zones provided by the local government, and one of the major banks in South Korea has funded mobile phone chargers at these Wi-Fi spots, so everyone can access the internet and get their phones charged at designated spots in the city. In January 2014, the South Korean government announced that it will upgrade the country's wireless network to 5G by 2020 making downloads about 1,000 times faster than with the current LTE (4G) network. Moreover, in September 2014, the European Union and South Korea agreed to cooperate on developing ultra-fast fifth-generation wireless communications networks, i.e. 5G. The agreement covers government, research and educational institutes and private companies, and aims to forge a consensus on key functionalities for the new standard by the end of 2015. The big telecommunications compa-

| | U-City | Smart City |
|----------------|---|--|
| Purpose | Solutions to urban problems, improvement of quality of life, job creation, use of data, system efficiency | Solutions to urban problems, improvement of quality of life, job creation, low-cost and high efficient space |
| Concept | Physical capital ICT centric Digital city | Physical + social capital Digital + knowledge city Intelligent city |
| Target | New towns System integration basis Service system | Old & new towns Solution basis Smart grid |
| Agent | Central and local governments | Private firms (Cisco, IBM, etc.), institutions and universities |
| Means | Government driven U-city world forum U-city road show | Global city alliances Governments, academia, NGO, ‘City protocol society |

Table 1. The different U-city and Smart City concepts

Source: Korean Planning Association

nies and the South Korean government agreed on a roll-out plan for 5G network starting from 2017. Thus, South Korea will maintain its technological front runner status and prepare for future ICT functionalities, also in the smart cities’ area.

Unlike the smart city concept, which originated in Western countries, the South Korean U-city (Ubiquitous City) is driven by establishment of ubiquitous ICT systems in new towns mostly through government/local government top-down measures; Smart city is a concept centered around physical, intellectual and social capital in existing cities (see table below). This implies that the South Korean central government and local governments are the main drivers to U-cities development in South Korea.

The South Korean Government established a first phase of the U-city plan from 2009 to 2013, and a second phase plan is running from 2014 to ⁵ 2018. The first plan focused on setting up the basic infra-structure for U-city, the second plan is trying to combine U-city with various national agendas such as urban regeneration, balanced

national development and national safety measures. Additionally, the second plan seeks to support private companies in developing U-city technologies and promoting overseas business through international cooperation. Target countries are among others Mongolia and Malaysia.

The most prominent U-city example is the creation of the U-city Project in the Incheon Free Economic Zone (“IFEZ”), also called New Songdo City. The gross area is total 209 km² including Songdo, Yeongjong and Cheongra, which are all areas reclaimed from the shallow waters of the Yellow Sea. Each area has a different development concept, such as international business and high-tech industry for Songdo, logistics, tourism and leisure for Yeongjong, and international finance and sport leisure for Cheongra. IFEZ is the leading U-city project and runs from 2006- 2020 with a budget of approximately \$ 490 million. The New Songdo City is built to be smart from the beginning. A key element is the Operations Centre which manages a large number of wireless CCTV’s to monitor and overview the city in terms of for

⁴ <http://cityprotocol.org/>

⁵ Korean Ministry of Land, Infrastructure and Transportation



Figure 2. Infrastructure in Seoul, Korea

instance safety and security (disaster, fire and crime), traffic and transportation information.

Many other U-city projects in Korea are heavily focused on the traffic sector. Bus information service applications are common and are created via using open data. A well-known example is the Daum Kakao's taxi app Kakao Taxi, which has proven to become the 'Korean Uber'. Kakao Taxi finds the fastest available cab based on the distance, traffic, and ETA. After identification, it sends the driver's name, photo, phone number and car information to the passenger. The passenger can also send notification messages to friends telling the ride information. As the ride is finished, both the passenger and the driver can rank their service and experience. In the near future, Daum Kakao is planning on adding its payment service Kakao Pay or Bank-Wallet Kakao to Kakao Taxi.

The challenge with the Korean U-city concept is that it is mainly driven by the government. Several Korean ministries are involved in the national U-city scheme and they sometimes fail to coordinate their planning of policies and budgets. Moreover, U-city projects are highly up to political decision-making, thus a possible change of government

results in uncertainty of on-going projects.

The viability of the Korean U-city concept will be tested in the coming years with the emerging IoT technologies, the focus on healthy living and citizens, as well as the efforts to export to countries where lack of ICT infrastructure is a key factor. Most importantly, however, is Korea's ability to keep being the main developer of future ICT infrastructure, which is widely considered to be the main competitive advantage of the Korean U-city concept.

CASE 3: GERMANY

In Germany, the main element of smart cities is sustainable growth and transportation, and how smart solutions can improve energy management and achieve energy-efficiency. The Federal government launched the 2010-plan to phase out nuclear power, which puts heavy emphasis on developing renewable energy technologies as well as energy-efficient solutions. Grounded in historical reasons, Germany has a huge interest in privacy and data protection – perhaps to the furthest extent in the world. Hence, this is a prerequisite for the development.

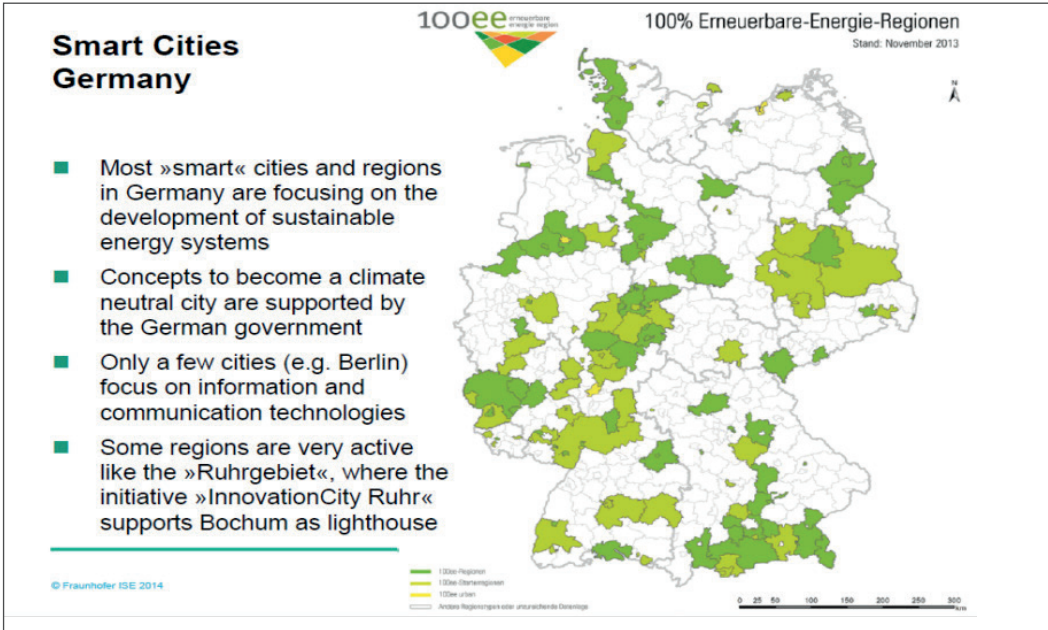


Figure 3. Map of Smart cities and energy efficient regions

Thus, "Efficient Energy Use" plays a crucial role in Germany's smart cities' conceptualization. Many municipalities and regions in Germany have set the goal of Renewable Energy Self-sufficiency (RESS). Main drivers are Munich, Berlin, Hamburg, and Mannheim. The Federal Ministry of Economics and Energy therefore promotes research on energy efficient cities and energy efficient heating and cooling networks. In addition to the energetic optimization of individual buildings, the aim of raising energy efficiency depends crucially on a comprehensive approach to urban areas as well as to local and district heating networks. This potential is improved significantly via intelligent use and networking of innovative technologies with research and pilot projects.

Germany launched a project called "100 % Erneuerbare-Energie-Regionen". This project identifies and monitors regions, municipalities and cities that want to convert their future energy supply entirely to renewable energy. At present, there are already more than one hundred and forty

counties, municipalities, regional associations and cities in Germany that are following this goal. The project supports committed actors in the regions through communication, transfer and networking services. In addition, the contest "Energy-Efficient City" of the Federal Ministry of Education and Research aims at increasing the target energy efficiency in cities and municipalities geared towards the climate protection targets of the Federal Government and the relevant municipal structures and functions.

"Elektromobilität" (e-cars) is another major focus area for the German government. It is expected that Germany will have one million e-vehicles by 2020 and 6 million in 2030, meaning that Germany will be a leading provider and a leading market for electric mobility by 2020. Germany had 24,000 electric vehicles on its roads in 2014. The Federal Ministry of Transport, Building and Urban Affairs has implemented a program named "Electro-mobility model regions" in Germany. The electric mobility scheme is

⁶ <https://us.drive-now.com/#>

financially supported in eight German metropolitan regions and the funding comes from funds from an economic stimulus package. Another aspect of smart transportation and 'Elektromobilität' is the DriveNow software⁶ program. The connected car integration enhances the consumer experience by connecting the DriveNow users' daily needs across content categories as well as providing access to real-time information and a personalized view of their surroundings. This interactive solution dovetails with BMW's overarching goal to become the leading provider of electric mobility. The program received recognition from media outlets including Wired.

On the R&D side, the research foundation Fraunhofer has launched the Fraunhofer Morgenstadt, which is a large-scale project addressing the various challenges and opportunities of Smart Cities. The Morgenstadt program explores how district-level, municipal and regional demonstration and innovation projects, which integrate clean technologies with business models, can result in Cities of the Future with net-zero emissions, minimal waste and maximum quality of life for its⁷ citizens.

In Munich, the "Smart Cities and Communities solutions integrating energy, transport, ICT sectors through lighthouse (large scale demonstration – first of the kind) projects" started in 2014-2015. The total budget for the projects is approximately € 200 million. The plan stems from the Munich City Council decision "Climate Protection Program 2013", which includes more than 60 individual measures in eight actions fields. The scope is to identify, develop and deploy replicable, balanced and integrated solutions in the energy, transportation sectors, and ICT actions through partnerships between municipalities and industries. The projects will be lighthouse projects as identified by the Communication on Smart Cities and⁸ Communities.

CONCLUSION

This brief presentation of policies and trends has

only vaguely opened the black box that the concept of Smart Cities constitutes. However, we see some distinct characteristics of the continents embodied by the three countries.

While the U.S. is heavily favoring the involvement of the private sector in development of smart cities, the South Korean U-city approach is much more top-down and government controlled. Expanding the view to include a wider range of Asian countries one would find that South Korea is actually very liberal compared to China or Japan.

Germany also has a strong government involvement in Smart City initiatives but with a specific aim to reduce energy consumption and generate a shift from fossil fuels to renewables. A bold strategy backed by the industry and research institutions paving the way for many comprehensive solutions with a potential global impact. The article has furthermore highlighted the difference between an infrastructure and application focus. Again, this is a distinction that would stand out even more if we include for instance India or Brazil, where basic infrastructure still is a major challenge. In a country such as the U.S. the ICT backbone is still not aligned between urban and remote rural areas, whereas South Korea has an impeccable infrastructure and a strong focus on functionality and technical systems, and now needs to shift their priorities and put the user at the core.

This is where the Danish focus on user-friendliness and human utility comes into the picture. Danish smart city solutions are unique and the leading principle seems to be that the more inclusive we can make our solutions the better they will fare.

This is something valuable that Danish businesses, municipalities and researchers can bring to the table, if they want to collaborate internationally. Likewise, the private initiative, the strong strategic aims and the focus on ICT systems from the three countries described are strongholds that also Danish partners could learn from. The combination and innovation of smart cities has only just begun.

⁷ <http://www.morgenstadt.de/en.html>

⁸ http://www.muenchen.de/rathaus/Stadtverwaltung/Referat-fuer-Gesundheit-und-Umwelt/Klimaschutz_und_Energie/Klimaschutzstrategie/IHKM.html