

Smart City Report 1:

The evolution of smart city: case studies of Barcelona, Spain and Helsinki, Finland

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Executive summary

More than 50% of the world's population lives in urban areas. By 2050, it will be nearly 70%. This raises huge challenges for municipalities and city planners. As cities are being developed, in order to cope with increasing demands and challenges created by urbanization, smart solutions are required.

The advance of information & communication technologies (ICTs) has stimulated the 'smart city' concept, where ICTs are 'combined with infrastructure, architecture, everyday objects to address social, economic and environmental problems' (Townsend 2014, p15). Yet this concept is fuzzy. It is criticised as rhetoric to justify capital accumulation aimed at young middle classes (Datta 2015), with socio-economic equality, local heritage and participation being residual concerns (Watson 2015). These criticisms apply more so in developing regions, where the scale of the urbanisation process, unevenly developed governance arrangements, and significant informality of urbanisation pose severe challenges for sustainable development.

On the bright side, there is potential for smart cities to help solve the various urban challenges. In January 2016, the United Nations General Assembly published the Sustainable Development Goals (SDGs) as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The 17 goals are broad and interdependent, covering poverty, hunger, health, education, gender equality, clean water, sanitation, affordable energy, decent work, inequality, urbanization, global warming, environment, social justice and peace. Smart city solutions have the potential of addressing: SDG 6 on clean water and sanitation, SDG 7 on affordable and clean energy, SDG 11 on sustainable cities and communities, SDG 12 on responsible consumption and production, and SDG 15 on life on land. For example, smart sensors allow cities to reduce energy costs and emissions through more efficient buildings, electricity grids, street lights, transportation systems, and energy and water networks at a time when cities already account for 70% of greenhouse gas emissions. And more widely, smart, sustainable cities aim for the realization of a better quality of urban life for all. Having side that, we have to recognize the evolutionary nature of smart city concept and practice. There is no single city that has a crystal-clear idea on what they want to achieve through smart technologies in the first instance. Neither is the citizen-centric approach recognized and accepted by all (even now). Moreover, a place's existing economic, social and institutional backgrounds exert strong impact on how smart city solutions are revealed and implemented along-time. This is of particular importance for less-

avored places, where there are limited industrial foundations and/or thin population base to nourish a fully-bloom smart thinking.

Therefore, in this study, we adopted an evolutionary approach in studying the smart city practice. In particular, we are inspired by Boyd Cohen (2015), who conceived three stages in smart city development: The first phase is technology-driven, which refers to a technocratic approach in using technological innovations to transform cities into highly efficient havens for innovators. In the second stage, technology is regarded as an enabler, but with the city firmly in control of its future. In the third stage, cities are beginning to embrace citizen co-creation models which put community into the DNA of the next generation of smart cities. For many commentators, cities need to continue to embrace the innovative capacity of their residents – the end-users of the urban interface, who are able to detect “bugs in the system” well before the city administrators can. The citizens can also work collaboratively to fix the problems and improve the city with rapid, cost-effective innovations.

Since the phenomenon we are interested in (smart cities) is difficult to separate from their environment (the city), a case study approach is deemed as most appropriate. We have chosen Barcelona and Helsinki for focused study in this report, as they are the leading players in the current smart city field according to the various smart city rankings. In each case, we first identified their world-famous projects, and the most relevant agencies spearheading their smart city initiatives. These secondary data provided rich background information before embarking on our fieldtrip. Semi-structured, in-depth interviews were then conducted in Barcelona in September and Helsinki in October 2019. 15 interviews were conducted in each city with the most relevant players in the smart city field, resulting in rich textual database for our following analysis. Our interviews were structure around the following questions:

- 1) What were the economic, industrial, cultural and institutional pre-conditions of a locality?*
- 2) How the Smart City approach was identified and selected among the various competing urban development strategies?*
- 3) Are there any significant cornerstones where development directions, rationales and perhaps partners had changed so far?*
- 4) How are the different dimensions of smart city gradually added into the whole portfolio of the city?*
- 5) Are there any lessons learned regarding the development of Smart Cities?*

Based on our study, we have made the following recommendations to practitioners and policymakers in Taiwan, with the purpose of facilitating the transformation of Chung Hsing New Village towards a smart and sustainable city. But as can be seen below, these recommendations are generally applicable in other cities and countries that aim to embark on a smart development trajectory.

Recommendation list:

- 1. Understanding your culture and socio-economic conditions before planning for smartness*
- 2. Understanding your citizens' needs beforehand*
- 3. Involving residents in the planning and implementation process*
- 4. Low density doesn't work for smart city*
- 5. Infrastructure and transport connection are crucial*
- 6. Garnishing strategic partnership and networks with leading smart centers*
- 7. Being flexible in land usage*
- 8. Being committed but taking small steps*
- 9. Bringing private sectors on board*
- 10. Identifying your niche and building an international reputation around it*

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Conceptual framework

Our stand

The advance of technologies, especially the applications of ICT, mobile technologies, cloud and big data in urban management, have been observed by many as effective tools in facilitating urban growth and/or giving new lives to shrinking cities. Consequentially, ICT technologies have been seized upon as a ‘city solution’ by a growing number of entrepreneurial governments and large multinational companies (Graham and Marvin 2001). The label of ‘smart city’ is perceived by many as the soft competitive advantage of their localities. Ever since IBM coined the term of ‘Smarter Planet’ in 2008, 294 cities have won the title of ‘Smart21 Communities’ from the Intelligent Community Forum by 2019 (ICF 2019). Nonetheless, along with a rising interest in the roles of ICT in facilitating city living, there is a growing awareness that ‘smart city’ technologies and images are far from enough – they have to be intelligently used, which in turn is more a question of governance than technological capabilities. Furthermore, the concept of ‘Smart City’ is fuzzy and often confounded with other ideas such as the wired city, digital city, e-governance and smart communities (Hollands, 2008; Cocchia, 2014). One of the most widely cited definitions of smart city is from Giffinger et al. (2007). In practice, however, environmental and technological standards, especially ICT infrastructure, are the exclusive foci (Kitchin, 2014). The ignorance of politicians and corporate investors towards citizen involvement in smart city investment is worth of particular attentions, given the potentially negative socio-institutional consequences of smart city rhetoric, such as social exclusion, urban gentrification, deepened class division, and shaky environmental commitment (Hollands 2008).

This study goes beyond the dominant technocratic focus (Nam and Pardo 2011) and corporate storytelling (Söderström et al. 2014) in current smart city initiatives. We recognise that **‘responsive’ actions** – those that recognise the importance of vision, well-evidenced strategic decisions with logic chains running from policy cause to urban effect, and a capacity to monitor, evaluate and adapt in the face of changes – are critical in advancing ‘urban circulars’ and shaping urban futures. We label this the **‘real intelligent’** city approach, which goes beyond an inward focus on learning and innovation (Nam and Pardo, 2011) to excel in **cross-city, cross-region collaborations and learning**. This implies that in-depth empirical case studies, especially comparative research, is urgently needed to challenge the ‘one-size-fit-all’ narrative on smart cities, and contextualise specific initiatives in different contexts (Kitchin 2014).

The definition of smart city

As mentioned earlier, the definition of smart city is still emerging as it is shaped by the specific needs and contexts of countries and cities (Neirotti et al. 2014). In Cocchia's (2014) systematic review of the literature, the author managed to list at least eleven alternative terms used in current political and theoretical literature. Many of them had been regarded as exchangeable with 'smart city'. Most terms emphasize on wider ICT adoption, sustainable outcomes, and efficient city management. Giffinger et al. (2007)'s report offered one of the earliest dimensional analysis of smart cities. These scholars distinguished six characteristics of smart city in economy, people, governance, mobility, environment and living, and then defined a smart city as 'a city well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens' (P11). Pardo and Nam (2011) further grouped these characteristics into three dimensions, including technology; the human; and the institutions. At the moment, Giffinger et al. (2007)'s taxonomy seems to gain popularity among following-on studies. Neirotti et al. (2014), for example, defined smart city through ICT's pertinent application domains, including: natural resources and energy, transport and mobility, buildings, living, government, and economy and people.

Different countries and continents tend to differ in their emphasis as well. For example, Neirotti et al. (2014) noticed that Asian cities had paid particular attention to the Transport and Mobility domain, but less in Government, Economy and People. European cities had so far emphasized softer aspects of the SC concept. Both North and South American cities systematically exhibited lower smart initiatives than their European and Asian counterparts. In particular, there was a substantial lack of environmental regulation in South America. Another interesting finding from these authors was that, there was a negative correlation between the smart domains focusing on hardware and those on software. This is to say, '*cities that invest in hard domains are also less likely to invest heavily in soft domains, and vice versa*' (p31). This led to the tentative conclusion that there are at least two smart city models: one focused on technological development and one on human and social well-being.

Although inspiring, existing studies tend to look at smart cities in a snapshot, as if cities arrive at their current practice overnight. But as hinted above, country-specific and city-specific factors will influence the focus and sequence of investing in a particular domain. This is of particular relevance to places like Chung Hsing New Village, where there is no 'smart' foundation but the aspiration to take advantage of what smartness could offer. Therefore, in examining our cases in Barcelona and Helsinki, we adopted an evolutionary view in examining their trajectories along the smart city path.

The evolution of smart city

Compared to cross-sectional studies on smart cities, longitudinal work on the thinking and practice against the smart city logo is rare. Professor Boyd Cohen from the Universidad del Desarrollo in Santiago, Chile, seems to be the first to explicitly lay down the three phrases of smart city. The following discussion largely draws upon his post in FastCompany. For Cohen (2015):

*Smart Cities 1.0 was laid down and led by IBM and several other multinational technology companies. It is characterized by technology providers encouraging the adoption of their solutions to cities, which in turn were not equipped to properly understand the implications of the technology solutions, or how they may impact citizens' quality of life. It's like someone who may wait in line for the latest Apple gadget without even knowing what they might use it for. Smart Cities 1.0 is also the underlying philosophy behind most of the bespoke smart city projects proposed around the globe from PlanIT in Portugal to Songdo in South Korea. These future city visions have been driven by private sector technology companies such as Living PlanIT and Cisco. In Townsend (2014)'s book on *Smart Cities*, the author presents a thoughtful critique of Smart Cities 1.0, arguing that tech-driven futuristic urban vision was missing out on the key dynamic of how cities interact with their citizens.*

Smart Cities 2.0 is led by cities, and supported and responded by technology providers. In this generation, the municipality, led by forward-thinking mayors and city administrators, takes the lead in helping determine what the future of their city looks like, and what the role is for the deployment of smart technologies and other innovations. In this phase, city administrators increasingly focus on technology solutions as enablers to improve quality of life. One of the best examples of Smart Cities 2.0 is what Rio's mayor did when he went to IBM to seek their expertise in creating a sensor network to mitigate the role of landslides in the hillside favelas. This project has received significant global media attention, especially as it grew to a full-blown 21st-century central operation center connected to streaming video for crime detection and prevention and integrated emergency services administration among many other integrated smart services.

Most leading smart cities, including Taipei, probably are in Smart Cities 2.0 stage. Barcelona, for example, has more than 20 smart cities program areas, and literally more than 100 active smart cities projects, ranging from Wi-Fi in public spaces and public transit, to intelligent lighting and the promotion of an electric vehicle charging infrastructure. It has sought to provide global leadership by not just initiating projects, but also supporting the growth of the smart cities industry and city networks through their Smart City Expo and the City Protocol initiative, introduced below. Like many leading cities, Barcelona has identified significant opportunities for using technology to facilitate improved quality of life for citizens and visitors.

In Smart Cities 3.0, leading cities are beginning to embrace citizen co-creation models to drive the next generation of smarter cities, instead of using a tech-driven provider approach (Smart Cities 1.0), or a city driven, technology enabled model (Smart Cities 2.0).

Vienna, for example, is a leading city regularly at the top of the annual smart cities rankings. It continues to be active in the 2.0 model and, like Barcelona, also has more than 100 active smart cities projects. But some of those projects have a different feel. For example, in a partnership with the local energy company, Wien Energy, Vienna included citizens as investors in local solar plants, and together they contribute to the city's 2050 renewable energy objectives. It also has a strong focus on citizen engagement in addressing affordable housing and gender equality. Vancouver led one of the most ambitious collaborative strategy-making initiatives by engaging 30,000 citizens in the co-creation of the Vancouver Greenest City 2020 Action Plan. Similarly, Barcelona recently completed an innovation project, called BCN Open Challenge, where the city posted six challenges and leveraged a private platform, Citymart, to solicit ideas from local and global citizens and innovators.

Smart Cities 3.0 is not just for cities in the developed world. Medellin, Winner of the Urban Land Institute's Innovative City of the Year Award, for example, has focused on urban regeneration from the bottom-up by engaging citizens from the city's most vulnerable neighborhoods in transformative projects, such as the cable car and electric stairs projects, and new technology-enabled schools and libraries. Medellin has recently expanded its commitment to citizen innovators by supporting the develop of an impressive innovation district (Ruta N) to attract and retain entrepreneurial talent. Based on its website, Ruta N aims to lead the economic development of the city towards intensive activities in science, technology, and innovation, in an inclusive and sustainable way.

Smart Cities 3.0, as Medellin has demonstrated, appears to be grounded more in issues of equity and social inclusion. The emergence of sharing cities, through projects such as Repair Cafes, tool lending libraries, is one example where cities are providing the enabling conditions to allow local sharing activities to emerge. They have the potential to not only optimize underutilized resources but also raise the quality of life for all. Cities like Amsterdam and Seoul seem to be taking the lead in promoting sharing activities amongst citizens and fostering sharing startups as well.

For Cohen (2015), a blend of Smart Cities 2.0 and Smart Cities 3.0 probably represents the best chance for the future. City administrators need to continue to lead by example, supporting the growth of broadband digital infrastructure, wireless networks, e-government and Internet of things sensor networks. But this Smart Cities 2.0 capability should be increasingly geared towards enabling citizen co-creation and urban entrepreneurship, so that residents are able to detect needs, and collaboratively work to fix the problems and improve the city. In a world, cities must move from treating citizens as recipients of services, or even customers, to participants in the co-creation of improved quality of life.

Factors influencing this evolution

Cohen's (2015) analysis of the evolution of smart city is plausible and provoking. It offers policymakers a clearer mind-map in terms of where they are and where they should head to. Having said that, it is not always easy to move from Smart Cities 1.0 to 2.0 and 3.0. Sometimes it might not even be feasible, or

advisable, to employ a 3.0 model in particular domain, such as when a technology is not yet mature. Therefore, it is important to discuss the preconditions or the contexts of the smart city transition.

Another unaddressed question in Cohen (2015) is the driver of this evolution. According to Martin (2010) and Martin and Sunley (2006), for example, path creation (in this case, the transformation of smart city model) is as important as path dependency. So it is worthwhile to ask whether it is internal or external factors that spark the initial change? Who are the main actors leading this process? And can we have a bottom-up push in the first instance instead of waiting for the last phrase? Martin (2010) proposed viewing institutions as composite entities that can be layered-on, converted, and recombined. These reconfigurations in turn, provide potential dynamics to break the current equilibrium and the 'lock-in' effect. Following this logic, then, we need a better understanding of how and under what conditions, could these institutional reconfigurations happen.

Third, the potential connections between the taxonomy of smart city domains and its evolution are far from clear. This is to say, we do not know whether Smart Cities 1.0 tends to prioritize the hardware of technologies, and Smart Cities 3.0 places higher attention to the soft sides of smart city applications. This connection, nonetheless, is potentially useful in detecting where a city is progressing to, and how it compares to others.

Set against these limitations, this study aims to address the following questions:

- 1) What were the economic, industrial, cultural and institutional pre-conditions of a locality?
- 2) How the smart city approach was identified and selected among the various competing urban development strategies?
- 3) Are there any significant cornerstones where development directions, rationales and perhaps partners had changed so far?
- 4) How are the different dimensions of smart city gradually added into the whole portfolio of a city?
- 5) Are there any lessons learned towards the development of Smart Cities?

In what follows, we will first present the case of Barcelona, focusing on the evolution of its smart city practice. Then we will present the story of Helsinki. We end this report with ten plausible recommendations to Taiwan policymakers and practitioners.

The ‘smart’ trajectory of Barcelona

Batalla and Ribera-Fumaz’s (2012) report provided a good summary of the Barcelona smart city trajectory until 2011. The following review has largely drawn upon this report. According to these authors, Barcelona, and in particular, its urban regeneration model, has attracted wide attention when it won the Royal Institute of British Architects’ Gold Medal in 1999 —the first time it was awarded to a city rather than a specific architect or practice. The associated ‘Barcelona model’ has consequently been held aloft as the model for successful social, economic and cultural revitalization at the urban scale (Balibrea, 2001; García Ramón and Albet, 2000; Marshall, 2004), and an exemplar of ‘universal global best practice’ (De Jong and Edelenbos, 2007). Albeit economically successful, Marshall (2004) had commented that *“most of the programmes for which Barcelona is renowned, certainly up to the mid-1990s, were not conceived with the aim of boosting the city’s economy, or global competitiveness”*. Rather it was perhaps a natural reaction of the public sector towards a run-down city center, dilapidated buildings, and rising unemployment and crime rates.

Pre-phrase of Smart City

The ‘unintended’ economic benefits had very quickly grasped the attention of the policymakers, especially the new elected Mayor, Pasqual Maragall (1982-97), an economist by training. Being highly entrepreneurial in using the investment opportunity offered by the 1992 Olympics, Maragall crafted the Barcelona model with a stronger economic logic, and thus exemplifies the replacement of urban managerialism with entrepreneurship (Harvey 1989). It was during the 1990s that Barcelona embarked on the pre-phrase of Smart City. In particular, a new single vision for the city’s ‘post-industrial’ transformation has proceeded apace from that time, informed by the rise of the ‘new economy’. The vision thus aimed to establish Barcelona as a global ‘knowledge city’, one ready for global competition (Gdaniec, 2000). Thus, at the start of the new century, Barcelona City Council (BCC) and local institutional actors have been driving forward the process of urban transformation in accordance with the perception that:

“The new economy develops in an international framework, it has a global character, it has made creativity and information processing one of the basic competitive and productivity factors and it is organised around city networks. At the same time, this international framework generates an increasing interdependence between urban areas, and turns competition among

cities in a game that takes place in the board of the international economy” (Pacte Industrial de la Regió Metropolitana de Barcelona, 2001: 65).

This had been the guiding principle for Barcelona economic and political elites. On that purpose, There have emerged a plethora of projects from the district to the metropolitan level to produce a city according to that understanding (Charnock and Ribera-Fumaz, 2011).

Smart City 1.0

With the emerging discussion on smart cities in the new century, Barcelona had once again been entrepreneurial in adopting technological policies to complement its knowledge-based economic (KBE) strategy. In doing so, it had taken a conscious step in designing a smart city, based on the idea that cities, by taking advantage of technological innovations, would have better chances of being more competitive in global markets than the ones which do not. In this sense, Barcelona had entered Smart City 1.0 through its entrepreneurial government and an economic-focused development rational. In particular, the then Mayor of Barcelona, Joan Clos (1997-06), was prioritizing efficient municipal management and “city making”. Using technologies to better manage and respond to citizens’ needs was emphasized upon. E-governance therefore became a major government procurement item, and the selling focus of big corporates.

Mayor Clos directed the regeneration project for the neighbourhood of Ciutat Vella, following a comprehensive plan that combined planning intervention, financial and social investment and facilities strengthening in order to open up this district to the city and to improve the quality of life for its residents. He also started a thorough reorganisation of the economic and financial structure of the City Hall with the aim of reaching budgetary stability and, at the same time, establishing a consistent investment programme to tackle the period after the Olympic Games. Some of the representative cases are the design, preparation and holding of the first Universal Forum of Cultures during the summer 2004, which pushed the consequent development of the area of Besós and Diagonal Mar, an urban development project ten times as big as the 1992 Olympic Games. Another major and highly relevant project is the Barcelona 22@, a new technological neighbourhood built on the old Poblenou.

Yet, when the above projects were launched, urban regeneration and job creation was the primary justification. As one interviewee from AMB recalled:

‘When the concept of smart city first came in, the Municipal government found it very big, including almost everything. They didn’t know how to put this concept into practice. But actually

the government realized they were already doing smart city stuff anyway...it took them several years to break down the concept into smaller, implementable elements' [interview: 26th Sep 2018].

The director of Ecology System Research Center added more:

'I was the Director of the Technology Department of the city in the 1980s. I remembered what was emphasised by the policymakers changed from environment to sustainability, to ecology, to smart cities, and now to resilience...all these names started with urbanization, and I remember in the 1980s politicians used 'environment' in every sentence of their speeches, and now use 'smart city' a lot. Many of these are trendy concepts promoted by the EU...with Spain entering the EU, it came with money but also regulations and legislations' [interview: 26th Sep 2018]

Without much knowledge on what smart city technologies might offer, Barcelona had ranked not very well in the many international comparative studies and rankings that explore productivity and innovation during the last decade. Indeed, with the crisis, two reports on urban competitiveness and economic performance had ranked the city 115th and 193rd in the world (Ni and Kresl, 2010; Brookings Institute, 2011). According to Batalla and Ribera-Fumaz (2012), the other cornerstone of the Barcelona model, including public leadership and social concerns, had also been eroded in the last fifteen years by the economic rationale behind the new policies and the increasing role of private actors in transforming the city. But public entrepreneurship did push Barcelona on the trend of major urban changes in the years to come.

Smart City 2.0

In this context, and with the arrival in 2011 of a new liberal Mayor in the BCC, Mr Xavier Trias, the elite consensual vision of the city has been changing. During his tenure:

'I firmly supported that a Smart City strategy is essential to foster economic progress and improve people's wellbeing and quality of life. Being a Smart City is about providing better public services and developing a more sustainable and efficient use of the city's resources... it is important to place technological innovation at the service of the people to improve their wellbeing and quality of life. In Barcelona, we develop innovative solutions with sensors and mobile applications in areas as diverse as safety, public transport, lightning, parking, water and waste management, health and social care. All these areas are important to provide better services and benefits for all citizens, but Smart Cities also provide the opportunity to help citizens to

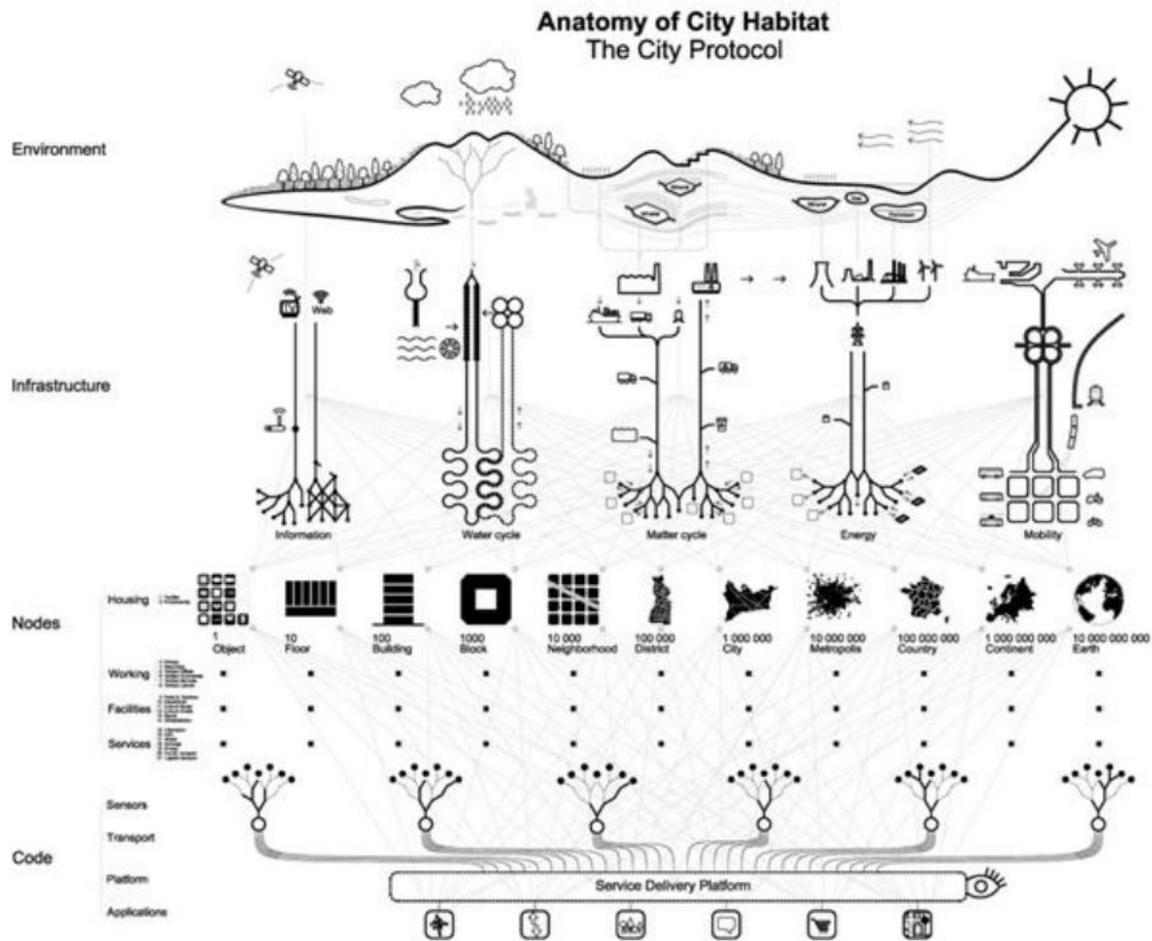
personally interact with their cities through Open Government and Open Data.' [interviewed by Eurescom (2015)]

The new government approach is based on the will of reinforcing the 'smart city' brand of Barcelona as a promoter of a new economy of urban services. More ambitiously, the goal was to promote Barcelona as an essential reference for all cities seeking to redirect their economies and international image following this paradigm (Gascó-Hernandez 2018). During the first two years under Mayor Trias, the Barcelona City Council had begun planning new projects. However, in 2013, the City Council recognized the importance of having a comprehensive yet explicit smart-city strategy, and declared its willingness to become the first truly smart city in Spain. The City Council thus established this definition of a smart city: "a self-sufficient city of productive neighborhoods at human speed, inside a hyper-connected zero emissions metropolitan area." Technology and built infrastructure, economy, people and communities, and natural environment were key components in this characterization. So, Barcelona Smart City 2.0 was much more comprehensive and purposive than its previous practice (fig 1).

One interviewee from the University remarked that:

'After taking position, the previous government under Xavier Trias had to do something different, something transformative (given the economic and social crisis at that time). Someone developed the idea of smart transport, but most of Barcelona had been developed and at high density. So the government focused on 22@ instead. But the aim was ambitious: they wanted to integrate the whole city as well as many municipal functions. Two practice stood out: The first one was to further reinforce Barcelona as a brand and role model. The city started to build the smart city framework (and sell it to other places). What elements to choose to fill int this framework will depend on which city they are dealing with. Second and related, was the stronger engagement of the private sectors. Government didn't invest a lot of money but tried to get money from the private sectors. They seduced them in by saying that 'if your projects work well in Barcelona, you can sell them internationally'. So you see, by now, the city brand feeds into its own success' [interview: 27th Sep 2019].

Figure 1. Conceiving the smart city



Source: Ajuntament de Barcelona (2012: 3)

The starting point of this Smart Cities 2.0 phrase took place in the first Smart City Expo and World Congress, held in November 2011 under the title ‘Smart society for innovative and sustainable cities’. In preparing this event, the work of urban planner Ildefons Cerdà, creator of Eixample neighbourhood, had been evoked as a pioneer of smart city idea applied to Barcelona, because of the effects of the rationalisation of urban space derived from the creation of the urban octagonal net, which aimed at efficient management of resources and integration of technologic innovations in the city. From then on arises the sketch of the guidelines of the two major future projects for the city, closely interrelated: the Smart City Campus at 22@ and the development of the City Protocol. Linked to this approach, the BCC created the Institute of Technology for Urban Habitat, a foundation to promote innovation in new urban services which joins planning and infrastructures, housing, environment and ICT departments.

From this perspective, the 22@ district, whose implementation started more than a decade ago, has been integrated to some extent in the reformulation of the general discourse of internationalization of the city – thus presenting another example of public entrepreneurship, or what Miao and Phelps (2018) termed as public intrapreneurism. Consequently, it has been a light shift in the argument that explains, promotes and legitimize the opening of the 22@ as a lab of public space, infrastructure and data to the private sector.

Barcelona's aim was twofold: use new technologies to foster economic growth and improve the well-being of its citizens. The strategy to achieve it included international positioning, international cooperation, and 22 smart local programs implemented primarily by public-private partnerships (see Table 1). The unit in charge of realizing it was Urban Habitat, which is responsible for the maintenance of the city and improving the urban landscape, including urban transformation and regeneration.

Program	Year launched	Main dimensions addressed ^a	Strategic projects	Results ^a
Telecommunications and networks	2013	Built infrastructure	New telecommunication networks. Antennas Plan, WiFi	New telecommunication Networks: >500 km of optical fibre
Urban platform	2013	Technology	Sensor platform, CityOS, iCity, CityDB	NA
Smart data	2013	Technology	City Key Performance Indicators, Situation Room	NA
Smart lighting	2013	Technology, built infrastructure, natural environment	Master lighting plan, sensors	Master lighting plan: 1.155 urban lights with LED bulbs
Energy self-sufficiency	2013	Technology, built infrastructure, natural environment	Self-sufficient islands, smart grid, cooling and heating network, building protocol, smart-meter electricity distribution, corporate buildings	Cooling and heating network: 29km connecting >80 buildings
Smart water	2013	Technology, built infrastructure, natural environment	Remote irrigation, smart sewer system, water-table management, remote ornamental fountains, pilot water telemetry metering	NA
Smart mobility	2013 but most in 2014	Technology, built infrastructure, natural environment	Zero emissions mobility, vehicle guideway system, public-space utilization, "sensORIZATION," and identification of new services (such as Les Corts pilot), mobility plan, orthogonal bus network, smart parking	Orthogonal bus network: 17 vertical routes, eight horizontal routes, three diagonal routes SensORIZATION and identification of new services: 50 sensors installed Mobility plan: >500 hybrid taxis, >130 electric bikes to rent
Urban transformation	2013	Built infrastructure	Paseo de Gracia, Parallel Avenue, Paseo de San Juan, La Sagrera, New Museum Center of Montjuïc	NA
Smart urban furniture	2014	Built infrastructure	Smartquesina kiosks	Kiosks: 44 available
Urban resilience	2013	Governance, built infrastructure, natural environment	United Nations program, infrastructure table, urban services	NA
Smart citizens	2013	People and communities	Fablabs, Citizen Sensors, Whabit	Fablabs: two fablabs open each year involving 5.400 citizens and 200 institutions
Open government	2013	Management and organization, technology, people and communities	Open data, citizen virtual office, e-administration	Open data: 322 available datasets, 80% with >3 quality rating on Tim Berners-Lee's scale Citizen virtual office: >40% virtual procedures in one year, 34% users >50 years (no digital divide)
Barcelona In Your Pocket	2013	Management, organization, technology, people and communities	Barcelona Contactless, Digital Identity, Apps4BCN, Mobile Ecosystem	Barcelona Contactless: 8.000 pieces of urban furniture connected, with >15 actors public and private actors Apps4BCN: >650 apps (88.5% developed privately), >36% of apps downloaded, eight challenges, >350 developers Mobile ecosystem: >12.000 companies, >86.000 workers, €18 billion revenue
Smart garbage collection	2013	Technology, built infrastructure, natural environment	Optimized waste collection, green mobile point	NA
Smart regulation	2014	Policy context	Tenders, legislation	NA
Smart innovation	2013	Economy	Smart City Campus, Smart City Tour, Smart City Cluster, Urban Lab, Competence Center mSmart City, Spark Lab, BIT Habitat	Urban Lab: 43 pilot proposals, 18 pilots
Health and social services	2013	Technology, governance, people and communities	Catalan Health Plan, Strategic Plan SITIC, iSalut.cat, Vincles	Bloomberg Philanthropy Prize winner, 20.000 assistant networks, 100.000 users, 110.000 potential users
Education	2013	Technology, governance, people and communities	Educat, mSchools, Raspberry BCN, 4DLife, Smart Hort (vegetable garden)	NA
Smart tourist destination	2013	Technology, governance, people and communities, economy	Geographical information system of tourism, Catalonia Experience Program	NA
Infrastructure and logistics	2013	Economy	Industrial sector	NA
Leisure and culture	Not begun	Technology, governance, people and communities	—	NA
Security	2014	Technology, governance, people and communities	—	NA

a Results are available only for very specific projects reported up to 2014.

Source: Gascó-Hernandez (2018)

In terms of general results, Ferrer (2015) reported €85 million of added GDP impact in 2014, as well as 21,600 jobs, of which 1,870 were the direct result of smart-city programs. The City Council invested €53.7 million in smart projects in 2014; in return, for each invested euro from the municipal budget, an additional €0.53 euros were invested by third parties, including private businesses. As reported by Ferrer, the projects added €43 million to the city's economic activity between 2011 and 2014. They were

also expected to save 9,700 tons of CO₂ and 600,000 liters of water consumption annually (Ferrer 2015).

Galvadà and Ribera (2012) however, were more skeptical of such projections, arguing that most of the initiatives did not make a clear contribution to environmental sustainability and lacked bottom-up approaches involving people and communities. They also argued that specific projects aimed at making the economy more dynamic had a socially negative impact, because they favored the concentration of talent and an influx of new types of residents in certain districts while displacing people already there, mostly of low-middle socioeconomic status who were vulnerable to increased costs for housing. More broadly, smart city projects to these authors were raising many questions on the reshaping of collective resources to private interest and the re-definition of the public in the city and the technological district.

Smart City 3.0

The growing popularity of Barcelona, the rising living costs and the social segregation had led to several mass public demonstrations in the first decade of the new century. The current Mayor of Barcelona, Ada Colau, used to be an activist and grassroots campaigner for affordable housing. She was one of the founding members and spokespeople of the Plataforma de Afectados por la Hipoteca (PAH) (Platform for People Affected by Mortgages), which was set up in 2009 in response to the rise in evictions caused by unpaid mortgage loans and the collapse of the Spanish property market in the wake of the 2008 financial crisis. After reignited as the spokesperson, she founded Barcelona en Comú, a citizen platform that stood in the May 2015 Barcelona municipal elections. Barcelona en Comú won a simple majority in the elections, and on 13 June 2015 she was sworn in as the mayor. Very soon, Mayor Colau appointed Francesca Bria as the city's Chief Technology Officer. Bria has been a long-term supporter for 'democratisation of data', i.e., data be protected for citizens and used for their benefit. Her citizen-centered approach in data collection and utilize thus aligned closely with the new Mayor. Together they believe the fairest way for technology to advance is for local communities to be included in its development, and rewarded by clear evidence of how technology can improve their quality of life.

Having a strong left-wing government thus started the transformation towards the participatory model. A lot of ground work, however, was needed beforehand as remarked by a professor in the University of Barcelona.

'The existing government displaced a lot of the people involved in the projects designed by the previous government. The first thing they did was to cancel all the projects. You know people

coming to the current government are socialist. They think private companies are part of the problem. So they changed the direction: instead of encouraging private innovation, they want to support social innovation, which essential is to support open data and encouraging citizens to control and use the data...of course the current socialist party didn't break completely from what have been laid down by the previous government—although they could like to. In a way, this party did bring in innovation, as the previous party was in charge for too long. They were scared of change.' [interview: 27th Sep]

The Director from the Ecology System Research Center added on:

'The leadership of a city is very important. Last Mayor of Barcelona was very interested in smart cities. The current Mayor, at the beginning, rejected the smart city idea completely. But now they also embrace it, because the economic and innovation value to it. Also companies support it...I think the Barcelona approach to smart city is now devolved. The last government was mainly focused on e-government, but not the whole package. The current government, if it could win another term, might adopt a more holistic approach. Of course you could say the current left party focuses more on participation. So the time needed to decide something increases' [interview: 26th Sep 2019].

The policy direction of Barcelona was gradually evolving from there. According to an interview with Bria, there are three pillars in Barcelona's current smart city thinking (Forster 2018).

The first is around digital transformation, i.e., how a city government should work with technology or whether it even should. This is a fundamental re-think of the relationship between the public sector, private sector and citizens, and a move away from the technology-led agenda. The argument is that 'when you start with technology without a strong idea of why you are deploying the technology and for what kind of needs, then you only end up solving technology problems'. The associated technology lock-in cost might also be high.

One professor from the university of Barcelona remarked that

'The commissioner for Technology arrived in June 2016. Before that there was mainly critical debate on smart cities. But she transformed the discourse. The idea is to use digital platforms, such as 'decidem', to engage with the public. This platform was fully developed by the council,

and provides 'privacy by design' by setting up agreements with the private companies on protecting individual data'. [interview: 2nd Oct 2019]

DECODE is another initiative jointly led by Barcelona and Amsterdam, and involves a grouping of 14 European city, business and academic partners. The aim is to develop open hardware, software and business models to take on the quasi-monopolies being promoted through centralised web services. Blockchain is being used to allow users of services the opportunity to control who accesses their data rather than just handing it over to online providers. a distributed blockchain-based architecture is being developed for this, on top of which the city puts a cryptographic layer to guarantee privacy. So citizens can decide what data they want to share, with whom, on what basis, and for what purpose.

Digital innovation and support for Barcelona's 13,000 tech companies is the second pillar of the current Barcelona practice. For this purpose, Barcelona is creating an open digital marketplace to make procurement more transparent, so small companies should be able to come on board and compete in a fair way with the big players. This has also meant reworking procurement agreements to reflect that data is a public right for the common good. The envisaged situation is for partner companies to transfer good quality data to the city, so that the municipal government can reuse that in its open data platform, with privacy assured, so citizens and local companies can create value out of it.

The commissioner for Economic and Innovation added on that:

'for me the smart city concept is evolving. First you need to know the problems of your city and then you put down the infrastructure, which paves the foundation for further technology development. For example, now we are setting up the 5G platform, as we already have the largest optical fiber in the EU. For the asset of the city, I think we have the infrastructure, we are also keep developing it. We have lots of start-ups exploring these opportunities. Barcelona is a 'start-up city' for example' [interview: 1st Oct 2019].

Digital empowerment of residents is the third pillar of the Barcelona strategy. Now Barcelona is running 16 participatory processes in parallel, ranging from culture through mobility to urbanism, and have four public Fab Labs where it is prototyping new educational programmes for the digital age, so that people is capable to push the technology revolution go beyond technology agencies and companies.

Participation has always been in the blood of Spanish people, especially in Barcelona. That changes, therefore, is the model of participation and the effect it could have. According to the commissioner of participation:

‘This office was set up in the 1980s...there is always participation in Barcelona, but the effects depend on the politicians and their offices, as different offices emphasized on different things...I would say from 1979 and 2015/6, we were having a top-down participation, i.e., the government issued a document and we got discussed it and debated it, but no influence was made because of these. People couldn’t impact on decision-making. So I won’t call it real participation. Since 2016, we started implementing a bottom-up approach in participation. So people have real-say in the various affairs. Last year we passed a new legal framework for digital participation. And we have Decidin Barcelona set up and running in 2016. Local authorities need to use this platform and take around 40% of those suggestion given by their citizens. Proposals will need to reach the minimal number of signatures will get passed. Our office even set up a participation framework in order to better understand this process and improve the quality of our service’ [interview: 26th Sep 2018].

An officer from its Innovation Democracy Lab further commented that:

‘we think the digital infrastructure and the data should be open to all. We set up a chief data officer, Marius Boada in the government to centralize data collation for the government. In our Lab we designed this platform (Digital Commons), it is open, so people can use Apps to develop this platform further. Now it has been exported to other cities in Finland and France for example...the current government identified three focus areas on participation: the first is community activities and the engagement of civil society; the second is on active democracy; and the last one is on innovation and research into democracy. For example, we are having a workshop this afternoon to discuss and debate the impact of Airbnb in Barcelona. We will have over 30 data analysts joining us...I think Barcelona is now trying to move the concept of ‘smart city’ to ‘democracy city’’ [interview: 27th Sep 2019].

Reflective summary

Lessons from Barcelona for Chung Hsing New Village could be summarized as follows:

First of all, it is very important to know which smart city model/phrase suits the circumstance. To a certain extent, Barcelona is an outlier as it has a long tradition of participatory culture and democracy tradition. The current government pushes it further as it opens window for people to propose and decide on policies. Digital platforms are developed to meet this end, instead of the other way around.

Conversely, policymakers in Taiwan need to think about whether, and to what extent, its residences could feel comfortable, and be competent in participating in decision-making. Smart cities 2.0 model, with an experimental taste of the 3.0 model, might be a more suitable choice in the case of Taiwan and in Chung Hsing New Village in particular. Moreover, we could suggest using this new village as a testbed for the various Smart Cities 3.0 practice, such as active democracy platforms and research into the democracy process itself.

Second, Barcelona is densely developed so it has the scale to trial various urban innovations. In contrast, Chung Hsing New Village is facing the urgent challenge of losing population and aging. So a top priority for the government is to increase the population density in this area, and to explore the various factors that could help crystallize this density. Only after you have the density could come companies and service sectors. The example of Barcelona 22@ suggests the crucial role played by having a famous university to boost initial agglomeration. Specifically, the then Mayor of Barcelona successfully convinced the university of Barcelona to relocate its media and art faculties to 22@ at the beginning, on the promise of free land usage. The spillover effect of having a large number of students and staff was extraordinary and quickly attracted the opening of a big retail center, supermarket, and some start-up companies which have close collaborations with these faculties. The city then refurbished an old factory near the campus as an art center, and convinced the relocation of the national TV production company to set up a regional head-quarter next door – both again, added to the synergy of this place and quickened the development of 22@ as a center of technology, creativity and arts. Therefore, Chung Hsing New Village, supported by the Taiwan government, would try lobbying the top universities in Taiwan to set up their regional branches there. The existing education facilities and greenery could further add to its attraction as an alternative choice to de-congest many of the universities located in the city centers.

Third, to build a smart and sustainable city we do need to include new technologies, but technologies are not the goal. So these technology-focused projects better come later not at the beginning. Instead, a thorough survey of people's needs should come first. The interviews with various activists in Barcelona's participatory platforms suggested that, people tend to engage more in topics and issues that are closely related to their daily life and/or something they are familiar with. It is also important to include diverse

groups into the discussion to avoid bias in opinions. Last, debates should be encouraged in civic participation as they might trigger deeper reflections and compromise. Given these suggestions, we could suggest start thinking the New Village's regeneration through an interactive planning process. 3-4 focus group meetings, each with diverse demographic compositions, would be organized to discuss some of the urgent neighborhood issues. Then we could move on to invite participants to think more broadly about the future scenarios of their neighborhood, reaching agreement through debates and discussions. The last step is to suggest different technological tools to facilitate this transformation. Again, informed discussions should be organized.

Last, we think it is worth exploring experimental zones within Chung Hsing New Village, given that citizens might not have the knowledge to discuss something they do not know. At least 3 zones could be set up in experiment. The first zone could focus on education; The second zone offers democracy labs and start-up incubators; and the last one could accommodate creative and art industries. Local authority would then monitor their processes as well as organize cross-boundary collaborations. It is also recommended to co-design the urban environment in accordance to the overall imagine of Chung Hsing New Village as a smart and sustainable village, as well as to fit for the emphasis of each zone.

All in all, we see technology simplifies people's lives and leads to greener and better solutions. But the creation of urban spaces is only sustainable when rooted in the people. By adapting the smart city profile and taking an experimental approach, city developers in Taiwan will find smart cities less likely to emerge as isolated citadels. This will help to attract people willing to become active participant-residents. Because people are what make sustainability smart.

The ‘smart’ trajectory of Helsinki

The prospect of urban innovation excites the imagination. But dreaming up what a “smart city” will look like in some gleaming future is, by its nature, a utopian exercise. The messy truth is that cities are not the same, and even the most innovative approach can never achieve universal impact. What’s appealing for intellectuals in Barcelona or Amsterdam is unlikely to help millions of workers in Jakarta or Taiwan. To really make a difference, private entrepreneurs and civic entrepreneurs need to match projects to specific circumstances that rooted in their own history and socio-economic backgrounds.

Hence, we included another case from the Europe, Helsinki, is our exploration of smart city evolutions.

As introduced by Bell and Hietala (2017, p11-17), on a global scale Finland is a small country. It is around the 115th biggest country by population and the 64th by its land area. The population of Finland was merely 0.07 per cent of the world’s population. But the Finns have demonstrated that even a small country can jump to the top of the world. According to indices published by OECD, the UN, Eurostat, the World Economic Forum, WHO and UNICEF, Finland scores highly on health, equality, environment, human capital, safety and society, satisfaction and trust, information society and competitiveness. It was also ranked the most stable country in the world in 2016. In particular, Finns’ trust in the policy is the highest in Europe, and they have the second highest rate of trust in their political and legal systems.

Compared to other European countries, Finland is a latecomer to history as represented in written documents. Yet since gaining independence on the 6th December 1917, Finland has been progressing steadily with better access to education, learning and transforming. Helsinki is the main driving power in this transformation and now become a natural channel for the spread of innovations and modernization in Finland but also the world. This virtuous development cycle, if continued, will bring Finland to a completely new position in the international division of labour. In his book *The Creative City*, Charles Landry emphasizes the hidden resources of the city as well as its successful management of opposites:

Helsinki is a city which seems to have achieved a successful balance of proprieties between men and women, between the wish for safety and the need for cultural stimulation, in part by providing the unexpected within a secure framework. It has balanced its awareness of its own history with the desire for modernity and innovation. There are also more basic polarities which form an integral part of Helsinki’s culture: it embraces both heat and cold – snow and sauna; solitude and Finnish tango; light and

dark, land and sea. It is a modern urban culture, yet it has its roots in rural society – it is a culture rooted in the natural world. Helsinki’s ability to master these seemingly contradictions is an asset to be harnessed. The images entertained by foreigners are still stereotypical. Helsinki is thought of as ‘cold’, ‘distant’, ‘unknown’, ‘gloomy’ and ‘mysterious’. But when visitors come to the city their perceptions change radically for the better. Helsinki is less cold than they thought, there are unexpected things to do even in the cold, there is a passion and a ‘wilderness’. Helsinki has flourished despite an administrative practice, which depends overmuch on historical precedent, an excessively compartmentalized approach to development and a fear of organizational change. The unpredicted and the unexpected have nonetheless found their place’.

The successful modernisation of Finland in the 1990s, led by Helsinki, has placed this country and its capital city well for grasping the opportunities offered by smart city. International agencies estimated that smart cities are a strongly growing market globally that will be worth 1.3 trillion EUR by 2020. As the progress is ongoing and the market is extremely fragmented, it is impossible to give detailed numbers in terms of economic impact and number of jobs it creates in Finland. However, it is estimated that smart cities will have a remarkable impact in Finnish economy and the market will grow to billions of euro.

By now Finland is one of the leading European countries in developing smart cities. The overall purpose of transition towards smarter city platforms is to save inhabitants’ time in a sustainable way, improve their quality of life and create new business models, know-how and jobs. Efficient city-planning and development have been in focus for many years in Finland. Some of the technological structures are unique on world scale. For example, Helsinki produces electricity, district heating and cooling by a combined heat and power generator in a single process which requires significantly less fuel than separate productions would do. Both electricity and heat are distributed to 90% of the city’s houses, making it a rare solution. And similar to Barcelona, at least on the surface, Finnish cities are especially smart in terms of taking inhabitants and users into account. High level of interaction is emphasized and people are encouraged to participate actively in the development of smarter and sustainable city platforms. In addition, an increasing number of start-ups and other companies are involved in transformation process of smarter environment, mobility, governance, economy and living.

In what follows, we will review the evolution of Helsinki’s smart city trajectory

Culture in Smart City construction

Although Barcelona and Helsinki both emphasize on open data and citizen participation, we did notice distinct differences between the two leading smart cities. These differences in our mind are rooted in the diverse historical and cultural backgrounds of the two cities.

Diversity was first noted in the understanding of smart city. Whereas in Barcelona we heard criticism about this term, and a strong emphasis on democracy and ‘taking control of our city’; in Helsinki, smart city was often defined as ‘efficient city’; ‘making things work as they should be’; and ‘taking advantage of what you got’. Immediately we could sense a strong political favor of smart city in Barcelona and a pragmatism attitude in Helsinki.

Second difference lies in the cities’ attitude to the private sectors. In Barcelona, leveraging private investments was once the key focus of the municipal governments until the current mayor, who, given her social activist background, was hoping to get rid of big corporates and terminated all smart city programmes at the beginning. In Helsinki, there was no such big U-turn, but a gradual welcoming attitude to private investments. One officer from the Urban Research & Statistics Unit remarked that

‘Helsinki now wants to be corporate friendly. We used to emphasise on welfare state and believe the state and the public sectors should do quite a bit (on providing services). Now we are trying to encourage investment and being open’ [interview: 15th Oct 2019].

Third, technology innovation and improvement have long been practiced in Helsinki. For example, Helsinki was an early adopter of inventions in energy and communications, which was started in the 1960s and 1970s. But the city has not been very good at marketing itself. Comparatively, the city of Barcelona has been highly entrepreneurial since the 1980s and emphasizing on city brand and images ever since the 1990s. Now ‘Barcelona’ itself has become a selling point and an attraction for private investment. Being unnoticeable internationally perhaps reduced the pressure on Helsinki to trial something bold, and leap-forward in the current smart city competition. But the key question is to identify the opportunity and lever for this leap-forward.

Besides these cultural differences, Helsinki also distinguishes from Barcelona on the trajectory of building a smart city, to which we will turn now.

Smart City 1.0

After reviewing various literature on the growth of Helsinki’s smart city solution, we are tempted to suggest that Helsinki has never been trapped in the Smart City 1.0 model, where international high-tech

corporates dominate its technology development. This stands in contrast to Barcelona in the 1980s when the city started to embrace this concept without a clear idea of what it was about.

Several factors might explain this phenomenon:

First of all, and perhaps ironically, the reason that Helsinki missed being a prey of those tech giants might be exactly of its marginalization in the global arena in the 1980s and early 1990s. Compared to the highly proactive and entrepreneurial approaches of the Barcelona municipal government in revitalizing the city, Helsinki in the 1990s was still much more self-contained than other European cities. Part of the reason could be derived from its late membership in the EU: Finland became an EU member only in 1995 and adopted the euro in 2002. Another reason might be the traditional Finnish protectionist policy in economic activities. From 1950 onwards the Senate of the autonomous Grand Duchy and later the government of an independent country used legislation to control foreign ownership in Finland. Although direct foreign investment did pick up in the 1980s, it was not until 1994 that the deregulation of foreign ownership took place, following the launch of the European Economic Area at the beginning of that year (Bell and Hietala 2017, p287).

Secondly, Helsinki was not as severely impacted by economic recessions as Barcelona. Its average GDP growth rate was 2.9% between 1865 and 1995. The period of growth after the second world war until the mid-1970s was exceptional. GDP grew by an average of nearly 5%, and between 1994 and 2000, the growth of GDP was on average of 4.7%. Therefore, by the 1990s, Finland had become one of the richest countries in the world. More importantly, technology improvement had contributed significantly to Finland's growth. It was estimated that two thirds of its economic growth had been derived from improved productivity and one-third from additional labour input (Hjerpe 1990). During the global recession years 2007-13, job losses in the Helsinki Metropolitan area was not as extensive as in other European cities. In Helsinki itself the decrease was some 6,000, mainly as a result of lay-offs. In comparison, Barcelona had been suffering from economic structural transformation since the 1970s and 1980s. The Olympic Game was to some extent, a desperate effort of the municipal government to re-boost the economic development. The successive investment projects were also centered around economic boosterism.

Thirdly, there were strong municipal corporations in place in Helsinki. Even now, many of the major infrastructure operations in Helsinki are still publicly-owned. These include *Forum Virium*, which is an innovation unit within the Helsinki City Group. It develops new digital services and urban innovations

in cooperation with companies, the City, other public sector organizations and Helsinki residents. *Finnvera*: which is a Finnish state-owned specialized financing company. It provides loans, guarantees, venture capital investments and export credit guarantees to domestic clients. *Helen*: a state-owned energy company. It has almost 400,000 customers throughout Finland and its district heat covers over 90% of Helsinki's heating needs. *Stara*: the Helsinki City Construction Services, which spearheads the construction, environmental management and logistics services to the capital. With almost 1,500 employees and hundreds of utility vehicles and other machines, this municipal enterprise is responsible for maintaining and constructing the streets, parks, natural areas and city-owned buildings in Helsinki; and *VTT*: which is Northern Europe's largest applied research organization (primarily public funded). It produces a wide range of technology services and research services both for domestic and international customers in both the private and public sectors. So we can see there is almost a whole production chain in technology development and urban management that being nourished under the Helsinki City along time, which could be easily adjusted to cater for the needs of smart city. This is demonstrated most strongly in the energy and transport domains for example. Therefore Helsinki has much lesser urgency to rely on foreign techniques in solving its domestic problems compared to Barcelona. On the contrary, Helsinki might even be supporting its domestic enterprises to better prepared for the smart city market opportunities by providing a restrictive foreign investment policy.

Last but not least, Helsinki had a substantially large and world-leading ICT giant – Nokia, whereas Barcelona has always been dominated by small and media sized enterprises. Before going downturn, Nokia was no double the technology leader in the world, which not only advanced the communication infrastructure in Finland, but also cultivated a large number of skilled technicians and ICT specialists. In our interview with Nokia as well as the city council, notice was drawn to its a spillover effect.

'There are a lot of spin-offs from Nokia, where the well-trained technicians started their own companies after leaving Nokia. This actually helped boost our growing industry in ICT. An example is KYYTI, which explores smart transport solutions in rural areas of Helsinki'
[interview: Forum Virium, 15th Oct 2019].

From above comparison, we could already distill the strong influence of the city council and other public sectors in the smart city development of Helsinki. Therefore, when this concept spread to Finland and adopted by Helsinki, there was no doubt that it embraced the more sophisticated models straight away. We will turn to this now.

Smart City 2.0

In Smart City 2.0, technology is regarded as an enabler, but with the city firmly in the driver's seat. This model believes that city administrators need to continue to lead by, for example, supporting the growth of broadband digital infrastructure, wireless network, e-government and e-services and IoT sensor networks.

The strong leadership of the city is demonstrated by its 2017-2021 strategy, in which Helsinki declared its ambitious to become the world's best functioning city. This strategic goal, set by the mayor Jan Vapaavuori, is to be achieved through digitization and the adoption of smart technologies. These are three examples of how Helsinki uses smart city technologies:

First, open data. Forum Virium with its innovation partners has made pioneering efforts in opening city data through its award-winning *Helsinki Region Infoshare (HRI)*. This service has driven the opening up of public sector data in the municipalities of the Helsinki Metropolitan Area since 2011. Over 1000 data sets created with public funds have already been given free, open access. These include traffic, city planning and real estate, construction, culture, economy and taxation, education and training, environment and nature, health, housing, information technology, jobs and industries and law in formats that make it easy for software developers, researchers, journalists and others to analyze, combine or turn it into web-based or mobile applications. This data helps citizens to follow the decision-making process, send feedback to the city or reserve open spaces for their use. Today, dozens of mobile apps developed by start-ups and enthusiastic citizens are making the most out of open data. At the start of 2014, the HRI service became part of municipalities' regular operations.

Interview with an officer in the Infoshare program revealed more information:

'We have a very crazy (massive) data archive. But they are crude data with not much analysis involved. We'd like to see these data being used as they are very valuable. Some of the contexts are digitalized, but some are not...we have to do a lot of hard work before we can integrate these data together, as they are collected under different terms, definitions etc...we are also trying to work with companies. If companies use our data, we will make sure we own the data, and we will try to release the data if possible. Of course some data are more sensitive, so we will made a decision on those...data sharing is becoming easier and easier. Companies realize open APIs is going to happen anyway. It is not good to fight against it. They are forced to find new ways to build their competitive advantages, not just monopolizing the data...we use co-creation process

in solving problems with students and researchers. They sometimes developed solutions/apps by using the open data we provided. In many occasions it would be the developers who own the copy right, whereas we will pay for their products if they are useful. At the moment we are discussing of releasing a new dataset on 'habits' and scholars are discussing how to use these data meaningfully...for me these developments are more useful than merely keep the data' [interview: 17th Oct 2019].

Here it is interesting to notice that, while the open data initiative launched in Barcelona, *DECODE*, aims to promote democracy in data collection and usage, and give control to citizens in determining whether to keep their personal information private or share it for the public good; in Helsinki, the century-long effect in data collection by the public sector has been turned into information sharing and experimental platform to both residences and companies. In this sense, *DECODE* pushes data decentralization further (and is perhaps more politically driven as well); whereas *Infoshare* does take a more administrative approach, such as in unifying the data format and deciding what data to make public and what not. So we could see divergence emerging in specific application of the smart city technologies, which highlights the importance of 'fit-for-purpose' policy design. The officer from *Forum Virium* added more information here on its open data initiative:

'At the moment we just provide an open data platform. But New York goes steps further. It emphasizes on data analysis and process. I am very impressed with what they are doing. Of course as a public agency we are not thinking of commercializing our services and platform. But we surely could use this model to help others, especially cities in Asia and Africa...we could do more here' [interview: 15th Oct 2019].

These companies introduce the second excel domain for Helsinki: *mobility*. Helsinki has set itself bold target to become completely carbon neutral by 2035. In Helsinki's metropolitan area, the electrification of buses has already begun, with an aim to have over 100 electric buses in operation by 2020. The city has also been a testing platform for new smart mobility solutions, thanks to its open data platform. Different smart mobility concepts within the metropolitan area, such as self-driving robot busses, were proposed with the aim of reducing air pollution and smoothen traffic. *Stara*, another important municipal-controlled company, plays a crucial role here. *Stara*'s roots run deep in the history of Helsinki and the construction office established in 1878, which was tasked with maintaining the city's fixed property and carrying out construction and repair work. Since 2009, *Stara* has been taking care of

Helsinki as an independent department. It offers all full range of city engineering and maintenance services. An innovative concept promoted by Stara recently is called the *Mobility-as-a-Service* model, which hopes to make car ownership unnecessary by promoting existing services like ride-hailing, trip planning and car-sharing.

An interesting comparison can be made with Barcelona here, which also stands out with its pioneer work in mobility. In Barcelona, the hot concept being promoted at the moment is the *superblock model*. Essentially, these superblocks are mini neighbourhoods around which traffic will flow, and in which spaces will be repurposed to “fill our city with life”. This model is supposed to help achieve the municipal government’s goal of reducing the traffic by 21%, and freeing up nearly 60% of streets currently used by cars to turn them into so-called “citizen spaces” (Bausells 2016). In this scenario, smart transport technologies come as secondary, complementary solutions to the environmental problems. In Helsinki, however, there is no pre-existing residence blocks, neither is there high density as in Barcelona. So ride-sharing solution is prominent. This companion underlines the importance of understating your city first before implementing any technology innovations – a lesson to be drawn by Chung Hsing new village.

A final example in Helsinki links with the city’s ambition: *to provide citizens one more hour a day through smart services*. With this extra hour, citizens could pursue their hobbies, doing sports and spending time with their families – all relevant to well-being. Helsinki appointed the area of Kalasatama to be the place to experiment smart urban living and services. From there, initiatives can expand into the wider smart city district of Helsinki. Kalasatama used to be a harbour and industrial area in Helsinki, and now being chosen by the City as the testbed with everything from social and healthcare services to waste management, energy solutions and smart parking.

‘A number of infrastructure services have been and will be automated. Solar panels, smart metering and smart remote control systems have also been embedded here. Additionally, the district has also tested a unique vacuum waste collection system whereby waste collection points transport waste to waste management facilities via underground pipelines’ [interview with manager in Forum Virium: 7th Oct 2019].



Fig 1: Kalasatama under construction



Fig 2: vacuum waste collection system

Developing and building Kalasatama will continue to 2030, and by then there will be 20,000 inhabitants and 8000 jobs – currently 3000 people live in the area. This is a place created together with residents, companies, city officials, researchers and other stakeholders. 70 companies are taking part at the moment, presenting all size of groups: there are 31 micro-sized, 17 small, 5 medium-sized and 17 large

entities. In addition, agile piloting is run for start-ups. As for funding, 5b EUR is already invested by private sector and 600m EUR by the City of Helsinki.

Examples of smart solutions present in Kalasatama:

Floating, customized apartments and smart houses with adaptive and scalable technology related to heating and lighting
Digital health services
Shared electric cars
Co-created senior house with 500m ² of shared spaces
Future school (new ways of teaching, no class rooms, latest learning technologies)
HIMA Smart Metering, home appliances controlled by mobile devices
Carbon neutral zoo
Old power plant facilities “produce culture” as the spaces are available for events
Solar park for which the residents crowdfunded the panels – it balances the electricity supply
Smart Grid, IoT solutions testing, personal data usage for customized services.

Also differ from the individual urban entrepreneurship and even inter-city competitions we noticed in Spain, Finland adopted a more collaborative approach. The six largest cities of Finland (Helsinki, Espoo, Vantaa, Tampere, Oulu and Turku, see fig 3) together have facilitated an open innovation platform called ‘The Six City Strategy’ – 6Aika, which consists of common development of smart solutions and implementation of experimental projects intending to tackle challenges related to urban environment. These cities cover 30% of the Finnish population and the whole urban community participates in developing and testing of innovative concepts. The Strategy runs between 2014 and 2020 as part of Finland’s structural fund programme for sustainable growth. 26 projects with a total budget of 45 million EUR have been executed ever since. The strategy plays an essential role in boosting Finland’s economy and competitiveness and implements the EU-level territorial development instrument ITI- Integrated Territorial Investment in Finland. As a cross-sectoral multicity model, the Six City Strategy represents a unique set-up of sustainable and smart city development. Supported by this strategy, companies can freely experiment their innovative solutions in these six cities. All data, experiences and standards are shared between stakeholders (6Aika 2019).



Fig 3: The Six City Strategy

More broadly, Helsinki has been proactively learning best practice from other regions internationally. For example, from experiences once shared by Amsterdam, Helsinki learned to appreciate the bottom-up Smart City culture. A more recent partnership with TNO resulted in indicators to follow up smart city successes in the Kalasatama district. Helsinki is also part of a Smart City network that spreads through the Nordic region, as they share similar infrastructural and environmental challenges. From this network, Helsinki learns for example from Copenhagen on innovations that make the city more resilient towards climate change.

No matter it is administrative restructuring within the Helsinki metropolitan area, in Finland, or international benchmark exercise, Helsinki demonstrated what Miao and Phelps (2018) termed the state Intrapreneurism in advancing the smart city practice.

Smart City 3.0

As mentioned earlier on, Helsinki is appreciating a bottom-up approach in trialing smart city solutions. Traditionally, the Finns are very down-to-earth and self-reliance, who believe in self-development and human capital, as demonstrated by the setting up of education system by local educational groups (Bell and Hietala 2017). This echoes the remark from our interviewee from Helsinki Smart and Clean Institute:

‘Helsinki is following our nature to promote a citizen-centric approach. We are very laid back. There is not much of a hierarchy in our society and institutions. Our Mayor could be talking to citizens in different neighborhoods...I think such grassroots approach comes from our welfare state tradition. For example I take it for granted that I have a say for the city...our democracy is more of a dialogue in nature (compare to Barcelona); demonstration is more of a minor and less common thing’ [interview: 16th Oct 2019].

So for some commentators, ‘functional’ is a term that is synonymous with Finland and its capital city Helsinki. But as part of its 2017-2021 strategic plan, Helsinki aims to take this one step further by becoming the ‘most functional city in the world’. Together with residents, the city is rallying to create coordinated, efficient and humane public services which will make everyday life easier for citizens. Stara undoubtedly has a pivotal role to play in this roadmap. As the city pushes ahead with its five-year plan, Sami Aherva, the Head of Stara Logistics, points out that whilst technology is a vital tool, the primary focus will always be on the needs of citizens:

‘The strategy hopes to make Helsinki competitive on a global scale. It’s a pretty bold aim. We don’t want to be among the top 10; we want to be the most functional city in the world. We are going to remodel our services and enhance the lives of our citizens through technology. However, this will be based on citizen demand; we’re going to make sure that we listen to every single inhabitant to create a meaningful city structure... We are trying to solve real problems for real people in Helsinki. It’s not just about data: it’s about better decisions and better approaches to city issues. When it comes to our services – be they technical, street maintenance, construction or logistics – we don’t want to deliver services the way we always have. We want to collaborate with these innovators and networks to renew and improve our city. This program is very much about social capital; it’s about improving the quality of life for our residents and our companies’ (Mullan 2018).

Digitisation goes hand in hand with the City of Helsinki’s five-year strategy. Ilpo Laitinen, Head of Stara Administration, argues that this accessible data has not only made the city more transparent, but it has also helped to foster citizen engagement.

“Through the open data project, one of the data sets that you can access is the city’s decision-making data which helps to make this an increasingly transparent process. At the same time, Helsinki also wanted to create an open source services platform whereby companies, SMEs and

even residents can work together to develop our own services. We are at that stage where we are now developing our services and engaging citizens to be a part of the process. Our coders follow certain codes of conduct and guidelines, to ensure that they're making services based on citizens' needs, rather than experimentation," Laitinen adds (Mullan 2018).

By creating participation engagement programmes and making residents a part of this journey, the Nordic capital isn't implementing technology for technology's sake but rather is implementing digitally-savvy public services which are community based. Additionally, the City of Helsinki has encouraged locals to 'Reboot the City' by hosting a series of hackathon events. This has led to the creation of 'helper' – an app which provides optimal routes for Helsinki winter maintenance crews, as well as Call Plate, an automation technology which alerts car owners when they have parked in restricted places.

As Helsinki's 2021 deadline inches closer, Aherva from Stara says that the city will not only transform its processes and technologies, it will also *"change the whole culture of the city."* He says: *"The city's services are going to transform. It's a game-changing type of approach. The role of the public and private sectors will no longer be black and white: it's more collaborative. Helsinki is the platform that many companies could try something new"* (Mullan 2018). In this regard, Helsinki is also starting to embrace a more entrepreneurial approach in marketing its smart city approach, like what Barcelona has been doing since early 2000s.

Reflective summary

1. Smart city development will not work in low density places, as re-emphasized by the Economic Development Manager in Espoo: *'All of our investments are centered around the five urban hubs. Transport system linking within and between these hubs are also important'*. If the pre-condition is low density, like in the case of Chung Hsing New Village, providing transport access is of crucial importance as both the cases of Espoo and Teka revealed.
2. Try working with, and sometimes around, your heritage. Again this was implied by our interviews with the city of Espoo – a purposely planned 'Garden City' with relatively low density population, high percentage of green space, low rise buildings, and high car dependency. Working with the city's history was shown by setting up the *'Espoo Innovation Garden'* programme. According to our interviewees, the reason was because Espoo has always been a Garden City. So the idea is for every residence in Espoo to become a 'Gardener'. But it also has to work around the heritage from time to time. This was reflected in mixed land use and high-rise building, both of which are alien to the city. So it was the city center

around the metro station that got density development. But the government was also clear in thinking of building a growth corridor linking Espoo to the wider city regions and to Europe.

3. This leads to the third recommendation to Chung Hsing New Village: establishing partnership both physically and symbolically with the economic centers in Taiwan. Chung Hsing is in an awkward situation at the moment with limited public transport linkage and almost non-existent economic and social connections with the major cities in Taiwan. The development strategy of Espoo is of significant relevance here. On the one hand, Espoo joined the 6Aika in order to collaborate with its neighboring cities; on the other, Espoo has been strategically extending its connection with EU-wide centers of growth. The city even developed its own philosophy of smart growth – ‘the City as service’, i.e., the whole city is presented both as provider but also testbed of services to facilitate people’s life.

4. Interview with the officer from Teka, where Nokia was planning to build a big office site but never realized it, shed more light on the opinions for Chung Hsing New Village:

‘At the moment this site is primarily for residential...we do not have many people around during daytime as they all work somewhere else. There is no rail access here which exacerbates the difficulty of attracting offices...we keep this as a living lab area. I do not want to plan everything, because plans can become out of date every quickly...I also think development should take small step, such as 3-year cycle. This gives you reality to think about what people want and to deliver that’ [interview: 17th Oct 2019].

The hidden message therefore, is to keep the planning flexible and implement it in small time framework. So that trial projects could be tested and the land could be flexible for future changes.

5. Several interviewees from Helsinki remarked that, the biggest challenge that Helsinki saw in developing a smart city is the integration of new systems into old ‘legacy’ systems. Since the inert transformation of the built environment always slows down Smart City development. One remedy given by our interviewees, was to immediately take action, but to do so in a gentle way by taking small steps. Agile methods and pilot projects can be the key to the solutions in this. The operating model of Forum Virium Helsinki is based on user-driven open innovation through an agile development manner.

Recommendation

According to Aurigi (2006), one *“major limit of far too many ICT-based regeneration initiatives in Western cities has been a somehow enthusiastically deterministic way to see the effects of information technology on urban functions.”* In the late 1990s, Graham and Marvin (1999) reached the same conclusion after analyzing a series of international strategies and projects developed by different cities in order to use ICTs for supporting urban development. As pointed out by these two authors, in fact, these types of initiatives *“are often intimately connected with utopian and deterministic ideas of technology’s beneficial and linear impacts upon the social, environmental and spatial development of cities [and their] real benefits [...] to localities may be dubious or massively overblown because they remain inappropriate to real local needs.”*

This situation seems to be caused by difficulties in understanding that integrating ICTs in urban areas is much more than a technological matter and placing too much emphasis and preoccupation on infrastructures and devices can be misleading and dangerous (Aurigi, 2005; 2006; Graham, 2000; Mino, 2000). For this reason, cities aspiring to become smart need to proceed with great caution and adopt an approach that allows them to look beyond technology and consider other non-technical yet crucial factors. This is what the City of Barcelona and Helsinki have been doing during the development of their smart city strategies, thanks to an approach in which the technological component has been rightly combined with several “human factors” (Nam and Pardo 2011) which have been essential to the success of their initiatives. These include a citizen-centric approach, strong leadership, and political commitment (Hill et al., 2011). In this way, it has been possible to manage the complex organizational context that has allowed for the planning and implementation of the strategy. Moreover, an interdisciplinary environment in which sectoral and departmental separation has been gradually eliminated in favor of cross-collaboration.

What are the general implications to Taiwan and to Chung Hsing New Village in particular? We have come up with the following ten recommendations

1. ***Understanding your culture and socio-economic conditions before planning for smartness.*** In both Barcelona and Helsinki, we see the influence of their political and cultural heritages on the thinking and implementing of smart city strategies – sometimes converge but most often divergent. There is no benefit fighting against who you are and what your people are valuing about. Instead, being clever in using and mobilizing these cultural traditions could help win voters’ support and

facilitate the implementation process. A good case in point here is the e-democracy movement in Barcelona and the ‘one more hour per day’ slogan in Helsinki. They are rooted in the local history and discourse, and people understand and welcome them.

2. ***Understanding your citizens’ needs beforehand.*** We see a universal movement from techno-centric to citizen-centric approach in smart city construction worldwide. Of course this does not necessarily mean city leaders have to give decision power to citizens completely; instead, this is about building trust; and offering communication channels through which residences can have their voice heard and their opinions respected. Here Lee and Lee (2014)’s citizen-centric typology for smart city services provides a starting point to understand what do we mean by a ‘citizen-centric’ approach. Their proposed typology consists of four dimensions, including: mode of technology (automate–informative–transformative), purpose of service (hedonic–utilitarian), service authority (voluntary–mandatory), and delivery mode (passive–interactive). The last two dimensions are of particular interest here. For service authority, ‘voluntary’ services are defined as services in which service beneficiaries can intentionally pick the time or contents of services; whereas ‘mandatory’ services are provided regardless of the will of citizens. The delivery mode captures the relationship between customer and providers. A passive service is a service processed without the need to obtain any feedback from service consumers; while ‘interactive service’ requires a customer's input and reaction in order to process the service. Therefore, a gradual shift from mandatory and passive to voluntary and interactive in providing smart services might be the way forward.
3. ***Involving residences in the planning and implementation process.*** This is one step further compared to point 2, but it does require a fundamental re-think of administration culture and a re-structure of hierarchy to embrace this suggestion. Like our interviewee, the Commissioner for Participation in Barcelona remarked, *merely giving citizens the platforms to discuss issues is not participation. It is only when citizens can jointly decide on these issues, that a truly democratic society is emerging.* Another benefit of involving residences in the implementing process, as several interviewees in Helsinki rightly pointed out, is to discover problems earlier and to find solutions before formal actions could be taken by the government. A good example here is the Living Labs exercise in Helsinki (Hielkema and Hongisto 2013). By bringing challenges to the developer community and supporting the resulting applications in the media, these labs drive the use of Open Data and further the Smart City development. Through using the innovative capacity of the participants in the competitions, they were able to raise awareness to the new possibilities that were

offered by the Open Data. The new startups and the growth of the SMEs in the emerging Mobile Application Cluster in Helsinki Region is evidence of the strength of these Living Labs. Therefore a relatively easy start for Chung Hsing New Village, is to organize one planning/foresighting competition in designing the space; and then hold regular competitions in the smart city application domains, so to make Chung Hsing the destination for SMEs and start-up to showcase their ideas.

4. ***Low density doesn't work for smart city.*** This is a warning given by officials in both Barcelona and Helsinki, as almost all smart city applications, no matter in the domains of environment, transport, government, education and infrastructure, aim to solve people's problems and facilitate live and work. Therefore increase population in Chung Hsing New Village should be a key priority for the government. There are different approaches of doing this. One of the highly recommended approach from Barcelona, as mentioned earlier on, is to set up a university campus (especially top universities), so a critical mass could be assembled quickly. Students are also big consumers of services and retails functions, so will stimulate other businesses to grow. Barcelona 22@ has been successfully ticked start with the relocation of the media and art faculty there. Another potential solution is to attract branches of established Taiwanese companies and/or international corporations. This is achievable if the right preferential policies and incentives are offered. This approach is similar to the science/industrial park model, and has been successfully applied in Taipei City. But the downside is the lost of public revenue and the complicity of land ownership in Chung Hsing. It is also important to leverage synergy between this village and its surrounding growth centers to make this model work. The last potential is to attract major public entities as what has been done in Sejong, South Korea (Kang 2012). But for this approach to work, Chung Hsing New Village should be prioritized in political agenda and supported strongly by public sectors from different levels – or at least in Taizhong City for minimal effect. Ideally, the Taiwan government could also delegate some of its central functions there to make Chung Hsing an essential visiting point. Comparing the three potential approaches, we think the first one could be the easiest to pursue, which also suffer less uncertainties in the future.
5. ***Infrastructure and transport connection are crucial.*** This is drawn from the strong implication from our visit of Espoo and its industrial area of Kera. Having an important transport hub within or near Chung Hsing will facilitate its accessibility – which to us is a major obstacle for its development at the moment. Surrounding this transport hubs and along the transit-oriented development corridor, Chung Hsing could further attract offices, residentials and retail functions,

making it dynamic and lively again. More important, smart transportation system could be trialed here and rolled out more widely in other cities. Drawing on the good practice in Taipei, New York, Singapore and London, some plausible projects could include: traffic monitor system of freeway to increase the efficiency and safety of freeway; personalized traffic guidance for customized information; parking lot guidance system; an integrated information dashboard that combine data from public and private travel; an environmental impact monitoring system; and travel-sharing platforms. Actually, Chung Hsing New Village could host research centers and competitions on these ideas and become the ‘brain’ of transport in Taizhong.

6. ***Garnering strategic partnership and networks with leading smart centers.*** It is becoming important to learn and exchange best practices across cities and regions. Both Barcelona and Helsinki are very proactive in this regard. Besides joining the Spanish Network of Smart Cities, Barcelona has partnered with Amsterdam in trialing its DECODE project; and working with New York and London in leading the global debate on smart city practice. For Helsinki, it is active in the Nordic Smart City Network, which is a collaboration project between five countries, five capitals, and fourteen cities to explore the Nordic way to create livable and sustainable cities. Within Finland, the 6Aika initiative mitigates the potential competitions between the six cities and create a bigger market for smart city solution providers. Chung Hsing New Village, therefore, needs to proactively set up partnerships with other leading smart cities in Taiwan first, and then explore international smart city platforms in the long run. Based on Yueh (2010)’s calculation of smart city ranking in Taiwan, the first layer smart cities were: Taipei city, Hsinchu city, Taichung city, Taipei country, Taoyuan country, Kaohsiung city, Miaoli country and Keelung city. We could suggest Chung Hsing to establish strong partnership with Hsinchu city and Taichung city in the first instance, given their leading position and geographical proximity. It could also trial twinning with Hsinchu by providing experimental and trial spaces and facilities to companies in Hsinchu. At the same time, Chung Hsing might also benefit from the reversed brain drain that has been supporting Hsinchu’s extraordinary development in the last three decades.
7. ***Being flexible in land usage.*** Although the concept of smart city started emerging in 2008 and by now there are a handful of organizations established to study the trend, promote standards and best practice, and benchmark cities against each other, the whole smart city market is still embryonic, and ‘best practice’ comes and goes frequently. Therefore to avoid being ‘locked’ in one or a few technological solutions, it is advisable to keep flexibility in mind when drafting Chung Hsing New

Village's smart development strategy, and being flexible in land allocation. This is also why we suggested establishing several experimental zones in Chung Hsing to start with, in order to identify what works and what not through a trial-and-error process. Good examples are drawn from Kera and Kalasatama. For the former, the local government retains a proportion of land vacant before it knows for sure what best use to put in. For the latter, an experimental approach was taken. New solutions and projects were often jointly submitted to the city council by citizens groups and private sectors. All these experimental sites are relatively small, as the purpose was to agile testing instead of permanent constructing.

8. ***Being committed but taking small steps.*** This recommendation follows the above in allowing rooms for further development and alternations. Yet the public sector, as the main driver and often the financial supporter to smart city initiatives, need to have a long-term perspective in expecting returns from its investment. Castells and Hall (1994) once reminded us that, in order to build synergy between different elements in a science park, a decade's commitment was often required. The same applies to smart city. Once strong government commitment is in place, we recommend small steps in launching new projects. This is partially due to the cultural heritage that smart cities need to work with or around; partially due to the high risk, and high return nature of many smart city programmes. One effective way of mitigating project failure is through close monitoring, accounting, in-time adjusting and quick feedback mechanism (Miao 2018). Taking small steps also give policymakers and project leaders the time to examine other cities' practice, learn lessons and improve their own projects. Both Barcelona 22@ and Kalasatama for example, have demonstrated the importance of small improvement but long-term commitment.
9. ***Bringing private sectors on board.*** No smart city projects would be financially sustainable if there are no private partners on board. In the case of Barcelona 22@, for example, the city council had innovatively introduced a new land usage category – the '22a', in order to encourage land exchange and industrial transformation. Now with its Superblock model, the city government has once again brought in CISCO and other domestic companies to jointly fund the initiative in exchange for piloting their transport monitoring systems. In Helsinki, the traditional welfare state mind-set is changing as policymakers realize the limitations on public sectors for intervening in economic affairs. By providing Open Data, Helsinki has successfully attracted the attentions from not only domestic companies, start-ups but also multinational corporations, which is arguably the single most effective policies that the city government has ever launched in supporting private participation.

Therefore to regenerate Chung Hsing New Village through smart and sustainable approach, private partners are important and crucial in its long-term viability. It requires innovative public-private partnership, given the land ownership complicity, to attract private interests. It also requires novel legal settings to protect companies' interests for the long run.

10. ***Identifying your niche and build an international reputation around it.*** The benefits of building a unique reputation in the smart city market are twofold. First, reputation attracts private companies. In both Barcelona and Helsinki, the city councils have introduced similar ideas of 'city as lab' and encourage private companies to trial their innovation solutions. The city then issue certifications to these companies, which, given the strong reputation of both cities in smart city filed, bear substantial credit for the companies to then sell their products to other markets. Second, reputation boosts citizens' confidence and help to generate a unified discourse around who they are and what they are good at. In Barcelona, for example, their e-democracy platform has given residences stronger trust in their leaders. In Helsinki, the slogan is the 'most functional city in the world', which captures the image of Finns nicely and unified its populace to further its smart city ambition. The transformation from public managerialism to entrepreneurialism (Harvey 1989) is seemly none-reversible and unavoidable. The key, then, lies in identifying and garnishing your best-selling point to the world, consistently and innovatively.

Adopting all these recommendations takes time, vision and leadership. But with Chung Hsing New Village, at least we are starting somewhere!

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