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Master's Thesis of Fine Arts·Design

# Built-from\_Zero Smart Cities: A Critique

무에서 탄생된 스마트 시티에 대한 비판

August 2018

Graduate School of Design  
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# Built-from\_Zero Smart Cities: A Critique

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# Abstract

## Built-from\_Zero Smart Cities: A Critique

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The world is urbanizing and to address the challenges accompanying this, governments and city-makers are employing technology in the form of Smart Cities. Smart Cities can take many forms: the most common are either created from zero or existing cities are retrofitted into “smarter” cities. In both cases, the concept of the Smart City is based on a sustainable city built on Information and Communications Technology (ICT), infrastructures that enhance the quality of life for the inhabitants. The research question proposed by this thesis asks what makes a city a desirable place for quality living? Although Smart Cities can provide advantages, such as a sustainable urban ecosystem and a safer urban environment, Built-from-Zero Smart Cities are not present in Smart City Index ratings. This thesis examines four critiques of the Smart City model: (i) Built-from-Zero Smart Cities are money-making “products” for stakeholders that provide a combination of smart devices, and applications that deliver a specific solutions for technologies such as smart lighting, parking and waste management; (ii) Smart Cities are perceived as the start of a dystrophic future urban environment; (iii) Smart Cities are particularly vulnerable to cyber-crime; and (iv) the Smart City model produces cities characterized by social polarization.

This thesis examines Songdo as a case study of Built-from-Zero Smart Cities. It argues that market and scholarly attention about Smart Cities focuses on hyper-technology and sustainability, but fails to address its impact on social life, on the quality of life in such a manufactured city. This thesis advocates that for Built-from Zero Smart Cities to reach higher levels of quality living and be included in the Smart Cities indexes, more attention must be given to the relationship between the physical spatial environment and social life.

**Keywords:** Smart Cities, Songdo, Built-from-Zero, social life, spatial environment, quality living.

**Student Number:** 2014-25253



## 초록

인류는 점점 도시화되고 있고 그에 동반되어 따라오는 도시 환경 문제들을 관리하기 위해 정부들과 도시를 건설하는 사람들은 한 해결책으로 첨단 기술을 사용하고 있다. 일부 경우에선 스마트 시티들이 무(zero)에서 탄생되고 있으며 이미 자리 잡은 도시들은 “더 스마트한” 도시로 탈바꿈하는 중이다. 스마트 시티의 컨셉은 정보 통신 기술(ICT)과 주민들의 삶을 더욱 운택하게 할 의도로 건설된 인프라들을 바탕으로 건설된 지속 가능한 도시를 그린다.

본 논문의 중심 연구 문제는 어떤 것이 도시를 양질의 삶을 누리기에 바람직한 장소로 만드는가 하는 것이다. 스마트 시티가 지속 가능한 도시 생태계와 더욱 안전한 도시 환경 같이 여러 장점들을 제공할 수 있긴 하지만, 무(zero)에서 탄생된 스마트 시티들은 거의 사람이 살고 있지 않으며, 따라서 어떤 스마트 시티 지수에도 나오지 않는다. 이 문제에 대한 답을 찾기 위해 본 논문은 스마트 시티 모델에 대한 다음 4가지 주요 비판들을 분석하려 한다: 스마트 시티는 주주들을 위한 돈을 버는 마케팅 트렌드로서-예를 들어 스마트 조명, 주차 및 심지어 쓰레기 관리를 위해 한 구체적인 해결책을 전하는 스마트한 장비들과 애플리케이션 프로그램들의 조합일 뿐이라는 비판; 스마트 시티는 도시 환경에 급격하게, 비정상적인 영향을 미친다는 비판; 스마트 시티는 사이버 범죄에 취약하다는 비판; 및 스마트 시티 모델은 사회적 양극화를 지지하는데 이용되어 왔다는 비판.

무에서 건설된 스마트 시티인 송도를 한 사례 연구로 이용한 본 논문은 스마트 시티에 대한 시장과 학계의 관심은 주로 하이퍼-테크놀로지와 지속 가능성으로 쏠려 있으며, 사회 생활의 역동성이 도시 환경에 미치는 영향에 초점을 맞추지 못하고 있다. 본 논문은 이미 자리 잡은 도시들이 스마트 도시로 탈바꿈했다는 점에서 무에서 건설된 스마트 시티가 타당할 수 없다고 주장하는 것이 아니라, 도리어 질적으로 더 나은 삶에 도달하려는 이들 경우엔, 사회 생활과 공간 환경의 관계에 대해 더 많은 관심을 가져야 한다고 강력히 주장한다.



# Chapter 1. Introduction

## 1.1. Issues

In 1950, 70% of the world population used to reside in rural areas. In 2007, for the first time in history the percentage of people living in urban areas started to be higher than the population living in rural areas<sup>1</sup> (Fig. 1). In 2014, The United Nations World Urbanization Prospects Report estimated that almost half of the world's population lived in urban areas. In 2014, statistics demonstrated that 3.9 million resided in cities, and the most populous urban centers of the world were Tokyo (38 million), Delhi (25 million), Shanghai (23 million), and Mexico City, Mumbai and São Paulo (each about 21 million).<sup>2</sup>

By 2030, the world is projected to have 41 mega-cities, which means each city will have more than 10 million inhabitants.<sup>3</sup> Going by this trend, it is predicted that by 2050 the world's population will increase by 2.5 billion people,<sup>4</sup> and two-thirds of humankind will be living in cities.<sup>5</sup> Thus, the world is gradually becoming urban: "cities are the future of humankind"<sup>6</sup> as alleged by Colin Harrison and Ian Abbott Donnelly. Cities work as a complex and giant hub that enhances communication among people, cultural activities and

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<sup>1</sup> United Nations, Department of Economic and Social Affairs, and Population Division, *World Urbanization Prospects: The 2014 Revision: Highlights*, 2014, 7.

<sup>2</sup> Ibid., 8.

<sup>3</sup> Ibid., 12.

<sup>4</sup> Ibid., 7.

<sup>5</sup> Ibid.

<sup>6</sup> Colin Harrison and Ian Abbott Donnelly, "A Theory of Smart Cities" Proceedings of the the 55th Annual Meeting of the International Society for the Systems Sciences University of Hull Business School, UK, 2011, 1-15.

<http://www.interindustria.hu/ekonyvtar/en/Smart%20cities%20and%20communities/Publications/A%20theory%20of%20smart%20cities.pdf>.

economic welfare; however, there are challenges.

Challenges of urbanization includes the Urban Heat Island (UHI)<sup>7</sup>: an urban agglomeration affected by overheating occurred as a consequence of the high number of human activities. Another factor that causes UHI are the materials used for constructing infrastructure in cities such as asphalt, concrete, and bricks. In fact, daily heating absorbance of urban areas is greater than its rural surroundings that are significantly greener. So, it is not surprising that city authorities are hedging their bets at making cities greener through vertical forests, indoor green walls etc. Scientists contend that UHI could be one of the major cause of global warming and climate changing. For instance, according to a study on China financed by NASA and run by the Georgia Institute of Technology “rapid urbanization in southeastern China in the past 25 years is responsible for an estimated warming rate much larger than previous estimates for other periods and locations [...] These results are further evidence of the human impact on climate.”<sup>8</sup>

One of the biggest challenges of metropolitan areas in the twenty-first century is the logistical management, such as transportation logistics and government logistics, due to both rapid urbanization and population growth. These challenges include issues such as air quality and water pollution, squatter settlements, inadequate public infrastructure, transportation defects, and health risks. Due to these challenges, urban planners and city authorities are increasingly being required to enact and implement sustainable development solutions to the problems arising out of this steady growth of cities. To resolve these issue, policymakers and businesses are promoting the creation and retrofitting of cities into

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<sup>7</sup> Liming Zhou and Robert Dickinson, “Heating Up: Study Shows Rapid Urbanization in China Warming the Regional Climate Faster than Other Urban Areas,” *Georgia Tech Research News*, June 22, 2004, <http://gtresearchnews.gatech.edu/newsrelease/china-climate.htm>.

<sup>8</sup> Zhou and Dickinson, “Heating Up.”

Smart Cities.<sup>9</sup> The Smart City phenomenon has become a trend and a panacea to urban problems.<sup>10</sup> This is evident in the astonishing growth in the number of articles, media and publication about the subject between 1995 and 2017<sup>11</sup> (Fig. 2).

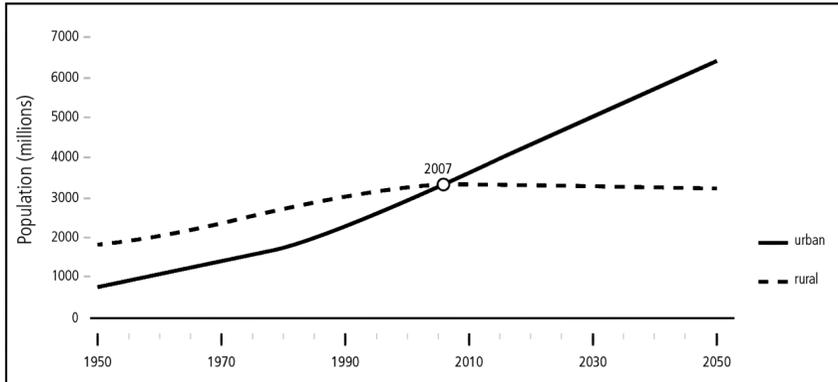


Fig. 1. Data and prospects of the global population residing in urban and rural areas from 1950 to 2050. (Source: United Nations, World Urbanization Prospects: The 2014 Revision Highlights, 7.)

<sup>9</sup> Ayona Datta, “A 100 Smart Cities, a 100 Utopias,” *Dialogues in Human Geography* 5, no. 1 (March 2015): 49–53, <https://doi.org/10.1177/2043820614565750>.

<sup>10</sup> Ayona Datta, “New Urban Utopias of Postcolonial India: ‘Entrepreneurial Urbanization’ in Dholera Smart City, Gujarat,” *Dialogues in Human Geography* 5, no. 1 (March 1, 2015): 3–22, <https://doi.org/10.1177/2043820614565748>.

<sup>11</sup> Johan Colding and Stephan Barthel, *An Urban Ecology Critique on the “Smart City” Model*, *Journal of Cleaner Production*, vol. 164, 2017, 95–101, <https://doi.org/10.1016/j.jclepro.2017.06.191>.

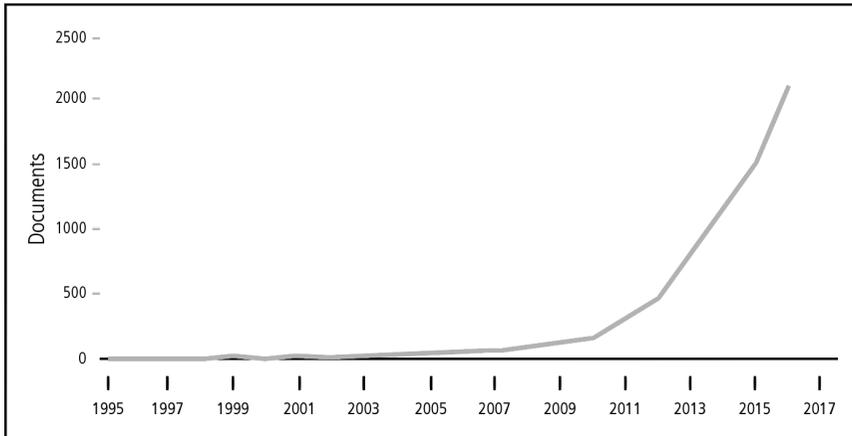


Fig. 2. Growth of documents speaking about the “Smart City” model. (Source: [goo.gl/9zVTce](http://goo.gl/9zVTce)).

## 1.2. Purpose of Research

This thesis addresses the negative implications of the Smart City phenomenon, aiming to identify some of the challenges that it presents for policymakers and stakeholders. This study aims to highlight the major trends of how the Smart City phenomenon is influencing the livability of cities. This research raises the issue of what makes a city livable, and what is desirable for city life. This thesis aims to critique the Smart City paradigm with its unbalanced focus on technology and sustainability.<sup>12</sup> The purpose of this thesis is not to propose the abolishment of technology, but to demonstrate that it alone does not assure quality living. Smart Cities should not forget to direct their attentions to adaptability, accessibility, diversity and Social Life and their capabilities instead of focusing primarily on ICTs and high-tech technology.<sup>13</sup>

<sup>12</sup> Chris Richter, Sascha Kraus, and Pasi Syrjä, “The Smart City as an Opportunity for Entrepreneurship,” *International Journal of Entrepreneurial Venturing* 7, no. 3 (2015): 211-226, <https://doi.org/10.1504/IJEV.2015.071481>.

<sup>13</sup> Leonidas G. Anthopoulos, “Understanding the Smart City Domain: A Literature Review,” in *Transforming City Governments for Successful Smart Cities*, ed.

Built-from-Zero Smart Cities have the opportunity to create the perfect “smart” urban environment. They also have to create social life from zero and urban form. Retrofitted Smart Cities at the top of Smart Indexes such as London and New York already have established social matrices. This thesis aims to address the reason why Built-from-Zero Smart Cities, like Songdo, are not present in city indexes. Their goal of answering if the Smart City’s main ingredient alone, technology, is able to provide quality living. Songdo has been selected as a case study for various reasons: it is the first U.S.-South Korean real estate joint initiative,<sup>14</sup> has been argued as the first large-scale new city planned as Smart and international business district,<sup>15</sup> the other Built-from-Zero Smart Cities did not land the same fame and completion that Songdo reached. Aside from being one of the most progressed Built-from-Zero Smart Cities so far, there is a vast amount of freely accessible data related to Songdo available.

### 1.3. Literature Review

#### *Smart City*

The literature about Smart Cities details positive accounts of the Smart City phenomenon by focusing on various aspects, especially its technological,<sup>16</sup> entrepreneurial,<sup>17</sup> and sustainability<sup>18</sup>

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Manuel Pedro Rodríguez-Bolívar (Cham; Switzerland: Springer, 2015), 9–21, [https://doi.org/10.1007/978-3-319-03167-5\\_2](https://doi.org/10.1007/978-3-319-03167-5_2).

<sup>14</sup> Benedikt Olesya, “The Valuable Citizens of Smart Cities: The Case of Songdo City,” *Graduate Journal of Social Science* 12, no. 2 (April 2016): 17–36.

<sup>15</sup> Olesya, “The Valuable Citizens of Smart Cities,” 17–36.

<sup>16</sup> Richter, Kraus, and Syrjä, “The Smart City as an Opportunity for Entrepreneurship,” 211–226.

<sup>17</sup> Annalisa Cocchia, “Smart and Digital City: A Systematic Literature Review,” in *Smart City*, ed. Renata Paola Dameri and Camille Rosenthal-Sabroux (Cham; Switzerland: Springer International Publishing, 2014), 13–43, [https://doi.org/10.1007/978-3-319-06160-3\\_2](https://doi.org/10.1007/978-3-319-06160-3_2).

characteristics. Proponents of Smart Cities are mainly private companies and municipalities.<sup>19</sup> The majority of blogs, articles, and policymakers' reports neglect the negative outcomes caused by the collaboration of for-profit organizations with governments' initiatives in Smart Cities development, the implementation of Information and Communications Technology (ICT) and monitoring technologies in cities.<sup>20</sup>

Scholarship tends to critique the concept of Smart Cities. The first critique is of the Netherlands who questioned the nomenclature of Smart City, defining it as a label.<sup>21</sup> Other critiques were built upon this about the definition of Smart City, focusing mainly on outlining the confusion of the term "Smart City" itself.<sup>22</sup> In literature reviews various definitions are identified (Table 1).

Various academics have argued that the concept of Smart Cities is defined based on entrepreneurship.<sup>23</sup> For instance, by combining the most applied definitions of Smart City in recent literature, Chris Richter, Sascha Kraus, and Pasi Syrjä assert that "a Smart City is an agglomerated area affected by a high concentration of learning, entrepreneurship and innovation as a result of creative citizens and institutions, as well as the implementation of a digital infrastructure with the overall objective to achieve economic growth and a high quality of life, all while

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<sup>18</sup> Anum Yoon, "How Smart Cities Enable Urban Sustainability," *Triple Pundit*, August 12, 2015, <http://www.triplepundit.com/2015/08/smart-cities-enable-urban-sustainability/>.

<sup>19</sup> Robert G. Hollands, "Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?" *City: Analysis of Urban Trends, Culture, Theory, Policy, Action* 12, no. 3 (November 26, 2008): 303–320.

<sup>20</sup> Cocchia, "Smart and Digital City," 13–43.

<sup>21</sup> Richter, Kraus, and Syrjä, 211-226.

<sup>22</sup> Anthopoulos, "Understanding the Smart City Domain," 9–21.

<sup>23</sup> Ibid.

keeping in mind the scarcity of natural resources.”<sup>24</sup>

Scholars also describe the marketing implications within Smart Cities and the stakeholders,<sup>25</sup> defining the Smart City concept as Utopian<sup>26</sup> and neglecting the dystopian tendencies and cyber security danger of Smart Cities that are mainly formed by blogs and websites such as Forbes,<sup>27</sup> and hinted at by a few scholars such as Anthony M. Townsend<sup>28</sup> and R. Kitchin.<sup>29</sup> The Smart City’s “utopia” has been commented as a tool to generate a positive perception of it, to increase the interests of business elites and diverting the focus from actual urban problems, like urbanization.<sup>30</sup> Moreover, scholars depict the tendency of Smart Cities to privatize urban space<sup>31</sup> creating social polarization. Reinhold Lehel Stadler argued that although the ICTs technologies increase public space

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<sup>24</sup> Richter, Kraus, and Syrjä, “The Smart City as an Opportunity for Entrepreneurship,” 211-226.

<sup>25</sup> Lidia Mayangsari and Santi Novani, “Multi-Stakeholder Co-Creation Analysis in Smart City Management: An Experience from Bandung, Indonesia,” *Procedia Manufacturing* 4 (2015): 315-321.

<sup>26</sup> Amy Glasmeier and Susan Christopherson, “Thinking about Smart Cities,” *Cambridge Journal of Regions, Economy and Society* 8, no. 1 (March 2015): 3–12, <https://doi.org/10.1093/cjres/rsu034>; Ayona Datta, “A 100 Smart Cities, a 100 Utopias,” *Dialogues in Human Geography* 5, no. 1 (March 2015): 49–53; Taylor Shelton, Matthew Zook, and Alan Wiig, “The ‘Actually Existing Smart City,’” *Cambridge Journal of Regions, Economy and Society* 8, no. 1 (March 2015): 13–25, <https://doi.org/10.1093/cjres/rsu026>.

<sup>27</sup> Hatem Zeine, “The Problems with Smart Cities,” *Forbes*, June 19, 2017, <https://www.forbes.com/sites/forbestechcouncil/2017/06/19/the-problems-with-smart-cities/>.

<sup>28</sup> Harrison and Donnelly, “A Theory of Smart Cities,” 1-15.

<sup>29</sup> Rob Kitchin and Martin Dodge, “The (In)Security of Smart Cities: Vulnerabilities, Risks, Mitigation, and Prevention,” *Journal of Urban Technology*, December 12, 2017, 1–19, <https://doi.org/10.1080/10630732.2017.1408002>.

<sup>30</sup> Giuseppe Grossi and Daniela Pianezzi, “Smart Cities: Utopia or Neoliberal Ideology?” *Cities* 69 (September 1, 2017): 79–85, <https://doi.org/10.1016/j.cities.2017.07.012>.

<sup>31</sup> Rama Krishna Reddy Kummitha and Nathalie Crutzen, “How Do We Understand Smart Cities? An Evolutionary Perspective,” *Cities* 67 (July 2017): 43–52, <https://doi.org/10.1016/j.cities.2017.04.010>.

desirability, but also the segregation of individuals.<sup>32</sup> The dissatisfaction around Smart Cities, has been discussed regarding closed planning, state-authored market fundamentalism, reduced social capital addressing inequalities, and land grabbing.<sup>33</sup> Lastly, although the negative implications of Smart Cities has been addressed more frequently by conventionally accredited sources,<sup>34</sup> the topic and proposal of regulations over the urban trend has been extremely scarce and mainly concerned sustainability.<sup>35</sup>

Definition of Smart City	Reference	
“A Smart City is a city well performing built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens.”	Giffinger	Organisation for Economic Co-operation and Development and International Telecommunication Union, eds., <i>M-Government: Mobile Technologies for Responsive Governments and Connected Societies</i> (Paris : OECD, 2011).
“A smart community is a community that has made a conscious effort to use <i>information technology</i> to transform life and work within its region in significant and fundamental rather than incremental ways.”	California Institute	“California Institute,” 2001, <a href="http://smartcommunities.org/concept.php">http://smartcommunities.org/concept.php</a>
“A city to be smart when investments in human and social capital and traditional (transport) and modern ( <i>ICT</i> ) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.”	Caragliu et al.	Andrea Caragliu, “Smart Cities in Europe.,” <i>Journal of Urban Technology</i> 18, no. 2 (2011): 65–82.
“Smart city is defined by IBM as the use of <i>information and communication technology</i> to sense, analyze and integrate the key information of core systems in running cities.”	IBM	“IBM100 - Smarter Planet,” CTB14, March 7, 2012, <a href="http://www.ibm.com/ibm/history/ibm100/us/en/icons/smarterplanet/">http://www.ibm.com/ibm/history/ibm100/us/en/icons/smarterplanet/</a> .

<sup>32</sup> Reinhold Lehel Stadler, “ICTs as a Tool to Increase the Attractiveness of Public Spaces,” *Mokslas - Lietuvos Ateitis* 5, no. 3 (May 6, 2013): 216–228, <https://doi.org/10.3846/mla.2013.39>.

<sup>33</sup> Kummitha and Crutzen, “How Do We Understand Smart Cities?” 43–52.

<sup>34</sup> Cocchia, “Smart and Digital City,” 13–43.

<sup>35</sup> Harrison and Donnelly, “A Theory of Smart Cities,” 1-15.

<p>“Smart City is the product of <i>Digital City</i> combined with the <i>Internet of Things</i>.”</p>	<p>Su et al.</p>	<p>Kehua Su, Jie Li, and Hongbo Fu, “Smart City and the Applications” (IEEE, 2011), 1028–31, <a href="https://doi.org/10.1109/ICECC.2011.6066743">https://doi.org/10.1109/ICECC.2011.6066743</a>.</p>
<p>“Concept of a Smart City where citizens, objects, utilities, etc., connect in a seamless manner using <i>ubiquitous technologies</i>, so as to significantly enhance the living experience in 21st century urban environments.”</p>	<p>Northstream</p>	<p>“Northstream,” accessed April 29, 2018, <a href="http://northstream.se/">http://northstream.se/</a>.</p>
<p>“A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, <i>communications</i>, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens.”</p>	<p>Hall</p>	<p>Doug Schuler, “Digital Cities and Digital Citizens,” in <i>Digital Cities II: Computational and Sociological Approaches</i>, ed. Makoto Tanabe, Peter van den Besselaar, and Toru Ishida, vol. 2362 (Berlin, Heidelberg: Springer Berlin Heidelberg, 2002), 71–85, <a href="https://doi.org/10.1007/3-540-45636-8_6">https://doi.org/10.1007/3-540-45636-8_6</a>.</p>
<p>“Smart City is a city in which it can combine <i>technologies</i> as diverse as water recycling, advanced energy grids and mobile communications in order to reduce environmental impact and to offer its citizens better lives.”</p>	<p>Setis-Eu</p>	<p>“EUROPA - SET-Plan Process   SETIS - European Commission,” accessed April 29, 2018, <a href="https://setis.ec.europa.eu/set-plan-process">https://setis.ec.europa.eu/set-plan-process</a>.</p>
<p>“A smart city is a welded geographical area, in which high technologies such as <i>ICT</i>, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a welded pool of subjects, able to state the rules and policy for the city government and development.”</p>	<p>Dameri</p>	<p>Renata Dameri, <i>Searching for Smart City Definition: A Comprehensive Proposal</i>, vol. 11, 2013.</p>

Table 1. Various definitions of Smart City. (Source: [http://doi.org/10.1007/978-3-319-03167-5\\_2](http://doi.org/10.1007/978-3-319-03167-5_2))

## Quality Living

Quality living, or Quality of Life, is not an easy definable term and it has been delineated by a broad range of researchers in various fields such as international development, healthcare, political science, built environment, education, etc.<sup>36</sup> Broadly, Quality of Life, Charles Montgomery defines quality living as a place that has happy inhabitants because they live in optimal settings where they have opportunities and can prosper.<sup>37</sup> Following on from the definition of quality of life by Greek philosophers such as Aristotle, Constantinos A. Doxiadis, created the Ekistics science of human settlements: A scientific mode of study that considers every kind of human settlement and that focus on geography, ecology, human psychology, anthropology, culture, politics, and aesthetics,<sup>38</sup> argued that in order to achieve happiness and safety, there should be a balance between the five elements of human settlements: maximum contacts, minimum effort, optimum space, quality of the environment, to achieve an optimum in the synthesis of all principles.<sup>39</sup> Hamam Serag El Din defines urban quality of life as a term “*not used to describe some physical features but to describe all the relationship, the dynamics, and the reticular relationship that exist between those physical features.*”<sup>40</sup>

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<sup>36</sup> Hamam Serag El Din et al., “Principles of Urban Quality of Life for a Neighborhood,” *HBRC Journal* 9, no. 1 (April 1, 2013): 86–92, <https://doi.org/10.1016/j.hbrj.2013.02.007>.

<sup>37</sup> Charles Montgomery, *Happy City: Transforming Our Lives through Urban Design*, (New York: Farrar, Straus and Giroux, 2013), 36.

<sup>38</sup> Charles S. Asher, “Constantinos A. Doxiadis. Ekistics: An Introduction to the Science of Human Settlements. Pp. 527. New York: Oxford University Press, 1968” *The Annals of the American Academy of Political and Social Science* 383, no. 1 (May 1, 1969): 212–13, <https://doi.org/10.1177/000271626938300172>.

<sup>39</sup> Constantinos A. Doxiadis, “Ekistics, the Science of Human Settlements,” *Science* 170, no. 3956 (1970): 393–404.

<sup>40</sup> Serag El Din et al., “Principles of Urban Quality of Life for a Neighborhood,” 86–92.

### *Songdo International Business District (IBD)*

Songdo is currently incomplete,<sup>41</sup> but is receiving attention from scholars. The steps to its birth and building process are extensively overviewed by Nir Kshetri, L. Alcantara Lailani, and Yonghoon Park who describe the building of Songdo as an aerotropolis, an urban settlement whose infrastructures, economy and layout are centered on an airport.<sup>42</sup> Sofia T. Shwayri outlines the construction of Songdo, its history and the politics behind it and the validity of the city as an exportable mode of eco-city;<sup>43</sup> other material can be found on the Incheon Free Economic Zone (IFEZ) official website.<sup>44</sup> Chigon Kim, writes that after the 2007 global economic crisis Songdo has been marketed as an eco-friendly city and delves in the politics behind the creation of the city.<sup>45</sup>

Various critiques of Songdo exists. The city's goals have been criticized by Pamela Licalzi O'Connell for "only being a hub for attracting foreign investment."<sup>46</sup> Sondo has also been criticized for not being an "actually existing smart city"<sup>47</sup> by Taylor Shelton,

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<sup>41</sup> Paul Mullins, *The Ubiquitous-Eco-City of Songdo: An Urban Systems Perspective on South Korea's Green City Approach*, vol. 2, 2017, 4-12, <https://doi.org/10.17645/up.v2i2.933>.

<sup>42</sup> John D. Kasarda, "Global Airport Cities," (London: Insight Media, 2010), <http://www.aerotropolis.com/files/GlobalAirportCities.pdf>.

<sup>43</sup> Sofia T. Shwayri, "A Model Korean Ubiquitous Eco-City? The Politics of Making Songdo," *Journal of Urban Technology* 20, no. 1 (January 1, 2013): 39-55, <https://doi.org/10.1080/10630732.2012.735409>.

<sup>44</sup> Incheon Free Economic Zone Authority, "IFEZ 인천경제자유구역," *인천경제자유구역*, Incheon Free Economic Zone, accessed April 29, 2018, <http://www.ifez.go.kr/>.

<sup>45</sup> Chigon Kim, "Place Promotion and Symbolic Characterization of New Songdo City, South Korea," *Cities* 27, no. 1 (February 1, 2010): 13-19, <https://doi.org/10.1016/j.cities.2009.11.013>.

<sup>46</sup> Pamela Licalzi O'Connell, "Korea's High-Tech Utopia, Where Everything Is Observed," *The New York Times*, October 5, 2005, <http://tofulgalaxy.com/wp-content/uploads/2010/11/nytimes.pdf>.

<sup>47</sup> Taylor Shelton, Matthew Zook, and Alan Wiig, "The 'Actually Existing Smart

Matthew Zook, and Alan Wiig in the paper “The 'Actually Existing Smart City” in the Cambridge Journal of Regions, Economy and Society, and of having imaginary utopian goals by Benedikt Olesya.<sup>48</sup> Arthur Seigel, professor of Finance and Entrepreneurial Management at the Harvard Business School, underlines the skepticism about if the quality living of Songdo would have been enough to attract foreign investors in this overnight-built modern Utopia.<sup>49</sup> Paul Mullins, a Research Assistant at The Bartlett Centre for Advanced Spatial Analysis (CASA), through analyzing the evolution of Songdo commented that “selling the U-City [Ubiquitous City] model was prioritized over a fully realizing or conceptualized U-City model.”<sup>50</sup> Also, Nir Kshetri, professor at the Department of Management of the University of North Carolina at Greensboro, highlighted the troublesome relationship between the Korean Government and its partner, the U.S. real estate agency, arguing that both the economic and social benefits of the new Songdo city are yet to be realized.<sup>51</sup> This thesis adds to the existing literature by analyzing how Songdo is performing in offering quality living, and enhancing quality living through the Smart City ideals and questioning if the city by implementing those Smart City ideals can provide-from-zero quality living.

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City,” 13–25.

<sup>48</sup> Olesya, “The Valuable Citizens of Smart Cities,” 17–36.

<sup>49</sup> Arthur I. Segel et al., “New Songdo City,” *Harvard Business School Case 206-019*, September 2005.

<sup>50</sup> Mullins, *The Ubiquitous-Eco-City of Songdo*, 4-12.

<sup>51</sup> Nir Kshetri, L. Alcantara Lailani, and Yonghoon Park, “Development of a Smart City and Its Adoption and Acceptance: The Case of New Songdo,” *Communications & Strategies* 96 (quarter 2014): 113–26.

## 1.4. Method

This thesis was conducted using a qualitative methodology,<sup>52</sup> and including a case study of Songdo, interviews<sup>53</sup>, and a resident survey.<sup>54</sup> The survey was conducted to see how Songdo is perceived as a city. The Songdo Homeowners Association did not respond to the survey. Local and foreign people between the age of 18 and 34 years old, of which 50% male 50% female, responded to the survey. All of the surveyed people are students, and one currently works in Songdo. Two out of the twenty respondents at the time that the survey was undertaken did not reside in the city because of high rent, but both commuted daily to their respective universities in Songdo (Fig. 3).

## 1.5. Outline

This thesis is divided into five chapters. Chapter 1 examines the issues that drove the creation of the Smart City concept, the literature on the subject and the purpose driving this research. Chapter 2 discusses the definition of Smart City, its marketed advantages, the world to be the “smartest” between already established cities retrofitted into Smart Cities, and the phenomenon of the planning and creation of built-from-zero Smart Cities. Chapter 3 examines the disadvantages of Smart Cities, showing that the phenomenon is mixing public and commercial interests across different cities in the world, that its massive promotion of surveillance makes the environment more vulnerable to becoming a dystopia over time, that it is vulnerable to hacking, and that it has

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<sup>52</sup> Norman K. Denzin and Yvonna S. Lincoln, eds., *The SAGE Handbook of Qualitative Research*, 3rd ed. (Thousand Oaks, CA: Sage Publications, 2005).

<sup>53</sup> See Appendix 3.

<sup>54</sup> See Appendix 4.

been used to increase social polarization. Chapter 4 identifies how quality living can be defined. Chapter 5 concludes with a case study and analysis of Songdo to understand if being built from scratch as a Smart City grants the city quality living.

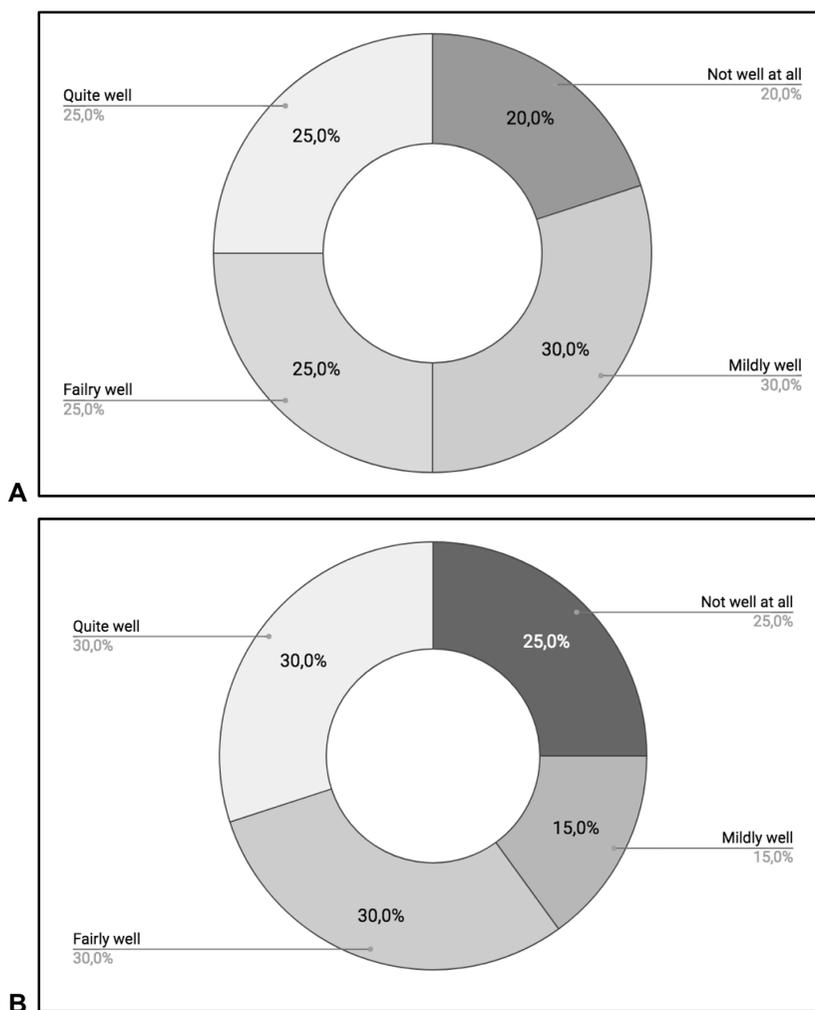


Fig. 3. Survey results, [A] "How well acquainted are you with the concept of Smart City?"; [B] "How well acquainted are you with what Songdo is doing to be a Smart City?", 30 November 2017.

## Chapter 2. Definition of Smart Cities and their Advantages

### 2.1. Historical Precedents

The Smart City phenomenon has no globally accepted definition<sup>1</sup> and each country and city presents its own concept. The developmental goals of the Smart City are under a global debate at the United Nations.<sup>2</sup> In fact, if the term “Smart City” is searched online, the results tend towards sustainability, road maps for institutions for the enhancement of quality of life and green development, usefulness of ICT infrastructure, inclusion of citizens in public life, reduction of digital divide.<sup>3</sup> However, there is no comprehensive or consistent definition for Smart City. The main limitation are the ambiguous meanings associated with the word “smart” and the “Smart City” label such as Knowledge City,<sup>4</sup> Digital

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<sup>1</sup> The Centre for Internet and Society, “Sustainable Smart Cities India Conference 2015, Bangalore,” *Centre for Internet and Society* (blog), September 21, 2015, <https://cis-india.org/internet-governance/blog/sustainable-smart-cities-india-conference-2015-bangalore>.

<sup>2</sup> United Nations Economic Commission for Europe (UNECE), “United for Smart Sustainable Cities (U4SSC),” United Nations Economic Commission for Europe, accessed September 16, 2017, <https://www.unece.org/housing-and-land-management/united-4-smart-sustainable-cities-u4ssc.html>.

<sup>3</sup> Robert G. Hollands, “Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?” *City: Analysis of Urban Trends, Culture, Theory, Policy, Action* 12, no. 3 (November 26, 2008): 303–320.

<sup>4</sup> John Psarras, Kostas Ergazakis, and Kostas Metaxiotis, “Towards Knowledge Cities: Conceptual Analysis and Success Stories,” *Journal of Knowledge Management* 8, no. 5 (October 1, 2004): 5–15, <https://doi.org/10.1108/13673270410558747>.

City,<sup>5</sup> Wired City<sup>6</sup> and Sustainable City<sup>7</sup> (Table 2). The most common definitions are Digital City and Smart City, but over time the “Smart” label has been used more (Fig. 4).<sup>8</sup> Usually, Digital City and Smart City are presented without stating their differences or similarities.<sup>9</sup> Although the Smart City concept is vague, the term “Smart City” can be a first step toward a globally acknowledged definition. Many of today’s Smart City plans have started gravitating towards mitigating the impact of rapid urbanization. In the 1980’s, efforts to handle urban challenges was “New Urbanism,” which aimed at creating more sustainable neighborhoods.<sup>10</sup> In the 1990’s, “Smart Growth” consisting of planning more compact and walkable cities. The most recent “Smart City” concept is an urban planning theory without a globally accepted definition, but largely accepted as a possible solution for quality “future living.”<sup>11</sup>

Concept	Definition	Reference	
<b>Wired city</b>	“Wired cities refer literally to the laying down of cable and	Hollands	Hollands, R. G. (2008). Will the real smart city please

<sup>5</sup> Helen Couclelis, “The Construction of the Digital City,” *Environment and Planning B: Planning and Design* 31, no. 1 (February 1, 2004): 5–19, <https://doi.org/10.1068/b1299>.

<sup>6</sup> Hollands, “Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?” 303–320.

<sup>7</sup> Lorena Batagan, *Smart Cities and Sustainability Models*, vol. 15(3), 2011, 80-87.

<sup>8</sup> Leonidas G. Anthopoulos, “Understanding the Smart City Domain: A Literature Review,” in *Transforming City Governments for Successful Smart Cities*, ed. Manuel Pedro Rodríguez-Bolívar (Cham: Springer, 2015), 9–21, [https://doi.org/10.1007/978-3-319-03167-5\\_2](https://doi.org/10.1007/978-3-319-03167-5_2).

<sup>9</sup> Annalisa Cocchia, “Smart and Digital City: A Systematic Literature Review,” in *Smart City*, eds. Renata Paola Dameri and Camille Rosenthal-Sabroux (Cham; Switzerland: Springer, 2014), 13–43, [https://doi.org/10.1007/978-3-319-06160-3\\_2](https://doi.org/10.1007/978-3-319-06160-3_2).

<sup>10</sup> Geoff Boeing et al., “LEED-ND and Livability Revisited,” *Berkeley Planning Journal* 27, no. 1 (2014): 31–55.

<sup>11</sup> Cocchia, “Smart and Digital City,” 13–43.

	connectivity not itself necessary smart”		stand up? City: Analysis of Urban Trend, Culture, Theory, Policy, Action, 12(3), 303–320.
<b>Virtual city</b>	“Virtual City concentrates on <i>digital representations</i> and manifestations of cities”	Schuler	Schuler, D. (2002). Digital cities and digital citizens. In: M. Tanabe, P. van den Besselaar, T. Ishida (Eds.), <i>Digital cities II: computational and sociological approaches</i> 2362, (pp. 71–85). Berlin: Springer.
<b>Ubiquitous city</b>	“Ubiquitous city (U-City) is a further extension of digital city concept. This definition evolved to the ubiquitous city: a city or region with <i>ubiquitous information technology</i> ”	Anthopoulos et al.	Anthopoulos et al., Architecture for urban development. IEEE 6th International conference on Intelligent Environments, (pp. 301–306). IEEE Xplore.
<b>Intelligent city</b>	“Intelligent cities are territories with high capability for learning and innovation, which is built-in the creativity of their population, their institutions of knowledge creation, and their <i>digital infrastructure</i> for communication and knowledge management”	Komninos	Komninos, N. (2006). The architecture of intelligent cities: integrating human, collective and artificial intelligence to enhance knowledge and innovation. <i>IEEE 2nd IET International Conference on Intelligent Environments</i> (pp. 13–20). IEEE Xplore.
<b>Information city</b>	“Digital environments collecting official and unofficial information from local communities and delivering it to the public via <i>web portals</i> are called information cities”	Anthopoulos et al.	Anthopoulos et al., Architecture for urban development. IEEE 6th International conference on Intelligent Environments, (pp. 301–306).

<b>Digital city</b>	“The digital city is as a comprehensive, <i>web-based representation</i> , or reproduction, of several aspects or functions of a specific real city, open to non-experts. The digital city has several dimensions: social, cultural, political, ideological, and also theoretical”	Couclelis	Couclelis, H. (2004). The construction of the digital city. <i>Planning and Design</i> , 31(1), 5–19 (Environment and Planning).
<b>Smart community</b>	“A geographical area ranging in size from neighborhood to a multi-county region whose residents, organizations, and governing institutions are using <i>information technology</i> to transform their region in significant ways. Co-operation among government, industry, educators, and the citizenry, instead of individual groups acting in isolation, is preferred”	California Institute	California Institute (2001), <a href="http://smartcommunities.org/concept.php">http://smartcommunities.org/concept.php</a> .
<b>Knowledge city</b>	“A Knowledge City is a city that aims at a knowledge-based development, by encouraging the continuous creation, sharing, evaluation, renewal and update of knowledge. This can be achieved through the continuous interaction between its citizens themselves and at the same time between them and other cities’ citizens. The citizens’ knowledge-sharing culture as well as the city’s appropriate design, <i>IT networks and infrastructures</i> support these interactions”	Ergazakis	Ergazakis, M., Metaxiotis, M., & Psarras, J. (2004). Towards knowledge cities: conceptual analysis and success stories. <i>Journal of Knowledge Management</i> , 8(5), 5–15 (Emerald Group).
<b>Learning city</b>	“The term ‘learning’ in ‘learning cities’ covers both individual and institutional learning. Individual learning refers to the acquisition of knowledge, skills and understanding by individual people, whether formally or	The Organisation for Economic Co-operation and Development (OECD)	<a href="http://www.oecd.org/">http://www.oecd.org/</a>

	informally. It often refers to lifelong learning, not just initial schooling and training. By learning, individuals gain through improved wages and employment opportunities, while society benefits by having a more flexible and technological up-to-date workforce”		
<b>Sustainable city</b>	“Sustainable city uses <i>technology</i> to reduce CO2 emissions, to produce efficient energy, to improve the buildings efficiency. Its main aim is to become a green city”	Batagan	Batagan L. 2011 <i>Revista de Informatica Economica</i> , 15(3), 80–87.
<b>Green city</b>	“Green City follows the Green Growth which is a new paradigm that promotes economic development while reducing greenhouse gas emissions and pollution, minimizing waste and inefficient use of natural resources and maintaining biodiversity”	The Organisation for Economic Co-operation and Development (OECD)	<a href="http://www.oecd.org/">http://www.oecd.org/</a>

Table 2. The different meanings of smart city. (Source: [http://doi.org/10.1007/978-3-319-03167-5\\_2](http://doi.org/10.1007/978-3-319-03167-5_2))

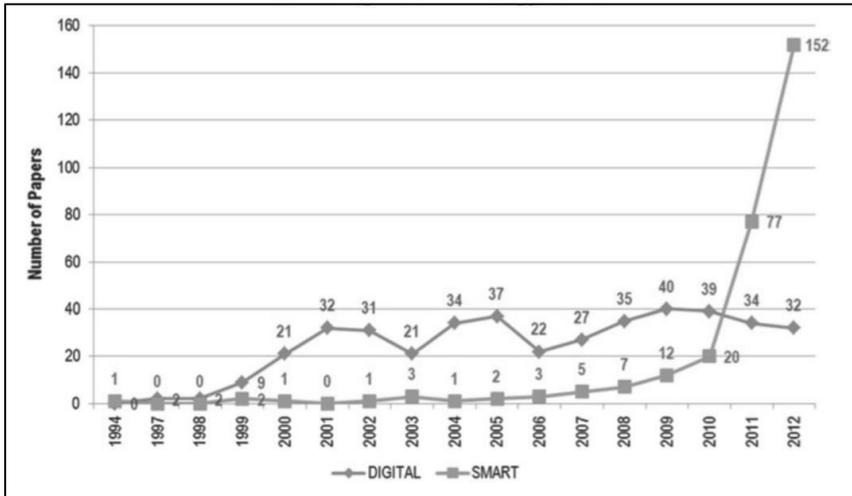


Fig. 4. Annual terminology usage report of the terms Smart and Digital City. (source: [http://doi.org/10.1007/978-3-319-03167-5\\_2](http://doi.org/10.1007/978-3-319-03167-5_2), 28)

## 2.2. Types of Smart Cities

Globally, a Smart City is mainly conceived as a city that uses Information and Communications Technologies (ICT) to serve and protect inhabitants while enhancing their well-being in the process. ICT is now the crux of Smart City infrastructure. As asserted by Anthony M. Townsend, the Smart City concept is an “information revolution,”<sup>12</sup> where “the smartphone becomes a platform for reinventing cities from the bottom up.”<sup>13</sup> The Smart City phenomenon shows how people are finding an answer to a range of urban challenges in technology.

Some urban planners contend that the term Smart City is not a new concept, except that now it is used mostly when referring to ICT cities. According to this school of thought, Smart City is a concept is actually the adoption of the aforementioned Smart Growth theory.<sup>14</sup> The “Smart Growth” theory emerged in the 1990s. It focused on the urban landscape and transportation system. At its core was an emphasis on the steady move towards making technological innovation the heart of modern infrastructure. “The Smart Growth” theory concentrates on the growth of city centers to avoid urbanization.<sup>15</sup>

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<sup>12</sup> Anthony M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*, (New York: W.W. Norton & Company, 2013), xiii.

<sup>13</sup> Townsend, “Smart Cities: Big Data,” xiv.

<sup>14</sup> Colin Harrison and Ian Abbott Donnelly, “A Theory of Smart Cities.” Proceedings of the 55th Annual Meeting of the International Society for the Systems Sciences, University of Hull Business School, UK, 2011), 1-15, <http://www.interindustria.hu/ekonyvtar/en/Smart%20cities%20and%20communities/Publications/A%20theory%20of%20smart%20cities.pdf>.

<sup>15</sup> Hans Schaffers et al., “Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation,” in *The Future Internet: Future Internet Assembly 2011: Achievements and Technological Promises*, eds. John Domingue et al. (Berlin, Heidelberg: Springer Berlin Heidelberg, 2011), 431–46, [https://doi.org/10.1007/978-3-642-20898-0\\_31](https://doi.org/10.1007/978-3-642-20898-0_31).

Since 2005, the Smart City concept was used by companies such as Cisco, IBM, and Siemens to spread the idea of applying complex information systems to incorporate the service of public infrastructure and services such as means of transport, the dispensation of water and electricity, and security for buildings and urban environment.<sup>16</sup> Smart City projects, can be viewed as technological experiments on existing and new cities that aim to manage and mitigate the effects of urbanization. This kind of "smartness" is accomplished through integrating ICT systems into a city's infrastructure.

Hence, the main ingredients are a well-developed and extensive Internet and a steady flow of data. These basic requirements of Smart Cities explain why the first action that a city government is supposed to undertake is to build a broad Wi-Fi network. A Smart City has its structure sustained by three main pillars: life-enhancing, hyper-networked, and sustainability.

### **2.2.1. Life Enhancement**

A Smart City needs to be able to provide a high-quality life to its inhabitants, who in turn have to be active contributors to this distributed and consistent wellbeing. Cities achieve this with excellent performances in six interconnected features: economy, governance, environment, people, mobility, and living<sup>17</sup> (Fig. 5). For example, there cannot be a situation of Smart Living, in which people have extraordinary quality living levels that is not Smart Environmentally. Furthermore, if the inhabitants of a city are not creative with an innovative open-minded attitude it would also not be considered Smart Economy.

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<sup>16</sup> Cocchia, "Smart and Digital City," 13–43.

<sup>17</sup> Townsend, *Smart Cities*, 2.

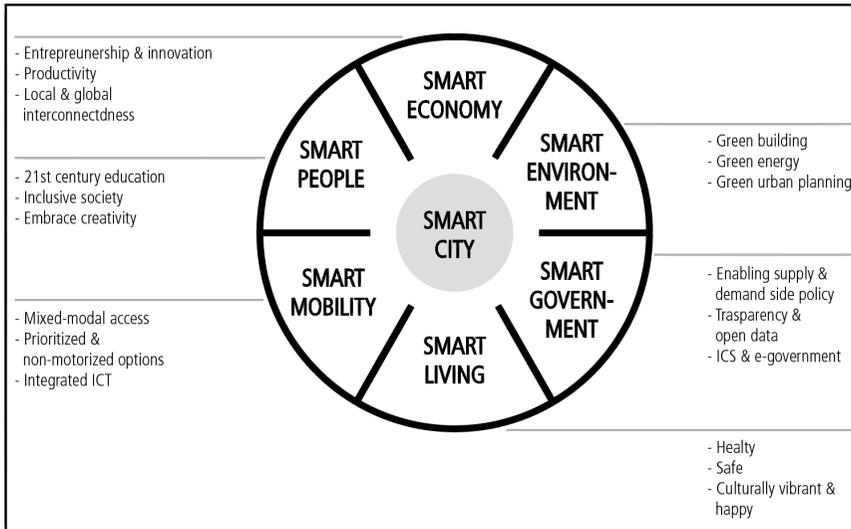


Fig. 5. The Smart City “wheel.” A pie chart portraying the six main Smart features that comprise the Smart City. (Source: <http://www.cognitiv.co.uk/news/all/83/1/> )

A Smart Economy means a competitive city. It consists of a city with innovative attitudes and entrepreneurship, a positive and well-planned economic image, a flexible labor market, and transformational capabilities. A Smart City’s ability to enhance the lifestyle of its inhabitants largely depends on being able to rely on IoT and its sensors that acquire and process big data.

A Smart Government is one that needs to be transparent. Its population needs to participate actively in decision-making processes, it needs to provide excellent public and social services and be active in the creation of political strategies. The Seoul city government is a Smart Government. It is making efforts in implementing the already efficient e-government, which is also listed as one of the best in the world.<sup>18</sup>

A Smart Environment is one that is outstandingly handled and preserved. A city with this goal uses sustainable methods to produce

<sup>18</sup> Seoul Metropolitan Government, “Seoul E-Government. Seoul, Ready to Share with the World!” *Citynet*, 2014, <http://citynet-ap.org/wp-content/uploads/2014/06/Seoul-e-Government-English.pdf>.

energy resources, and manages pollution. For example, since 2008 the City Government of Buenos Aires (GCBA) has managed complaints about the city environment through its Environment and Public Spaces Ministry. The ministry has been collecting the complaints in real time through social media and mobile devices. Any inhabitant can, for example, take a picture of a road in poor condition and tweet it directly with a description and its location. To reduce the energy waste, the GCBA converted 91,000 public street lights to LED technology the city is continuously illuminated without consuming large amount of energy. Every LED has an antenna that connects to a central system providing a real-time insight into power outages, broken lights, and vandalism to the city inhabitants.<sup>19</sup>

In the Smart City concept, Smart People, are defined as being well educated and qualified city inhabitants. They are people with an affinity to lifelong learning, multicultural, creative and open minded. For instance, in Moscow's educational initiatives: the introduction of electronic-grade books, electronic-class registers, class monitoring, and distance "tele-education" classes for people with disabilities.<sup>20</sup> These services enable people with disabilities to have access to distance learning. Through these innovations 90% of people with disabilities finally have the opportunity to be educated.<sup>21</sup>

Another component of the Smart City is the Smart Transports Infrastructures, or Smart Mobility. It is a transports system that is locally and internationally easily accessible, sustainable, innovative, safe, and available through ICT infrastructures. For example, in Curitiba, Brazil, the Smart City projects focus a lot on creating more sustainable and Smart transportation infrastructures, combining new

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<sup>19</sup> Jennifer Alsever, "4 Smart Cities That Put People First," *Wired*, accessed June 13, 2016, <http://www.wired.com/brandlab/2015/10/4-smart-cities-that-put-people-first/>.

<sup>20</sup> Moscow IT Department, "Smart City 2012-2016 Strategy," *LinkedIn* (blog), March 13, 2012, <https://www.slideshare.net/DITMoscow/smart-city-20122016-strategy>.

<sup>21</sup> *Ibid.*

technologies and information technologies to create electro mobility (e-mobility) and an “energy efficient and low-carbon transport services.”<sup>22</sup>

In sum, Smart Living means an outstanding quality of life achieved through cultural facilities, exceptional health conditions, safety, remarkable housing quality and education facilities, touristic infrastructures and social unity.<sup>23</sup> For instance, an innovative Smart Living initiative is being carried out by the Japanese tech company Hitachi. The program essentially incorporates elements of IT and related tech infrastructure to supplement commercial interests of cities alongside boosting their state of security. For example, authorities will be given a real-time notice should there be the risk of overcrowding on a subway platform. A likely response will be to allocate more transport alternatives to alleviate the overcrowding thereby improving the safety and convenience of commuting.<sup>24</sup>

## 2.2.2. Hyper-networked

The second pillar of Smart Cities is that they be connected to devices such as smartphones, tablets, smartwatches, which in turn are connected to the Internet to create a constant flow of data. This data is used to manage the core services of a city from healthcare to public safety, from transport systems to buildings. South Korea is

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<sup>22</sup> KTH Royal Institute of Technology, “Smart City Concepts in Curitiba – Innovation for Sustainable Mobility and Energy Efficiency,” KTH Royal Institute of Technology, accessed March 28, 2017, <https://www.kth.se/en/itm/inst/energiteknik/forskning/ecs/projects/smart-city-concepts-curitiba/smart-city-concepts-in-curitiba-innovation-for-sustainable-mobility-and-energy-efficiency-1.561109>.

<sup>23</sup> Centre of Regional Science, “Smart Cities. Ranking of European Medium-Sized Cities” (Centre of Regional Science, Vienna UT, October 2007), [http://www.smart-cities.eu/download/smart\\_cities\\_final\\_report.pdf](http://www.smart-cities.eu/download/smart_cities_final_report.pdf).

<sup>24</sup> Anum Yoon, “How Smart Cities Enable Urban Sustainability,” *Triple Pundit*, August 12, 2015, <http://www.triplepundit.com/2015/08/smart-cities-enable-urban-sustainability/>.

a world leader for excellent networking and broadband penetration. LG and Samsung, which are among the most powerful companies in the global technology and telecommunication sector, are based in South Korea. It is not surprising that the ICT infrastructure of the country is impressive and 90% of households have fast Internet connection. With the Internet of Things (IoT), globally, South Korea has one of the highest smartphone penetration rates with 4 out of 5 people owning a smartphone.<sup>25</sup> For instance, in Seoul the government offers more than 10,000 free Wi-Fi areas (Fig. 6).<sup>26</sup> At some Wi-Fi areas it is possible to find smartphone charging spots to charge while using the Wi-Fi service. Outside of Seoul there is extensive access to the fast LTE (4G) network nationwide. The city government invested over \$40 million on the project.<sup>27</sup>

The government of South Korea is in partnership with the European Union to develop fifth-generation (5G) wireless networks. The plan also includes the continuous upgrade of the country's wireless networks by 2020.<sup>28</sup> Naturally, this is expected to be faster than the already high-speed 4G.<sup>29</sup>

Other examples of hyper-networked cities include Bandung, Buenos Aires, Dubai, and Chicago. In 2014, Buenos Aires developed and launched BA-Wi-Fi, one of the largest public Wi-Fi systems.<sup>30</sup> In Bandung, Indonesia, the government invested heavily in the installation of 40,000 Wi-Fi connections in a bid to reach all

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<sup>25</sup> Kang Yoon Seung, "South Korea Has 4th Highest Smartphone Penetration: Data," *Yonhap News Agency*, July 8, 2015, <http://english.yonhapnews.co.kr/business/2015/07/08/91/0503000000AEN20150708000700320F.html>.

<sup>26</sup> Keith Kim, "10,000 Places to Get Free Wifi in Seoul! (With Maps and Apps)," *Seoulistic* (blog), 2013, <https://seoulistic.com/quick-tip/10000-places-to-get-free-wifi-in-seoul-with-maps-and-apps-2/>.

<sup>27</sup> *Ibid.*

<sup>28</sup> Maria Skou and Nicklas Echsner-Rasmussen, "Smart Cities Around the World," *Perspektiv*, 25 (December 2015): 61–67.

<sup>29</sup> *Ibid.*

<sup>30</sup> Alsever, "4 Smart Cities."

10,000 neighborhoods of Bandung, and 5,000 Wi-Fi hotspots.<sup>31</sup> The goal in Dubai is to transform it into the Smartest City in the world by 2021 beginning with enhancing the networks of the city and aiming at making the entire city's services and facilities available on smartphones,<sup>32</sup> by implementing Wi-Fi infrastructure and providing 5,000 hotspots to make free Wi-Fi available in 100 sites in Dubai and Abu Dhabi.<sup>33</sup> In Chicago, city authorities are making efforts to offer free Wi-Fi in all public areas, especially in the ones with limited Wi-Fi access. These public Internet hotspots would enable people to connect to the Internet without the need of purchasing an Internet plan.<sup>34</sup> Currently, there are 80 Wi-Fi hotspots that cover all the city's neighborhoods, thereby contributing to Chicago's reputation as a technology-friendly city.

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<sup>31</sup> Tan Wee Kang, "Bandung's Smart City Initiatives," Enterprise innovation, December 8, 2015, <http://www.enterpriseinnovation.net/article/bandungs-smart-city-initiatives-246675038>.

<sup>32</sup> Neeraj Dassani, Dnyanesh Nirwan, and Gopalakishnan Hariharan, "Dubai - a New Paradigm for Smart Cities," KPMG International Cooperative, July 2015, 6, <https://www.kpmg.com/AE/en/Documents/Dubai%20A%20new%20paradigm%20for%20smart%20cities.pdf>.

<sup>33</sup> *Ibid.*, 6.

<sup>34</sup> Chicago City Hall, "The City of Chicago Technology Plan" (Chicago: Chicago City Hall, 2013), <http://techplan.cityofchicago.org/wp-content/uploads/2013/09/cityofchicago-techplan.pdf>.



Fig. 6. One of the 10,000 free Wi-Fi hotspots of Seoul. (Source: <https://seoulistic.com/quick-tip/10000-places-to-get-free-wifi-in-seoul-with-maps-and-apps-2/> )

### 2.2.2.1. Internet of Things

The Internet of Things (IoT) enables the running of Smart Cities which relies on devices such as lights, connected sensors, and meters to enable them function correctly (Fig. 7). The system enables the generation of data that is then analyzed and incorporated into the development of the most appropriate infrastructure and other related utility services.<sup>35</sup>

The concept of Internet of Things (IoT), created by Kevin Ashton in 1999, refers to devices and machines, “things” that own a personal IP address and through sensors are able to connect to the Internet and communicate between each other and their users, and analyze information. IoT devices can be a smartphone that interacts with a washing machine and a smartwatch that communicates with a laptop, to sensors in a city that offer real-time monitoring of

<sup>35</sup> Andrew Meola, “How Smart Cities & IoT Will Change Our Communities,” *Business Insider*, December 20, 2016, <http://www.businessinsider.com/internet-of-things-smart-cities-2016-10>.

transportation infrastructure. There are currently a great variety of objects that are able to connect to the Internet, and the ones that are not connected can be made connectable through wireless sensor tools like Radio Frequency Identification (RFID) and Near-Field Communications (NFC).

IoT devices are constantly being created (Fig. 8). For instance, IoT largely used within transportation infrastructures. In Copenhagen, a city where almost half of the inhabitants use bikes on a daily basis, IoT monitoring is leveraged to acquire bike traffic data that is then used to improve bike route logistics in the city. IoT enables Copenhagen to gauge such utilities as energy and water consumption of buildings. Nearly 60% of regular building managers were fairly familiar with IoT in the United States.<sup>36</sup> Another 43% of those surveyed agreed that IoT had a potential to shape how they would run their buildings in the next couple of years. About 96% of multinational businesses are projected to develop IoT systems within three years<sup>37</sup> and 68% of businesses have already made such vital IoT investments. The overall global market for IoT is expected to grow from its \$212 billion in 2012 to \$8.9 trillion by 2020.<sup>38</sup>

As technological devices such as smartphones, computers, and home appliances decrease in price and increase in availability and quality, there is a corresponding growth in the interest in the IoT. One good example of the combination of the use of IoT and the Smart City projects is Pachube, an IoT platform, launched publicly in 2008. It gained a reputation for processing millions of data points across multiple platforms serving a host of customers in the private and public sector. Its patrons and stakeholders employed the Software as a service (SaaS) to enable them appropriately process all the data

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<sup>36</sup> Ibid.

<sup>37</sup> Ibid.

<sup>38</sup> Will Lassalle, "What Is the IoT (Internet of Things), and Why Does It Matter?" *Institute for Digital Transformation* (blog), July 11, 2016, <https://www.institutefordigitaltransformation.org/what-is-iot-and-why-does-it-matter/>.

coming across multiple systems. The user-friendly interface of Representational State Transfer (REST) Web Services architectural style is widely credited with simplifying the process of designing and deploying an assorted range prototypes of connected devices so that they are able to conceive of any possible service. The outcome of this bold experiment includes such products as the Current Cost energy monitoring device and laid the foundation for the first generation of IoT App Store features that opened the door to processes as mapping visualization, mobile, analytical, graphing among others. This process enables the synchronization of bulk data generated by Pachube with other vital web content services.<sup>39</sup>

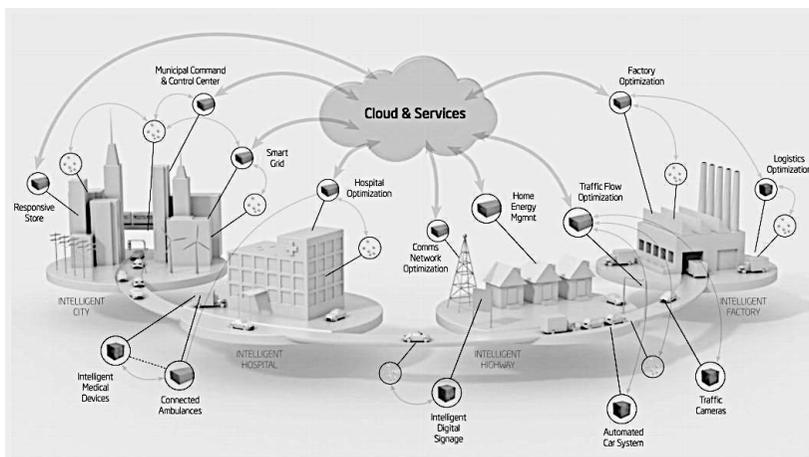


Fig. 7. The IoT World (Source: <https://opentechdiary.wordpress.com/tag/internet-of-things/>)

<sup>39</sup> Usman Haque, "Pachube," Umbrellium, accessed September 16, 2017, <http://umbrellium.co.uk/initiatives/pachube/>.

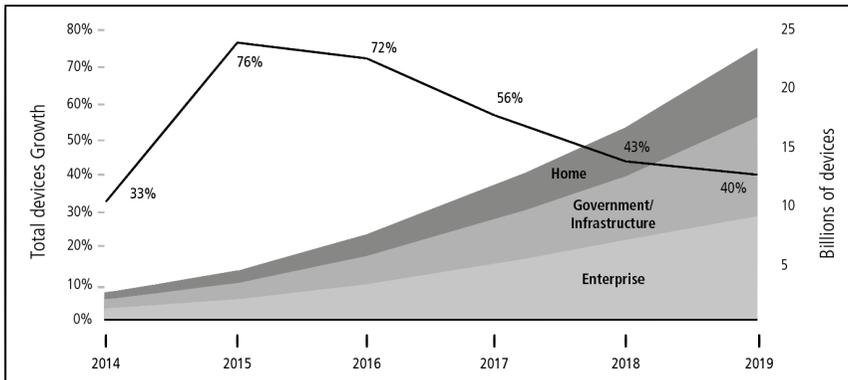


Fig. 8. The Internet of Things growth (Source: <https://goo.gl/images/GZLP95>)

### 2.2.3. Sustainability

Sustainability is a pillar of the inner Smart City concept. This feature is constituted in the other five Smart City features, especially in Smart Mobility and Smart Living. In Smart City programs, it is possible to notice that sustainability is one of the main ingredients of the Smart Paradigm. Smart City concepts can bolster sustainability across the board. Florida is known as having the best practice of sustainability in the transport sector. The hi-tech interface, All Aboard Florida, is used to provide an eco-friendly railway service throughout the state. Like most tech services, it is driven by big data to mitigate the impact of adverse conditions such as noise and vibration of trains. The system can monitor and implement fuel consumption patterns and incorporate efficiency targets and cut back on pollution levels.

Paris is another example of how sustainability is embedded in every aspect of the Smart City theory. This city's plan focuses on being more Smart through projects of re-vegetation and urban agriculture; building green walls, roofs, and green public areas is the proper solution to meet the increasing inhabitants demands for a

healthier environment and to adapt at the city to climate change.<sup>40</sup> “Paris, Smart City 2050” unbuilt futuristic vision of Vincent Callebaut Architectures studio features eight “green” towers located in different areas of the city that represent an effort to lower greenhouse gas emissions. These “Mountain Towers” are run by three different types of renewable energies: photovoltaic and thermic to produce electricity and hot water during the day, and hydroelectric during the night. The “Antismog Towers” are photocatalytic titanium dioxide structures that filter the smog. “Farmscrapers Towers” (Fig. 9) consists of three vegetable towers implanted in an urban forest.<sup>41</sup> These projects feature green areas such as the integration of vegetable gardens integrated to railroad lines and cycling paths, and green rooftops and balconies integrated into their structures.

Among the other mechanisms important to maintain a sustainable environment there are vital services as providing reliable measurement of average weather and consumption patterns, water levels, etc. In some instances, general waste management processes are increased by the flow of data that allows for proper planning to match resources with needs to maximize efficiency.

The South Korean U-Green Service is another example of usage network of sensors. Elements such as water and air excellence are monitored through sensors that sends the data acquired directly to the smart devices of Seoul’s inhabitants. Through these devices citizens of Seoul are able to control their daily energy and water consumption and it gives them the chance to know how to reduce their waste.

Although it can be assumed that instead of the eco-friendly

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<sup>40</sup> Smart and Sustainable Bureau, “A View of 2020 and Beyond,” Smart and Sustainable Paris, June 2015, 9, <http://docplayer.net/38351300-Smart-and-sustainable-paris-a-view-of-2020-and-beyond.html>.

<sup>41</sup> Vincent Callebaut Architectures, “Paris Smart City 2050,” Vincent Callebaut Architectures, accessed September 16, 2017, [http://vincent.callebaut.org/object/150105\\_parissmartcity2050/parissmartcity2050/projects](http://vincent.callebaut.org/object/150105_parissmartcity2050/parissmartcity2050/projects).

development process, the Smart City phenomena absorbed into its requirements the qualities of the Eco-City paradigm, such as “physical” initiatives to create green areas, enhance the quality of life of the inhabitants, and protect the public environment, etc. The Smart City phenomena differs from the Eco-City initiatives because it is more focused on the usage of ICT infrastructures.<sup>42</sup>



Fig. 9. “Antismog towers” project proposed by Vincent Callebaut Architectures for the city of Paris. (Source: [http://vincent.callebaut.org/object/150105\\_parissmartcity2050/parissmartcity2050/projects](http://vincent.callebaut.org/object/150105_parissmartcity2050/parissmartcity2050/projects) )

## 2.3. Smart Cities Today

Throughout the world not only old cities are in the process of being developed into Smart Cities, but also “smart-from-the-start”<sup>43</sup>

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<sup>42</sup> John Spacey, “Smart City vs Sustainable City,” *Simplicable*, July 20, 2016, <https://simplicable.com/new/smart-city-vs-sustainable-city>.

<sup>43</sup> The Economist Newspaper Limited, “Starting from Scratch,” *The Economist*, September 7, 2017, <https://www.economist.com/news/briefing/21585003-building->

cities or New Smart Cities are being built. Retrofitted to Smart Cities, are already-built cities, such as New York, London and Paris, that are making efforts to implement ICT technology and Smart Initiatives to the already built institutional, social, and physical infrastructure. New Smart Cities are cities that have been Planned-from-Zero based on the Smart City ideals.

## **2.3.1. Retrofitted into Smart Cities**

### **2.3.1.1. Rankings**

The Smart City concept is a competition among cities all around the world. It is a race to be “at the top,” to be the best eco-friendliest city, to be the most technological city, to be the Smartest City. It is now difficult to distinguish if governments are more interested in winning the global competition, or in creating a better life for their citizens. A quantitative study<sup>44</sup> of the 100 largest cities in the world reveals that in 2018, 83 cities have ongoing Smart Cities projects, 9 have projects planned but not yet implemented, 7 cities have an unknown status, and only 1 city has no plans to begin smart initiatives.<sup>45</sup> The Mumbai case aside, this study shows that a great amount of metropolitan areas are interested in retrofitting its infrastructure to Smart. For instance, 33 of the most populous cities are located in China; of these, 30 cities have ongoing Smart City projects and 3 are unknown. This global race is resulting in a transformation of the overall concept between retrofitting existing cities into Smart Cities and Built-from-Zero Smart Cities.

This race is gauged by indexes, rankings, awards, congresses,

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city-future-costly-and-hard-starting-scratch.

<sup>44</sup> See Appendix 1.

<sup>45</sup> FE Online, “Smart City List Released Today; Mumbai Wants Nothing to Do with It; Here Is Why,” *The Financial Express*, June 23, 2017, <https://www.financialexpress.com/india-news/smart-city-list-released-today-mumbai-wants-nothing-to-do-with-it-here-is-why/732232/>.

and exhibitions. To list some, there are: the Smart Cities India Awards 2017,<sup>46</sup> the Cresco Award 2017,<sup>47</sup> the Smart City Excellence Awards,<sup>48</sup> the BW Business world Smart Cities Conclave & Awards,<sup>49</sup> the CMO Asia Smart Cities Awards 2017,<sup>50</sup> the C40 Cities Bloomberg Philanthropies Awards,<sup>51</sup> the Smart Cities Expo World Forum,<sup>52</sup> the Smart Cities World Expo,<sup>53</sup> and the Smart Cities UK 2018 Conference Expo and Awards.<sup>54</sup>

The Smart City Expo World Congress (SCEWC) is the most prominent event in the world for Smart City initiatives. Its purpose is to identify, recognize and support the most groundbreaking city proposals that have the most potential to change the future of cities globally: “Cities, companies, entrepreneurs and startups, social innovators, research centers, universities, public and private organizations and consortiums are welcome to submit projects and

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<sup>46</sup> Exhibitions India Group, “Winners of Smart Cities India Awards 2017,” Smart Cities India Awards, accessed December 3, 2017, <http://www.smartcitiesindia.com/smart-cities-india-awards-2017.aspx>.

<sup>47</sup> Fondazione Sodalitas, “Cresco Award,” Cresco Award, accessed December 3, 2017, <https://crescoaward.ideatre60.it/>.

<sup>48</sup> TM Forum, “TM Forum Smart City Excellence Awards 2017,” TM Forum Smart City InFocus, accessed December 3, 2017, <https://smartcityinfocus.tmforum.org/tm-forum-smart-city-excellence-awards-2017/>.

<sup>49</sup> BW Businessworld, “Smart Cities Conclave and Awards 2017,” BW Businessworld, accessed December 3, 2017, <http://bwevents.co.in/bwsmartcities/delhi/>.

<sup>50</sup> CMO Asia, “CMO Asia Awards,” CMO Asia, accessed December 3, 2017, <http://www.cmoasia.org/awards.html>.

<sup>51</sup> C40 Cities Climate Leadership Group, Inc., “C40 Cities Bloomberg Philanthropies Awards,” C40, accessed December 3, 2017, <http://www.c40.org/awards>.

<sup>52</sup> Smart City Expo, “The Smart Cities Expo World Forum -Awards,” *Smart City Expo* (blog), accessed December 4, 2017, <http://smartcitiesexpoworldforum.com/awards/>.

<sup>53</sup> Fira de Barcelona, “Smart City Expo World Congress,” Smart City Expo, accessed December 4, 2017, <http://www.smartcityexpo.com/it/>.

<sup>54</sup> 4alofus, “Smart Cities UK 2018,” Smart Cities 2019, London, accessed December 4, 2017, <http://www.smartcityuk.com/>.

initiatives that cover one of this year's tracks: Governance, Economy, Mobility, Society, Sustainability, Data & Technology and Circular Economy.”<sup>55</sup> At this conference there are three main categories in which prizes are awarded: The City Award, the Project Award, and the Innovative Idea Award. The City Award honors cities for their innovative and sustainable strategies. The Project Award rewards already developed successful Smart projects. And lastly, the Innovative Idea Award boosts new ideas and concepts at the beginning of their development. In 2015, among 105 countries and 568 cities, Bandung (Indonesia), Buenos Aires (Argentina), Curitiba (Brazil), Dubai (United Arab Emirates), Moscow (Russia), and Peterborough (United Kingdom) were the cities awarded in the City Award category (Fig. 10).



Fig. 10. Fira the Barcelona Smart City Awards. (Source: <http://www.smartcityexpo.com/en/the-event>)

The reason why Smart City “competitions” are unlikely to be

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<sup>55</sup> Fira de Barcelona, “Event,” Smart City Expo World Congress, accessed March 28, 2017, <http://www.smartcityexpo.com/en/the-event>.

accurate about “which city is the Smartest,” is that there is no specific universal criteria to consider when deciding how a Smart City should be. As a consequence, it makes it open to a wide range of interpretations of the phenomena and it could be decided by each individual and the local conditions around them. Thus, it is ineffective to rank cities according to the label of “Smartest” without first assessing the development context of each city.

Instead, the concept of Smart Cities needs to be reviewed as part of a wider revolution of information and technology processes across space and time. Distinguishing this wave of current technology from previous ones is that it primarily focuses on the individual is connection to society. Which includes the built and structural environment under which human relations are shaped and determined.<sup>56</sup> For example, it is possible that a city may be considered Smart under the following conditions:

1. that it consists of the perfect retrofitting and upgrading of old or existing cities in cities that works well with the new technologies;
2. that it is an entirely new city that has been developed from scratch, such as Masdar or Songdo;
3. that it incorporates many of the latest hi-tech gadgets as part of a carefully coordinated plan;
4. that it provides a balance between technology and the well-being of residents;
5. that individuals own smartphones and have the appropriate access to Internet;
6. that citizens are involved in the well-being of the city; and
7. that citizens are open to using and engaging with these services.

Citizen engagement is extremely important, because, ultimately the purpose of the Smart City is to serve and meet the needs of the

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<sup>56</sup> Townsend, *Smart Cities*, 3.

citizens. Failure to meet this key requirement defeats the entire purpose of such projects. Meeting this requirement requires some degree of solid economic basis, which means that citizens should have the means to acquire and use such services such as eco-friendly automobiles, living in an updated networked housing. That in itself raises some fundamental questions about whether such a project is viable everywhere. Undeveloped countries are not ready for Smart City initiatives because they would privilege the elites and not the well-being of the poor who are unable to afford the “Smart life.”

Therefore, being that a Smart City is not universally accepted, it is possible to designate a Smart City from different perspectives. Every expo, ranking, or competition decides how to judge the Smart City by different criteria. These city competitions add to the confusion of identifying what is ultimately a Smart City and makes it more difficult to create international guidelines for the cities to upgrade their environments and enhance the life of their inhabitants. For example there are: the Cities in Motion Index (CIMI), A.T. Kearney Global Cities Index, the Cities Prosperity Index of the United Nations, the Z/Yen Global Financial Centers Index (GFCI), the Global City Competitiveness Index of The Economist, the Brookings Global Metro Monitor Map, and the MMF Global Power City Index.

### **2.3.1.2. CIMI Index Criteria**

The CIMI Index, created by the Instituto de Estudios Superiores de la Empresa (IESE) Business School of the University of Navarra boasts that they are more precise in defining the achievement in excellence of cities because their ranking “has a higher number of dimensions, and hence indicators, and greater geographical coverage than most of the rankings considered.”<sup>57</sup> This index

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<sup>57</sup> IESE Business School Center for Globalization and Strategy, “IESE Cities in Motion Index” (Pampolna: University of Navarra, 2016), 42,

evaluates cities on their “Smartness” basing their grade on how excellent the cities perform on ten major indicators: the economy, human capital, technology, the environment, international outreach, social cohesion, mobility and transportation, governance, urban planning, and public management.<sup>58</sup> Their analysis covers 181 cities in the world, 72 of which are capitals. This evaluation is supposed to be the one with the broadest geographical coverage globally.

For the CIMI index, Human Capital is the first criteria. It has various micro-criteria that contributes to Human Capital level of excellence of a City. They range from Higher Education, based on the Euromonitor data on population with secondary or higher education, to business schools that are in the top ten of polls, as designated by the Financial Times, to the number of students that decide to study abroad according to UNESCO reports. Also the number of Universities, as listed in the QS Top Universities, of Museums and Art Galleries, data acquired from 2thinknow, a data innovation agency established in 2006,<sup>59</sup> are important indicators. Lastly, the expenditure on leisure and recreation, expressed in millions of US dollars, is a key factor for the CIMI.<sup>60</sup>

The second criteria is Social Cohesion. Which includes criteria such as the ratio of deaths per 100,000 inhabitants, the unemployment rate and the Gini Index number: an index representing the income or wealth distribution of the residents of a nation developed by Corrado Gini. The Gini Index expresses, through a scale from 0 to 100, the wealth equality situation in a city. Numbeo provides reports for the crime rate, the health index and the price of real estate. Another criteria indicator, from the International Labor Organization, is the ratio of women working in public

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<http://www.iese.edu/research/pdfs/ST-0396-E.pdf>.

<sup>58</sup> Ibid.

<sup>59</sup> 2thinknow, “Welcome to 2thinknow,” 2thinknow, accessed July 22, 2018, <https://2thinknow.com/>.

<sup>60</sup> IESE, “IESE Cities in Motion Index,” 43.

administration.<sup>61</sup>

The third key factor is Economy, which includes aspects important to the economic development of a city, ranging from productivity, calculated with the division of GDP to the number of days required to start a legal business the more favorable environments for starting a local company. Other indicators are the number of headquarters of publicly traded companies and the number of people starting new businesses, and the number of entrepreneurs, since together they represent economic dynamism. They also value the importance of GDP as a key indicator to the economic well being of a city.

The fourth criteria is Public Management. All data used to calculate this factor comes from the World Bank and 2thinknow. The World Bank reports the total tax rate paid by businesses and reserves per capita. 2thinknow highlights the number of foreign embassies in a city, which indicates the importance of the city at the global level. Key to the public management is the use of Twitter by local self-defined leaders such as writers, activists, businesses, and business leaders. Taxes paid plays an important role since the lower they are, the easier it is to invest and make the city grow financially.

The fifth factor is Governance, Cities are evaluated on the strength of legal rights, the perception of the corruption, the functions of the innovation department, the range of government Web services and their open data platform.

The sixth factor is Environment, key to determining whether a city is environmentally friendly or not. Indicators such as CO2 and methane emissions are taken into consideration as well as the Pollution Index on an annual mean. The number of people who have access to water supply and environmental performance index are also used as key factors.

Mobility and Transportation are the seventh factors. They take into consideration the traffic index, how much time is spent in traffic

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<sup>61</sup> Ibid.

and the CO2 emissions to measure the inefficiency of driving. Often key factors are number of roads accidents, number of metro stations and flights arriving and departing from the city airports. It is also important the spread of public means of transportation and the index of traffic when commuting to work every day.

The eighth factor is Urban Planning. This indicates the percentage of the population that has access to clean sanitation facilities and the percentage of the population that can avoid contact with human or animal excretes, the number of people per household, the number of bicycle shops and cycling enthusiast—as the bicycle can be seen as a sustainable means of transportation and also as a metric to the city cultural aptitude—and the number of architecture firms per capita.

The ninth factor is International Outreach. Five indicators define this dimension: the number of international tourists, and airline passengers, the number of hotels per capita and the ranking of cities from the Sightstmap app, where they use the number of photos taken and uploaded to Panoramio, and the number of meetings and conferences held in that city.

The last factor is Technology. This is also the factor with the most indicators starting from the number of broadband subscribers to the number of actual broadband users and of IP addresses per capita. Also important indicators are the number of Facebook users, and smartphones users, the quality of Web services offered from the city, and the number of Wi-Fi hotspots in the city.<sup>62</sup>

### **2.3.1.3. New York**

Looking at the 2014–2015 ballpark figure for the overall rankings of different Smart City indexes present in the CIMI, New York and

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<sup>62</sup> Ibid.

London are at the top. The only ranking in which they do not place within the top ten is the Cities Prosperity Index of the United Nations (Table 3). Also in the 2017 and 2018 IESE Cities in Motion Index, New York and London rank in first and second place respectively.<sup>63</sup>

By embedding hyper-technology throughout the city, New York is performing outstandingly in enhancing the life of its inhabitants. City authorities are transforming New York into a technological city using new construction materials, innovative technologies, and digitally networking all its inhabitants (Fig. 11). In the IESE rankings, the city is ranked first under the sector of Economy and third in Technology. Other sectors in which it ranks high are Human Capital and Transportation. New York ranks high also in Public Management, Government and International Outreach. However, it ranks low for Environment, despite all the on-going Smart City projects to improve it, and it places between the lowest for Social Cohesion. Despite all the crime prevention projects such a real-time gun violence prevention, the crime ratio and death ratio per 100,000 inhabitants is still high. The health of inhabitants and the employment rates and gender equality are the most urgent issues to tackle for New York to become a top ranking Smart City in all sectors.

In 2015, New York City's mayor, Bill De Blasio, unveiled a strategic sustainability policy plan dubbed "One New York: The Plan for a Strong and Just City." At its core are a series of interconnected objectives aimed at addressing such issues as the city's environmental and socioeconomic challenges. The plan aims to offset previous patterns of dislocations in resource allocations by revamping the policy planning process to become rooted in equity across all sectors. A key theme running through its diverse strands

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<sup>63</sup> IESE Business School University of Navarra, "IESE Cities in Motion Index 2017," *Cities in Motion* (blog), May 25, 2017, <https://blog.iese.edu/cities-challenges-and-management/2017/05/25/164/>; IESE Business School University of Navarra, "IESE Cities in Motion Index 2018," *Cities in Motion* (blog), May 23, 2018, <https://blog.iese.edu/cities-challenges-and-management/2018/05/23/iese-cities-in-motion-index-2018/>.

are questions of social justice. The plan acknowledges the vital role of digital resources in the process of advancing this cause to make it possible to improve the coordination and provision of vital public services across this sprawling metropolis, signaling its commitment to taking New York City into the Smart City phenomena.<sup>64</sup>

City Ranking	CIMI-2015 (IESE)	Global Cities Index-2015 (A.T. Kearney)	Cities Prosperity Index-2015 (United Nations)	Global Financial Centers Index-2015 (Z/Yen)	Global City Competitiveness Index- 2014 (The Economist)	Global Metro Monitor Map-2014 (Brookings)	Global Power City Index- 2015 (MMF)
1	New York City	New York City	Oslo	London	New York City	Tokyo	London
2	London	London	Copenhagen	New York City	London	New York City	New York City
3	Paris	Paris	Stockholm	Hong Kong	Singapore	Los Angeles	Paris
4	San Francisco	Tokyo	Helsinki	Singapore	Hong Kong	Seoul	Tokyo
5	Boston	Hong Kong	Paris	Tokyo	Tokyo	London	Singapore
6	Amsterdam	Los Angeles	Vienna	Seoul	Sydney	Paris	Seoul
7	Chicago	Chicago	Melbourne	Zurich	Paris	Osaka	Hong Kong
8	Seoul	Singapore	Montreal	Toronto	Stockholm	Shanghai	Berlin
9	Geneva	Beijing	Toronto	San Francisco	Chicago	Chicago	Amsterdam
10	Sydney	Washington, D.C.	Sydney	Washington, D.C.	Toronto	Moscow	Vienna

Table 3. Comparison between various Smart City Indexes published between 2014 and 2015. (Source: "IESE Cities in Motion Index" (University of Navarra, 2016), 43).

<sup>64</sup> Jeff Merritt, "Building a Smart + Equitable City" (New York: Mayor's office of Tech and Innovation, September 2015), <http://www1.nyc.gov/assets/forward/documents/NYC-Smart-Equitable-City-Final.pdf>.

#### 2.3.1.4. London

The population of London is growing at a fast rate. It is currently estimated to be 8.94 million<sup>65</sup> and projected to reach 10 million by 2030. Consequently, the London City Hall is coming under increased pressure to improve the city's transportation logistics and to provide the quality of life for its inhabitants with adequate housing and jobs. In the CIMI, overall, London ranked second. For Human Capital it ranked first, for International Outreach second, and it ranked third for Economy and Transportation (Fig. 12). Like New York, London is not performing very well in the Social Cohesion indicator. The city also has to work harder in improving health services, and reducing crime and the unemployment rate. London, a city that invests a lot in entrepreneurship human resources, ranked first for Human Capital; in the words of David Gann, Chairman of the Smart London Board, "The concept is simple. A smarter London must be a place in which people want to live, work and play. It will foster talent, support and accommodate population growth and sustainable prosperity."<sup>66</sup>

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<sup>65</sup> "Population of London 2018 Demographics and Important Facts," *Live Population* (blog), July 22, 2017, <http://livepopulationof.com/population-of-london/>.

<sup>66</sup> Office of the Mayor of London, "Smart London Plan," (London: Office of the Mayor of London, 2014), [https://www.london.gov.uk/sites/default/files/smart\\_london\\_plan.pdf](https://www.london.gov.uk/sites/default/files/smart_london_plan.pdf).

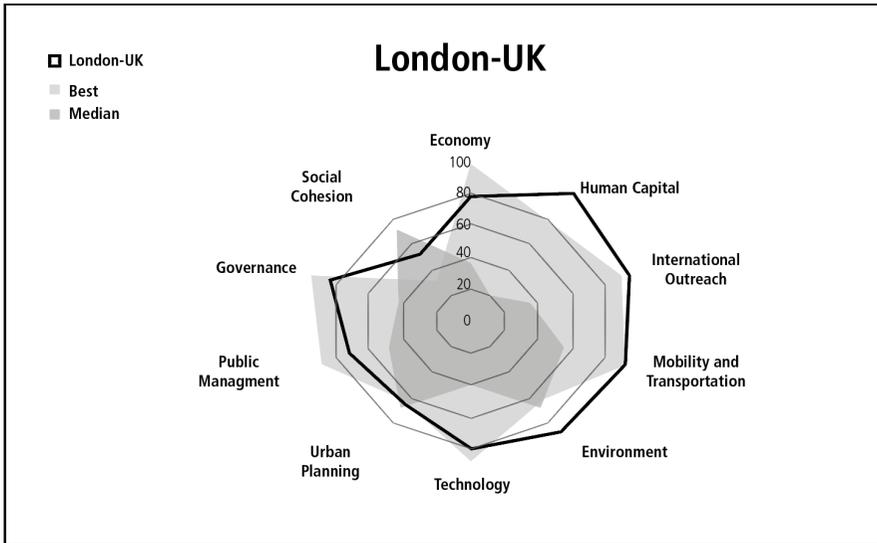


Fig. 11. Smart City profile of the city of New York. (Source: “IESE Cities in Motion Index” (University of Navarra, 2016), 52)

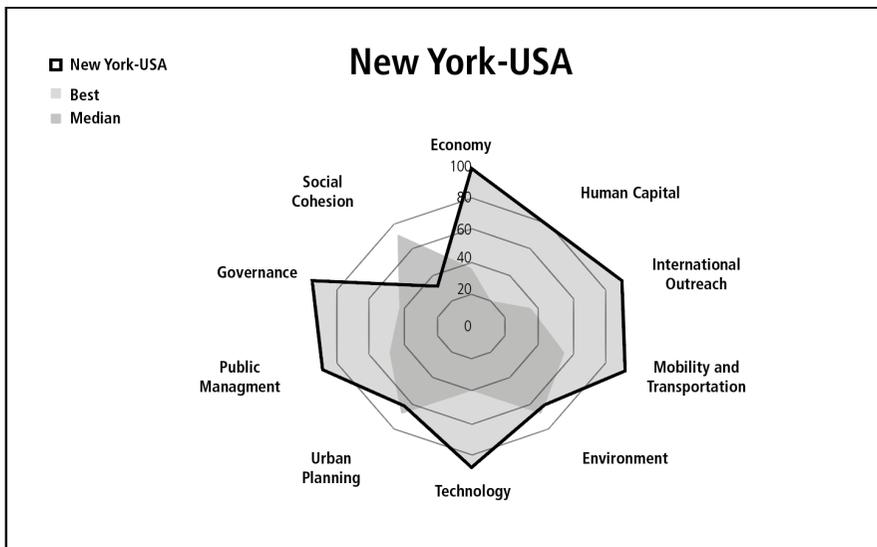


Fig. 12. Smart City profile of the city of London. (Source: “IESE Cities in Motion Index” (University of Navarra, 2016), 52)

## 2.3.2. Built-from-Zero Smart Cities

The New Smart Cities are not present in the international Smart City rankings. The EasyPark Smart City Index, for the 2017 ranking stated “we did not analyze really new cities that are planned to be the smartest in the world but are not yet fully finished or not widely known (e.g. Masdar City) due to lack of data.”<sup>67</sup> Built-from-Zero Smart Cities although are self-proclaimed as Smart, fail to meet the same numbers of the already established cities retrofitted to Smart meet in the various Index indicators and are not considered valid for review because of their built status and obtainable data. It happens because the already established cities were already successful as cities; before self-proclaiming themselves as Smart they already possessed human capital, international relationship, a developed transportation infrastructure etc. the only thing they have to do to be Smart is to improve what they already have. Despite the various struggles, among all the New Smart City projects, Songdo and Masdar are more developed in the construction stage, have the deepest developed plans, and are the most acknowledged New Smart City globally, making them valuable for further analysis.

The first requirement for building a Smart City from the scratch is having access to a substantial tract of land, coupled with extensive capital and financial resources. As all the other Smart initiatives, these Built-from-Zero Smart Cities are all planned to be sustainable and equipped with the best high-end technology. Among these “urban dreamscapes”<sup>68</sup> there are PlanIT Valley, Portugal, Konza Techno City, Kenya, various Chinese Smart Pilot Cities (Guilin City, Yunlong Demonstration Zone, Panyu District, Yangling Agricultural

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<sup>67</sup> EasyPark Group, “2017 Smart Cities Index,” *EasyPark*, accessed July 22, 2018, <https://easyparkgroup.com/smart-cities-index/>.

<sup>68</sup> James Holloway, “Kenya Kickstarts Multi-Billion-Dollar Konza Tech City,” *New Atlas*, January 30, 2013, <http://newatlas.com/konza-silicon-savanna/26033/>.

Hi-Tech Industries Demonstration Zone, Lecong Town),<sup>69</sup> India has announced a plan to create twenty four sustainable Smart Cities for 2 million people, by Alkesh Sharma, the CEO of the Delhi-Mumbai Industrial Corridor Corp. Among the most distinguishes Built-from-Zero Smart Cities is Songdo for being a Smart International Business District (IBD) and for its Ubiquitous City concept; and Masdar which is unique for its commitment to aiming for a zero-environmental impact.

Although all the built-from-zero Smart Cities are high-tech and eco-friendly, they are generally sparsely populated and heavily referred to as “ghost cities.”<sup>70</sup> In many ways, when visiting Songdo, Masdar City, and PlanIT Valley, Portugal one can easily observe that these glittering cities having empty streets. This trend has become a source of concern for observers.

All these New Smart City projects require major investments: \$19 billion was allocated for Portugal’s “perfect city,”<sup>71</sup> \$14.5 billion for the Kenyan “Silicon Savannah,” \$22 billion for Masdar, and more than \$35 billion for Songdo. The finances of the stakeholder industries, governments and corporations all have to be reliable, and they also need to be secure and free from changes in leadership that could risk the future of on-going projects. In some cases, the government offices have problems of financial management and organization, as Ian James commented in an article on Korea Exposé: “Even Songdo’s vision of perfection is not immune to encroachment. The city was on the verge of bankruptcy a few years back, which means that the planners probably had to compromise with the pressures of local developers. [...] But it appears that like

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<sup>69</sup> Biyu Wan et al., “Smart City Development in China: One City One Policy,” *ZTE Communications*, 13, no.4 (December 2015): 40-44.

<sup>70</sup> Nanette Byrnes, Tim Mullaney et al., “Cities Get Smarter,” *MIT Technology Review* 118, no. 1 (December 2014): 59-66.

<sup>71</sup> Greg Lindsay, “A City in the Cloud: Living PlanIT Redefines Cities as Software,” *Fast Company*, August 23, 2010, <https://www.fastcompany.com/1684055/city-cloud-living-planit-redefines-cities-software>.

the UAE’s Masdar City, another perpetually unfinished ‘international’ ‘green’ and ‘futuristic’ gated community, Songdo may be just one more city on its ways to becoming one more exhibit in the Museum of Futures That Never Were.”<sup>72</sup> This combination of factors puts these artificial cities through a constant series of announcements of completion postponements. As presented in a picture taken from an article written in 2013, Songdo was thought to be completed by 2015 but now the date has been postponed to 2020<sup>73</sup> (Fig. 13).

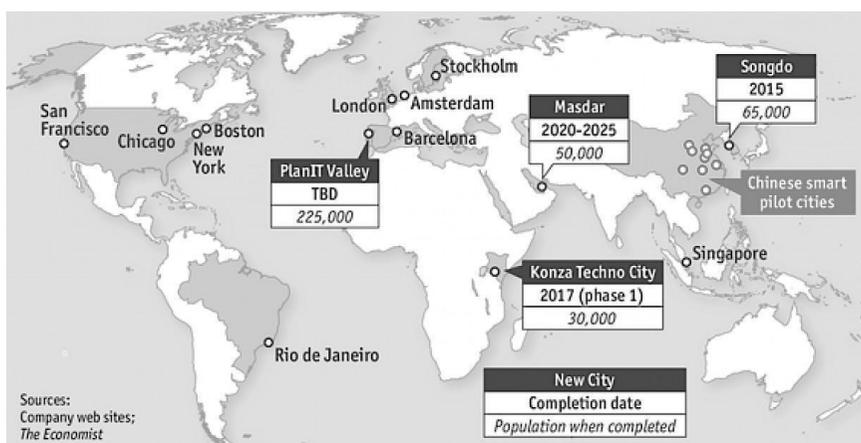


Fig. 13. Built-from-Scratches Smart City projects around the world in 2013  
(Source: <https://www.economist.com/news/briefing/21585003-building-city-future-costly-and-hard-starting-scratch>)

<sup>72</sup> Ian James, “Songdo: No Man’s City,” *Korea Exposé*, October 14, 2016, <https://koreaexpose.com/songdo-no-mans-city/>.

<sup>73</sup> Sang Keon Lee et al., “International Case Studies of Smart Cities: Songdo, Republic of Korea” (Inter-American Development Bank, June 2016), 2-30, <https://doi.org/10.18235/0000411>.

## 2.4. Attempts to Regulate and Standardize the Smart City

Attempts to regulate and standardize the Smart City phenomenon are few. Among them there are the Smart City Council and the United Smart Cities program of the UN that have achieved public credibility. The main goal of the Smart City Council, based in United Kingdom, is to create a world with the best lifestyle and jobs thanks to the highly developed technology and intelligent design. The Smart Cities Council proclaims itself as the neutral advisor to these cities. It has the help of top universities and laboratories. The The Smart Cities Council lists various methods and provides guidelines that can help develop a Smart City: readiness guides; financing templates and case studies; policy framework and case studies; visibility campaign; and regional networking events.<sup>74</sup>

Also, 16 United Nations agencies, programs, funds and secretariats created the initiative United for Smart Sustainable Cities (U4SSC), a platform active globally that aims to help the Smart City stakeholders, helps define what a Smart City is, encourages the creation of guidelines for policies, and helps the process of retrofitting cities into Smart and sustainable ones utilizing ICT infrastructures based on the Sustainable Development Goals (SDGs), international standards and urban Key Performance Indicators (KPIs).<sup>75</sup>

The United Nations Economic Commission for Europe (UNECE) and International Telecommunication Union (ITU) joined the efforts of 300 international experts of Smart Cities to define Smart Sustainable City. They concluded: “A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness,

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<sup>74</sup> Smart Cities Council, “Smart Cities Council,” Smart Cities Council, accessed December 4, 2017, <https://smartcitiescouncil.com/category-membership>.

<sup>75</sup> UNECE, “United for Smart Sustainable Cities.”

while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects.”<sup>76</sup>

This definition aims to start a more global conversation on the Smart City, bringing together the private and public sector with international organizations and academia, and helps discuss and create new urban solutions. The program has it been accepted by 64 countries around the world between 2015 and 2020. The interaction between companies and decision makers in cities is the core object of this project. The ultimate goal is to accelerate Smart urban initiatives, help the sustainable growth of these cities while focusing on an efficient and transparent use of the resources by giving them access to the latest technologies to guarantee better lifestyles for their citizens.<sup>77</sup>

Governments should be more careful when beginning Smart City initiatives, buying Smart City solutions, and collaborating with private companies that activate them. It is important that government pursue solutions that are not just sustainable and high-end technologically fascinating, but that also comprehend cyber security frameworks that are guaranteed to unquestionably work.<sup>78</sup>

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<sup>76</sup> United Nations Economic Commission for Europe (UNECE), “Housing and Land Management,” United Nations Economic Commission for Europe, accessed December 4, 2017, <https://www.unece.org/housing-and-land-management/united-4-smart-sustainable-cities-u4ssc.html>.

<sup>77</sup> Ibid.

<sup>78</sup> Nicole Kobie, “Why Smart Cities Need to Get Wise to Security – and Fast,” *The Guardian*, May 13, 2015, sec. Technology, <http://www.theguardian.com/technology/2015/may/13/smart-cities-internet-things-security-cesar-cerrudo-ioactive-labs>.

## Chapter 3. Critique of Smart Cities

The involvement of private stakeholders to develop Smart Cities raises the issue of the Smart City as marketing ploy, where the City is seen as a product. Moreover, given that the widespread usage of more surveillance implies less privacy. This opens the issue of the possibility of a future dystopia, where Smart Cities, like Orwell's 1984's Big Brother, are able to have access to every moment of a person's life by monitoring their every move. This data flow created by Smart technologies and acquired by Smart Cities, reveals the Smart City's weakness to cyber-crime. Also, the Smart City projects revealed Social Polarization tendencies.

### 3.1. Stakeholders and Marketing Opportunity

The Smart City is popular among entrepreneurs and provides a promising situation for business marketing. Corporation's investment in Smart City technologies is growing.<sup>1</sup> Globally, between 2010 and 2030, the yearly investment required for the infrastructure projects in Smart Cities is projected to be around 1.8 trillion dollars. A substantial part of these ventures will be used for city developments creating new sections in the business field.<sup>2</sup> Germany's VDE (Verband der Elektrotechnik, Elektronik und Informationstechnik) prospected that prospected that the Smart City section of the market will have a tremendous growth; indeed, globally, between 2014 and 2019, the Smart City market is prospected to grow from 13.9% to 19.9% (Fig. 14). In 2014, 25% of the Smart City market share was

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<sup>1</sup> Teena Maddox, "Smart Cities Expected to Invest \$80B in Technologies in 2018," *Tech Republic*, February 20, 2018, <https://www.techrepublic.com/article/smart-cities-expected-to-invest-80b-in-technologies-in-2018/>.

<sup>2</sup> Siemens AG, "Smart Cities: Facts and Forecasts," Siemens Global, June 7, 2015, <https://www.siemens.com/innovation/en/home/pictures-of-the-future/infrastructure-and-finance/smart-cities-facts-and-forecasts.html>.

in industrial automation, 18.2% in power supply, 17% in smart security, 13% in smart education, 9.5% in Living and Building, 8.5% in Medical care, 8% in Transport and 0,5% in Water network<sup>3</sup> (Fig. 15). Moreover, market research predicts that by 2023 the global income for Smart technology will be \$27.5 billion—three times what it was in 2013 (\$8.8 billion). In 2023, the Asia-Pacific region is projected to be the most lucrative technology market with a volume of \$11.3 billion per year.<sup>4</sup>

These trends raise the question of who are the stakeholders in these Smart City projects. Companies like IBM, CISCO,<sup>5</sup> Huawei, Siemens, Ericsson, Microsoft, ST Electronics,<sup>6</sup> and Samsung are some of the many companies providing funding and/or launching Smart City projects. It can be noticed that the majority of the companies that are in the Smart City wave have a high profile place in the electronic technology market.

For instance, IBM, one of the main companies who believed in and contributed to the creation of Smart City trend before it became popular, is funding many Smart City projects in countries like China,<sup>7</sup> Kenya and India,<sup>8</sup> through the Smart City Challenge program “that contributes IBM technology and the skills and expertise of teams of

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<sup>3</sup> Siemens AG, “Smart Cities: Facts and Forecasts.”

<sup>4</sup> Ibid.

<sup>5</sup> Patrick Nixon, “Santiago Says its Smart City Challenges Not Technology-Related,” *BNamericas*, August 18, 2016, <https://www.bnamericas.com/en/news/technology/santiago-smart-city-challenges-not-technology-related>.

<sup>6</sup> Info-communications Media Development Authority, “Opening up New Smart City Opportunities for ICT Firms,” Singapore Government, November 3, 2017, <http://www.imda.gov.sg/infocomm-and-media-news/buzz-central/2013/11/opening-up-new-smart-city-opportunities-for-ict-firms>.

<sup>7</sup> IBM, “Nanjing, China,” IBM, accessed July 22, 2018, <https://www.smartercitieschallenge.org/cities/nanjing-china>.

<sup>8</sup> Jonathan Silver, “The Rise of Afro-Smart Cities Should Be Viewed with Caution,” *Africa at LSE* (blog), July 16, 2014, <http://blogs.lse.ac.uk/africaatlse/2014/07/16/the-rise-of-afro-smart-cities-should-be-viewed-with-caution/>.

IBM experts to address key challenges facing cities around the world.”<sup>9</sup>

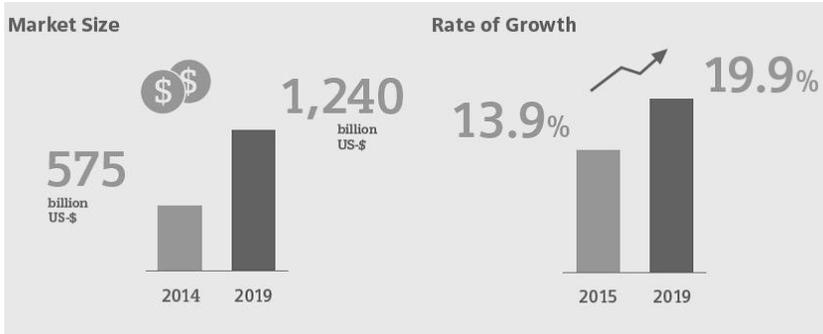


Fig. 14. Market Size and market rate of growth of Smart Cities 2014-2019. (Source: <https://goo.gl/3iXWdt>).

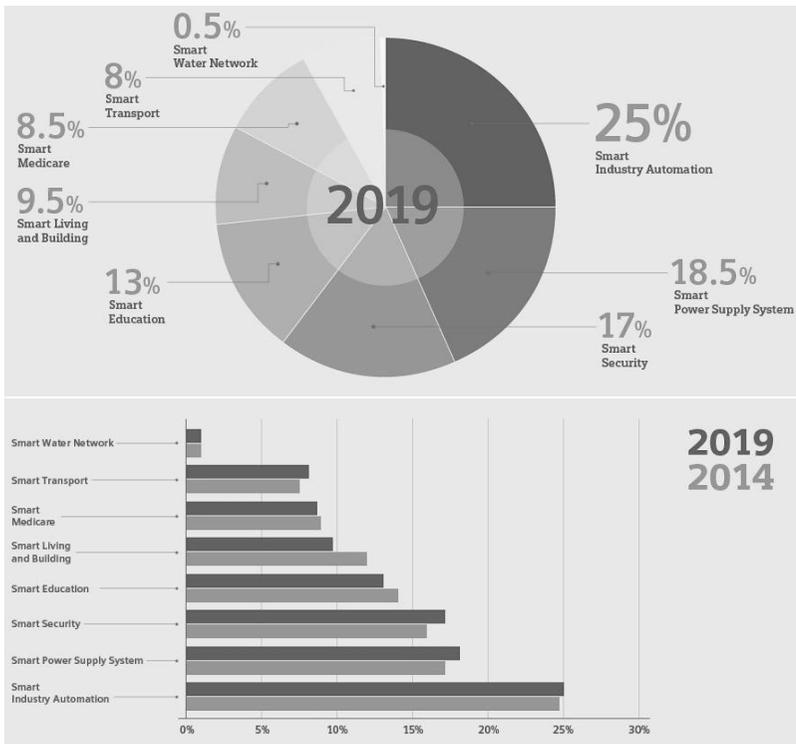


Fig. 15. Global Smart City Market. (Source: <https://goo.gl/3iXWdt>)

<sup>9</sup> IBM, “Smarter Cities Challenge,” IBM, accessed July 22, 2018, <https://www.smartercitieschallenge.org/about>.

Huawei is funding Smart City projects. The company is helping Nigeria's cities to become Smart and invested 6 million dollars in the creation of an Innovation and Experience Centre to promote and show what has been done.<sup>10</sup> The stakeholders<sup>11</sup> of Songdo are: Gale International, the majority stakeholder (61%), followed by Posco (30%), and Morgan Stanley Real Estate (9%)<sup>12</sup> who invested 350 million dollars.<sup>13</sup> Songdo is an example of Smart Cities being used as a new marketing trend. This Smart City concept can be bought and repeated anywhere in the world for \$40 billion.<sup>14</sup> Branding the city as Smart-this and Smart-that is a convenient advertising and public relations strategy.

Robert Holland, a longtime critic of Smart Cities, believes that cities are marketed as "Smart," because of the attention given to them, and it can be seen as a "high-tech" variation of urban entrepreneurship.<sup>15</sup> In fact, all the Smart initiatives in the majority of the cases involve a great amount of money and are usually pushed or either supported by tech companies. There are various features that a city has to have to be called Smart and they can all be connected to entrepreneurship.<sup>16</sup> These features are: the presence and quality of ICT infrastructure and its application; business-led

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<sup>10</sup> Zakariyya Adaramola, "Why Huawei Is Supporting Nigeria's Smart Cities Initiative," *Daily Trust*, August 21, 2017, <https://www.dailytrust.com.ng/news/it-world/why-huawei-is-supporting-nigeria-s-smart-cities-initiative-md/210886.html>.

<sup>11</sup> See Appendix 2.

<sup>12</sup> Gale International, "Songdo International Business District," Gale International, accessed July 22, 2018, <http://www.galeintl.com/project/songdo-international-business-district/>.

<sup>13</sup> Korea JoongAng Daily, "Morgan Stanley to Invest in Songdo," *Korea JoongAng Daily*, September 11, 2006, <http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=2811811>.

<sup>14</sup> Ekim Tan, "New Songdo: City in a Box," *Mediamatic*, accessed July 22, 2018, <http://www.mediamatic.net/en/page/229716/new-songdo-city-in-a-box>.

<sup>15</sup> Robert G. Hollands, "Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?" *City: Analysis of Urban Trends, Culture, Theory, Policy, Action* 12, no. 3 (November 26, 2008): 303–320.

<sup>16</sup> Hollands, 303–320.

urban growth; and high-tech and creative industries. Moreover, ICT infrastructure is considered as the most important requirement when concentrating on business-led urban growth.<sup>17</sup> For instance, “big data” collected by ICT infrastructures can be sold and capitalized on by large organizations; also, the government is dependent on the private sector to make certain that Smart Cities are sustainable in the long run through practicable business models. Hence, the government is going to encourage entrepreneurs and their economic activity; lastly, the key factors of economic growth in Smart Cities are tolerance, talent, and technology.<sup>18</sup>

Another example of the connection of Smart Cities and marketing has been offered by Stuart Taylor, the Service Provider Transformation Group Managing Director of CISCO. In the company’s blog, under the article title “How to make money from Smart Cities”, they propose a set of requirements that support the ones above the others to boost the “potential business return.”<sup>19</sup> For each of the business “layers”, there is a requirement for partners and vendors in the cities to extend their services and solutions. This would ensure that the initiatives of smart city are attained.<sup>20</sup> Starting from the bottom layer, Network Connection supports Network Access, creating the grounds for Technology Platform that sustains the Smart City Solutions layer, etc. (Fig. 16).

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<sup>17</sup> Ibid.

<sup>18</sup> Chris Richter, Sascha Kraus, and Pasi Syrjä, “The Smart City as an Opportunity for Entrepreneurship,” *International Journal of Entrepreneurial Venturing* 7, no. 3 (2015): 211-226, <https://doi.org/10.1504/IJEV.2015.071481>.

<sup>19</sup> Stuart Taylor, “How to Make Money from Smart Cities,” *Cisco Blogs* (blog), September 2, 2014, <https://blogs.cisco.com/sp/how-to-make-money-from-smart-cities>.

<sup>20</sup> Taylor, “How to Make Money from Smart Cities.”

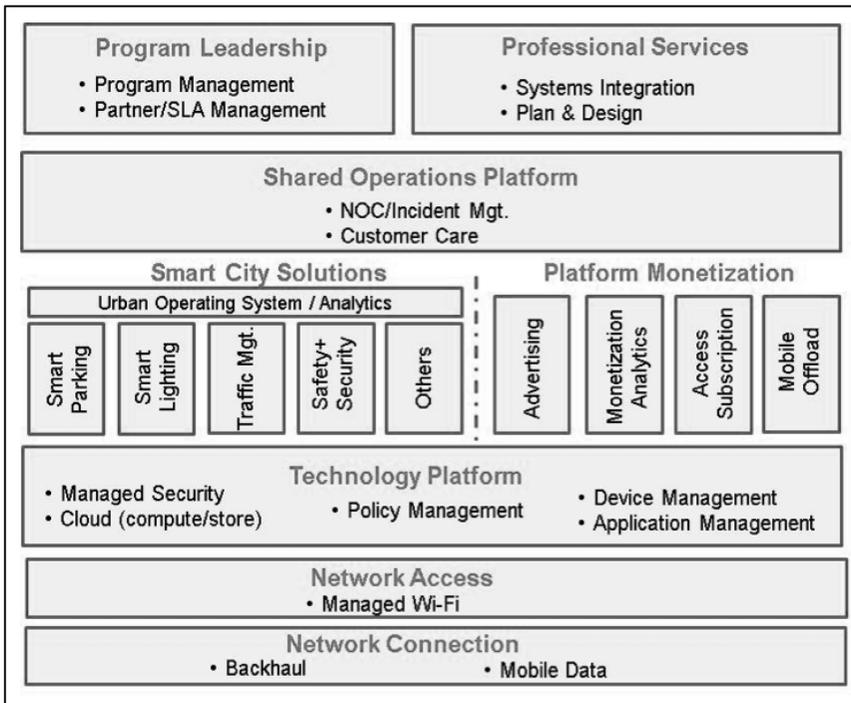


Fig. 16. Seven layers to make money from Smart Cities (Source: <https://blogs.cisco.com/sp/how-to-make-money-from-smart-cities> )

Taylor argues that the development of Smart Cities would create great chances for the investors involved. Furthermore, the development of Smart Cities would produce great value for the cities and their residents.<sup>21</sup> In 2011, CISCO addressed the Smart City phenomena as a method to make money; at the opening of the Evolving Models for Sustainable Urban Design Symposium Wim Elfrink, the chief globalization officer of CISCO stated, “It’s the creation of a new industry!” Every speaker spoke about the fact that when building Smart Cities, a public-private partnership with governments will require a collaborative, multi-stakeholder approach, i.e. investment in infrastructures by private organizations

<sup>21</sup> Ibid.

that will will receive savings and dividends in the future.<sup>22</sup> This method, now called PPP or P3, is also referred to as “the brain behind Smart Cities.”<sup>23</sup> Without private financial support Smart City projects would not have enough funds. Laetitia Gazel, CEO of a U.S.-European based technology and IoT enabling company, said “without a P3, a smart city plan will most likely remain stuck on the drawing board [...] You can give P3s credit for significant projects dating back decades, such as the Transcontinental Railroad, the Golden Gate Bridge and the Interstate Highway System. More recently, the new Port Miami Tunnel project connects one of the world’s largest and busiest ports to the interstate highway system more quickly and safely, alleviating traffic congestion by taking more than 1.5 million trucks out of the downtown Miami area each year.”<sup>24</sup>

That the relationship between marketing and the Smart City paradigm can generate many positive results, such as the ability to implement a wider range of development projects that would not be possible otherwise, and the growth of a new thriving and innovative market that contributes to the economy. Although the connection of marketing and the Smart City paradigm is advertised as positive, it also has its downsides. Negative outcomes such as favoring the interests of the stakeholders more than the one of the city inhabitants. This question was raised about the Songdo project: was the main interest of the Korean government to enhance the lives of the inhabitants or to make a profit? (Fig. 17).

The negative aspects of Songdo contributed to the fundamental reason that the initial proposal to construct the project triggered

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<sup>22</sup> Greg Lindsay, “Smart Cities: Getting Greener, and Making Money Doing It,” *Fast Company*, February 24, 2011, <https://www.fastcompany.com/1731432/smart-cities-getting-greener-and-making-money-doing-it>.

<sup>23</sup> Laetitia Gazel, “Why P3s Are the Brains Behind Smart Cities (Industry Perspective),” *Government Technology*, April 12, 2017, <http://www.govtech.com/opinion/Why-P3s-Are-the-Brains-Behind-Smart-Cities-Industry-Perspective.html>.

<sup>24</sup> Gazel, “Why P3s Are the Brains Behind Smart Cities.”

environmentalists to voice opposition that such a gigantic project would destroy the marine and natural environment at the site of the project, famous for clean water and a huge fish diversity; the highest-quality surf clams in South Korea are produced here. The critics of the Songdo project sarcastically called the Songdo Tidal Flat “Meon-eoh-geum” (먼어금) literally translated as “endlessly far,” and also created a fertile ground for satirical cartoons where, for instance, in a museum, a teacher addresses her students saying, “These are the organisms that used to live in Ganghwa Tidal Flat” indicating a display include river puffers, swimming crabs, large-eyed herring, shrimps, and a fisherman<sup>25</sup> (Fig. 18).

	PROS	CONS
Local	<ul style="list-style-type: none"> <li>• Secure, non-polluting energy supply</li> <li>• Jobs (short-term: construction; long-term: operations/management and technical support)</li> </ul>	<ul style="list-style-type: none"> <li>• Destruction of ecosystem</li> <li>• Decline of local fisheries and related jobs (long-term)</li> <li>• Lost opportunity for eco-tourism and related jobs (long-term)</li> <li>• Increased risk of flooding</li> <li>• Impact on natural landscape</li> </ul>
National	<ul style="list-style-type: none"> <li>• Achievement of GHG reduction goals</li> <li>• Fiscal saving from reducing fossil fuel imports</li> <li>• Immediate stimulation of employment</li> </ul>	<ul style="list-style-type: none"> <li>• Large initial cost for construction</li> <li>• Decline or extinction of legally protected species</li> <li>• Decline of fisheries and eco-tourism along the west coast and associated possible long-term net loss in employment</li> <li>• Disruption of tidal processes in Yellow Sea</li> </ul>
Global	<ul style="list-style-type: none"> <li>• Mitigation of global climate change</li> </ul>	<ul style="list-style-type: none"> <li>• Decline of biodiversity</li> <li>• Destruction of globally unique ecosystems and natural landscapes</li> </ul>

Fig. 17. “The tradeoffs of tidal power projects between local, national, and global goals toward climate mitigation.” (Source: <http://www.environmentmagazine.org/archives/back%20issues/2011/may-june%202011/conflict-of-greens-full.html> )

<sup>25</sup> Yekang Ko, Derek K. Schubert, and Randolph T. Hester, “A Conflict of Greens: Green Development Versus Habitat Preservation – The Case of Incheon, South Korea,” *Environment*, June 2011, <http://www.environmentmagazine.org/archives/back%20issues/2011/may-june%202011/conflict-of-greens-full.html>.



Fig. 18. Sarcastic sketch related to the construction of Songdo IBD: in a museum, a teacher addresses her students, "These are the organisms that used to live in Ganghwa Tidal Flat." The displays include river puffers, swimming crabs, large-eyed herring, akiami paste shrimp, and a fisherman. (Source: <http://www.environmentmagazine.org/archives/back%20issues/2011/may-june%202011/conflict-of-greens-full.html> )

## 3.2. Information and Communication Technologies Dystopia

Smart Cities have been compared to world's imagined in high-tech movies such as *The Matrix*, *Metropolis*, *Blade Runner*, and *The Hunger Games*, and settings for dystopian novels like George Orwell's *1984*. In other words, Smart Cities have been compared to works of fiction with a distinctly dystopian future world view.<sup>26</sup> Even though these dramatic scenarios are far from a probable future, hidden behind these comparisons are the insecurities of people about cities mainly based on ICT infrastructures. Many of the fantasies that populate films and books seem to take more and more

<sup>26</sup> Lahuerta, Juan José, "L'immagine Della Città Del Futuro Nella Letteratura Distopica Della Prima Metà Del '900" (Barcelona: Universitat Politècnica de Catalunya, Departament de Composició Arquitectònica, 2014), 40-260, <http://hdl.handle.net/2117/95444>.

inspiration from current problems, from ecological disasters to increasingly high crime in the suburbs, and then exasperate them to the point where they become cataclysms.

Utopia/Dystopia and cities have, however, a history. David Harvey, in *Spaces of Hope*, argued that the idea of the city is built on the dichotomy of utopia-dystopia.<sup>27</sup> The goal of a perfect city is the absence of privacy and a world where physical and digital realities are merged to open a discussion about the connection of Smart Cities to the dichotomy of Utopia and Dystopia.<sup>28</sup>

A utopia defines a perfect and desirable environment. For centuries the idea of a utopia consisted of a literary genre that best represented the aspirations of humanity. The idea of creating a utopian model to follow for those who ruled was the city's image. According to utopian literature, the industry and the technological process provided the opportunity to create a better world.<sup>29</sup> Nineteenth-century utopian visions were all linked to technology.<sup>30</sup> For instance, Francis Bacon's *New Atlantis*<sup>31</sup> laid the foundations for a utopia based on the usage of science and technology rather than religious morality. The utopian literature of the period started to spread the idea of science and technology as a solution to every problem.<sup>32</sup>

As Zygmunt Bauman points out in *Liquid Times*,<sup>33</sup> a utopia is nothing more than a response to human uncertainty and fear. By contrast it creates the idea of a perfect and orderly world. Progress only seems to be a way to escape disaster rather than a means to

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<sup>27</sup> David Harvey, *Spaces of Hope*, (Berkeley, CA: University of California Press, 2000).

<sup>28</sup> Harvey, *Spaces of Hope*.

<sup>29</sup> Lahuerta, Juan José, "L'immagine Della Città," 150.

<sup>30</sup> Ibid, 40-260.

<sup>31</sup> Francis Bacon, *New Atlantis* (Montana: Kessinger, 1992).

<sup>32</sup> Lahuerta, Juan José, "L'immagine Della Città" 63.

<sup>33</sup> Zygmunt Bauman, *Liquid Times: Living in an Age of Uncertainty* (Cambridge, UK: Polity Press, 2007).

reach a utopia. The literature of technological utopia has as common ground the model of society that reaches enhanced life conditions through the use of science and technology. The ideal city of the future in which all these life enhancements features reach realization has canonical and conventional features: the architecture and construction of the city is equivalent to the construction of a utopia. In other words, technology is used to improve living conditions and, in this sense, architecture is the technology that makes everything possible.<sup>34</sup> The Smart City seeks to create a perfect city that enhances his inhabitants life by excelling in all the city features (transportation, safety, government etc.), and reaches its perfection through technological means that are used as a *panacea*. However, as in literature, a utopia has its corresponding dystopia.

A dystopia describes a negative, abnormal or undesirable future. The invention of the term is generally attributed to the English philosopher John Stuart Mill (1806-1873), who used it for the first time as opposed to the term utopia, indicating the exact opposite of it, therefore, an "undesirable" place.<sup>35</sup> It is with the publication of George Orwell's novel *1984* that the dystopian and pessimistic city vision of the future replaces a utopian one. Orwell's vision of a future society corresponds to a certain form of city, one in which there is strong political power, severe segregation and hierarchical system and the omniscience eye of Big Brother.<sup>36</sup>

Foucault<sup>37</sup> offers two examples of ideal cities where architecture becomes an instrument to monitor everything. The first model is the City of Chauz, at Arc-et-Senans, where buildings are circled and open inward where all axes converge towards a centered building with administrative, economic and surveillance functions. The second is the Panopticon, the project of the "ideal" prison by Jeremy

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<sup>34</sup> Lahuerta, Juan José, "L'immagine Della Città," 68-70.

<sup>35</sup> Lahuerta, Juan José, "L'immagine Della Città," 49.

<sup>36</sup> Ibid.

<sup>37</sup> Michel Foucault, *Discipline and Punish: The Birth of the Prison*, (New York: Pantheon Books, 1977).

Bentham, conceived in 1791.<sup>38</sup> Foucault's critique of modern society is based on the notion of a prison outside of the prison, where the control of behavior is exercised by surveillance based on the principle of permanent observation.<sup>39</sup> Power is visible, but not identifiable. All this power is applied by the accepted rules, rules of behavior commonly accepted by the society. It is not important who exercises the power because the people (the prisoners) enforce "the power" itself by the knowledge of being constantly observed. In the Panopticon, the guardian had the powers of a god: omnipresence and omniscience.<sup>40</sup> Modern society, according to Foucault, is characterized by social control, that is, a set of tools used by society to guide and monitor human conduct.<sup>41</sup>

Smart Cities, relying on the ever-pervasive presence of the Internet that can create a reality in which technology envelops every aspect of our existence and every moment of our daily life. According to the critical designer Keiichi Matsuda "AR [Augmented Reality] and the concept of ubiquitous computing, it's a future that's already being willed into existence right now by Silicon Valley and the big tech companies—think HoloLens, Magic Leap. The question is, is it something we want?"<sup>42</sup> Said Matsuda, producer of the six minutes short film *Hyper-Reality*. The short film outlines though an ironical and critical approach, depicts a kaleidoscopic view of a plausible virtually augmented future where the pervasive virtual reality envelops our physical reality giving to the viewer an overwhelming feeling of asphyxiation. The protagonist, Juliana Restrepo, undergoes the "virtual colonization" of her cognitive system. AR is so

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<sup>38</sup> Lahuerta, Juan José, "L'immagine Della Città" 208.

<sup>39</sup> Foucault, *Discipline and Punish*, page number

<sup>40</sup> Lahuerta, Juan José, "L'immagine Della Città," 281.

<sup>41</sup> Ibid.

<sup>42</sup> Kevin Holmes, "Short Film 'Hyper-Reality' Imagines an Oversaturated AR Future," *Creators*, May 19, 2016, [https://creators.vice.com/en\\_us/article/z4q7q5/short-film-hyper-reality-explores-an-oversaturated-ar-future](https://creators.vice.com/en_us/article/z4q7q5/short-film-hyper-reality-explores-an-oversaturated-ar-future).

pervasive that almost erases her concrete reality (Fig. 19). Matsuda argues:

“Everyone sees this as the successor to the smartphone, it’s the thing that’s going to keep Silicon Valley at the top of its game. I don’t know, it’s got lots of amazing possibilities but all the times when I’m designing these things I’m always thinking of the price we have to pay on our privacy. As soon as you’re in this world you’re in a surveillance state, a total surveillance state, all of your conversations are monitored, your social value, it compromises us in lots of different ways. The film’s trying to understand if that level of invasion is something we want. Is it something we’re willing to accept or is it something to push back on, before it’s too late?”<sup>43</sup>

This film represents the insecurities of people about a city mainly based on ICT infrastructure. It represents how the concept of privacy will not have the same meaning for millennials that it has for those in the baby boomer generation. Today, everyone is more inclined to give up their privacy to access the public dimension of the Internet. The Internet and its world, can be considered as a public environment where privacy is a privilege for those people with hacking skills.

The way privacy is currently perceived will change or disappear. Films and books of future utopias/dystopias share two common denominators: the absence of privacy and the absence of freedom, with governments acting like a panopticon controlling people. Sang Keon Lee, Vice Director at Korea Research Institute for Human Settlements, in his research paper “International Case Studies of Smart Cities: Songdo, Republic of Korea” stated that in Songdo “the IFEZ integrated operation center is located on the 3rd and 4th floor of G-Tower at 175 Art center-daero, Yeonsu-gu, Incheon city. The center is composed of mainly integrated control room, observatory,

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<sup>43</sup> Holmes, “Short Film ‘Hyper-Reality’ Imagines an Oversaturated AR Future.”

equipment room and conference room, over a total area of 1,169.5 m<sup>2</sup><sup>44</sup> (Fig. 20).



Fig. 19. Shots from the short movie *Hyper-Reality* (Source: <https://goo.gl/tBKqen>).

In Rio de Janeiro, the Centro de Operações Prefeitura do Rio de Janeiro (COR) (Fig. 21) was built with the help of IBM Brazil to improve the safety and well-being of the inhabitants. In the monitoring room, 70 employees oversee what it is happening in real-time in the city through CCTV cameras, sensors and Google satellites. These monitoring staff also communicate constantly with the staff of the various departments of the city, such as mobility and

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<sup>44</sup> Sang Keon Lee et al., “International Case Studies of Smart Cities: Songdo, Republic of Korea” (Inter-American Development Bank, June 2016), 2-30, <https://doi.org/10.18235/0000411>.

health-care, and private companies that are active in the functioning of the city , such as the ones who build roads or take care of the trash disposal.<sup>45</sup>

These two examples look similar to the operation center of *The Truman Show* (Fig. 22). The movie tells the story of Truman Burbank, the unaware celebrity of “The Truman Show,” a worldwide-broadcasted reality show. He lives his entire life in a fictional town built inside a dome in Hollywood where he is monitored 24 hours a day by thousands of cameras.<sup>46</sup>

The enormous amount of data generated and collected through these smart devices provides a clear window into the lives and of people and their routines, in ways that have implications for privacy. The majority of Smart City projects heavily rely on CCTV cameras, even though the main goal is supposed to be the safety of city inhabitants, it is easy to imagine why such a method would lead to dystopian ideas. The utopias of a city functioning perfectly like a robot and the catastrophic scenarios of a 24/7 lack of freedom seems Orwellian, but it is something Sunbelt American have already become acquainted with, through traffic intersection cameras and ambient private camera systems, two terribly invasive models of observed omniscience.<sup>47</sup> Arguably, it can be observed that the Smart City could function best in a more or less totalitarian political system. For instance, surveillance cameras fully cover Beijing, the capital of China. These cameras supervise each and every “corner” of the city (Fig. 23), as asserted in a report by the state media’s mouthpiece, The People’s Daily. It was claimed by the Beijing Public Security

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<sup>45</sup> Christopher Frey, “World Cup 2014: Inside Rio’s Bond-Villain Mission Control,” *The Guardian*, May 23, 2014, sec. Cities, <http://www.theguardian.com/cities/2014/may/23/world-cup-inside-rio-bond-villain-mission-control>.

<sup>46</sup> Wikipedia, “The Truman Show,” *Wikipedia*, September 4, 2017, [https://en.wikipedia.org/w/index.php?title=The\\_Truman\\_Show&oldid=798947729](https://en.wikipedia.org/w/index.php?title=The_Truman_Show&oldid=798947729).

<sup>47</sup> Tony Chavira, “The Smart Panopticon-Opolis,” *Smart Cities Dive*, August 22, 2011, <http://www.smartcitiesdive.com/ex/sustainablecitiescollective/smart-panopticonopolis/28454/>.

Bureau that the system managed to have 100% surveillance of the city in 2015.<sup>48</sup>



Fig. 20. IFEZ integrated operation center (Source: Sang Keon Lee et al., “International Case Studies of Smart Cities: Songdo, Republic of Korea” (Inter-American Development Bank, June 2016), doi: 10.18235/0000411, 26.)



Fig. 21. Centro de Operações Prefeitura do Rio de Janeiro (COR). (Source: <http://thecityfixbrasil.com/2015/01/23/programa-rio-resiliente-e-lancado/>)

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<sup>48</sup> Vivienne Zeng, “‘Every Corner’ of Beijing Covered by Surveillance Cameras, State Media Proudly Announce,” *Hong Kong Free Press*, October 5, 2015, <https://www.hongkongfp.com/2015/10/05/every-corner-of-beijing-covered-by-surveillance-cameras-state-media-proudly-announce/>.



Fig. 22. The “Control Room” in the movie The Truman Show. (Source: <https://goo.gl/images/b1bh3E>)

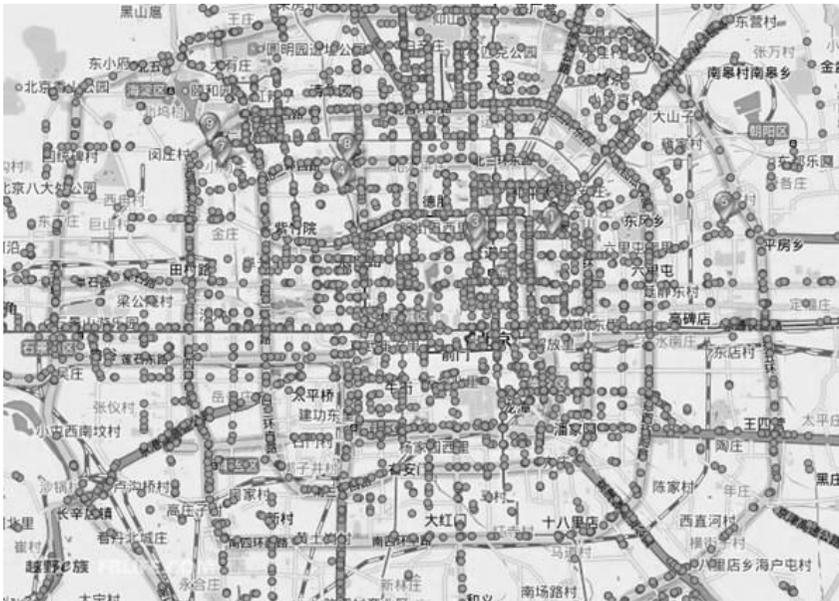


Fig. 23. Beijing CCTV map (Source: [https://www.hongkongfp.com/2015/10/05/every-corner-of-beijing-covered-by-surveillance-cameras-state-media-proudly-announce/.](https://www.hongkongfp.com/2015/10/05/every-corner-of-beijing-covered-by-surveillance-cameras-state-media-proudly-announce/))

## 3.3. Hacking Cyber-security

### 3.3.1. Cyber-security

Every member state of the UN agrees that it is difficult, due to Smart City's disorganized nature, to create guidelines about what should be done to regulate and secure the Smart City phenomenon.<sup>49</sup> The lack of clearly defined parameters, terminologies, and regulations across the world regarding what exactly the Smart City has left Internet security to individuals, public and corporate entities to set their own courses in ways that may not always be in congruence with serving the long term interest of citizens. The term Cyber security refers to the collection of technologies, best practices, assurance, risk management approaches, actions, training, tools, policies, security concepts, security safeguards and guidelines which are applied to protect the assets of the users, organizations and the cyber environment.<sup>50</sup>

The data from Smart City is collected in secured private sections of the web and those applications and websites used by users are not allowed to share the data without the consent of the owner. However, this system has real vulnerabilities: any cyber-attack could easily steal and expose everything we consider private. So, if everything is interconnected virtually, a small mistake could lead to big consequences. Usually a first name, surname, password and email address are the only personal information required when registering a new account on social networks and any other related websites. It is rare when signing up to a website that one is asked to

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<sup>49</sup> Charletta Anderson-Fortson, "Cyber Security and the Need for International Governance," *The National Law Review*, May 16, 2016, <https://www.natlawreview.com/article/cyber-security-and-need-international-governance>.

<sup>50</sup> ITU, "Cybersecurity," ITU, accessed December 4, 2017, <http://www.itu.int:80/en/ITU-T/studygroups/com17/Pages/cybersecurity.aspx>.

send an identification or social security number to certify that it is actually you registering. Therefore, it is easy to create fictitious profiles, or to illegally take a person's identity. In many cases, it is difficult to guarantee the true identity of the person registered.

Because Smart cities rely on complex, networked pools of digital technologies and ICT infrastructure they are susceptible to malicious attacks. First, any device that relies on software to function is a potential target for a malware attack. Hacks can routinely be carried out remotely and all it takes is for a single device to be compromised. If that happens, then the whole assemblage becomes susceptible to myriad cyber-attacks that can among other things, alter, disrupt, deceive, degrade or destroy computer systems and networks. In the end, it brings to the fore fundamental questions about how the process of making city systems and infrastructures "Smart" has in the same vein made them somewhat vulnerable to multiple cyber-attack threats.

If a Smart City initiative is implemented, usually, various Smart features are integrated within urban areas. In the world, there are nearly 200,000 traffic control sensors that are susceptible to being hacked by hackers. These hackers may be on the other side of the world using a drone, or the hack might originate from a city's security organization lack of technical knowhow to correctly encrypt the traffic control sensors. What would happen, for example, if all the traffic light sensors came under a cyber-attack? The result would be surely dystopian.

In Songdo, for example, one of the deputies of the facility stated that since CCTV footage is not stored for more than 30 days they do not worry about the security or cyber threats: "I do not have to worry about this. It will not happen. There is no important data in this center. Honestly, the Smart City has not reached that stage yet," he said referring to the possibility of cyber threats. In his opinion he did

not think “it’s time to talk about security.”<sup>51</sup> However, Sean Sullivan, security analyst and well known researcher of internet security F-Secure, an online security and privacy products company, has clearly warned that in the future, these Smart Cities would be quite vulnerable to hackers as compared to the smartphones and computers in the modern world today. Although, at present the hacker community has not exercised effort to carry out an attack to compromise these kind of devices, it is indeed possible to hack the Smart Cities. However, compared to large scale attacks, at the present, hacking pranks are observed, such as fidgeting with highway signs or transport systems, leading to outage or chaos (Fig. 24).<sup>52</sup>



Fig. 24. Xi'an, China, in 2014 Traffic control sensors are vulnerable to hacking. (Source: <http://www.theguardian.com/technology/2015/may/13/smart-cities-internet-things-security-cesar-cerrudo-ioactive-labs>).

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<sup>51</sup> IFEZ Integrated Smart City Operation Center Representative 2. Interview by Klara Lucilla Romigioli. Songdo, October 3, 2017.

<sup>52</sup> Nicole Kobie, “Why Smart Cities Need to Get Wise to Security – and Fast,” *The Guardian*, May 13, 2015, sec. Technology, <http://www.theguardian.com/technology/2015/may/13/smart-cities-internet-things-security-cesar-cerrudo-ioactive-labs>.

Global Security Researcher James Lyne, of the IT company Sophos, believes that there are security systems which rely on obscurity. They make use of the protocols which are not usually applied in the mainstream computing world. Networks are isolated so there is no tampering. The devices that are targeted the most are those used by everyone since the financial benefits are highest. However, the pattern may change with the advancement of a connected future. Keeping in mind the security risks, vendors like the ones who sell appliances or connecting technology, are not allowing researchers like Cesar Cerrudo, the chief technology officer at IOActive Labs, a globally acknowledged firm that offers, and is active in, research on cybersecurity. In Cerrudo's opinion cities are usually prepared for flooding or earthquakes, but not for cyber-attacks.<sup>53</sup>

Cerrudo stated that governments "do a lot of tests for functionality on the system and devices, but they don't do any security testing. So, basically, they are trusting the vendors."<sup>54</sup> So, Cerrudo suggested that all governments should own a Computer Emergency Response Team (CERT), in the same numbers big corporations do to defend themselves from cybercrime, fix the security problems, and maintain their own system under constant observation running penetrations tests.<sup>55</sup>

In 2017, the first global summit on development and the first conference on data and cities took place. Kelsey Finch, policy counsel with the Future of Privacy Forum, gives advices for a better management of the big data collected and published:<sup>56</sup>

1. It should be important to employ experts who are prepared to manage the big data acquired and, so, the privacy related issues. Experts who are constantly checking, updating and

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<sup>53</sup> Kobie, "Why Smart Cities Need to Get Wise."

<sup>54</sup> Ibid.

<sup>55</sup> Ibid.

<sup>56</sup> Brendon Bosworth, "6 Tips to Help a 'smart' City Navigate around Privacy Issues," *Citiscopes*, June 8, 2017, <http://citiscopes.org/story/2017/6-tips-help-smart-city-navigate-around-privacy-issues>.

maintain the well-functioning of the privacy securing systems;

2. Engage the community: the city inhabitants should be constantly updated to data and how it is collected so that they can provide feedback regarding the privacy issues;
3. Minimize data collected, and “de-identify” personal data: minimization of the collection of data is believed to be the first step to a better privacy—limiting the personal information that can be acquired to the strictly necessary;<sup>57</sup>
4. Use local storage: it was advised that local storage was much more preferable to the Internet “cloud” with only aggregated data sent to online storage;
5. Stipulate contractual agreement on the way the data collected it is important for the contractors to stipulate contractual agreement on the way the data collected can or can not be used;
6. Be careful with how open data is handled.<sup>58</sup>

### 3.3.2. Cyber-crime

If IoT is “secure” or not is still uncertain. In fact, IoT can be a great gamble with online appliances being vulnerable to being compromised by cyber-criminals.<sup>59</sup> There are three main causes of cyber-crime: imperfection of the structure of the Internet; imperfections in the hardware and software; and the increasing number of web frameworks. There are four main categories of cyber security: espionage, cyber-crime, cyber warfare, and cyber terrorism. These categories can be classified further into cyber

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<sup>57</sup> Ibid.

<sup>58</sup> Ibid.

<sup>59</sup> Dale Walker, “What Is IoT?” *Proquest*, February 3, 2017, <https://search.proquest.com/docview/1864800108?accountid=6802>.

warfare and cyber-crime. Cyber warfare means the unauthorized penetration into another network or computer, or any other computer system activity, based on support of or on behalf of a government is referred to as Cyber warfare. The politico-military stream associated with the information technologies is being applied for reasons which are not consistent with the international stability maintenance and security. It may influence state security; but, instead cyber-crime is recognized as an economic stream where information technology is criminally misused.

Since 1998, cyber-crime has increased significantly. By 2015, cybercrime was defined as a service where an individual would access the dark web and hire a hacker. As compared to computers, mobile technology would be subjected to an attack on a large scale since there are more mobile users. Furthermore, since a large scale breach is profitable, it is more common. The targets are usually small to medium sized organizations since their protection is low due to limited resources.<sup>60</sup>

In 2016, based on statistics collected on a bi-weekly basis of major cyber-attacks published on open sources, 1061 cyber-attacks have manifested across the Internet. (Fig. 25) Statistics on cyber threats are difficult to obtain, and these statistics are not comprehensive.<sup>61</sup> In 2017, the most common type of cyber-attacks (Fig. 26) was cyber-crime, 64.5%, followed by cyber espionage, 22.4%, then hacktivism, 7.9% and only 5.3% of cyber warfare (Fig. 27). In the first half of 2017, malware has been the most used form of attack among cyber-attacks techniques, followed by targeted attacks and hijackings. Targets are usually industries followed by governments with individuals accounting for 7.9% (Fig. 28).<sup>62</sup>

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<sup>60</sup> Anderson-Fortson, "Cyber Security."

<sup>61</sup> Paolo Passeri, "2016 Cyber Attacks Statistics," *Hackmageddon*, January 19, 2017, <https://www.hackmageddon.com/2017/01/19/2016-cyber-attacks-statistics/>.

<sup>62</sup> Paolo Passeri, "February 2017 Cyber Attacks Statistics," *Hackmageddon*, March 20, 2017, <https://www.hackmageddon.com/2017/03/20/february-2017-cyber-attacks-statistics/>.

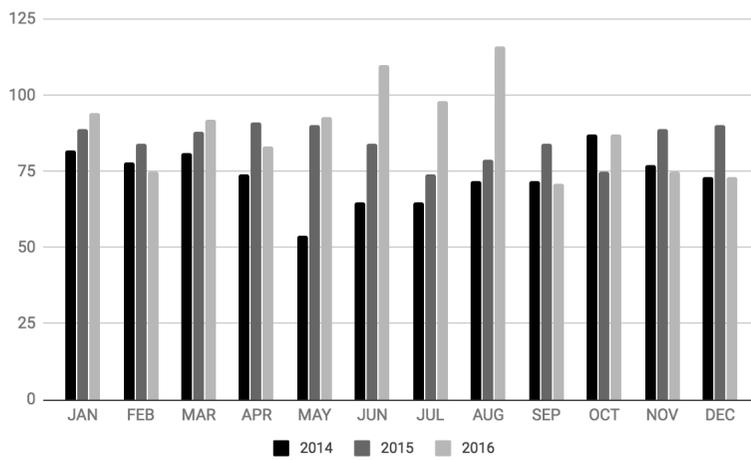


Fig. 25. Monthly Cyber Attacks. (<https://hackmageddon.com>)

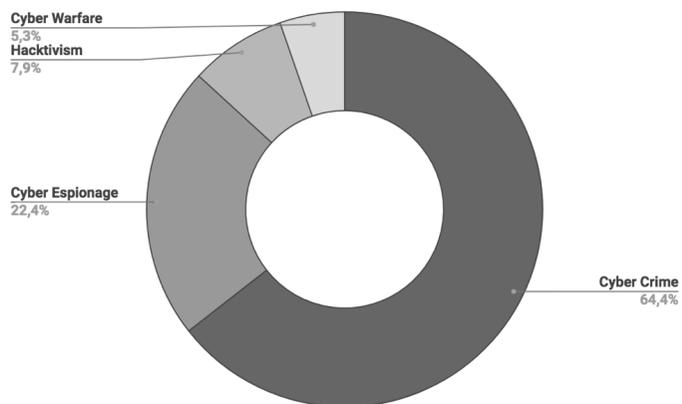


Fig. 26. Motivations behind Cyber Attacks. (<https://hackmageddon.com>)

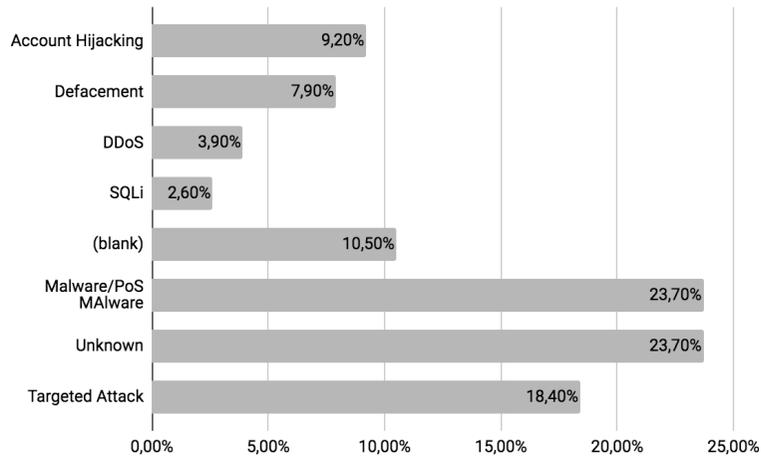


Fig. 27. Cyber-attack vectors. (Source: <https://hackmageddon.com>)

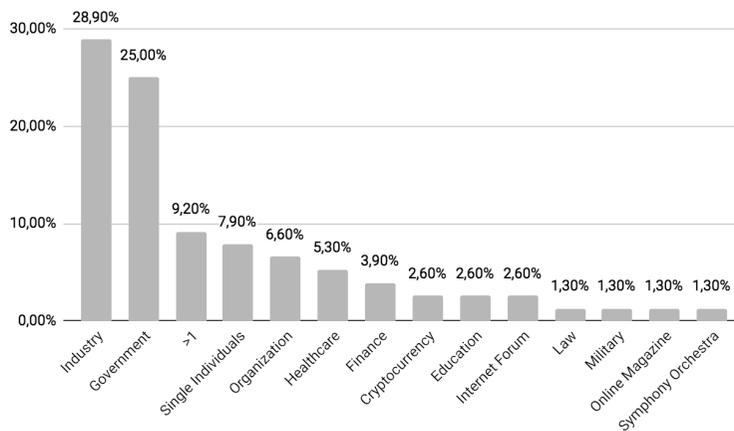


Fig. 28. Cyber-attack target distribution. (Source: <https://hackmageddon.com>).

### 3.4. Social Polarization

David Harvey argued that capitalist investment in urban infrastructure does not guarantee future capital accumulation. Although this investment momentarily improves an area and produces employment and generates social polarization since it

diverts public (welfare) resources to help attract mobile global capital. Growing inequality and social polarization are problems that Smart Cities have to face. Information technology, instead of increasing the living standards for its citizens, has been proved as the cause of the deepening social divisions in cities. Poorer citizens and traditional communities are excluded from the new highly “gentrified neighborhoods and leisure/entertainment provision, created thanks to the arrival of educated, mobile middle class professionals and IT workers,” as stated by Robert Hollands, Professor of Geography, Politics and Sociology at the University of Newcastle.<sup>63</sup> Cities are now serving more global mobile IT businesses instead of looking after ordinary residents by creating services exclusively for rich clients.

Also, in the developing countries that were believed to be unprepared for the Smart City wave, the middle and high classes were favored over the lower classes, as well as used the Smart City initiatives for anti-poor motives. In the presence of an urban policy, the elite global nations have integrated a system with prestige projects and high-value real estate development. They have not considered the requirements of the poor as an integral part of the economy. According to Seth Kugel in the New York Times, Brasilia, referred to as the planned urbanization essence, does not indicate any trace of the working class or the underclass.<sup>64</sup>

In Kigali, Africa, a Smart City project evicted 80% of the original inhabitants to make way for the new tenants. Smart Cities development in Africa only take into account the middle class as it is quite hard to imagine the ability of the poor households to even manage minimum spending when the Smart City plans portray

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<sup>63</sup> Robert G. Hollands, “Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?” 303–320.

<sup>64</sup> Neil Blackshaw, “Whose City Is It Anyway? The Harsh Truth about Urbanisation,” *The Guardian*, April 16, 2014, sec. Cities, <http://www.theguardian.com/cities/2014/apr/16/whose-city-is-it-anyway-the-harsh-truth-about-urbanisation>.

luxury apartments to be bought; it was observed that the African market is being misread by potential property developers. Old and new master plans have been created by the central governments and are usually “top-down” impositions based on the anti-urban, anti-poor stance present between political leaders. To manage the unemployed and poor citizens of the urban areas, many African political and economic elites believe that the urban area removal is most suitable. This idea does not take into account that in some countries in Africa, such as Angola, the Democratic Republic of Congo, Ghana, Kenya, Nigeria, Rwanda and Tanzania, the poor inhabitants were born in the cities and such a policy is seen as a denial of the reality present in developing countries regarding modern urbanization.<sup>65</sup>

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<sup>65</sup> AllAfrica, “Africa: Urban Planners Skeptical of ‘Smart Cities,’” *AllAfrica*, May 7, 2014, <https://allafrica.com/stories/201405071502.html>.

## Chapter 4. Quality Living in Built-from-Zero Smart Cities

The focal point of the Smart City paradigm is to increase the well-being of the inhabitants of the urban area by implementing technological and environmentally sustainable improvements to all the elements that form the urban space on different scales of evaluation. The use of this ecological attitude and technological methods, presumably, would allow a city and its services to function in a more logical and comprehensive way, based on achieving the maximum possible efficiency, and improving both the quality of life of citizens and the environmental impact on the city itself. Although the level of intelligence of a city can be quantified by numbers, examining indicators such as pollution levels, smartphones penetration, renewable energy generation, households, Internet access, open data, and availability, are also important in assessing a city's level of intelligence through the quality living impact on inhabitants.

Existing cities that are being retrofitted to Smart Cities already have established urban and social interactions, and as a defined urban form, they only have to work on retrofitting the cities into Smart Cities. On the other hand, Built-from-Zero Smart Cities have the opportunity to create a Smart City from scratch, but they have to attract people and establish, from scratch, an environment where social life can flourish. City-makers of Built-from-Zero Smart Cities focus more on technology and marketing the Smart City than on creating the city fabric for a social life. In order to create optimal quality living and maximize the inhabitants health and happiness, rather than wealth,<sup>1</sup> it is also important to give attention to urban interactions. Thus, creating quality living in the urban spatial

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<sup>1</sup> Collins English Dictionary, "Quality of Life Definition and Meaning," *Collins English Dictionary*, accessed April 3, 2018, <https://www.collinsdictionary.com/dictionary/english/quality-of-life>.

infrastructure is fundamental to giving attention both to the physical and social space of the city, so that interactions between the two can flourish and city inhabitants can reach a comfortable daily life.

A city that provides quality living is a city that offer its citizens a seamless social daily life. As defined by Constantinos Doxiadis, a city has to enable its inhabitants to comfortably commute, accomplish daily routines and enjoy social interactions.<sup>2</sup> The city has to provide its inhabitants with optimal environments where they can easily integrate, express themselves, grow, develop, prosper, and achieve life ambitions.<sup>3</sup> This is supported by the argument that the environment has an influence on its inhabitants, as stated by Charles Montgomery, Canadian writer and urbanist, in his book *Happy City*: “The fact is, a person is so far formed by his surroundings, which his state of harmony depends entirely on his harmony with his surroundings.”<sup>4</sup> As a consequence, if these are the conditions that come to create a quality urban living, it is possible to argue that successful cities are the ones where the inhabitants are happy.

Due to its dual meanings, the definition of “quality” is complicated. It can vary from “general excellence” to “unique feature or property.”<sup>5</sup> It is essential to remember that, whenever there is a discussion about quality, it is a subjective estimation of a product, or service, or space. It is inaccurate to assume that the attitudes towards, and the requirements of the environment are the same for every user. Different variables, such as age, gender, cultural background, religion, and individual perceptions, contribute to shaping a personal definitions of “high quality.”<sup>6</sup>

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<sup>2</sup> Constantinos A. Doxiadis, “Ekistics, the Science of Human Settlements,” *Science* 170, no. 3956 (1970): 393–404.

<sup>3</sup> Charles Montgomery, *Happy City: Transforming Our Lives through Urban Design*, (New York: Farrar, Straus and Giroux, 2013), 36.

<sup>4</sup> Montgomery, *Happy City*, 4.

<sup>5</sup> Nicola Dempsey, “Quality of the Built Environment in Urban Neighbourhoods,” *Planning Practice and Research* 23, no. 2 (May 2008): 249–264, <https://doi.org/10.1080/02697450802327198>.

<sup>6</sup> Dempsey, “Quality of the Built Environment in Urban Neighbourhoods,” 249–264.

Subjective opinions and ratings of quality from users or residents should not be the only measurement of city quality. There are objective ways to measure the quality of spaces, such as assessments of building construction<sup>7</sup> and the extent of trees and greenery, adequate and numerous leisure facilities, hospitals, footpaths and transportation, school and offices, retail facilities, etc.<sup>8</sup>

Although the value and interrelations of physical and social spaces can be analyzed quantitatively, other than suitable amounts and values of physical elements of the space, a city that is a place of quality living has to be a fertile environment for urban interactions and social life within the physical space. This implies also that the elements that generate quality urban life are not measurable through monetary or quantitative means. As sustained by Peter Kinderman, Professor of Clinical Psychology at the University of Liverpool, aspects of life such as health, family and relationships, etc. “are all important contributors to our sense of satisfaction with our lives. [...] the relationship between wealth and well-being is complex: put simply, poverty makes people miserable, but wealth doesn’t necessarily make people happy.”<sup>9</sup> A city should hypothetically provide enough variety of flexible, diverse and suitable environments that support the inhabitants’ culture, hobbies, private and community growth on a personal and business level, to satisfy the inhabitants’ happiness by delivering seamless daily routines.

Even though it is difficult to objectively measure the quality of an environment for living, it is possible to estimate how the macro-elements (i.e. architectural model, commuting infrastructure, residential land usage, etc.) and micro-elements (i.e. Internet

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<sup>7</sup> Nicola Dempsey et al., “Elements of Urban Form,” in *Sustainable City Form*, ed. Mike Jenks and Colin Jones, vol. 2 (Dordrecht, Holland: Springer 2008), 21–51, [https://doi.org/10.1007/978-1-4020-8647-2\\_2](https://doi.org/10.1007/978-1-4020-8647-2_2).

<sup>8</sup> Dempsey, “Quality of the Built Environment,” 249–264.

<sup>9</sup> Peter Kinderman, “Should Governments Measure Happiness?” *Greater Good*, September 25, 2015, [https://greatergood.berkeley.edu/article/item/should\\_governments\\_measure\\_happiness](https://greatergood.berkeley.edu/article/item/should_governments_measure_happiness).

penetration, crime rate, clean streets, inhabitant satisfaction, etc.) of the urban space fulfil the criteria of, for instance, quantity, diversity, and adaptability that provide the right mixture to create an environment in which social life can flourish. So, on a broad city scale, it is possible to evaluate a city's quality of life by how various micro-elements of the urban spatial space are satisfied and on how they have impact on the social life of the inhabitants. Adaptability,<sup>a</sup> accessibility,<sup>b</sup> and diversity are the main factors that create social life;<sup>d</sup> the more the dimensions of social life and urban form<sup>e</sup> meet, the more quality living is present in a city. Social Life and its criteria influence how the physical space, urban form, is lived and inhabited (Fig. 29).

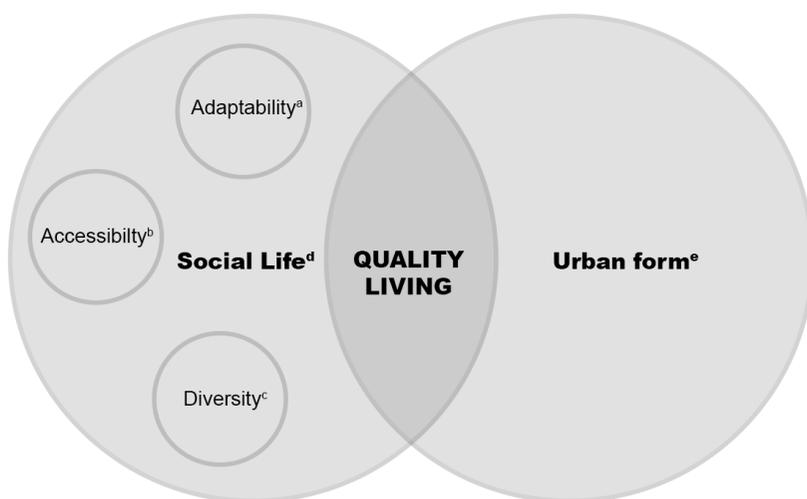


Fig. 29. Production of Quality Living in the city environment.

## 4.1. Adaptability

Adaptability is another factor that influences how a city offers quality living. Urban plans have been traditionally developed with rigid design systems.<sup>10</sup> However, to cope with the fluctuation of city variabilities such as the number of population of the contemporary urban society, a flexible design approach is necessary providing the possibility of flexible physical and social development.<sup>11</sup> An adaptable plan of the city is required to sustain the needs of various residents for it and to be dynamic to deal with long-term urban changes such as population trends, technological advances, and environmental challenges. Residents should be able to mould the city and appropriate its spaces. Usually the built form already exists, but it has to be able to be changed and molded according to resident needs. New environments and buildings have to be transformable. The possibility to mold and transform the city, provided by its adaptability, helps the creation of a more livable space. Urban plans that comprise adaptability make it possible to create a new cities that are more flexible than traditional cities.<sup>12</sup>

## 4.2. Accessibility

A city should be easily accessible, not only through the transport infrastructure, but also in terms of living expenses. For instance, a city is accessible if the living space is affordable, safe and adequate

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<sup>10</sup> A.M. Laddaga, *Elasti-City: A Study of Adaptability Across City Scales* (Vancouver: University of British Columbia, 2011), <https://books.google.co.kr/books?id=dyrFtwEACAAJ>

<sup>11</sup> Nur Esin Altaş and Ahsen Özsoy, "Spatial Adaptability and Flexibility as Parameters of User Satisfaction for Quality Housing," *Building and Environment* 33, no. 5 (September 1998): 315–23, [https://doi.org/10.1016/S0360-1323\(97\)00050-4](https://doi.org/10.1016/S0360-1323(97)00050-4).

<sup>12</sup> Christina Schmidt and Liane Filtenborg Laustsen, "The Adaptable City: Exposing Urban Synergies in the Reconstruction of Ladegårds Å" (Aalborg University, 2015), [http://projekter.aau.dk/projekter/files/213016956/The\\_Adaptable\\_City\\_URB02.pdf](http://projekter.aau.dk/projekter/files/213016956/The_Adaptable_City_URB02.pdf).

(large enough) for a different range of economic classes. An accessible commuting infrastructure implies efficient transit and transportation. Transport infrastructure defines how easily residents can reach places. Accessibility is a layered concept depending on various things such as, how good the transport system is and the usage of the transport system. Important factors defining high quality commuting accessibility, are the quality of commuting from home to city center, the journey to work, and to city services such as grocery stores, post offices, community centers, etc. In terms of minimizing time and distance, a city should be compact, automobile independent, walkable with suitable footpaths and have adequate cycle paths.<sup>13</sup>

### 4.3. Urban Form

Urban form has been defined as the spatial configuration of fixed elements on various scales, like paths, nodes edges and landmarks, on a broader scale, or the type of urban settlement (market town, central business district or suburbs), on a regional scale,<sup>14</sup> or even the building materials, façades and fenestration on a narrower scale. Nicola Dempsey, senior lecturer at the Department of Landscape of the The University of Sheffield, argues that “these levels of spatial disaggregation influence how urban form is measured, analyzed and ultimately understood.”<sup>15</sup>

Through its analysis of physical and perceptible items, Kevin Lynch, author of *Image Of The City*, studied what makes a city attractive to the masses, the characteristics of environmental elements, and their impact on the visual quality of the created

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<sup>13</sup> Dempsey et al., “Elements of Urban Form,” 21–51.

<sup>14</sup> William P. Anderson, Pavlos S. Kanaroglou, and Eric J. Miller, “Urban Form, Energy and the Environment: A Review of Issues, Evidence and Policy,” *Urban Studies* 33, no. 1 (February 1996): 7–35, <https://doi.org/10.1080/00420989650012095>.

<sup>15</sup> Dempsey et al., “Elements of Urban Form,” 21–51.

environment, describing it as a “quality that raises the chances of stimulating a strong image in any given observer.” This quality is related to the city structure, color, layout, and cultural components. A city environment would have to fulfill all these requirements to be visible for the common observer. Peoples’ mental representation of the city, derived from the mental map of what it is inside the city, and the actual city incorporate the unique elements called Lynchian. He identified five types of elements: paths, edges, districts, nodes, and landmarks. Paths are “the channels along which the observer customarily, occasionally, or potentially moves,” like streets, canals, and railroads. Various different features can help express the continuity, such as similar names or the appearance of the buildings in it. Also the pavement composition, the width or narrowness of the path can bring focus to a specific route. As a result, many factors could break this continuity, such as a sudden change in the use of the building, so people would have problems finding their way since the path is deeply united with the environment, and the sudden separation of a route from common surroundings could lead to problems. Every path has a starting and ending point, and if these two are clear and recognizable then the path will be strong enough to help connect parts of the city. Additionally, clear hierarchy is also a key factor to improve the directional quality. Lynch, defines edges as “the linear elements not used or considered as paths by the observer. They are the boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls.”<sup>16</sup> The line that divides two areas with distinct characteristic is called edge. It can be natural, like a river or artificial, such as and highway or a bridge. Districts are seen as a thematic unit, with common features and a divided visual identity from the environment. Good physical aspects, such as continuity and homogeneities of materials, spaces, details, uses, etc. are key factors for the creation of an identity of the district. Also, the name plays a vital role in the

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<sup>16</sup> Kevin Lynch, *The Image of the City*, (Cambridge, Mass.: MIT PRESS, 2005), 72.

establishment of a district. Nodes, by Lynch's definition, "are the strategic foci into which the observer can enter, typically either junctions of paths, or concentrations of some characteristic."<sup>17</sup> Nodes are the get-together places such as stations, plazas, and even ordinary street intersections. Since they can be junctions, nodes are also connected to paths, being their convergence. Landmarks are external characteristics that work as reference points. They also change based on personal experience. Landmarks are usually static and unique features. It is best if there are not many landmarks as an abundance will undermine their use.<sup>18</sup>

Urban form has also been defined as *evolutionary*,<sup>19</sup> sustained by the argument that long-lasting urban elements, like buildings and urban infrastructure, impact the spatial form of new components.<sup>20</sup> The key factor to define it, more than the temporal circumstances, is the reaction to historical events, technologies, policies, and preferences throughout history.<sup>21</sup>

#### 4.4. Diversity and Social Life

Diversity does not strictly refer to multi-ethnic residents or other demographic and cultural conditions such as age or level of education. It represents a key factor to the understanding of who is actually participating in the city life and the depth of their role in urban life.<sup>22</sup> Diversity can be created with mixed-use development which

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<sup>17</sup> Lynch, *The Image of the City*, 72.

<sup>18</sup> *Ibid.*

<sup>19</sup> Anderson, et al., "Urban Form, Energy and the Environment," 7–35.

<sup>20</sup> M. Wegener, "Transport Network Equilibrium and Regional Deconcentration," *Environment and Planning A* 18, no. 4 (April 1986): 437–56, <https://doi.org/10.1068/a180437>.

<sup>21</sup> John S. Adams, "Residential Structure of Midwestern Cities," *Annals of the Association of American Geographers* 60, no. 1 (March 1970): 37–62, <https://doi.org/10.1111/j.1467-8306.1970.tb00703.x>.

<sup>22</sup> Localeur, "What Factors Make a City Great?" *Huffington Post* (blog), June 19, 2014, [https://www.huffingtonpost.com/localeur/what-factors-make-a-city-urban-planning\\_b\\_5511883.html](https://www.huffingtonpost.com/localeur/what-factors-make-a-city-urban-planning_b_5511883.html).

comprises the importance within an urban spatial environment of various types of spatial functions such as sub-urban, economic, cultural, entertainment facilities, etc. These functions should be blended and combined, physically and functionally, with pedestrian connections. Mixed-use developments can be found on various scales from buildings and city blocks, to neighborhoods.<sup>23</sup> Jane Jacobs, a well-known journalist, author and activist who influenced urban studies, sociology and economy, sustained that the mere existence of cities does not automatically presume the creation of diversity;<sup>24</sup> in her opinion: “although cities may fairly be called natural economic generators of diversity and natural economic incubators of new enterprises, this does not mean that cities automatically generate diversity just by existing.”<sup>25</sup>

From an economic point of view residents catalyze the development of shopping facilities, restaurants, and venues of entertainment. The circumstances producing diversity in the city are discoverable through the observation and examination of those spaces where diversity is generated and how it is generated.<sup>26</sup> Although the development of a neighborhood with facilities such as shopping centers, restaurants, cinemas would be stimulated by a residential type of population; this type of neighborhood would also be desirable for the day-time working population.<sup>27</sup>

Jane Jacobs defines four conditions indispensable to creating diversity in city streets and districts. Firstly, the multi-primary function of districts: the neighborhood and at least two parts of which is made have to serve more than one primary function. This mixed-function

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<sup>23</sup> Atlanta Regional Commission, “Mixed-Use Development,” *Quality Growth Toolkit*, accessed April 2, 2018, [https://web.archive.org/web/20111128011547/http://www.atlantaregional.com/File%20Library/Local%20Gov%20Services/gs\\_cct\\_mixedusetool\\_1109.pdf](https://web.archive.org/web/20111128011547/http://www.atlantaregional.com/File%20Library/Local%20Gov%20Services/gs_cct_mixedusetool_1109.pdf).

<sup>24</sup> Jane Jacobs, *The Death and Life of Great American Cities*, (New York: Vintage Books, 1992), 190.

<sup>25</sup> Jacobs, *Death and Life*, 193.

<sup>26</sup> Jacobs, *Death and Life*, 194.

<sup>27</sup> *Ibid.*, 204.

of the space has to guarantee the presence of people who, based on different time schedules, go outdoors and use the facilities together. Secondly, the blocks have to be short, meaning that in the streets, the opportunities to turn corners are frequent. Thirdly, the districts should comprise buildings that vary in age and condition. Lastly, there should be population density.<sup>28</sup> Commercial and retail facilities, such as supermarkets, shops warehouses, restaurants and cafés are important in the mixture of diversity of spaces that create quality living.

Social life plays a crucial role in creating quality living conditions and increasing the life quality of a city. As a consequence, the quality living of the inhabitants of the city is proportionate to the harmony between the physical and social space. The ecosystems of social space impacts how the physical space is used, and vice versa. There are three main social environments where people spend the majority of their time: private (home, partner, family and friends); semi-private (acquaintances, neighbors, etc.); and business environments office, co-workers and/or consumers, etc.). The percentage and specific time spent in these environments is also an important element in fostering urban interaction. In cities, time has a direct influence on the urban space.<sup>29</sup> This interaction between time and urban space, can be explained by using an example of how parks are physically formed. It was argued by Jane Jacobs that the physical arrangement of a neighborhood has a physical influence on parks.<sup>30</sup> The mixed use of buildings automatically creates diversity of users in the park because of entering and exiting the park at different times, as sustained by Jacobs: “the park thus possesses an intricate sequence of uses and users.”<sup>31</sup>

The leisure environments are extremely important to support and satisfy the inhabitants’ lifestyle and recreational time. Mixed to the

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<sup>28</sup> Ibid., 196.

<sup>29</sup> Ibid., 174.

<sup>30</sup> Ibid., 125.

<sup>31</sup> Ibid.

other usage of spaces in the neighborhoods there should be indoor and outdoor spaces to be used for leisure purposes such as libraries, cinemas, indoor and outdoor sports facilities, public and private places where people can congregate. Consequently, business spaces also have to be comprised in the mixture of spaces, therefore office spaces, business parks, banks and building societies. Lastly, different experiences in housing can lead to diversity in social life because of the everyday lifestyle it forms. For instance, one who lives in a low density neighborhood with a big garden is going experience the urban environment in a different way compared to one who lives in a city center apartment. Other variabilities that can influence the everyday life are the type of building, its age or height, its exposure to sunlight and the possibility to modify the living spaces.

The city should enable the creation of various kind of opportunities such as education (formal and informal), family and personal growth, and career progression, for city inhabitants of different economic classes, ages and inabilities. It should create an environment that, with its characteristic of diversity and adaptability, supports and adjusts to the inhabitants' ambitions, favoring their prospering.

## Chapter 5. Songdo: Case Study of a Smart City

Songdo is a Smart City built from the scratch, on land reclaimed from the Yellow Sea.<sup>1</sup> It is a large city of 100 acres located near Incheon, about 60 kilometers west of Seoul, the capital of South Korea. This city project cost more than \$35 billion to build an area of about 54 km<sup>2</sup>. Initially, the smart initiatives in South Korea were labeled as a U-City by the “Seoul Metropolitan Government Ordinance on Ubiquitous City Construction Projects.”<sup>2</sup> Its distinctive features stems from the fact that the country’s U-City models are rooted in the development of excellent ICT systems for newly built urban dwellings.<sup>3</sup> From the “Act on the Promotion of Smart City Development and Industry,” 2017, the U-City concept has been revised to “Smart City.”<sup>4</sup> The U-City Strategy Plan (UPS) began in 2008, with construction of the city beginning on August 7, 2009.<sup>5</sup> The completion of the construction of Songdo has been scheduled to be completed in 2020<sup>6</sup> (Fig. 30). In January 2017, the population of

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<sup>1</sup> Chris White, “South Korea’s ‘Smart City’: Not Quite Smart Enough?” *South China Morning Post*, March 25, 2018, <http://www.scmp.com/week-asia/business/article/2137838/south-koreas-smart-city-songdo-not-quite-smart-enough>.

<sup>2</sup> Seoul Metropolitan Government, “Seoul Metropolitan Government Ordinance On Ubiquitous City Construction Projects,” Seoul, Seoul Legal Administration Services, 2015.

<https://legal.seoul.go.kr/legal/english/front/page/law.html?pAct=lawView&pPromNo=3183>.

<sup>3</sup> Maria Skou and Nicklas Echsner-Rasmussen, “Smart Cities Around the World,” *Perspektiv*, 25 (December 2015): 61–67.

<sup>4</sup> Korea Legislation Research Institute, “Act On Public-Private Partnerships in Infrastructure,” Seoul: Korea Legislation Research Institute, 2017, [https://elaw.klri.re.kr/eng\\_service/lawView.do?hseq=42913&lang=ENG](https://elaw.klri.re.kr/eng_service/lawView.do?hseq=42913&lang=ENG).

<sup>5</sup> Manfred Schrenk et al., *Ubiquitous Eco-City Planning in Korea. A Project for the Realization of Ecological City Planning and Ubiquitous Network Society*, 2018, Real Corp.

<sup>6</sup> *Ibid.*, 925-930.

Songdo was 113,423 of which 2,492 were foreigners (Fig. 31).<sup>7</sup> The main goal for the city is to accommodate 259,669 inhabitants and 101,780 households.<sup>8</sup> The project was designed by architects from the Kohn Pedersen Fox firm, and funded by the Korean government, Gale International, real estate development based in New York City, and POSCO Engineering & Construction.

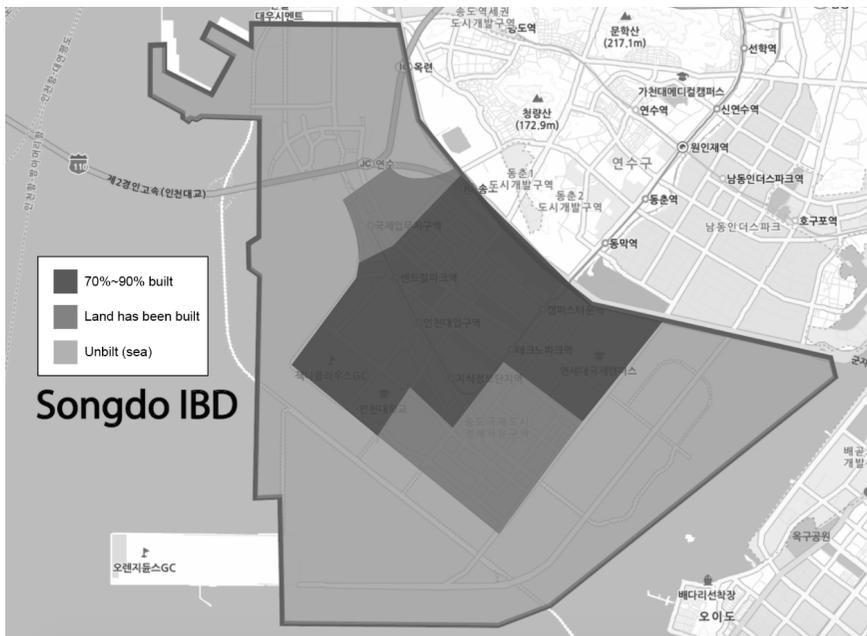


Fig. 30. Status of Songdo's constructions. (Source: <https://map.naver.com/>)

<sup>7</sup> Incheon Free Economic Zone Authority, "IFEZ 인천경제자유구역 / IFEZ Incheon Free Economic Zone." *인천경제자유구역 / Incheon Free Economic Zone*, accessed April 29, 2018, <http://www.ifez.go.kr/>.

<sup>8</sup> Incheon Free Economic Zone Authority, "한눈에 보는 IFEZ 개발계획 / IFEZ Development Plan at a Glance," *인천경제자유구역/Incheon Free Economic Zone*, September 2017.

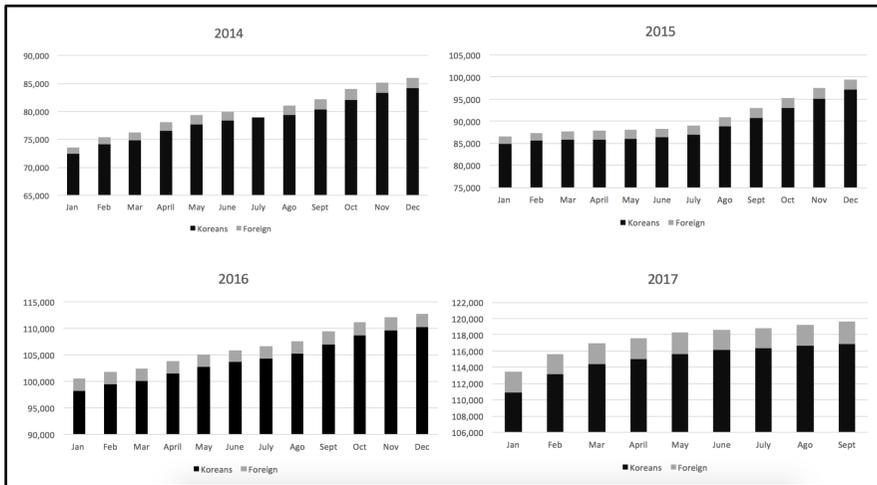


Fig. 31. Population in Songdo between 2014 and 2017. (Source: [http://www.ifez.go.kr/frt/biz/bbs/layout01/selectBoardList.do?bbsId=BBSMSTR\\_0000000071](http://www.ifez.go.kr/frt/biz/bbs/layout01/selectBoardList.do?bbsId=BBSMSTR_0000000071))

The peculiarity of Songdo is that not only it is a city that offers a high standard of life through high-technology, but it is also an International Business District (IBD). The government of Korea has decided to make it of a Free Economic Zone (FEZ) modelled on those in China. Songdo is part of the Incheon Free Economic Zone (IFEZ) which also comprises the Yeongjong and Cheong-ra districts. These three areas are all part of the South Korean Ubiquitous City Plan, and each have distinct concepts: Yeongjong is conceived for logistics, tourism and leisure; Cheong-ra for international finance and sport & leisure; and Songdo for international business and high-tech industries. The building of Free Economic Zones in South Korea was a phenomenon that started in the 1970s and lasted until the financial crisis of 1997, these zones were envisioned as “export-processing zones.” Recent researches by Mullins and Shwayri highlighted the case of IFEZ, that showcases technology for export, could be seen as twenty-first century reconfiguration of those

“export-processing zones.”<sup>9</sup> The city plan is structured into eight zones,<sup>10</sup> see Table 4, that will become eleven in the future.<sup>11</sup> The city is integrated with international organizations such as the U.N.,<sup>12</sup> prestigious educational institutes, such as the Incheon global campus,<sup>13</sup> and research institutes, art centers, performance hall, Waterside Park, etc.

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<sup>9</sup> Paul Mullins, *The Ubiquitous-Eco-City of Songdo: An Urban Systems Perspective on South Korea's Green City Approach*, Open Access Journal, vol. 2, 2017, 4-12, <https://doi.org/10.17645/up.v2i2.933>.

<sup>10</sup> Incheon Free Economic Zone Authority, “투자필지정보/ Investment parcel information,” *인천경제자유구역/ Incheon Free Economic Zone*, accessed April 29, 2018, [http://www.ifez.go.kr/frt/biz/contents/CTS\\_000000000000307/getContents.do](http://www.ifez.go.kr/frt/biz/contents/CTS_000000000000307/getContents.do).

<sup>11</sup> Incheon Free Economic Zone Authority, “기반시설/Infrastructure,” *인천경제자유구역/ Incheon Free Economic Zone*, accessed April 29, 2018, [http://www.ifez.go.kr/frt/biz/contents/CTS\\_000000000000024/getContents.do](http://www.ifez.go.kr/frt/biz/contents/CTS_000000000000024/getContents.do).

<sup>12</sup> Jee-yeon Seo, “G-Tower in Songdo, Hub Building for U.N. Offices,” *Korean Herald*, June 26, 2010, <http://www.koreaherald.com/view.php?ud=20130626000718>.

<sup>13</sup> Incheon Global Campus, “Universities,” IGC Incheon Global Campus, accessed July 22, 2018, <http://www.igc.or.kr/en/university01.do>.

	<b>by district</b>	<b>square meter</b>
<b>1·3 zone</b>	international affairs	102,005
	educational facilities	54,013
	public government office building	18,5
	others	18,27
<b>4 zone</b>	commercial property land	57,255
	industrial land	109,483
	industrial land (study)	22,546
<b>5·7 zone</b>	Repurchase of industrial land	81,034
	neighborhood	26,114
	industrial land	243,018
	educational facilities	57,104
	school site	26,089
	others	17,88
	parking space	49,684
<b>6·8 zone</b>	housing facilities	493,451
	high-rise residential building	419,564
	commercial business	182,531
	physical training facilities	730,574
	school site	154,256
	others	127,131

Table 4. The 8 zone of Songdo and their land usage. (Source: [http://www.ifez.go.kr/frt/biz/contents/CTS\\_0000000000000307/getContents.do](http://www.ifez.go.kr/frt/biz/contents/CTS_0000000000000307/getContents.do))

## 5.1. Hyper-networked Technology and Sustainability

This self-proclaimed Smart City, follows the trends of sustainability and technology of the Smart City concept. It is a city that aims to be the home of leading international technology companies, business events, and to foster research and

development. Songdo aims to offer Smart transportation, Smart crime prevention, Smart disaster prevention, and Smart environment.<sup>14</sup> By the time of its full completion, it will be eco-friendly; energy usage will be a lot lower than a city of similar size, and water consumption will be reduced by furnishing each building with a wastewater internal recycling system. The city blocks feature a lot of greenery and many buildings possess a green rooftop (Fig. 32).

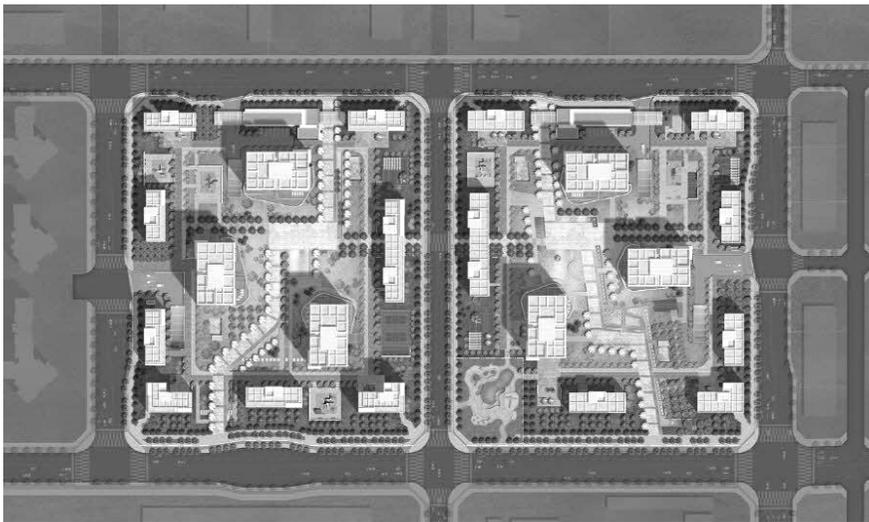


Fig. 32. Greenery in Songdo's city blocks (Source: <https://goo.gl/images/t1eBSc>)

To enhance the quality of life of its inhabitants, Songdo infrastructure is built to provide environmentally-friendly real-time services in both the private and public sectors.<sup>15</sup> For instance, as described in Sang Keon Lee's research: "IoT sensors are installed at houses and buildings to provide real-time information to users, of how much energy has been consumed and what measures can be

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<sup>14</sup> Sang Keon Lee et al., "International Case Studies of Smart Cities: Songdo, Republic of Korea" (Inter-American Development Bank, June 2016), 6-16, <https://doi.org/10.18235/0000411>.

<sup>15</sup> *Ibid.*, 6.

taken to minimize utility bills, through mobile applications. Using smart applications, users are able to manually turn off electric devices just by touching their smartphones and control the temperature and lighting of their houses before they return to their home.”<sup>16</sup> The goal is to install high-speed wireless and make a smart card available for every inhabitant. This smart card would give the inhabitants access to the city,<sup>17</sup> such as entering your house, using the subway, going to the cinema, paying a parking meter, etc.<sup>18</sup>

### **5.1.1. Empirical Research**

Under the overall framework of the IFEZ, an integrated operation center serves as a hub that links Songdo, Yeongjong and Cheong-ra under a single integrated system. This process makes it easy to control the cities effectively in real-time. A construction consortium made of the Incheon U-City Corp, the Incheon Metropolitan City and IFEZ are in-charge of managing various aspects of the project. This operations center monitors the city by managing a large number of wireless CCTVs to provide safety and security (disaster, fire and crime) and deliver traffic and transportation information to inhabitants.<sup>19</sup> To manage Songdo and the other two districts of Yeongjong and Cheong-ra, it was planned to build one monitoring center for each location; subsequently, it was later changed because the effective technology was sufficiently well developed in Songdo’s IFEZ’s tower. They save about 9 million USD by centralizing the operation center in Songdo’s IFEZ tower. Cutting-edge technology, that is used in Songdo in the public sector, is related to transportation infrastructure services, security, and the environment. To provide a

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<sup>16</sup> Ibid., 12.

<sup>17</sup> Nir Kshetri, L. Alcantara Lailani, and Yonghoon Park, “Development of a Smart City and Its Adoption and Acceptance: The Case of New Songdo,” *Communications & Strategies* 96 (2014): 113–26.

<sup>18</sup> Kshetri et al., “Development of a Smart City and Its Adoption and Acceptance,” 113–26.

<sup>19</sup> Skou and Echsner-Rasmussen, “Smart Cities Around the World,” 64.

superior and secure mobility, wireless technology is applied to the entire existing city transportation infrastructure, from vehicles to traffic lights. In Songdo CCTVS are easily recognizable and the map with all relevant information can be obtained with official documents from the IFEZ center. Also, some of the CCTV's poles are accessorized with emergency buttons that present Quick Response Codes (QR codes) that connect directly to an online public service with korean explanations<sup>20</sup> (Fig. 33). Three excellent example of the services provided for the transportation infrastructure are the Illegal Parking Control, the Traffic Signal Control System and the Public Transportation Information System. The Illegal Parking Control, via CCTV, monitors and informs drivers if their parking location is either legal or illegal, and guides them to the nearest public parking space. This CCTV surveillance is also used during the night to improve crime prevention (Fig. 34).

The Traffic Signal Control System in Songdo uses an improved version of the COSMOS (Cycle Offset Split Model of Seoul) technique to monitor and regulate the heaviest commute traffic with a Time Based Control (TBC) technique, and a Traffic Response Control (TRC) technique during regular traffic hours, when, as described by Sang Keon Lee, for instance "detectors at left turn lanes detect the flow of traffic and flexibly manages signal indications by sometimes skipping left turns when there are no cars that need to turn left."<sup>21</sup> Moreover, in case of emergency, such as the presence of an ambulance or a fire truck, the detectors intelligently reacts to the urgent situation and enhance the most effective route.

The Public Transportation Information service is accessible at every bus stop. As its name suggests, it offers information about the public transportation infrastructure by communicating information related to the subway and bus systems in several languages. These

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<sup>20</sup> Yeonsu-gu, "Home," *Better life Yeonsu*, accessed July 22, 2018, <http://cctv.yeonsu.go.kr/>.

<sup>21</sup> Lee et al., "International Case Studies of Smart Cities," 8.

bus stops are also used to monitor possible problems that might arise in the immediate surroundings and are supported by emergency alarm bells, activated if pressed and connected directly to operators in Songdo's main control center. During night hours, to save energy, the stops enter into power-saving mode and activate automatically through moving sensors when a person approaches.

The inhabitants and visitors are perpetually monitored by cameras that continuously acquire footage to provide them with safety and security. For example, Automatic Number Plate Recognition (ANPR) cameras notify, in real-time, a police station and relevant authorities of the presence of a specific vehicle registered to a person who committed tax evasion. Moreover, these CCTVs collect information and react in case of abnormal activities by immediately contacting a police station. In case of emergency, sound sensors identify if someone is screaming or shouting and nearby CCTVs turn toward the detected situation and acquires video footage, submitting it to the proper organizations for prompt action.<sup>22</sup>

Lastly, to improve the environmental quality of the city weather sensor are well spread throughout the city. These sensors collect and analyze information about wind, temperature and humidity to predict weather information, and deliver it to residents.

The IFEZ integrated center has been active since April 2017. Through sensors and CCTV, the monitoring staff, who have backgrounds in engineering, monitor the IFEZ cities. Alongside engineers, police officers are stationed in case of emergency. One deputy stated: "We collect Big Data to improve the Songdo inhabitants living conditions; data such as environment information like, micro-dust, and vehicle number recognition system, etc. The video footage is stored for 30 days and then discarded."<sup>23</sup> Although, a place that looks like a prison yard has been argued as unattractive

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<sup>22</sup> Ibid., 10.

<sup>23</sup> IFEZ Integrated Smart City Operation Center Representative 1. Interview by Klara Lucilla Romigioli. Songdo, October 3, 2017.

to people,<sup>24</sup> now CCTVs have been accepted by inhabitants. Ten years ago, Songdo inhabitants were more conscious about and doubtful of the presence of the surveillance in the city, but, according to one resident, they are more comfortable and residents are asking for more CCTV installation.<sup>25</sup> There are about 500 security systems, the number is more than 1,000 if also sensor other than CCTV are counted, and more CCTVs are planned to be installed.



Fig. 33. The Public Transportation Information service of Songdo (Source: Klara Romigioli)

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<sup>24</sup> Jane Jacobs, *The Death and Life of Great American Cities*, (New York: Vintage Books, 1992), 133.

<sup>25</sup> IFEZ Integrated Smart City Operation Center Representative 1. Interview by Klara Lucilla Romigioli. Songdo, October 3, 2017.



Fig. 34. [A] Emergency button on a CCTV in Songdo that has also a QR code that help to connect directly to [B] online public services with explanation purposes. (Source: Klara Romigioli, phone screenshot).

## 5.2. Quality Living

Existing cities retrofitted into Smart are not better than built-from-zero Smart Cities such as Songdo. It is arguable that they have the potential to be as successful in providing Quality Living as the existing cities retrofitted into Smart, but they are missing the social component. As stated by Nicholas Brooke, Chairman of Professional Property Services Limited, a specialist real estate consultancy: “The reality is that cities can turn their fortunes around, often with surprising speed if they get the formula right. [...] Cities dependent on a single economic sector are always going to be vulnerable.”<sup>26</sup> By

<sup>26</sup> The Counselors of Real Estate, “Focus on Global Issues: What Makes for a Successful City?” *Counselors of Real Estate*, accessed April 3, 2018, <https://www.cre.org/real-estate-issues/focus-global-issues-makes-successful-city/>.

integrating higher levels of adaptability, accessibility, diversity and social life, Built-from-Zero Smart Cities can be as successful in providing Quality Living as existing cities retrofitted into Smart.

### 5.2.1. Adaptability

In terms of adaptability, although business is the main function of the city, it has been argued that Songdo is not flexible to the fluctuation of external market forces because of the static relationship between the foreign/local actors and the global market.<sup>27</sup> Songdo is not adaptable and able to integrate elements that are not part of the primary city plan. Also, it has been stated that the ambition of achieving sustainable and technological city efficiency makes Songdo less able to cope with complex urban structures and the “bottom-up” approach that the Smart City paradigm markets.<sup>28</sup> The urban system of Songdo would be vulnerable if the population expanded beyond what was estimated in the original plan.<sup>29</sup> However, since Songdo is still incomplete (Fig. 35) as a city, arguably, is not possible to foresee if it will be flexible and able to adapt to the future variability, density and needs of its inhabitants.



Fig. 35. Uncompleted Songdo. (Source: <https://map.naver.com/>)

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<sup>27</sup> Richard Sennett, “The Open City,” *Urban Age*, November 2006, [http://downloads.lsecities.net/0\\_downloads/Berlin\\_Richard\\_Sennett\\_2006-The\\_Open\\_City.pdf](http://downloads.lsecities.net/0_downloads/Berlin_Richard_Sennett_2006-The_Open_City.pdf).

<sup>28</sup> Mullins, *The Ubiquitous-Eco-City of Songdo*, 4-12.

<sup>29</sup> *Ibid.*, 4-12.

## 5.2.2. Accessibility

In terms of accessibility, Songdo can be considered fairly accessible on a commuting level, but less accessible on a price level. As Songdo is a commerce hub and an Aerotropolis<sup>30</sup> (Fig. 36), the city is easily accessible by 61 foreign cities within a 3.5-hour flight. By plane, it is located 1.5 hours from Shanghai, 2 hours from Tokyo, and 3.5 hours from Hong Kong, making it possible for about 2.5 billion people to commute for daily business trips. Although Songdo is not currently accessible by train, a train line is planned to be built and completed by 2023,<sup>31</sup> it is accessible via bus and subway. The subway line in Songdo is directly connected to the subway of Incheon and composes six fully built stations that cut through the city map. As the Incheon subway network is connected to the Seoul subway network, the existence of the subway makes it possible to reach other districts without leaving the metro network. However, although the connection to the airport is of major importance, the subway connection was not planned in a favorable position to reach it quickly. This issue is compensated by the existence of buses and road connections to the airport, making it accessible in about 30 minutes by bus and/or car. There are 50 public transport buses that run throughout Songdo. Also, direct buses are available to reach the most popular areas of Seoul, such as Hongdae and Gangnam. Technically, the commuting time ranges between 40 minutes to 1 hour, however, because of traffic the commuting time can double. By mixing the usage of subway and bus the commuting time can be reduced. Songdo is also accessible by car and taxi (Fig. 37). Lastly, an asset of Songdo are the bike trails that are available throughout

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<sup>30</sup> Madlen Simon, "Songdo, Korea: Aerotropolis, Metropolis, and Cyberopolis," *102nd ACSA Annual Meeting, Globalizing Architecture/Flows and Disruptions* (Washington, DC: ACSA Press, 2014), 150–58.

<sup>31</sup> Andy Tebay, "First GTX Line to Fully Open in 2023, Construction to Begin Next Year," *Kojects* (blog), April 10, 2017, <https://kojects.com/2017/04/10/gtx-seoul-start-construction/>.

the city (Fig. 38). Songdo was planned to be a walkable city; its flat land and extensive bikes trails, about 25 km,<sup>32</sup> makes it possible to reach various parts of the city by bike or by foot. However, the commuting infrastructure has been reported to be implemented partially and only in some parts of the city, For instance, the water taxis and bike rentals are only readily accessible in the Songdo Central Park area.<sup>33</sup> Also, in contrast with the goals of making the city walkable, according to residents of Songdo, the sheer scale of the project has made walking the city impossible.<sup>34</sup>



Fig. 36. Songdo, South Korea, portrayed at the center of concentric circles showing the average time of flight needed to reach the various Asian commercial zones. (Source: “Songdo,Korea: Aerotropolis, Metropolis, and Cyberopolis,” in 102nd ACSA Annual Meeting, 151.)

<sup>32</sup> Salvatore Caschetto, “Songdo City: L’utopia che Diventa Realtà tra Tecnologia e Natura,” *Smart Innovation*, September 10, 2012, <http://smartinnovation.forumpa.it/story/69497/songdo-city-l-utopia-che-diventa-realta-tra-tecnologia-e-natura>.

<sup>33</sup> Lichá, *Songdo and Sejong: Master-Planned Cities in South Korea*, 2015.

<sup>34</sup> Mullins, *The Ubiquitous-Eco-City of Songdo*, 4-12.

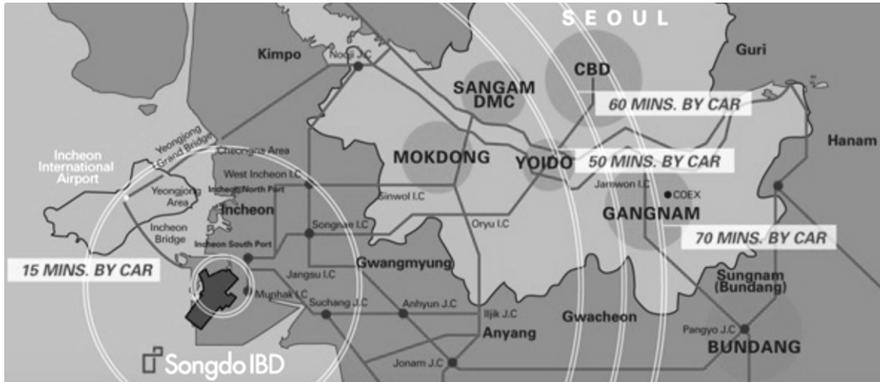


Fig. 37. Commuting from Songdo to other business districts. (Source: <https://goo.gl/images/shgjS6>)



Fig. 38. Bike trails in Songdo. (Source: <https://map.naver.com/>)

The cost of living in Songdo means the city is most accessible to both wealthy Koreans and foreigners. In one study, Songdo was

revealed to have socio-spatial disparity.<sup>35</sup> Songdo has been criticized for targeting mainly wealthy business people, and having a low impact on the welfare of the majority of the Korean population.<sup>36</sup> For instance, international Schools in Songdo are extremely expensive, one year tuition can surpass 25,000 US dollars.<sup>37</sup> Also, Songdo apartment prices vary widely based on their dimension. If the space is less than 66 square meters the deposit ranges between 5,000 USD and 9,000 USD, with monthly rent starting at a minimum of 500 USD. If the space is between 66 and 99 square meters, the deposit would start from 9,000 USD and the monthly rent would range between 580 USD and 620 USD. If the space exceeds the 99 square meters the deposit price starts at 36,000-54,000 USD, with renting ranging between 530 USD and 720 USD.<sup>38</sup>

### 5.2.3. Urban Form

Songdo has been used a modernist version of the urban models first implemented in Korea the 1950s. Songdo has a grid structure, a square-shaped structural form, and a structure reminiscent of towers in the parks by Le Corbusier who devised in the 1930s a dream city which he called “the Radiant City, composed not of the low buildings beloved of the decentrists, but instead mainly of skyscrapers within a park,”<sup>39</sup> all of which were developed in the 1930s, almost a century ago, and can be found today in Songdo

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<sup>35</sup> Mullins, 4-12.

<sup>36</sup> Kshetri et al., “Development of a Smart City and Its Adoption and Acceptance,” 113–26.

<sup>37</sup> Seoul International School, “Tuition and Fees,” *Seoul International School* (blog), November 15, 2012, <https://siskorea.org/admissions/tuition-and-fees/>.

<sup>38</sup> 첫사랑부동산/ First Love Real Estate, “인천송도오피스텔총정리/ Incheon Songdo Officetel Chungryung.” *첫사랑부동산/ First Love Real Estate Naver* (blog), November 16, 2015.

<https://m.blog.naver.com/PostView.nhn?blogId=tasman53&logNo=220540960248&proxyReferer=https%3A%2F%2Fwww.google.co.kr%2F>.

<sup>39</sup> Jacobs, *The Death and Life*, 29.

mixed with contemporary technology (Fig. 39). At the center of Songdo is a 40 hectares' park. All the blocks of buildings are connected to each other through the cycle paths and pedestrian pavements, which will open up in public areas designed to always have unbridled daylight, unspoilt by skyscrapers.<sup>40</sup>

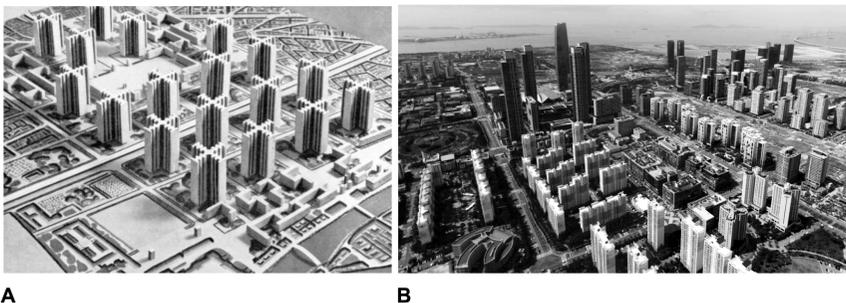


Fig. 39. [A] Le Corbusier's Towers in the Park. (Source: <https://goo.gl/images/T4gJKi>); [B] Aerial view of Songdo's high rise buildings, organized in blocks and surrounded by parks. (Source: <https://map.naver.com/>)

The human-scale size of city elements is important for Quality Living in cities. Districts with smaller and older buildings, compared to the ones with newer and larger buildings, are more successful from an urban vitality point of view.<sup>41</sup> Human scale spaces in a city allow the community to develop by allowing inhabitants to interact with each other.<sup>42</sup> The streets of Songdo are wide, between 7 and 80 meters (Fig. 40). In history, monumental scale, rather than human scale, was used by dictators to provoke fear in their citizens.<sup>43</sup> Also

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<sup>40</sup> Caschetto, "Songdo City."

<sup>41</sup> Tom Mayes, "Why Do Old Places Matter?" *Preservation Leadership Forum*, October 3, 2015, <http://forum.savingplaces.org/blogs/forum-online/2015/03/10/why-do-old-places-matter-community>.

<sup>42</sup> Charles Montgomery, *Happy City: Transforming Our Lives through Urban Design*, (New York: Farrar, Straus and Giroux, 2013), 6-25.

<sup>43</sup> Stephen Burke, "Placemaking and the Human Scale City," *Project for Public Spaces*, January 11, 2016, <https://www.pps.org/article/placemaking-and-the-human-scale-city>.

in Korea, the choice of building large roads can be understood looking into the way that public space was intended and understood originally in Korean cities and culture. In the 16th century (Joseon dynasty), the way public space is intended in Western culture did not exist. Traditionally, the power was centered on the aristocracy and the form of city space reflected this hierarchy.



Fig. 40. [A] Human-scale road size (Source: <https://goo.gl/G4BkAg>); [B] Songdo's road size. (Source: <https://goo.gl/images/95D15X>)

The city was organized around main roads originating from the royal palace and connecting it to the edges of the city. These main roads were the public space, which was used as a means to display power, such as royal processions, to control the behavior of the inhabitants of the city (Fig. 41). Therefore, in the past, social life was used to manifest itself within the private and protected space of the houses and the house smaller-sized intimate community.<sup>44</sup> So, although the city streets are bigger than human scale, culturally the wide roads could be part of the city as a cultural element.

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<sup>44</sup> Michela Leoni, "Appearances and Concealment: The Two Faces of Seoul's Public Space," *Marko & Placemakers* (blog), March 14, 2014, <http://markoandplacemakers.com/blog/appearances-and-concealment-the-two-faces-of-seoul-s-public-space>.



Fig. 41. Example of usage of large roads as power displaying in Korea's Joseon era. (Source: <https://goo.gl/ET1tET>)

#### 5.2.4. Diversity and Social Life

The international community constitute 2.15% of Songdo's population and, according to commentators, is considered cosmopolitan compared to its dimension and location,<sup>45</sup> especially due to the presence of international schools and international businesses. Also, Songdo has 41 educational facilities, 97 medical facilities, and 42 government facilities.<sup>46</sup> In Songdo there is an abundance of shopping centers, cafes and restaurants that target both western and local clientele. However, a city with an overabundance of chain and franchised facilities is not automatically a Quality Living city, arguably people do not want to spend their life in a monotonous and sterile "artificial haven,"<sup>47</sup> shopping malls, or a neighborhood populated with offices.<sup>48</sup>

With 9 libraries, 36 parks, 31 green zones, 1 exhibition center, a high amount of coffee shops and restaurants, an abundance of parks

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<sup>45</sup> Su-hyun Song, "Expats Make Songdo Cosmopolitan," *Korea JoongAng Daily*, September 22, 2014,

<http://koreajoongangdaily.joins.com/news/article/article.aspx?aid=2995172>.

<sup>46</sup> Incheon Free Economic Zone Authority, "인천경제자유구역/Incheon Free Economic Zone."

<sup>47</sup> Jacobs, *The Death and Life*, 46.

<sup>48</sup> Sydney Brownstone, "4 Reasons Why People Love Living in Cities and How We're Working on Ru," *Fast company*, August 6, 2014, <https://www.fastcompany.com/3033848/4-reasons-why-people-love-living-in-cities-and-how-were-working-on-ruining-them>.

and open spaces, and relatively few bars, and no night-clubs, Songdo has been commented as a city for families rather than young adults (people in their 20s, early 30s). Songdo restricts the types of individuals, such as Korean and international wealthy families and business people. The environment provides safety and technological innovations but does not provide a varied social life; for that, one has to travel to Incheon or Seoul. If in completing the city the policymakers are going to make more of the same, the present quality living situation will not change and the city won't objectively provide it to anyone other than to a determinate sector of people such as wealthy households and business people.

### **5.2.5. Survey**

The main purpose of the survey was to find how the residents of Songdo perceive the city by reviewing their opinions on the quality of the city's infrastructure, the daily life comfort, and how accepting they are of such high levels of surveillance systems and new technologies. Songdo receives praise for its high-quality urban infrastructures, water services, sewer services, adequacy of street lighting, cleanliness of streets, sidewalks, public facilities, and efficiency of the emergency services. The feature most liked by those surveyed was the "proximity to shopping," followed by "distance required to reach work/school." The majority of respondents claimed it was "very comfortable" to commute to work. The majority of respondents use buses to reach their work/school, and the rest reach their school or place of work by walking. Only 4.8% of the surveyed drives to work. This seems at odds with the opinion that the city feels like it is "empty," because the area is still in the construction stage, so residents feel like they living in an underdeveloped and underpopulated area. One resident commented that "sometimes it feels very empty, not a lot of people live here, and it's hard to have a social life—difficult to meet friends, go to a nice restaurant or a bar." A majority of those surveyed, 55%,

reported Songdo as being less underpopulated and 40% said it is averagely populated. Only the 5% of those surveyed reviewed Songdo as fairly populated.

Songdo's residents like living in an environment equipped with high-end surveillance technology, such as CCTV cameras and sensors. A majority of respondents said personal security was "extremely important," with theft and sexual assault/harassment of most concern. With regards to the degree that residents would sacrifice privacy to live in a safer city, the results ranged from freely giving large amount of personal data, to not granting access to personal data. The 55% reported of being comfortable with surveillance (Fig. 56), the 60% of those surveyed considered surveillance as an effective means of reducing crime (Fig. 57), the 68% of respondents felt that the amount of surveillance was too great (Fig. 59).

The survey revealed that residents perceive Songdo as a city still under construction but providing a comfortable daily life due to the proximity to the university, but uncomfortable regarding public transportation: 33% of those interviewed reported that the lack of public transportation as the feature that they disliked the most about the Songdo. Songdo at the moment can create an average quality of live for 3 months to 3 years, the period of time to complete their study. Only 1 of the 20 respondents consider a long-term future in Songdo of up to 10 years. Due to the limited number of participants in this survey and their specific age range, is not possible to argue that the result of this survey represents a more diverse demographic, but it is possible to assume that that surveyed residents perceive that the city offers a safe and clean environment, they also perceive it as a monotonous environment where it should be enhanced what allows social life among the community to flourish.

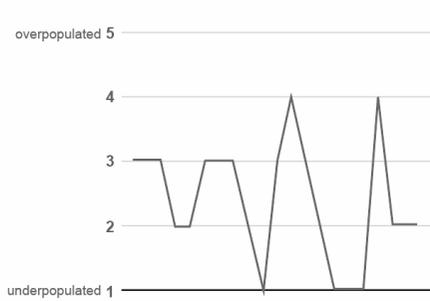


Fig. 41. Reply to, "How high is the demographic in Songdo?"

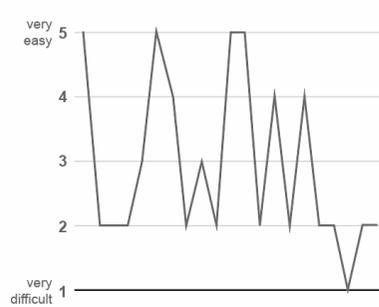


Fig. 42. Reply to, "Does Songdo makes it easy to have a social life?" (i.e. meeting friends, coffee shop, leisure time activities, pub, nightlife)

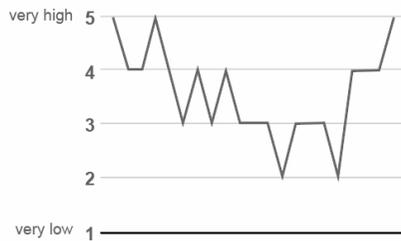


Fig. 43. Reply to, "How is the cost of living?"

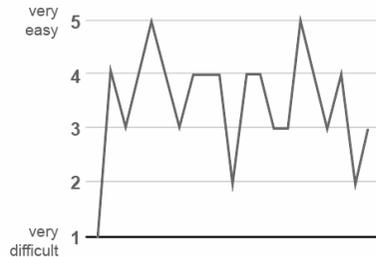


Fig. 44. Reply to, "How is the city connected by public transportation to other cities?"

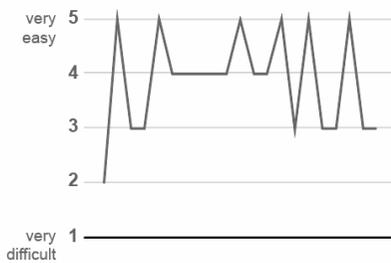


Fig. 45. Reply to, "How comfortable is to get to work/school?"

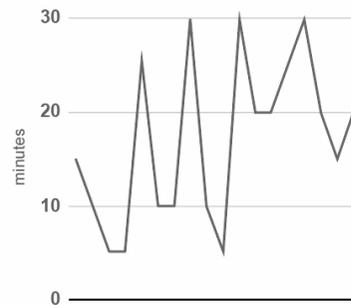


Fig. 46. Reply to, "How much does it take? (to get to work/school)"

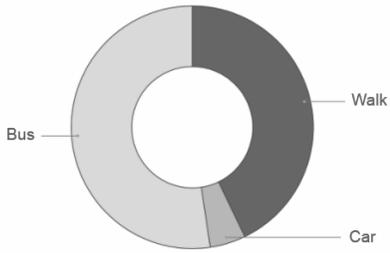


Fig. 47. Reply to, “How do you go to work/school?”

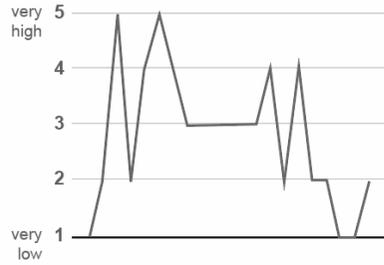


Fig. 48. Reply to, “Is it easy or difficult to meet your daily needs (Proximity to shopping for daily life)?”

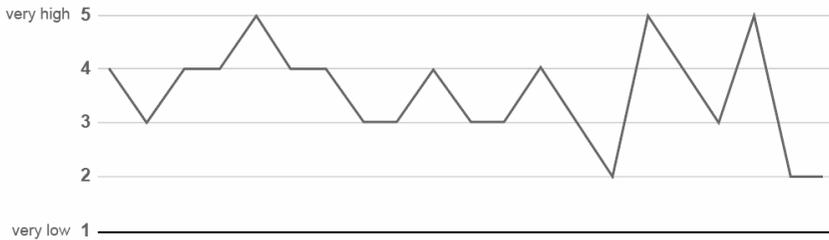


Fig. 49. Reply to, “How would you rate the quality of urban infrastructure?”

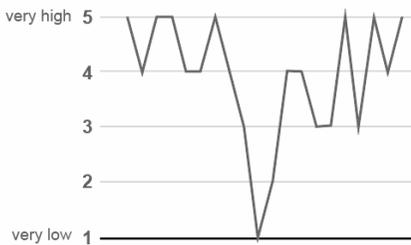


Fig. 50. Reply to, “How would you rate the quality of water services?”

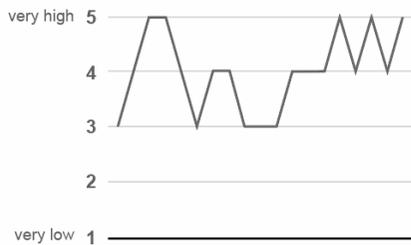


Fig. 51. Reply to, “How would you rate the reliability of sewer services?”

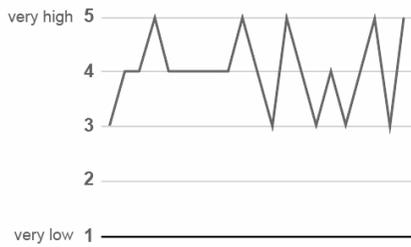


Fig. 52. Reply to, "How would you rate the adequacy of street lighting?"

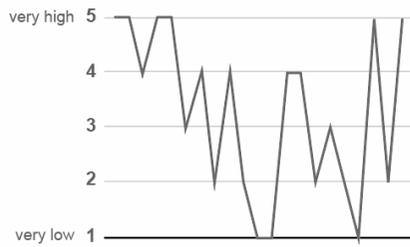


Fig. 53. Reply to, "How would you rate the condition of sidewalk pavement and roads?"

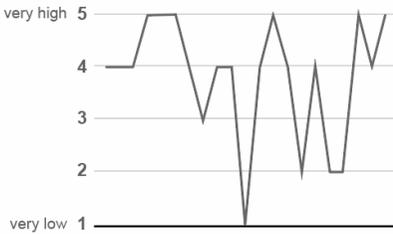


Fig. 54. Reply to, "How would you rate the cleanliness of streets, sidewalks, public leisures etc.?"

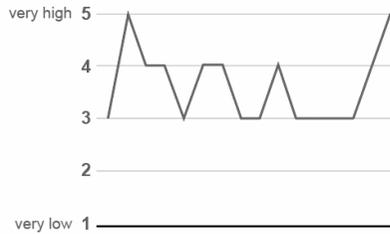


Fig. 55. Reply to, "How efficient are the emergency services?" (i.e. police, ambulance services etc.)

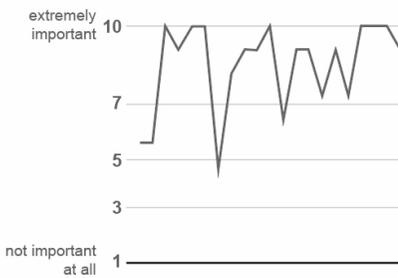


Fig. 56. Reply to, "How important is security to you?"

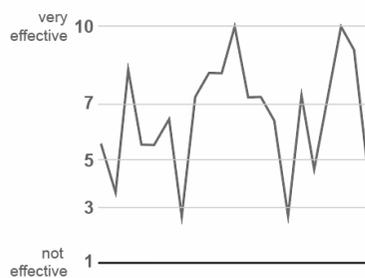


Fig. 57. Reply to, "Do you think surveillance is an effective way to reduce crime?"

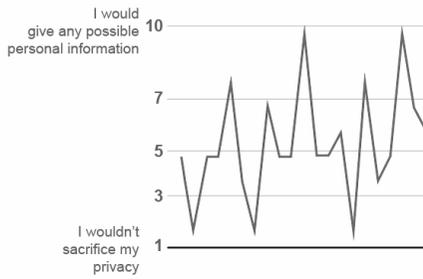


Fig. 58. Reply to, "To what degree would you sacrifice your privacy to live in a safer City?"

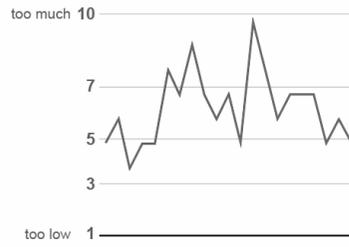


Fig. 59. Reply to, "What do you think about the amount of surveillance in Songdo?"

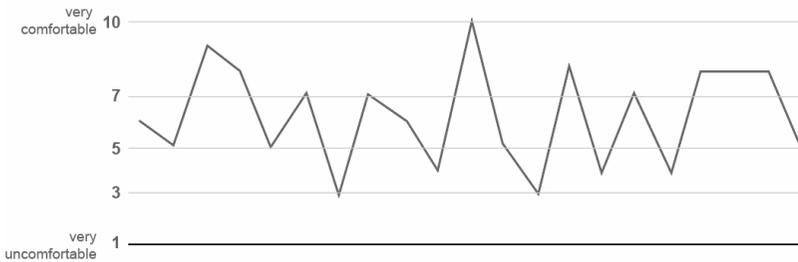


Fig. 60. Reply to, "To what degree do you feel comfortable with surveillance?"

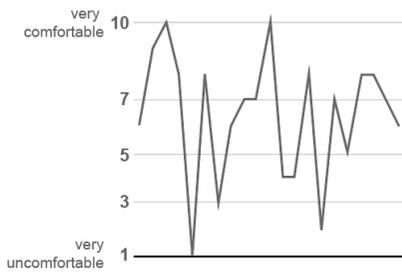


Fig. 61. Reply to, "Outside the door of your apartment?" (surveillance)

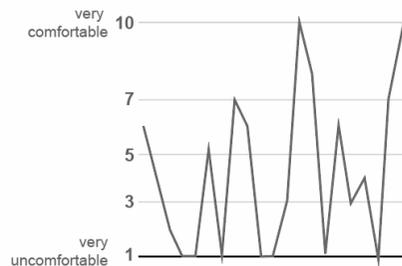


Fig. 62. Reply to, "Inside your house?" (surveillance)

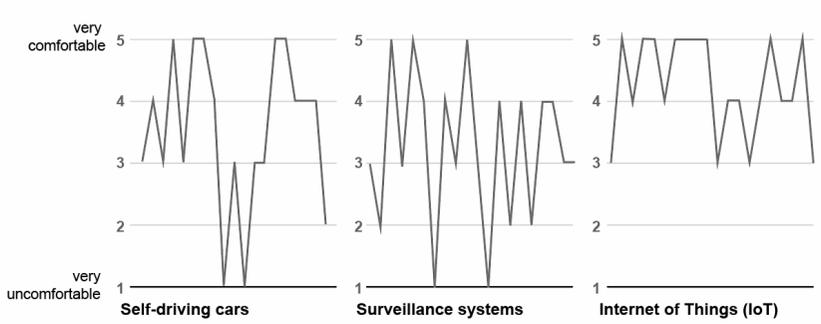


Fig. 63. Reply to, “Are you comfortable with new technologies embedded in our cities?”

## Conclusion

The difference between a retrofitted-to-Smart Smart City and a Built-from-zero Smart City is that the former has an existing economy, environment, government, transportation system, and social lives. The city is upgraded to a Smart City by adding ICT infrastructures and IoT technologies. A Built-from-zero Smart City is built on a tabula rasa site. Although the development of these two types of Smart Cities are different, the approach to providing enhanced quality living through the six city sectors—economy, environment, government, living, mobility, and people—is the same. Both types of Smart Cities enhance quality living by focusing on implementing environmental sustainability and installing high-end technology, such as IoT and ICT. However, many Built-from-Zero Smart Cities, such as Songdo, do not make the rankings of retrofitted cities in Smart City Indexes because they are not yet complete and there is not enough data to evaluate criteria such as, quality living, life enhancement, that is available for retrofitted Smart Cities.

There are four critiques of Built-from-Zero Smart Cities. First, the line between commercial and public interests is blurred due to the financial structure of Public Private Partnerships. Built-from-Zero Smart Cities can be thought of as a marketable “product” that creates economic advantages for its stakeholders more than enhancing the quality of life of its inhabitants. Second, Built-from-Zero Smart Cities have pervasive technologies, such as extensive networks of CCTV cameras and data collection from IoT devices that have a dystopian tendency. Even though these security aspects are marketed as

increasing the security of the inhabitants, they actually reduce the privacy of inhabitants. Third, the flow of “big data” created by the ICT and IoT infrastructure that infiltrates and monitors Smart Cities constitute a danger in terms of cyber-security since this potential danger has not been taken into account as a threat in the conception or design of Smart City infrastructure, thus, Smart Cities are vulnerable to cyber-crime. Finally, Built-from-Zero Smart Cities have resulted in the creation of urban life characterized by social polarization. Smart services, such as high-tech housing, self-driving cars, and smart devices are marketed to the middle and upper middle classes, not the working class. For instance, Songdo favors specific class of people: rich, international, local upper middle class families and business-related workers who can afford living in Built-from-Zero Smart Cities. This creates a social community that lacks diversity and creates a monotonous environment that struggles to flourish socially.

These critiques suggest that Built-from-Zero Smart Cities do not guarantee quality living, and seamless daily life in terms of, for example, social life, commuting, and community. A city that offers quality living fulfills the criteria that are necessary to create social life, such as the criteria of adaptability to the physical and social development of the city, and the criteria of economic, physical, accessibility, social, economic, and racial diversity that constitutes the social life. Built-from-Zero Smart Cities are not necessarily failures as cities, it may be too soon to tell if they can be beneficial to all members of society in the long term. As the model of Built-from-Zero Smart Cities develops, designers, stakeholders and governments should focus on creating a city with quality living by

building an environment in which social life can flourish instead of only considering quality of life in environmental and technological terms. Although, the intense pervasiveness of internet networks, CCTVs, and devices all gathering personal data may be accepted by future generations who may not perceive it as being dystopian, governments and companies should pay attention to safeguarding big data created by the IoT devices and Smart City ICT infrastructure. Further consideration of future Built-from-Zero Smart Cities should be given to enhance the lives of the city's inhabitants by including people with different incomes, meeting levels of affordability through a different social and economic classes. Providing a more social-oriented focus to quality living that includes diverse economic classes would make the concept of quality living less of a marketing tool and more a livable reality.

## Appendix 1

The 100 biggest urban centers in the world and the Smart City projects.

World rank	City (caps denote capital cities)	Country	City population	Metro population	Smart City projects
1	Shanghai	China	24,153,000	34,000,000	Yes
2	BEIJING	China	18,590,000	24,900,000	Yes
3	Karachi	Pakistan	18,000,000	27,506,000	Yes
4	Istanbul	Turkey	14,657,000	14,804,000	Yes
5	DHAKA	Bangladesh	14,543,000	18,898,000	Yes
6	TOKYO	Japan	13,617,000	37,800,000	Yes
7	MOSCOW	Russia	13,197,596	17,900,000	Yes
8	MANILA	Philippines	12,877,000	22,710,000	Yes
9	Tianjin	China	12,784,000	15,469,000	Yes
10	Mumbai (Bombay)	India	12,400,000	27,750,000	No
11	Sao Paulo	Brazil	12,038,000	21,243,000	Yes
12	Shenzhen	China	11,908,000	11,980,000	Yes
13	Guangzhou	China	11,548,000	14,044,000	Yes
14	DELHI	India	11,035,000	26,454,000	Yes
15	Wuhan	China	10,608,000	10,608,000	Yes
16	Lahore	Pakistan	10,355,000		Yes
17	Seoul	South Korea	10,290,000	25,600,000	Yes
18	Chengdu	China	10,152,000	14,427,000	Yes
19	KINSHASA	Congo D.R.	10,125,000	21,265,000	Yes
20	LIMA	Peru	9,752,000	10,852,000	Yes
21	JAKARTA	Indonesia	9,608,000	30,214,000	Yes

22	CAIRO	Egypt	9,500,000	20,440,000	In program
23	MEXICO CITY	Mexico	8,919,000	20,400,000	Yes
24	TEHRAN	Iran	8,847,000	15,233,000	Yes
25	BAGHDAD	Iraq	8,765,000		Unknown
26	Xian	China	8,705,000	13,560,000	Yes
27	LONDON	UK	8,674,000	13,880,000	Yes
28	New York City	USA	8,550,000	23,724,000	Yes
29	Nanjing	China	8,460,000	8,460,000	Yes
30	Bangalore	India	8,444,000	8,729,000	In program
31	Ho Chi Minh City	Vietnam	8,426,000	10,050,000	In program
32	BANGKOK	Thailand	8,281,000	14,566,000	In program
33	Chongquin	China	8,165,500	18,380,000	Yes
34	BOGOTA	Colombia	8,081,000	9,800,000	Yes
35	Lagos	Nigeria	8,048,000	16,060,000	Yes
36	RIYADH	Saudi Arabia	7,506,000	7,506,000	Yes
37	Hong Kong	China	7,234,800		Yes
38	Chennai	India	7,088,000	8,653,000	Yes
39	Hangzhou	China	7,082,000	9,188,000	Yes
40	Hyderabad	India	6,809,000	7,749,000	Yes
41	Rio de Janeiro	Brazil	6,454,000	12,281,000	Yes
42	Zhengzhou	China	6,406,000	9,468,000	Yes
43	Shenyang	China	6,255,000	8,106,000	Yes
44	Qingdao	China	6,188,000	9,046,000	Yes
45	SANTIAGO	Chile	6,158,000	6,582,000	Yes
46	Dalian	China	5,900,000	6,700,000	Yes
47	SINGAPORE	Singapore	5,607,000	5,607,000	Yes
48	Ahmadabad	India	5,577,000	6,357,000	Yes

49	Suzhou	China	5,468,000	10,578,000	Yes
50	St Petersburg	Russia	5,323,000	7,500,000	Yes
51	Harbin	China	5,282,000	6,704,000	Yes
52	ANKARA	Turkey	5,271,000	6,280,000	Yes
53	KHARTOUM	Sudan	5,185,000	5,185,000	Unknown
54	Yangon	Myanmar (Burma)	5,160,000	7,360,000	Yes
55	Casablanca	Morocco	5,118,000	6,861,000	Yes
56	Sydney	Australia	5,005,000	5,005,000	Yes
57	Jinan	China	4,694,000	7,068,000	Unknown
58	Melbourne	Australia	4,641,000	4,641,000	Yes
59	Changsha	China	4,597,000	7,432,000	Yes
60	Kolkata	India	4,497,000	14,618,000	In program
61	Fuzhou	China	4,468,000	7,200,000	Unknown
62	Surat	India	4,467,000	4,591,000	Yes
63	Abidjan	Ivory Coast	4,396,000	4,707,000	Yes
64	DAR SALAAM	Tanzania	4,364,000	4,364,000	Yes
65	Shijiazhuang	China	4,303,000	10,701,000	Yes
66	Jeddah	Saudi Arabia	4,276,000	4,276,000	Yes
67	Faisalabad	Pakistan	4,075,000	4,075,000	In program
68	Nanning	China	4,037,000	6,914,000	Yes
69	Alexandria	Egypt	4,028,000	4,984,000	Yes
70	AMMAN	Jordan	4,008,000	4,008,000	In program
71	Los Angeles	USA	3,976,000	13,131,000	Yes
72	Kunming	China	3,891,000	6,626,000	Yes
73	Changchun	China	3,815,000	7,674,000	Yes
74	Yokohama	Japan	3,733,000	3,733,000	Yes

75	KABUL	Afghanistan	3,678,000	3,678,000	Yes
76	BERLIN	Germany	3,671,000	6,004,000	Yes
77	Giza	Egypt	3,628,000	3,628,000	Yes
78	Urumqi	China	3,550,000	3,550,000	Yes
79	Wuxi	China	3,542,000	6,372,000	Yes
80	Busan	South Korea	3,526,000	8,202,000	Yes
81	Guayaquil	Ecuador	3,500,000	5,000,000	Yes
82	HANOI	Vietnam	3,435,000	7,588,00	In program
83	Hyderabad	Pakistan	3,429,000	3,429,000	Yes
84	ADDIS ABABA	Ethiopia	3,385,000	4,567,000	Yes
85	ALGIERS	Algeria	3,336,000	5,000,000	Yes
86	Kano	Nigeria	3,333,000	3,333,000	Unknown
87	Mashhad	Iran	3,312,000	3,372,000	Yes
88	Hefei	China	3,310,000	5,484,000	Yes
89	Changzhou	China	3,290,000	4,592,000	Yes
90	Taiyuan	China	3,212,000	4,202,000	Yes
91	Rawalpindi	Pakistan	3,189,000	3,189,000	Unknown
92	Tangshan	China	3,187,000	7,577,000	Yes
93	MADRID	Spain	3,141,000	6,240,000	Yes
94	NAIROBI	Kenya	3,138,000	6,547,000	Yes
95	Zibo	China	3,129,000	4,131,000	Unknown
96	Pune	India	3,124,000	5,057,000	Yes
97	Ibadan	Nigeria	3,050,000	3,520,000	Yes
98	Jaipur	India	3,046,000	3,046,000	Yes
99	Guiyang	China	3,037,000	4,024,000	Yes
100	Incheon	South Korea	3,002,000	3,002,000	Yes

## Appendix 2

Resident Business Main Status.

(Source: [http://www.ifez.go.kr/eng/en/m3/sd\\_p07/screen.do](http://www.ifez.go.kr/eng/en/m3/sd_p07/screen.do))

<b>Posco Global R&amp;D Center</b>	Size: Site area 82,560 m <sup>2</sup> , gross area 98,564 m <sup>2</sup>
	Features: International R&D Exchange Center, Residential Communication Center, Posco R&D Center (BT/IT)
	Project Cost: 279.7 billion won
	Implementer: Posco
	Period: June. 2008-Aug. 2010
<b>Incheon Global Campus</b>	Size: Site area 295,000 m <sup>2</sup> , gross area 650,850 m <sup>2</sup>
	Features: Student Enrollment 10,000/10 Residential Schools, Construction of public facilities, including library, student center, gymnasium, etc.
	Project Cost: Step 1 – 519.9 billion won
	Implementer: Incheon Global Campus
	Period: Step 1 June. 2008- 2015, Step 2, 2016
<b>Construction of Songdo Science Village</b>	Size: Site area 65,919 m <sup>2</sup> , gross area 2470,000 m <sup>2</sup>
	Features: Industrial Technology Complex (Venture Cluster), Business Complex Facilities
	Project Cost: 3.9644 trillion won
	Implementer: Songdo Techno Park
	Period: 2008-2013
<b>Bio Research Complex</b>	Project: Construction of Bio R & D and manufacture complex
	Location: 203-3, Songdo-dong, Yeonsu-gu, Incheon
	Size: 205,793 m <sup>2</sup>
	Project Cost: 400 billion won (Step 1)
	Foreign Investor: IBM (Singapore)
	Period : 2009-2013(Step 1)

<b>Samsung BioLogics</b>	Project: Production of biomedicine and construction of research facilities
	Location: 201-2, Songdo-dong, Yeonsu-gu, Incheon
	Size: 274,000 m <sup>2</sup>
	Project Cost: 2.1 trillion won
	Foreign Investor: Quintiles (USA)
	Period: 2011- 2020
<b>Mandobrose</b>	Project: Production and research of vehicle parts
	Size: 44,074 m <sup>2</sup>
	Features: Production of automotive application component (Electric motor) and construction of its R&D center
	Project Cost: 190 billion won
	Foreign Investor: Brose (Germany)
	Period : May 2010-Apr. 2012
<b>Dong-A Socio Group</b>	Project: Production of biomedicine and construction of research facilities
	Location: 213-4, Songdo-dong, Yeonsu-gu, Incheon
	Size: 144,810 m <sup>2</sup>
	Foreign Investor: Meiji Seika Pharma (Japan)
	Period: 2012-2017
<b>TOK Advanced Materials</b>	Project: Production and R&D of high-tech semiconductor materials
	Size: 28,308.1 m <sup>2</sup>
	Features: Production and research of photoresist for semiconductors
	Project Cost: 156 billion won
	Foreign Investor: TOK (Japan)
	Period: Aug. 2012- Oct. 2013
<b>Ajinomoto Genexine</b>	Project: Production of cell culture medium and construction of research facilities
	Location: 219-2, Songdo-dong, Yeonsu-gu, Incheon
	Size: 11,000 m <sup>2</sup>
	Project Cost: 35.7 billion won
	Foreign Investor: Ajinomoto (Japan)
	Period: 2013-2014

<b>Samsung Bioepis</b>	Project: Construction of research facilities for biopharmaceutical products
	Location: 201-2, Songdo-dong, Yeonsu-gu, Incheon
	Size: 10,179 m <sup>2</sup>
	Foreign Investor: Biogen Idec (USA)
	Period : 2011-2012
<b>Olympus Korea</b>	Project: Health Care Training Center and Service Center
	Location: 213-1, Songdo-dong, Yeonsu-gu, Incheon
	Size: 5,056 m <sup>2</sup>
	Project Cost: 363 billion won
	Foreign Investor: Olympus (Japan)
<b>Amkor Technology Korea</b>	Project: Production of the next generation semiconductor packaging and testing and construction of R&D center
	Size: 185,689 m <sup>2</sup>
	Project Cost: 1.159 trillion won
	Foreign Investor: Amkor Technology (USA)
	Period: 2012-2020

## Appendix 3

Place: IFEZ Integrated Smart City Operation Center, Seoul, South Korea.

Date: October 3, 2017.

### **Interview, representative 1:**

Q: Can you tell me more about the IFEZ operation center?

A: There are 3 areas. Each area is 20 km away from the others. The beauty is that we only have 1 Smart City operation center here in Songdo and we are managing 3 areas together. Initially, like maybe 10 years ago, we planned to have 1 one center for each location but it was later changed because we had the right technology developed here, so we think we can manage 3 areas together from here in Songdo. So meaning we saved like 9 million dollars because we don't need to build other operation centers.

Q: Which kind of services do you provide?

A: We are currently providing 5 public services, and since we are a government agency we want to offer public services first, and then later we are thinking of working together with the private companies.

Q: So no Public Private Partnership is involved?

A: We have PPP model applied because the built and in operation. We worked together with Incheon operation center which is our PPP model. Because that company is invested. Most of engineers hired for Songdo operation center are now working at Incheon smart city cooperation. They only have engineers and monitoring staff. They monitor what is going on in the city. They have the police officers stationed with them to have a fast reaction. But let me show you what kind of services we are providing. We provide 5 services: Traffic, security, environment, information providing and disaster prevention.

The first 2 are traffic services: there are cameras on the road so they can take data from there and to control and optimize the traffic flow. Through traffic VMS (variable message sign) we are providing traffic live information to the drivers.

As for fire prevention, we have super zooming cameras on the high rise building and they monitor the surrounding area so if there is a small flame of fire it can be detected right away.

We also provide information about the environment to citizens like ozone, micro-dust etc.

With Security service we can monitor public areas to enhance public safety. This are recognition system. They have a vehicle number recognition system. Vehicle and train to the city the plate numbers are registered in Songdo database. It's used when the police is looking for stolen cars or running away cars.

Q: For how long the footage is stored?

A: The video footage is stored for 30 days then discarded. The security footage is related to privacy and that's why they destroy it after 30 days (the video footage).

We collect data for traffic flow management and security enhancements. There is a need to retain data for at least 2 years. So we keep data but not video footage. The center started working from April 2017 so we need another 1.5 years of data.

Q: How many cameras there are in Songdo now?

A: About, all the facilities... 15,000 considering CCTV, cameras, sensors, traffic facilities... they all acquire data. There are different colors for CCTV and traffic facilities. If something goes wrong, there is a public message and is notified right away. All these services and basic infrastructure are connected on the platform and it's easy to collect them. It connects to the costs going down, so all these data helps the center to be more efficient. We have a software planner called cloud center, that's downstairs. This is center were we apply the virtualization technology. It can save space and operation cost.

Q: So all the CCTV maps etc. are open to the public?

A: Our maps are not opened to the public. The one online has less CCTVs. If you can come to the operation center and want to see it and ask information: they cannot see it. They are not allowed to see the footage. They are government agency and if someone feel less safe they can call and ask for more CCTV. If you have lost a child CCTV is really

important. Ten years ago we were really concerned about their privacy but now they are more comfortable and they are asking for more CCTV installation. They move because it's safe and clean. Do you provide any data, how many CCTV per person there are? We have 500 security system but they plan to install more. The number is more than 1000 if you count the other systems too.

**Interview, representative 2:**

Q: Did you participate in designing the IFEZ center yourself?

A: I was a system engineer and did not draw. There are two stages. Planning and construction. I divided two things, largely divided into requirement item requirement and item configuration. We are evaluating the current status of Smart City (Songdo) in the process of creating smart city services based on how much of this basic worry has been done, based on the data. The disadvantage is that how much you worry in this planning stage, how much you are worried about at the stage of construction, and how you are changing according to the times which is important.

Q: What do you think about the term Smart City?

A: Well, let's talk about that to students. The term smart city is, in effect "business." Picking up the national budget rather than approaching from a service point of view. Smart City It looks great, and I think, 'Well, then this investment will help the townspeople.' That's a disadvantage. The term smart city is not well defined.

Q: What do you think about the role of surveillance in Smart City?

A: CCTV is just one service in Smart City.

Q: What do you think about cyber-crime and Smart Cities?

A: That will not happen. I do not have to worry about this. There is no service to the end user. There is no important data in this center. It's about video files. There is no such data that is really important, for example, that North Koreans might like. Smart City is not a simple data center, there is no important data, and what is really important is that if the direction of smart city is simple, it is not important data if you only import the data of the sensor, and other organizations, such as a traffic center or a fire station. Security becomes important as soon as such data is shared. But honestly

Smart City has not reached that stage yet. (So you do not have to worry.)  
The world is not that important either. I do not think it's time to talk about security.

## Appendix 4

Survey title: Data collection of opinion and perception of Songdo as a Smart City.

Date: 15 - 30 November 2017

### Question and answers:

1. What is your name? (\*optional)  
[Open question].

2. What is your gender?  
Female, Male, Other (open question).

Answers: Female, male, male, male, female, female, male, female, female, male, female, male, male, female, female.

3. What is your age?  
18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75 or older.

Answers: 18-24, 18-24, 25-34, 18-24, 18-24, 18-24, 18-24, 18-24, 18-24, 18-24, 18-24, 18-24, 25-34, 25-34, 18-24, 18-24, 18-24, 25-34, 25-34, 25-34.

4. What is your occupation?  
[Open question]

Answers: Uni student, student, student, llsan, student, student, student, student, student, student, student, student, student, university student, student, student, civil engineer, student, student.

5. How well acquainted are you with the Smart City phenomenon?  
Not well at all, mildly well, fairly well, quite well, extremely well.

Answers: Not well at all, fairly well, not well at all, fairly well, mildly well, fairly well, quite well, quite well, not well at all, not well at all, quite well, fairly well, mildly well, quite well, mildly well, fairly well, mildly well, quite well, mildly well, mildly well.

6. Do you live in Songdo?  
Yes, no.

Answers: Yes, no, no, yes, yes.

7. Why did you move to Songdo?  
[Open question].

Answers: To study in INU, exchange, University, University exchange program, studies, exchange student program, just living here for 6 months to study, exchange semester, semester at INU, for studies, a university exchange program, for studying, study abroad, study, to study at INU, Studies, Studies and working, to study, because it was far from my house to university, my parents wanted.

8. How is the city connected by public transportation to other cities?  
1 = Very hard to go to other cities by public transportations  
5 = Very easy to go to other cities by public transportations

Answers: 1, 4, 3, 4, 5, 4, 3, 4, 4, 4, 2, 4, 4, 3, 3, 5, 4, 3, 2, 3

9. How high is the demographic in Songdo?  
1 = Underpopulated  
5 = Overpopulated

Answers: 3, 3, 3, 2, 2, 3, 3, 3, 2, 1, 3, 4, 3, 2, 1, 1, 1, 2, 2, 2

10. What are the features that you LIKE the most about Songdo as a City?  
Community, good schools, social homogeneity, nightlife, proximity to shopping, distance to work, public transportation, other.

Answers: Proximity to shopping, good schools, social homogeneity, clean air and shore view, more international feeling without being Itaewon or something like that, nightlife, proximity to shopping, distance to work, distance to work, proximity to shopping, community, proximity to shopping, distance to work, proximity to shopping, public transportation, distance to work, the quiet and big spaces, social homogeneity, good schools.

11. What are the features that you DISLIKE the most about Songdo as a City?  
Community, good schools, social homogeneity, nightlife, proximity to shopping, distance to work, public transportation, other (Open question).

Answers: Public transportation, nightlife, Public transportation, Public transportation, nightlife, social homogeneity, nightlife, urban quality, nightlife, Public transportation, still in construction so it feels like we live in the middle of nowhere, nightlife, nightlife, distance to work, sometimes feels very empty and not a lot of people lie here, proximity to shopping, Public transportation, nightlife, Public transportation, Public transportation.

12. How is the cost of living?

1 = Very low

5 = Very high

Answers: 5, 4, 4, 5, 4, 3, 4, 3, 4, 3, 3, 3, 2, 3, 3, 3, 3, 4, 4, 4, 5

13. How much did economic considerations influence your decision to live in Songdo? Why?

[Open question].

Answers: Very much the rent is too expensive, I lived there because I got for free the dormitory, not really because the university paid my stay, no influence, not at all, nothing, quite a lot I was planning to move to Tokyo but it is much more expensive to live there as a student, not at all, for us student it's quite cheap so it influenced me positively, nothing I have a scholarship, no influence, considerably much because it was expensive to live in Songdo, quite much because it is really expensive.

14. Does Songdo makes it easy to have a social life (i.e. meeting friends, coffee shop, leisure time activities, pub, and nightlife)?

1 = Not easy at all

5 = Very easy

Answers: 5, 2, 2, 2, 3, 5, 4, 2, 3, 2, 5, 2, 4, 2, 4, 2, 2, 1, 2, 2

15. How comfortable is to get to work/school?

1 = Very uncomfortable

5 = Very comfortable

Answers: 2, 5, 3, 3, 5, 4, 4, 4, 4, 4, 5, 4, 4, 5, 3, 5, 3, 3, 5, 3.

16. How do you go to work/school?

Walk, car, bus, subway, other (open question).

Answers: Walk, walk, car, bus, walk, bus, bus, walk, bus, bus, walking, university shuttle bus, bus, walk, bus, bus, bus, walk, walk, walk, bus.

17. How much does it takes?

[Open question]

Answers: 3 min, 10 minutes, 50 mins, 15 minutes from third party dormitory, 10 min, 5 minutes, 5 min, 25 minutes, 10 min, 10 minutes, 30 minutes, 5 or 15 minutes, 5 minutes by bus, 30 min, 20 min, 20 minutes, 25 min, 30

minutes, 20 min, 20 mins.

18. Is it easy or difficult to meet your daily needs (proximity to shopping for daily life?)

1 = Very difficult

5 = Very easy

Answers: 1, 2, 5, 2, 4, 5, 4, 3, 3, 3, 3, 3, 3, 4, 2, 4, 2, 2, 1, 1.

19. How would you rate the quality of the urban infrastructures?

1 = Very bad

5 = Very good

Answers: 4, 3, 4, 4, 5, 4, 4, 3, 3, 4, 3, 3, 4, 3, 2, 5, 4, 3, 5, 2.

20. How would you rate the quality of water services?

1 = Very bad

5 = Very good

Answers: 5, 4, 5, 5, 4, 4, 5, 4, 3, 1, 2, 4, 4, 3, 3, 5, 3, 5, 4, 5.

21. How would you rate the reliability of sewer services?

1 = Very bad

5 = Very good

Answers: 3, 4, 5, 5, 4, 3, 4, 4, 3, 3, 3, 4, 4, 4, 5, 4, 5, 4, 5.

22. How would you rate the adequacy of street lighting?

1 = Very bad

5 = Very good

Answers: 3, 4, 4, 5, 4, 4, 4, 4, 4, 5, 4, 3, 5, 4, 3, 4, 3, 4, 5, 3.

23. How would you rate the condition of sidewalk pavement and roads?

1 = Very bad

5 = Very good

Answers: 5, 5, 4, 5, 5, 3, 4, 2, 4, 2, 1, 1, 4, 4, 2, 3, 2, 1, 5, 2.

24. How would you rate the cleanliness of streets, sidewalks, public leisure etc.?

1 = Very bad

5 = Very good

Answers: 4, 4, 4, 5, 5, 5, 4, 3, 4, 4, 1, 4, 5, 4, 2, 4, 2, 2, 5, 4.

25. How efficient are the emergency services? (i.e. police, ambulance services, etc.?)

1 = Very bad

5 = Very good

Answers: 3, 5, 4, 4, 4, 3, 4, 4, 3, 3, 4, 3, 3, 3, 3, 4, 5.

26. How well acquainted are you with what Songdo is doing to be a Smart City?

Not well at all, mildly well, fairly well, quite well, extremely well.

Answers: Fairly well, fairly well, fairly well, quite well, quite well, quite well, fairly well, quite well, not well at all, not well at all, mildly well, mildly well, not well at all, quite well, not well at all, mildly well, fairly well, quite well, not well at all, fairly well.

27. How important is security to you?

1 = Not important at all

10 = Extremely important

Answers: 5, 5, 10, 9, 10, 10, 4, 8, 9, 9, 10, 6, 9, 9, 7, 9, 7, 10, 10, 10.

28. What crimes are you most concerned about?

Theft, Rape, Murder, Sexual Harassment, Nousey Neighbors, Others (open question).

Answers: Nousey neighbors, theft, sexual harassment, robbery and hit and run, theft, sexual harassment, theft, rape, rape, theft, murder, theft, theft, theft, rape, sexual harassment, theft, rape.

29. To what degree would you sacrifice your privacy to live in a safer City?

1 = I wouldn't sacrifice my privacy

10 = I would give any possible personal information

Answers: 5, 2, 5, 5, 8, 4, 2, 7, 5, 5, 10, 5, 5, 6, 2, 8, 4, 5, 10, 7.

30. Do you think surveillance is an effective way to reduce crime?

1 = Not effective

10 = Very effective

Answers: 5, 3, 8, 5, 5, 6, 2, 7, 8, 8, 10, 7, 7, 6, 2, 7, 4, 7, 10, 9.

31. What do you think about the amount of surveillance in this Smart City (Songdo)?

1 = Not enough

10 = Too many

Answers: 5, 6, 4, 5, 5, 8, 7, 9, 7, 6, 7, 5, 10, 8, 6, 7, 7, 7, 5, 6.

32. What kind of surveillance is provided in this Smart City (Songdo) that is not available in non-Smart cities?

[Open question]

Answers: Unknown, Unknown, Unknown, Unknown, Unknown, Unknown, Unknown, Unknown, Cameras (CCTV), Unknown, not known, Unknown, Cameras (CCTV), The density of cameras, Unknown, Unknown, don't know, no idea, Unknown, Unknown, Sorry I don't know.

33. To what degree do you feel comfortable with surveillance?

1 = Very uncomfortable

10 = Very comfortable

Answers: 6, 5, 9, 8, 5, 7, 3, 7, 6, 4, 10, 5, 3, 8, 4, 7, 4, 8, 8, 8.

34. Would you feel comfortable with surveillance outside the door of your apartment?

1 = Very uncomfortable

10 = Very comfortable

Answers: 6, 9, 10, 8, 1, 8, 3, 6, 7, 7, 10, 4, 4, 8, 2, 7, 5, 8, 8, 7.

35. (Surveillance) in your house would be ok?

1 = Very uncomfortable

10 = Very comfortable

Answers: 6, 4, 2, 1, 1, 5, 1, 7, 6, 1, 1, 3, 10, 8, 1, 6, 3, 4, 1, 7.

36. Did you move to Songdo because you feel safer?

Yes, no, other (open question).

Answers: No, no, no, no, studies, no, no, no, no, no, no but I feel safer, no, no, no, no, no, no, yes, no

37. Are you comfortable with new technologies embedded in our cities?

37A. Self-driving cars?

1 = Very uncomfortable

5 = Very comfortable

37B. surveillance system?

1 = Very uncomfortable

5 = Very comfortable

37C. internet of things (IoT)?

1 = Very uncomfortable

5 = Very comfortable

Answers:

A. 3, 4, 3, 5, 3, 5, 5, 4, 1, 3, 1, 3, 3, 5, 5, 4, 4, 4, 2.

B. 3, 2, 5, 3, 5, 4, 1, 4, 3, 5, 3, 1, 4, 2, 4, 2, 4, 4, 3, 3.

C. 3, 5, 4, 5, 5, 4, 5, 5, 5, 5, 3, 4, 4, 3, 4, 5, 4, 4, 5, 3.

38. Do you agree or disagree that Smart Cities are suitable for future urban living?

Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree.

Answers: Agree, neither agree nor disagree, agree, agree, agree, neither agree nor disagree, agree, agree, strongly agree, strongly agree, agree, neither agree nor disagree, agree, neither agree nor disagree, agree, strongly agree, strongly agree, neither agree nor disagree, agree.

39. How long do you think you will live in the Smart City (Songdo)?

[Open question].

Answers: 3 years, 6 months, maybe a couple of years until graduation, 3 months, 1 year and half, for 1 year, 3 months, 1 semester, six months, until December, 1 year, 4 months, 6 months, 4 months, 4 months, 1 year, 5 years, more than 10 years.

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