Review Paper Informatization Policy Vol. 27, No.1 (2020), pp.003-035
https://doi.org/10.22693/NIAIP.2020.27.1.003

Smart Cities: A Review of the Most Recent Literature

Mark C. Hoffman*

Abstract Interest in smart cities is growing; information and communication technology, urban planning, urban economy development, health, and many other areas are intertwined within smart city research and practice. The definition of smart city is evolving, and its vagueness is sometimes confusing. This review of the smart city literature tries to capture the big picture of this big idea. This review places into context work done since 2016, as earlier work is well reviewed in Albino (2015) and Cochia (2014). First is a review of the various smart city definitions. Second, an inventory of terms related to or subsumed by the smart city label are presented. Third, outcomes of indexes created to measure a city's smartness are presented. Fourth, the taxonomies used to organize the disparate content that falls under the smart city umbrella are discussed. Fifth, the most recent literature associated with six commonly recognized subgenres, namely smart economy, smart governance, smart living, smart people, smart environment, and smart mobility are reviewed. Sixth, important critiques of the smart city idea are presented.

Keywords : smart city, smart governance, smart mobility, smart living, smart environment

스마트시티: 최근 문헌에 대한 리뷰

마크 호프만*

요 약 스마트시티에 대한 관심이 증대되고 있다. 새로운 정보통신기술, 도시계획, 도시경제발전, 보건 등의 다양한 분야가 스마트시티 연구 혹은 실무에 적용된다. 그래서 스마트시티에 대한 정의는 다양하게 진화하고 있으며 때로는 혼란도 가지고 온다. 연구자들의 전공에 따라 개별적으로 연구되고 있는 스마트시티에 관한 전반적인 리뷰연구가 필요하다고 본다. 따라서, 이 논문에서 스마트시티라는 아이디어가 어떻게 발전해 왔으며, 주요 구성요소 그리고 실제적으로 집행되어 왔는지 정리해 보고자 한다. 특히 최근 2016년부터 지금까지 진행되어 온 학술적 연구들에 대해 중점적으로 살펴보았다. 이전 초기부터의 연구 정리는 Albino외 (2015), Cochia(2014)연구를 참조하면 된다. 이 리뷰논문에서는 먼저 스마트시티의 다양한 정의에 대해 소개하고 논의하였다. 두 번째로는 스마트 시티를 구성하는 여러 가지 관련 용어를 정리하였다. 세 번째로는 스마트 시티 발전정도를 측정하려는 시도인 인덱스에 관한 연구를 정리하였다. 네 번째로는 스마트 시티 연구의 건설적 비판(critique)으로 연구방향을 제시한 자료들을 분석하였다. 다섯 번째로는 스마트시티 연구를 어떻게 분류하고 구분할지에 대한 분류 체계(taxonomy)에 대한 제시가 있다. 여섯 번째로는 최근 가장 많이 언급되고 있는 여섯 가지의 분야- 스마트 경제, 스마트 거버넌스, 스마트 리빙, 스마트 피플, 스마트 환경, 스마트 모빌리티-에 대해 리뷰 하였다.

주제어 : 스마트 시티, 스마트 거버넌스, 스마트 모빌리티, 스마트 리빙, 스마트 환경

Received Jan 15, 2020; Revised Feb 5, 2020; Accepted Feb 7, 2020
* First Author, Professor, Grand Valley State University.(hoffmanm@gvsu.edu)

Ⅰ. Introduction

The idea of "smart cities" has become popular among those in a variety of interconnected professional and academic networks, including new information and communications technology (ICT), urban planning, economic development, healthcare, and city management. While the idea has spread, the details of the smart city often depend on one's perspective. Many commentators and researchers begin their discussion of smart cities by lamenting that the concept is amorphous, elusive, and evolving (Angelidou, 2014; Carvalho, 2015; Cocchia, 2014; Glasmeier & Christopherson, 2015; Hollands, 2008; Shelton, et al., 2015; Vanolo, 2014). However, these opening disclaimers obfuscate the closeness of the definitions they subsequently propose, which are harmonious even if falling short of uniformity. The challenge for most commentators and researchers is that the smart city encompasses such a multidisciplinary, multi-professional body of knowledge that expertise seems a claim only comfortable for egotistical intellectuals and ambitious consultants. Thus, while there is an explosion of literature on smart cities, the perspectives, emphases, and recommendations are heavily influenced by an authors' disciplinary and professional roots. For the intellectually curious, accessibility to the literature is best achieved by beginning within familiar fields and then taking the deep dive into the full body of literature.

This article is intended to assist readers who are curious about smart cities as an idea, its evolution in the recent history of ideas, its key dimensions, and how various implementations are being evaluated. It samples and organizes some of the most recent and relevant smart city literature, especially academic papers published since 2016 that are of interest to those generally curious from a broad academic perspective. The reader is advised to consult two literature reviews that are comprehensive and illuminating for older smart city scholarship(Albino, et al., 2015; Cochia, 2104).

The article proceeds as follows: First, a review of the various smart city definitions; Second, an inventory of terms related to or subsumed by the smart city label; Third, some of the indexes created to measure a city's smartness; Fourth, a discussion of the taxonomies used to organize the disparate content that falls under the smart city umbrella. Fifth, a review of the most recent literature associated with six commonly recognized subgenres, namely smart economy, smart governance, smart living, smart people, smart environment, and smart mobility; Sixth, some important critiques of the smart city idea.

Ⅱ. Literature Review

1. Definition

Many definitions have been offered for the smart city, and they do vary. These variations are often in service to the needs of the authors that provide them. Thus, the differences are more alternative emphases than discrepancies. Rather remarkably, there is a building consensus on the definition of a smart city, although this

definition is very expansive.

Cisco (n.d.), an ICT multinational headquartered in California's Silicon Valley, provides this definition:

> *A smart city uses digital technology to connect, protect, and enhance the lives of citizens. IoT sensors, video cameras, social media, and other inputs act as a nervous system, providing the city operator and citizens with constant feedback so they can make informed decisions.*

Cisco sells technology for smart cities. It places the technology of interconnected devices, often referred to as the "Internet of Things" (IoT), as the starting point of its definitions. It then emphasizes the benefits to potential clients.

Caragliu, et al.(2009) are European economists whose definition of smart cities pivots away from emphasizing technology and stresses the role of human capital:

> *We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance (p. 70).*

Michelucci, et al.(2016) are scholars of management. Thus, it is not surprising that they define the smart city as a process for managing resources. "Cities are smart when the city government has the ability to optimize the exploitation of both tangible and intangible assets, enhance citizens' quality of life, boost resource productivity, and solve emerging problems" (p. 25).

Angelidou (2014) is a scholar of urban planning. For her, the defining characteristic is the strategic planning activity behind the smart city development. "Smart cities are all urban settlements that make a conscious effort to capitalize on the new Information and Communications Technology (ICT) landscape in a strategic way, seeking to achieve prosperity, effectiveness, and competitiveness on multiple socio-economic levels" (p. 53).

The need to precisely operationalize the smart city is acute when creating a smart city index for the purpose of ranking. A team of academics from Austria, Slovenia, and the Netherlands (Giffinger, et al., 2007) created the first smart city index. While demanding precision, indexing also encourages expansion of the definition, as the prestige and authority of an index is associated with its perceived comprehensiveness. This is evident in their definition of smart cities.

> *It is not useful to solely focus on the performance of only one aspect of city development but on the performance in a broad range of characteristics. … A Smart City is a city well performing in a forward-looking way in these six characteristics [smart economy, smart people, smart governance, smart mobility, smart environment, and smart living], built on the 'smart' combination of endowments and*

activities of self-decisive, independent and aware citizens" (p. 10-11).

Lara, et al.(2016) offered The broadest definition of smart cities. It lacks any reference to ICT. A smart city is "a community that systematically promotes the overall wellbeing for all of its members, and flexible enough to proactively and sustainably become an increasingly better place to live, work and play" (p. 9).

2. Related Terms

The number of similar terms to "smart city" are numerous. "Smart city," in its current sense, can be traced (Batty, 2017, p.3) to the subtitle in a 1992 book by Gibson, et al (1992). The term used in the title and throughout the book was "technopolis," which obviously never caught on. During the 1990s, "smart" became popular in technology marketing, with products like Canada's SMART boards, Sweden's Ericsson smart phones, and Germany's Smart cars. With marketing winds behind it, "smart city" eventually became a popular term and, in the 2010s, the term absorbed many related ideas into its expanding definition.

Google Trends can provide some indication of the popularity of a topic over time. (According to Google, "topics" are a group of terms that share the same concept in any language.) As a topic in world-wide Google searches, smart city surpassed "new urbanisms" in 2008 and "sustainable city" in 2010. Smart city peaked as a topic in September 2015, which corresponds to the Obama Administration's announcement of a new smart cities initiative. (White House Office of the Press Secretary, 2015).

Google Trends is limited to terms that Google has identified. A less sophisticated approach to evaluation the current popularity of a term is the count of results Google finds after a search. As of August 2019, "smart city" yielded 34.6 million results in Google. That is 23 times more pages found than for its closest rival, "sustainable city." Below is a brief description of some of the related terms, and how they became associated, superseded, or absorbed by smart cities.

Sustainable city (1.52 million Google results) / **eco-city** (663,000). The sustainability movement has brought environmental concerns to the forefront of social discourse and policymaking. Sustainable cities emerged as a term to describe the response of cities to sustainable development. "Sustainable cities should meet their 'inhabitants' development needs without imposing unsustainable demands on local or global natural resources and systems" (Satterthwaite, 1992, p. 3). One of the major goals of smart city development is to reduce the environmental impact of dense human settlement (Shahidehpour, et al., 2018). Thus, smart city has begun to overlap with sustainable city in as much as technology is useful to accomplish this goal. D'Auria, et al.(2018) differentiate the two terms by "considering the smart city as mainly setting the guidelines of a transforming city, while the sustainable city is mostly thought as an approach and a philosophy to modern cities" (p. 1). A major coup for the smart city nomenclature came in 2013 when China officially replaced the description

of its urban planning model from "eco-city" to "smart city" (Neo, 2019). Some scholars (e.g., Ahvenniemi, et al., 2017; Bibri & Krogstie, 2017; Höjer & Wangel, 2015) compromise, using the term "smart sustainable cities" (which yielded 125,000 Google results).

New urbanism (1.37 million). The common element that underpins both new urbanism and smart cities is the need for a societal-level response to the accelerating urbanization of the world's population and its implications for quality of life. According to the Congress for New Urbanism (n.d.), this term is rooted in the 1980s reaction to post-war suburban sprawl. It indicates "a planning and development approach based on the principles of how cities and towns had been built for the last several centuries: walkable blocks and streets, housing and shopping in close proximity, and accessible public spaces." As new urbanism has advanced into the 21st century, it has promoted its approach as both sustainable and healthy. "Smart Urbanism" (which yield 90,700 Google results) has been used to more directly bind new urbanism to smart cities, with an emphasis on the human over the technological elements (Luque-Ayala & Marvin, 2015).

Digital city (999,000). Digital city refers to a web-based virtual reality of certain aspects of a city or its governmental services (Couclelis, 2004; Anthopoulos & Fitsilis, 2010). It may also refer to a new geographic distribution of living spaces, workspaces, and service locations created by the influence of ICT (Mitchell, 2000). Dameri (2014) makes a case that digital is a narrower term, limited to ICT-based initiatives, whereas smart is broader, including initiatives that meet desirable environmental and social goals, but not necessarily through ICT innovations. In any case, this term has declined in use since 2005.

Knowledge city (584,000). Yigitcanlar (2018) sees knowledge city as one of the three strong "brands," along with smart city and sustainable city, that compete for recognition as urban development strategies. In knowledge-based development, "knowledge is considered as a resource particularly suited to leverage economic growth in a way that may eventually bring social prosperity" (Carrillo, 2007, p. 5). Although originating from a different set of ideas, the close meaning of "knowledge" and "smart" and the overlap of interest in new technologies has eroded a clear separate identity for knowledge city. After Chang, et al.(2018) examined 20 published articles on existing approaches to smart and sustainable cities assessment, they advocated for the merger of knowledge-based urban development, smart city and sustainable development concepts.

Government 2.0 (225,000) suggests that government-maintained information is a public asset with citizens empowered to access, contribute, and innovate with that information. It differs from most other terms on the list because it is not limited to cities (Eggers, 2004; O'Reilly, 2009). However, smart cities usurp most of government 2.0 by claiming that city governments are the leaders in technology innovation. "Smart cities are at the vanguard of the new approach to solving urban problems. They are far more flexible, agile, and responsive than national governments. If there are solutions

to the world's hardest problems, smart cities will find them first" (Barlow & Levy-Bencheton, 2019, p. 21). Only in a few countries, such as South Korea, is the smart city seen as primarily a national government priority (Lee & Chang, 2019).

Intelligent city (199,000) / **i-city** (1,760) is defined by Komninos (2002) as "those spatial entities that, on the one hand, offer a real environment for technological innovation based on clusters and institutions for R&D, and product and process innovation. And on the other hand … are endowed with a digital capacity to manage and diffuse knowledge and technology" (p. 122). Allwinkle and Cruickshank (2011) see the intelligent city as a stage that precedes the smart city, where:

> *the point of emphasis and intervention begins to shift from innovation to application, from the back-office to front-line services, and in policy terms, the emphasis also shifts from the corporate to the civic, from the market to the community, and from the bureaucratic administration of the economy to a liberal democratic governance (p. 9).*

However, Pan (2018, pp. 26-27) finds that smart city connotes a vision too limited by a "mayor's horizon" and suggests that intelligent city or "iCity" is "more fitting to the Chinese national condition."

Responsive city (45,500). Like Government 2.0, the responsive city concept has a government focus. It refers to an improvement to governance and civic life through technology that instantly responds to the desires of citizens (O'Donnell, 2017) and avoids ideological-based policies advocated by politicians and pundits on the political Right and Left (Goldsmith & Crawford, 2014). Although starting from a different reference point, this vision can be incorporated into the smart city concept.

> *… the future vision of cyber-human smart cities involving a rich and active interplay of different stakeholders (primarily citizens, local businesses and authorities), effectively transforming the currently passive stakeholders into active ecosystem actors. Realizing such complex interplay requires a paradigm shift in how the physical infrastructure and people will be integrated and how they will interact. (Dustdar, et al., 2018, p.3)*

Ubiquitous city (31,400) / **u-city** (9,530). Smart technologies are increasingly embedded into a city's devices and services and linked to a wireless information network. This city-wide panopticon is sometimes referred to as the "ubiquitous city" or, particularly in South Korea, shortened to "u-city." (Anttiroiko 2013; Jang & Suh, 2010; Shin, 2009).

Sentient city (28,400). The sentient city can see, hear, and feel things happening within it. Shepard (2009) describes the future sentient city as "being capable of reflexively monitoring our behavior within it and becoming an active agent in the organization of our daily lives" (p. 1). The use of a sentient city in recent scholarship tends

to be in a more philosophical context than the use of smart city (e.g., Thrift, 2014; Trickett, 2109).

3. Smart City Indexes

Although indexes may be dismissed as promotional and gimmicky, with little value to knowledge building or theory testing, they serve an important function in the development of broad ideas like the smart city. Every smart city index needs to operationalize its definition and justify its selection of measures. Furthermore, indexes provide one way for professional planners and IT administrators to survey the smart city environment beyond their own locality.

The following are seven smart city indexes published between 2017 and August 2019. For brevity, nicknames are given based on the publisher. Each index has a different scope, uses different definitions, and balances the important elements with different weights. However, even with these differences, some cities frequently appear at the top of the lists.

- *"IESE": IESE Cities in Motion Index (Berrone & Ricart, 2019).*
- *"McKinsey": Smart City Technology Base by McKinsey Global Institute 2018 (Woetzel, et al., 2018)*
- *"Eden/OXD": Smart City Governments (Eden Strategy Institute & OXD, 2018)*
- *"Juniper": Global Smart City Performance Index (Juniper Research, 2017)*
- *"Berger": Smart City Strategy Index by Roland Berger (Zelt, et.al., 2019)*
- *"Bee": Global Smart Cities Ranking (Bee Smart City, 2018)*
- *"JUT": Smart City Discourse Network (Joss, et al., 2018)*

〈Table 1〉 lists the cities that made the top 10 rankings on any of the seven indexes. There is some agreement on the top cities. Singapore and London both made the top 10 on six of the seven; New York City made it on five of the seven; Amsterdam, Barcelona, and Chicago made it on four of the seven. No Latin American or African city was ranked in the top 10 list of any index.

4. Taxonomy

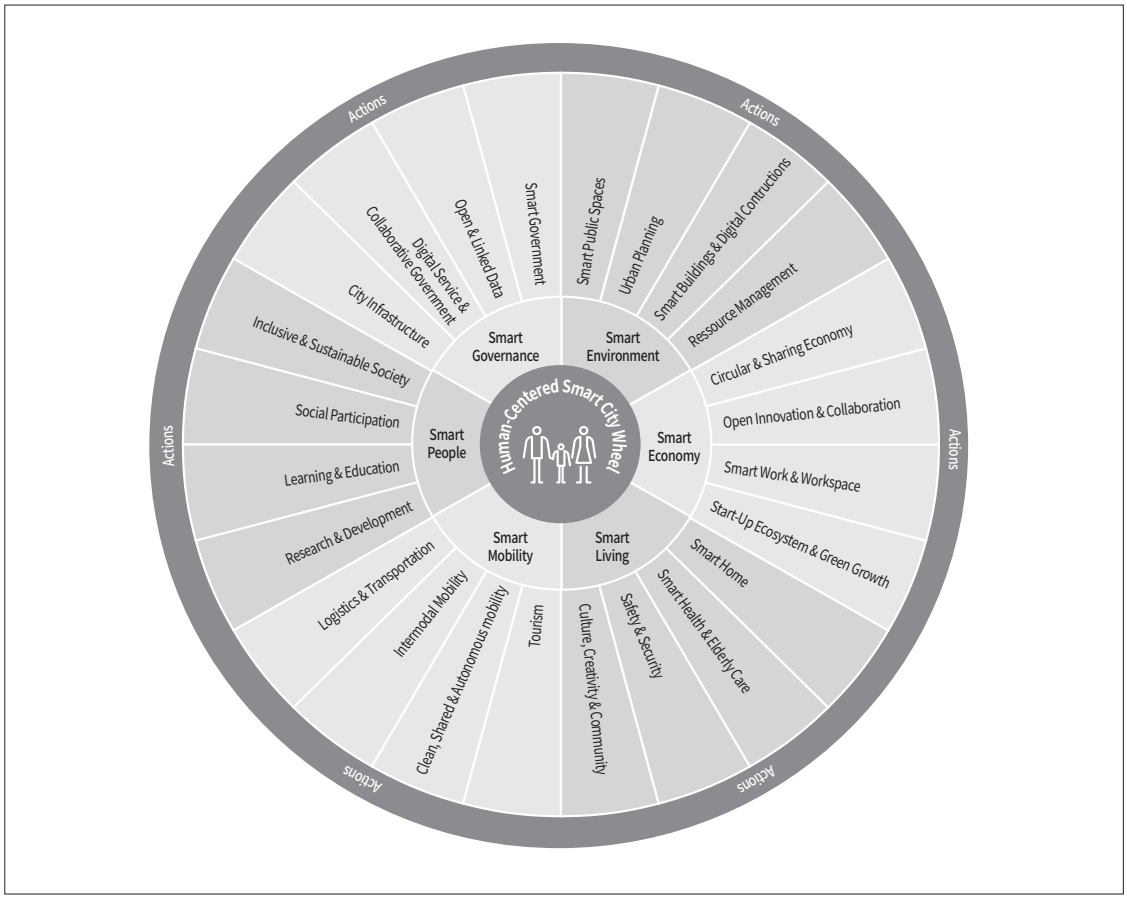
Given the breadth of subjects covered under the smart city moniker, it has become a challenge for scholars and commentators to find an adequate organizing taxonomy.

The most common taxonomy used in the literature (e.g., Hong Kong Smart City Blueprint, 2017;Pinochet, et al., 2019; Vidiasovaa, et al., 2017; Vinod Kumar, 2015) is the six domains introduced by Giffinger, et al. (2007): smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. The popularity of the taxonomy is largely due to its visualization as the "smart city wheel" in Fast Company magazine (Cohen, 2012). Since then, many adaptations have been made. For example, Figure 1 is a Smart City Wheel designed by Smart City Hub (n.d.) in Bern, Switzerland.

〈표 1〉 7개 지표에서 스마트시티 상위 10위 도시

〈Table 1〉 Cities that make top 10 smart city ranking in seven selected indexes

		IESE	McKinsey	Eden/OXD	Juniper	Bergen	Bee	JUT
Asia								
	Chongqing - China	-	-	-	-	8	-	-
	Delhi - India	-	-	-	-	-	-	9
	Hong Kong - China	-	10	-	-	-	-	7
	Seoul - South Korea	-	3	3	6	-	-	-
	Shanghai - China	-	8	10	-	6	-	-
	Shenzhen - China	-	-	-	-	9	-	-
	Singapore - Singapore	7	1	2	1	4	-	2
	Tokyo - Japan	6	-	-	8	-	-	-
Australia								
	Melbourne - Australia	-	-	8	10	-	-	-
Europe								
	Amsterdam - Netherlands	3	7	-	-	-	1	4
	Barcelona - Spain	-	-	9	9	-	8	3
	Berlin - Germany	9	-	-	7	-	9	-
	Copenhagen - Denmark	8	5	-	-	-	-	-
	Helsinki - Finland	-	-	5	-	-	-	-
	Jonkoping - Sweden	-	-	-	-	-	10	-
	London - United Kingdom	1	-	1	2	2	6	1
	Lublin - Poland	-	-	-	-	-	3	-
	Moscow - Russia	-	-	-	-	-	2	-
	Paris - France	4	-	-	-	10	7	10
	Reykjavik - Iceland	5	-	-	-	-	-	-
	Stockholm - Sweden	-	4	-	-	-	-	-
	Vienna - Austria	10	-	-	-	1	-	-
North America								
	Birmingham - USA	-	-	-	-	7	-	-
	Boston - USA	-	-	7	-	-	-	5
	Chicago - USA	-	9	-	5	5	-	8
	Columbus - USA	-	-	-	-	-	5	-
	Montreal - Canada	-	-	6	-	-	-	-
	New York City - USA	2	2	4	3	-	-	6
	San Fransisco - USA	-	6	-	4	-	-	-
	St. Albert - Canada	-	-	-	-	3	-	-
	Winnipeg - Canada	-	-	-	-	-	4	-



source : Smart City Hub, Bern, CH , reprinted here under the Creative Commons License (https://creativecommons.org/licenses/by-nc/4.0/deed.de)

〈그림 1〉 스마트 시티 휠
〈Fig. 1〉 Smart City Wheel

Recently, four alternatives to the smart city wheel have been proposed.

Afonso (2017) constructed a model consisting of ten "basic domains," each assigned a "basic indicator." The main objective of these domains and basic indicators is to “understand the structural weaknesses that need further attention to the city to be comparable to a smart city” (Afonso, et al., 2015, p. 231).

A second alternative has been offered by Winkowska, et al.(2019), who used 15,744 smart city-related studies to create a bibliometric map using the visualization of similarities (VOS) technique. They identified four clusters that constitute research sub-areas in the context of the smart city concept: smart technology, socio-economic aspects, environmental aspects, and urban logistics.

Allam and Newman (2018) proposed A third alternative. Their framework presents the

〈표 2〉 스마트 시티 기본 도메인 및 지표
〈Table 2〉 Smart City Basic Domains and Indicators

Basic Domains	Basic Indicators
Water	Piped water
Education	HDI-Education
Energy	Access to energy
Governance	HDI/Employment
Housing	Private residence
Environment	Garbage collected
Health	HDI-Health
Security	Homicides/1000
Technology	Computers/home
Transport	Mass transport

source : Afonso(2017)

〈표 3〉 6개의 스마트 시티 주제 영역과 35개 카테고리
〈Table 3〉 Six Smart City thematic Areas and 35 Categories

Thematic Area	Categories						
Smart Nature	Water	Pollution	Waste	Energy	Land	Green environment	
Smart Governance	Transparent governance	Participation in decision-making	Public and social services	Sustainable and smart city strategies	Governance effectiveness		
Smart Economy	Employment	Economic growth	Innovative spirit	Entrepreneur-ship	Employment		
Smart People	Education and qualification level	Social inclusion	Lifelong learning	Demography	Personal propensity	Social cohesion	
Smart Living	Health	Education	Safety	Household	Culture	Touristic attractivity	Buildings
Smart Mobility	Public transport	Public transport alternatives.	Traffic management	Innovative transport systems	Logistics	ICT	

source : Petrova-Antonova & Ilieva(2018)

smart city as three pillars: metabolism, culture, and governance. Metabolism is the pathways through which smart technology is introduced at the household level. The culture is the special urban areas for local communities and visitors. Governance is providing inclusivity to all stakeholders and opportunities to change.

A fourth alternative was offered by Petrova-Antonova & Ilieva (2018), who examined 183 articles on smart cities and cataloged a total of

1,152 smart city indicators. They classified these indicators into six thematic areas, each with between five and seven categories.

Afonso's taxonomy(2017) is supported by a sound argument with a tight association of domains and indicators. Winkowska, et al.'s taxonomy(2019) is the result of a bibliographic mapping of thousands of journal articles. Allam and Newman's taxonomy(2018) is a normative reimaging that promotes focus on quality of life issues over ICT. Petrova-Antonova & Ilieva's taxonomy(2018) is grounded in a rigorous examination of smart city indicators. Nonetheless, this article uses the more familiar six-domains of the smart city wheel as its organizing principle: smart economy, smart people, smart governance, smart mobility, smart environment, and smart living.

5. Smart Economy

A smart economy can be defined as "policies that stimulate innovation and creativity combined with scientific research, superior technology and care for the environment" (Balaceanu, et al., 2015, p. 507). The Irish government's policy statement on smart economy describes it similarly:

> *A key feature of this approach is building the innovation or 'ideas' component of the economy through the utilisation of human capital – the knowledge, skills and creativity of people – and its ability and effectiveness in translating ideas into valuable processes, products and services. A second important aspect is the greening of the economy and the development of green enterprise (Ireland Department of Taoiseach, 2008, p. 8).*

Smart economy as knowledge economy. As ideas, the smart economy and the knowledge economy have obvious similarities. The latter is defined by Angelidou (2015, p.98) as existing when "more knowledge-intensive than labor-intensive activities take place and the share of intangible capital compared to physical capital is expanding." The merging of these two concepts can be seen in recent case studies of Qatar (Gremm, et al., 2018) and Brisbane (Esmaeilpoorarabi, et al., 2018).

Smart economy as shared economy. The shared economy is a consumption model based on sharing goods, services, knowledge, and experiences through social networks rather than by possessing them (Gurashi, 2020, p. 41). Activities in the shared economy include couch surfing, car sharing, coworking, and crowdfunding. The shard economy is understood to have connections with smart cities for reasons that include: required connectivity, enabling technologies, and online platforms; improved uses of resources and assets; and predicated on trust by participants on privacy and security protocols (Gori, et al., 2015). Borsma (2017) envisions that the smart city's services will eventually follow the for-profit Uber model of shared economy.

Several recent publications, including Dyer, et al. (2017), Evans, et. al. (2019), and a South Korean government-sponsored study (reported in Cho, 2017) have explored the link between

the shared economy and the smart city.

There has been concern expressed that the shared economy is incompatibilities with some smart city objectives (Hill, 2015), is exploitive of the workforce (Attoh, et al., 2019), and is of reduced value to developing countries (Vinod Kumar & Dahiya, 2015, p. 48) and poor neighborhoods in developed countries (Thebault-Spieker, et al., 2015).

Smart economy as the new industrial revolution. Rifkin's Third Industrial Revolution (2011) popularized the idea that the convergence of ICT with green energy would bring about fundamental change to the economic order, even to the degree of an "eclipse of capitalism." In short, ICT is reducing marginal costs of distribution to near-zero, turning some products into fast, cheap, omnipresent services that can be powered by cheap, renewable energy. Rifkin believes this will make vertically-integrated companies obsolete and greatly enlarge the shared economy (Rifkin, 2014). Rifkin (2016, p. 19) connected this new industrial revolution to smart cities: "What's required now is a commitment to phase in a Smart Regions / Smart Cities Third Industrial Revolution economy if we are to avert catastrophic climate change and create a more prosperous and ecologically sustainable civilization."

6. Smart Governance

Haque (2015) suggests a dichotomy in government's information usage: defining problems and finding solutions versus understanding social values and empowering citizens. When Barlow and Levy-Bencheton (2019, p. 211) define smart governance, they include two sentences that reflect these two distinct uses. They say smart government solutions "are those that improve the quality, accessibility, and scope of the municipal services on offer to businesses and individual residents." They also say that smart government "builds trust through transparency and shared governance, adopting methodologies that allow and encourage citizen participation." The former, which might be termed e-government, is very evident in case studies of smart city projects while the latter, which might be termed e-democracy, is a primary concern in philosophical discussions of smart cities, but scarcer in real-world implementations.

E-government. Vinod Kumar (2015, p. 14) lists the main area of smart city e-Governance challenges as: "water supply and sanitation, power supply, urban transport and traffic management, pollution control and environmental sustainability, regulation of land use, management/decongestion of development within crowded zones, maintenance of civic infrastructure, policing, disaster management, and urban poverty."

There are now several volumes on the implementation of these e-government activities occurring around the globe (e.g., Alcaide Muñoz & Rodríguez Bolívar, 2018; Holzer, et al., 2018; Kumar, et al., 2018.) Recent literature has often found a weak capacity for city government to manage e-government projects. Razaghi and Finger (2018) reviewed 24 articles and concluded that governments are "not fully equipped to deal

with the complex nature of urban systems" (p. 688). Dameri and Benevolo (2016) examined 117 Italian cities and found no consolidated standards or best practices related to smart city governance. Bris, et al.(2019) investigated 16 reputedly smart cities from around the world and concluded that governance was not a top priority in any. Green (2019, p. 117-18) concluded that "technology alone cannot solve intractable social and political problems, but … to derive benefit from technology, [city government] must overcome institutional barriers to reforming policies and practices."

Several practical steps have been taken to improve government capacity to manage a smart city.

- *In 2014 the British Standards Institute released PAS 181 Smart city framework as "a good practice framework for city leaders to develop, agree and deliver smart city strategies."*
- *In 2015, the International Organization for Standardization released ISO/TS 37151 to provide principles and specifies requirements for smart city infrastructure performance metrics and "gives recommendations for analysis, including smartness, interoperability, synergy, resilience, safety, and security."*
- *In 2019, the World Economic Forum published Guidelines for AI Procurement for "all parties involved in the procurement life cycle - policy officials, procurement officers, data scientists, technology providers and their leaders - towards the overarching goal of safeguarding public benefit and well-being" (p. 4).*
- *In 2019, Gassmann, Bohm, and Palmie proposed the "smart city management model as a reference frame which should structure the time sequence of projects and should enable individuals to keep track of all relevant topics" (p.62)*

E-democracy. Vinod Kumar (2017, p. 20) defines e-democracy as the facilitation of "participation in government using digital or electronic means. These initiatives can include e-forums, e-town hall meetings (virtual and not real), e-consultations, e-referenda, e-voting, e-rule-making, and other forms of e-participation, and any form of 'digital engagement.'"

There are two dimensions to e-government in smart cities. One is using ICT to facilitate participation in decision making (Bouzguenda, et al., 2019). According to Gassmann, et al. (2019, p. 34), the creation of public value should be the core function of urban areas, and so this should also be the ultimate objective of smart cities." However, while e-government applications are abundant in recent smart city literature, e-democracy applications are scarce. A few recent e-democracy case studies include Barcelona (Calzada, 2018), Catania (Graziano, 2020), Genoa (Ribaudo, et al., 2016), Lagos (Olokesusi & Aiyegbajeje, 2017), and Turin (Michelucci & De Marco, 2017). In a case study of Barcelona, March and Ribera-Fumaz (2018, p. 825) concluded that "it is unclear how the interests of citizens are to be made compatible

with the interests of private capital and of the urban political elites." Verhulst (2018) lamented that artificial intelligence is not used enough to bring e-democracy applications to scale.

The other dimension of a smart city's e-democracy is public input into design and implementation of the various smart technologies. In reviewing the Smart Dublin initiatives, Kitchin, et al.(2019) note that citizens are seldom directly consulted on how initiatives are formulated or deployed. This observation is shared by Angelidou (2017, p. 13), who examined 15 smart cities across the globe and found that in eight "smart city strategies are characterized by a low performing or no participatory approach whatsoever." Farías and Widmer (2019) wished that smart cities would take seriously all the non-digital logics and concerns that collide with smart city projects.

Bifulco, et al. (2017) offered a more positive finding in that Living Labs, an EU-sponsored program that coordinates communication among city stakeholders around governance issues, showed positive participatory results in Amsterdam, Barcelona, and Helsinki. Simonofski, et al. (2018) also had encouraging results in La Louvière, Belgium, partly attributable to the Living Labs program.

Does government have an intelligent AI strategy? Cath, et al. (2018) reviewed reports by the White House, the European Parliament, and the UK House of Commons that outlined their respective visions on how to prepare society for the widespread use of artificial intelligence (AI). They raised concern about government's strategy for dealing with AI-related issues

> *That the different reports define various constellations of responsibility, emphasise the importance of cooperation, and mention specific areas of concern or even values to be upheld are all steps in the right direction. What is lacking in all the three reports is a tightly woven understanding of how responsibility, cooperation, and values fit together to design and steer the development of a 'good AI society' (p. 524).*

7. Smart Living

The literature on smart living usually takes a more human-centered perspective than other smart city topics. That is, rather than holding sustainability, efficiency, and security, as primary concerns, the smart living literature examines the costs and benefits of the integration of ICT on health, home, and happiness.

Smart health. The infrastructure and technologies of smart cities can be amalgamated with mobile and electronic health (m-health and e-health) services to create a richer concept: smart health (Al-Azzam & Alazzam, 2019; Solanas, et al., 2014). Generally, smart health is wearable and stationary sensors sending data to a health data cloud, where it is transformed by AI into guidance for improvement to an individual's health, assistance in navigating a health facility, or intervention into a health emergency. Below are summarized some literature reviews that covered some aspects of smart health. Also, below are examples of scholarship that has attempted to postulate a broad smart health

paradigm or smart health framework.

Hossain, et al. (2019) discussed a hypothetical smart health system. As a case study, an automatic voice pathology detection method was described where voice and electroglottographic signals were picked up by various smart devices, sent to a medical cloud, analyzed for indications of problems, and alerted to medical professionals if appropriate. Related scholarship includes: Pramanik, et al. (2017), who proposed a smart healthcare system framework; Palanisamy and Thirunavukarasu (2019), who reviewed 18 attempts in establishing an analytical framework for smart health; Ma, Wang, et al. (2018), who reviewed much of the literature related to design of smart healthcare systems; and Obinikpo and Kantarci (2017) presented a taxonomy of deep learning techniques applied to sensed data for prediction and decision making in smart health services.

Rocha, et al. (2019a) reviewed 44 articles in order to find: the most relevant smart city applications with an impact on healthcare; the technologies being used; the maturity levels of the applications; and major barriers for dissemination. Rocha, et al. (2019b) did the same for 13 articles related to promoting active aging, using different sensing devices. Both studies concluded that most of the reviewed articles were either of a descriptive and conceptual nature or in an early stage of development. The lack of concreteness was a major barrier to their dissemination. Nazir, et al. (2019) proposed research questions based on a review of 116 primary studies related to smart health.

Visconti and Martiniello (2019) explored innovative governance models for smart hospitals. The authors' thesis is that European public sector maintained a vital role in safeguarding health as a primary public good. However, the public sector often lacked the expertise to promote and run the technological investments needed for serving aging populations.

Ding, et al. (2016) described a technology application that would suggest low-pollution routes to commuters with respiratory problems. It could also proactively activate water sprays to reduce air-born pollution and pollen. Of importance to the broader discussion of smart living, the authors analyzed this application's privacy issues and proposed countermeasures.

Adame, et al. (2016) described a hybrid network that solves some shortcomings in current wireless technologies used in hospital patient monitoring systems. This system was pilot tested in a Barcelona hospital.

Smart homes. In a smart city, the home is where much data can be collected and where more efficiency can be achieved. It is also where people spend much of their time, so it has a great influence on quality of life. Li, et al. (2016) describe three generations of smart home technology: (1) wireless smart technologies; (2) artificial intelligence; and (3) robot assistants. Some of the literature summarized below suggests that expectations for the smart city fall short with much smart home technology.

Hargreaves and Wilson (2017) explore how and why people use smart home technologies and the impact on everyday life. They identified three meta-themes in the literature on smart homes: (1) views or 'grand narratives' for the smart home;

(2) users and their uses of smart homes; and (3) user-related challenges to realizing smart homes. Through a field trial, they found that use of available smart home technology was a gradual process of familiarization and adaptation, with much use relatively basic. They also concluded that smart home technology will not necessarily reduce energy consumption, depending on how users configure their systems and what changes in behavior result.

Wilhite and Diamond (2017) placed smart home technologies in a historical context, noting conflicts between goals of comfort and energy. They conclude that "the tendency to lock house and technology design into 'one size fits all' perpetuates a tendency in energy policy to neglect the diversity of household needs, knowledge and capacity to engage with complex systems" (p. 56). They claim smart home technologies should be malleable enough to accommodate the diversity of users.

Smart and Happy. There is evidence that smart cities have the potential to increase the quality of life. For example, a McKinsey & Company report (Woetzel, 2018) found that smart city technologies saved lives, reduced crime, decreased disease, cut daily commuting time, saved water, and improved emergency services. However, these are indirect measures of happiness. More direct measures are needed if happiness is to be the ultimate goal of smartness, which is the claim made by the director general of the Emirates Center for Strategic Studies and Research (Al Suwaidi, 2017) and operationalized in Dubai's smart city initiatives, labeled the "Happiness Agenda" (Al-Azzawi, 2019).

Can a smart city really make its residents happier? One of the few studies to tackle this question from a skeptical and academic perspective is Allam (2020):

> *Even though we can build arguments that data can be viewed as ways to support informed and intelligent decisions, we also need to acknowledge that the rise in data will be disruptive to our society, and this will also be seen through not only the urban economy but also the urban morphology. How then can we better prepare for such a change? Today computers are made to answer this for us. But are these answers correct? How can computers, machines void of life, create meaningful and vibrant communities? Can we rest our fate with machines? Do we ultimately have a choice? (p. xv).*

8. Smart People

Batty (2017, p. 4) wrote, "If the essence of urban development is individual action, then a city can only be as smart as its citizens." The smart people domain can include affinities to life-long learning, social and ethnic plurality, flexibility, creativity, open-mindedness, and participation in public life (Nam & Pardo, 2011, p. 287).

Smart learning. One active smart people research stream has involved the creation of smart learning environments (Hwang, 2014; Koper 2014; Noh, et al., 2014; Spector, 2014), which has been a prominent concept in China

(Liu, et al., 2017, pp. 185-215) and South Korea (Durán-Sánchez, et al., 2018; Kim, et al., 2013). There are now two journals involving the emerging notion of smart learning: Smart Learning Environments launched in 2014; Smart Technology and Learning launched in 2016. The following are some of the recent significant scholarship about smart learning environments.

Kinshuk, et al. (2016) argued that teaching methods and learning strategies must adapt to make effective use of advanced smart technologies. Thus, smart learning required "reengineering the fundamental structure and operations of current educational systems to better integrate these new technologies with the required pedagogical shift" (p. 561).

Zhu, et al. (2016) introduced a "smart education framework," featuring three elements essential to smart learning: (1) smart learning environments, (2) smart pedagogies, and (3) smart learners. Their model placed the learner at the center of the framework with smart pedagogies and smart environments supporting the smart learners.

Liu, et al. (2017) proposed a dual-core framework for smart cities: civil livable experience and urban innovative capability, which were supported by a smart learning environment. "The two cores that represent features of a smart city indicate that smart learning is the fundamental driving force to enhance citizens' wisdom and the basic solution to improve people's livable experiences" (p. 10).

Hoel and Mason (2018) suggested two models, a cognitive smart learning model and a smartness level model. This would serve as an antidote to the current technology focus of smart learning. "We can assume that technological problems are to be solved; there are now other issues related to semantic, organizational, legal and political interoperability that are the barriers" (p. 23).

Budhrani, et al. (2018) examine the smart learning literature for the core conceptual elements of learning environment, pedagogy, and learner as represented in the South Korean scholarly discourse of "smart learning" from 2010 to 2018.

Smart citizens. The idea of a smart city has been criticized for being too ICT-centric, top-down, and authoritarian. (See discussion below.) In the past few years, smart learning has been proposed as a countermeasure. That is, smart learning environments have emerged as a basis to postulate a smart citizen perspective that it is human-centered, bottom-up, and democratic. Manchester and Cope (2019) makes a case for offering critical, creative learning opportunities that begin to address the inequalities that constitute the contemporary smart city. Lam and Wong (2020) affirm the importance of the development of citizens rather than consumers in smart learning environments.

9. Smart Environment

Gassmann, et al. (2019) offer this definition of smart environment:

> *The concept of a smart environment focuses on minimizing the ecological footprint of a city without losses in other factors such as*

> *mobility and quantity of life. Objectives of a smart environment include the preservation of green areas and the reduction of ground sealing. … New concepts regarding urban greening processes such as the Garden City initiative in Singapore, the Hanging Garden in Sydney, or the Liuzhou Forest City in China are all examples of macroconcepts for smart cities. (p. 32)*

Smart environment is where the smart city and sustainability literature intersect. The potential for ICT infrastructure, such as smart meters, to help meet sustainability goals links the paradigms (Battista, et al., 2014; Wang & Moriarty, 2018a).

However, many scholars believe the smart city-model does not yet meet urban sustainability needs and smart city indexes give short shrift to sustainability measures (Colding & Barthel, 2107; Mundoli, et al., 2017). Some scholars prefer the term "smart sustainable cities" to stress the primacy of environmental concerns (Ahvenniemi, et al., 2017; Bibri & Krogstie, 2017; Höjer & Wangel, 2015). Smart city goals of improved traffic flows, parking management, and ridesharing should only be judged as desirable when they do not decrease use of energy-efficient public transportation. Thus, policy priorities must be established before smart cities can realize their smart environment potentials (Wang & Moriarty, 2018b).

Petrova-Antonova and Ilieva (2018) expressed a contrasting view. They looked at indicators used as performance measures in smart cities and found that environmental measures were more prevalent than socio-economic measures. Measures related to food were missing despite the WHO's warning that health problems related to dietary issues are an ever-increasing threat.

Much of the recent scholarship on smart environment, or smart sustainable cities, has been in the form of case studies looking at a particular technology or a particular location. For example, Maier (2016) studied energy usage at a 50-hectare (123-acre) brownfield, a former brewery in Graz, Austria. This case study included a comparison between grid-based power supplies and decentralized technologies (e.g., single-building gas boilers and solar collectors). Another example is Anguluri & Narayanan (2017), who devised a green index for the planning of smart cities, and demonstrated its use for Gulbarga, India.

One notable exception to the case study method is Bibri (2017), who proposed a multidisciplinary foundational framework for smart sustainable city development.

10. Smart Mobility

Smart mobility can be defined as "a concept, where with various past and real-time data, and with the help of information and communication technologies, travel time is optimized, resulting in reductions of space usage, road congestion, road accidents and emissions of harmful gases" (Brcic, et al., 2018, p. 1602). More specifically, types of services included are driving guidance, improving transport resources, improving

transport infrastructure, journey planners, locating objects, monitoring traffic, monitoring transport, parking, payment, reporting mobility, sharing transport, and traffic light optimization (Cledou, et al., 2018). The literature on smart mobility has had numerous case studies of individual cities and applications. In contrast, little scholarship has provided holistic and philosophical visions for the smart mobility domain (Benevolo, et al., 2016, pp. 16-17).

Bicycles and pedestrians. Although traffic congestion has been a primary concern in the smart mobility literate, in recent years, the number of studies that focused of bicycles has increased (e.g., Behrendt, 2016, 2019; Namiota & Sneps-Sneppe, 2019; Shen, et al., 2018). The same is true for studies on pedestrians (e.g., Akhter, et al., 2019); Betancur, et al., 2019); Cho, et al., 2019; Rothkrantz & Mirela, 2018).

Phones offer better tracking across all transportation modes. In this sense, the use of smartphones can support more balanced sensing of mobility behavior across the use of different transport modes. In addition, as carrying a smartphone has become a habit for many people, the issue of unreported gaps in the trip data is overcome. (Semanjski & Gautama, 2016, p. 227).

Battarra, et al. (2018, p. 556) examined 11 Italian cities and concluded "in cities with a well-functioning mobility system, ICTs are a means to improve the efficiency of the transport system, while in metropolitan contexts where there is a lack of transport infrastructure, the use of new technologies becomes only a label rather than being integrated into urban policies."

Hospitality and tourism. Smart tourism is usually included as smart mobility, as it involves people moving from place to place. However, the goals and technologies are distinct, isolating this subcategory from other smart mobility literature and frequently overlapping with smart economy issues. Li, et al. (2017) suggest this pithy definition for smart tourism: "ubiquitous tourism information." Jasrotia and Gangotia (2018) offer this longer definition:

> *Smart tourism destinations can be perceived as cities or places which utilize the available technological tools, innovations and techniques to enable pleasure, and experiences for the tourist and profit for the organizations and the destinations. In fact, smart cities act as a ladder for the establishment of smart tourism destinations. (p. 53).*

To expand the definition, two studies describe three aspects of smart tourism: destination, experience, and a business ecosystem. (Gretzel, et al., 2015; Xiang & Fesenmaier, 2017). This incorporated making the smartness of a city a tourist attraction, enhancing the tourist experience through ICT information provision and real-time monitoring, and coordinating the private and public smart initiatives to improve business profits and achieve public policy objectives.

As a concept, the rise of smart tourism has been very rapid. In 2009, smart tourism became part of Chinese tourism policy and later became

its central theme when "Beautiful China – 2014 Year of Smart Travel" was adopted by the Chinese National Tourism Administration (Shi, 2018, p. 139). From 2017 to 2019, worldwide interest in smart tourism exploded among professionals, policymakers, and scholars, as evidenced by:

- *In 2018, the EU initiated "European Capital of Smart Tourism" awards to recognize achievements by European cities as smart tourism destinations. The recipients so far: Helsinki, Finland; Lyons, France; Gothenburg, Sweden; and Malaga, Spain (Aramendia-Muneta, 2020).*
- *"Smart Tourism – Road to City Innovation and Development" was the theme of the 2019 World Tourism Cities Federation professional convention held in Helsinki (Baoyi, 2019).*
- *Three academic conferences with a smart tourism themes convened in Athens, Greece (International Association of Cultural and Digital Tourism, 2018), Orlando, Florida, USA (Rosen College of Hospitality Management, 2019), and Buenos Aires, Argentina (International Conference on Tourism, Technology & Systems, 2019).*
- *Special issues of Current Issues in Tourism (Ardito, et al., 2019), Information Systems Frontiers (Koo, et al., 2017), and Information & Management (Koo, et al., 2017) were dedicated to smart tourism.*
- *In 2018, the Journal of Tourism Intelligence and Smartness was launched as an open-access journal based in Turkey.*

11. Critiques of the Smart City

The smart city does not lack for critics and skeptics. Farías and Widmer (2017) complain that the smart city "is likely one of the most unbearable current policy discourses and frameworks not just due to its technological determinism" (p. 43). The following is a summary of the main streams of criticism.

The smart city is marketing. One criticism of the smart city claims it is mostly buzz aimed at selling computing hardware, software, and consulting, a marketing device for city branding, and an excuse to promote profit-making economic development plans (Holland, 2014, p. 55; Sterling, 2018; Wiig, 2016).

There is no doubt that the corporate world has interest in shaping the smart city idea because of its perceived value as a business opportunity. The size of the smart city market is estimated and forecast by several consulting firms, using different definitions and methodologies. At the conservative end of these estimates is Grand View Research (2019), which valued the global smart cities market at US$50 billion in 2017 and projected it to reach US$238 billion by 2025 at a compound annual growth rate (CAGR) of 18.9%, driven by investment in communication infrastructure and web-based services. At the high end of the estimates is Zion Market Research (2019), which valued the global smart cities market at US$955 billion in 2017 and projected it to reach US$2.7 trillion by 2024 at a CAGR of 16.0%, driven by use of advanced

technology in the construction sector.

The smart city is a tool of the elite. Some critics believe the smart city paradigm to be intrinsically a mechanism for the elite to increase their power and wealth.

The GTCs [Giant Tech Companies] promise what most city governments cannot deliver: new 'green-tech' solutions, large-scale long-term investments in urban infrastructures and new governance capabilities. What they want in return is the right to invest capital on scale into the infrastructures of the world's urban space-economies to shape on their own terms the conditions for the next long-term development cycle (Swilling, 2016, p. 25).

"Smartness" gives cover for exploitive practices and policies. Pali and Schuilenburg (2019) and Vanolo (2014) warn of a "smartmentality" where a single technology-centric vision of the city promises to solve all social and environmental problems, but is also a means of restricting alternative solutions that threaten the established power structure. Graham (2002) argues that smart city solutions "are currently being constructed, largely by, and for, the more powerful" (pp 53-54). Broussard (2018) coins "technochauvinism" to describe an absolute faith in technological solutions. She does not believe this to be new with smart cities, but deeply rooted in modern history. "When faced with the option of bringing more, different people into the workforce, nineteenth-century mathematicians and engineers chose instead to build machines that replaced people – at enormous profit" (p. 79).

The smart city is incompatible with democratic values. A third significant criticism of smart cities is based on the concern that technical problem solving will gradually replace democratic decision making, and stifle human creativity (Sennett, 2012). Harari (2018) even warns that the artificial intelligence (AI) associated with smart cities may favor dictatorships over democracies because the former can disregard privacy concerns and centralize more information. Because AI works better with more information, dictatorships might be more efficient at meeting social and environmental smart city goals than their democratic rivals.

The smart city offers little hope for most communities. Another concern is that everyone outside the developed world's megacities will never see the benefits of the smart city. Many cities are too poor (Peprah, et al., 2019), too small (Lytras & Visvizi, 2018b), too wanting for residents willing and able to use the technology (Lytras & Visvizi, 2018a), or too late to the smart city party (Pelton & Singh, 2018, p. 31).

The smart city makes everything more vulnerable to cyberattacks. Kitchin, et al.(2017, p. 19) point out that smart cities are promoted as a way to "manage uncertainty and risk in present day cities, yet they paradoxically create new risks, including making city infrastructure and services insecure, brittle, and open to extensive forms of vandalism, disruption and criminal exploitation." Creating a smart city is the equivalent of "painting a target on one's back" (Lauren, 2018, n.p.) and will need many safeguards to prevent cybercriminals from wreaking havoc (Pelton & Singh, 2018; Rainie, et al., 2014, p.14).

The tools that we shape then shape us. Batty, et al. (2012) are positive about smart cities, but they do provide an ominous warning:

> *Cities, which adopt ICT in diverse forms, change the very nature of the adoption process by using that same ICT. The nexus is complex and we ignore this interwoven complexity at our peril. The problems that we deal with characterize all cities and are what many years ago Horsts Rittel called wicked. When one tackled wicked problems, they became worse not better due to the unforeseen consequence and unanticipated effects which were ignored because the systems in question were treated in too immediate and simplistic terms (p. 506).*

Ⅲ. Conclusion

As the writing of this article reaches its completion, there are three contemporaneous events that may push the smart city idea into a higher profile for both the public and scholars.

The first is the deployment of 5G technology. Although many people may currently perceive 5G as the latest buzzword to sell expensive smartphones, or as a prize in a techno-political power games between the Chinese and American governments, it is much more than either of these. 5G's improved capacity will mesh together the ICT systems that are used for communications, monitoring and artificial intelligence while lowering the costs to do so. 5G makes the greatest ambitions for smart cities to be technically and financially possible. Zygmunt Lozinksi, an IBM telecom industry technical leader, predicts 5G will spur a period of the greatest innovation since microprocessors came out in the early 1970s" (quoted in Maddox, 2019).

Weighing in the other direction is the first high-profile public backlash against a smart city project, which has been occurring since late 2019 in Toronto, Canada. The 12-acre "Quayside" waterfront project, close to Toronto's central business district, was to tackle congestion, affordable housing, long commutes and extreme weather using smart technologies. The developer, Sidewalk Labs, is a Google-affiliated company headquartered in New York City. Jim Balsillie, former CEO of the Canada's RIM (developer of the BlackBerry brand phones) described the plan as "a move by Google to use data from people's lives in the physical world in the same way it now exploits their online lives" (quoted in Austen, 2020). Spurred by such privacy concerns, Toronto residents have been organizing a successful protest, forcing the plan to be scaled back. As of this writing, the future of the project remains in some doubt. This may be an anomalous case, fueled as much by ant-American sentiment as heart-felt privacy concerns. Or, it might be the beginning of a larger movement, like that which halted urban renewal projects in the 1970.

The third event likely to impact smart city development is the global coronavirus pandemic of 2019-2020, which has put a focus on some technologies related to smart cities. The whole world has seen news reports which give surveillance technologies partial credit for South Korea's success at retarding the virus's

spread while avoiding complete economic shutdown (e.g., Fisher & Choe, 2020). But also in the public discourse are the complaints against Korea's public text warnings that describe details of the lives of people who tested positive (e.g., Kim, 2020). While it will take years for scholars to fully dissect the true role of technology in South Korea's pandemic response, it is certain that smart city technologies will be taking on new significance as a tool in emergency management and national defense.

In the history of ideas, the smart city is a relative newcomer. With intimidating scope and complexity, this topic is undeniably important for the near future of humanity. Cities will continue to grow. The environment will continue to be threatened. Social problems will continue to fester. And certainly, technology will continue to develop. Will the net influence of this technology be alleviating or aggravating? Will it be available to everyone, or just a few? Will it be controlled by people, or will it be used to control people?

Perhaps it is best to respect the warnings but take the cue from those who would move forward with appropriate reforms and vigilance (Dustdar, et al., 2018; Green, 2019; Hollands, 2008; McFarlane & Söderström, 2017; Sadowski & Bender, 2019). By avoiding both marketing and cynicism, there are opportunities for scholars in many fields to give shape to the evolving idea of a smart city.

References

Adame, T., Bel, A., Carreras, A., Meli`a-Segui, J., Oliver, M. & Pous, R. (2016). "CUIDATS: An RDIF-WSN hybrid monitoring system for smart health care environments." *Future Generation Computer Systems, 78*, 602-615.

Afonso, R. A. (2017). *Smartcluster: a metamodel of indicators for smart and human cities* (Unpublished doctoral dissertation). Universidade Federal de Pernambuco, Recife, Brazil.

Afonso, R. A., Santos Brito, K., Nascimento, C. H., Garcia, V. C. & Álvaro, A. (2015). *Brazilian smart cities: using a maturity model to measure and compare inequality in cities. In K. Mossberger & N. Helbig (Eds.)* Proceedings of the 16th Annual International Conference on Digital Government Research (pp. 230-238), Phoenix, Arizina. Digital Government Society.

Ahvenniemi, H., Huovila, A., Pinto-Seppä, I. & Airaksinen, M. (2017). "What are the differences between sustainable and smart cities?" *Cities, 60A*, 234-245.

Akhter, F., Khadivizand, S., Siddiquei, H. R., Alahi, M. E. E. & Mukhopadhyay, S. (2019). "IoT enabled intelligent sensor node for smart city: Pedestrian counting and ambient monitoring." *Sensors, 19*(3374), 1-19.

Al-Azzam, M. J. & Alazzam, M. B. (2019). *International Journal of Advanced Computer Science and Applications, 10*, 171-176.

Albino, V., Berardi, U. & Dangelico, R. M. (2015). "Smart cities: Definitions, dimensions, performance, and initiatives." *Journal of Urban Technology, 22*, 3-21.

Alcaide Muñoz, L. & Rodríguez Bolívar, M. P. (2018). *International E-Government Development.* London, UK: Palgrave Macmillan.

Allam, Z. (2020). *Aligning technology and humanity.* Palgrave Pivot: London, UK.

Allam, Z. & Newman, P. (2018). "Redefining the smart

city: culture, metabolism and governance." *Smart Cities, 1*, 4-25.

Allwinkle, S. & Cruickshank, P. (2011). "Creating smart-er cities: An overview." *Journal of Urban Technology, 18*, 1-16.

Angelidou, M. (2014). "Smart city policies: A spatial approach." *Cities, 41*(Supplement 1), S3-S11.

Angelidou, M. (2017). "The role of smart city characteristics in the plans of fifteen cities." *Journal of Urban Technology, 24*(4), 3-28.

Anguluri, R. & Narayanan, P. (2017). "Role of green space in urban planning: Outlook towards smart cities." *Urban Forestry & Urban Greening, 25*, 58-65.

Anthopoulos, L. & Fitsilis, P. (2010). *From digital to ubiquitous cities: defining a common architecture for urban development*. 2010 Sixth International Conference on Intelligent Environments (pp. 301-306). Kuala Lumpur, Malaysia. Institute of Electrical and Electronics Engineers.

Anttiroiko A.-V. (2013). "U-cities reshaping our future: reflections on ubiquitous infrastructure as an enabler of smart urban development." *AI & Society, 28*, 491-507.

Aramendia-Muneta, M. E. (2020). European capital of smart tourism: An initiative to promote the tourism industry. In L. C. Carvalho, L. Calisto & N. Gustavo (Eds.), *Strategic Business Models to Support Demand, Supply, and Destination Management in the Tourism and Hospitality Industry* (pp. 255-265). Hershey, PA: IGI Global.

Ardito, L., Cerchione, R., Del Vecchio, P. & Raguseo, E. (2019). "Big data in smart tourism [special issue]." *Current Issues in Tourism, 22*(15).

Attoh, K., Wells, K. & Cullen, D. (2019). "We're building their data: Labor, alienation, and idiocy in the smart city." *Society and Space, 37*, 1007-1024.

Austen, I. (2020). You can't fight City Hall. But maybe you can fight Google. *The New York Times*. Retrieved from https://www.nytimes.com/2020/03/10/world/canada/toronto-sidewalk-labs-google.html.

Balaceanu, C., Gruiescu, M., Radulescu, V., Apostol, D. & Dogaru, M. (2015). "The relation between entrepreneurship and smart economy." *Journal of Information Systems & Operations Management, 12*, 505-512.

Barlow M. & Levy-Bencheton, C. (2018) *Smart Cities, Smart Future: Showcasing Tomorrow*. Hoboken, NJ: Wiley.

Baoyi, H. (2019, August 28). "Smart tourism is theme for industry summit in Helsinki." *China Daily*. Retrieved from https://www.chinadaily.com.cn/a/201908/28/WS5d6661a6a310cf3e35568670.html.

Battarra, R., Gargiulo, C., Tremiterra, M. R. & Zucaro, F. (2018). "Smart mobility in Italian metropolitan cities: A comparative analysis through indicators and actions." *Sustainable Cities and Society, 41*, 556-567.

Battista, G., Evangelisti, L., Guattari, C., Basilicata, C. & Vollaro, R. D. L. (2014). "Buildings energy efficiency: Interventions analysis under a smart cities approach." *Sustainability, 6*, 4694-4705.

Batty, M. (2017). *The Age of the Smart City* [working paper]. Retrieved from https://www.researchgate.net/publication/317351280_The_Age_of_the_Smart_City.

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., … Portugali, Y. (2012). "Smart cities of the future." *The European Physical Journal Special Topics, 214*, 481-518.

Bee Smart City (2018). "Global smart city ranking [web page]." Retrieved from https://www.beesmart.city/ranking.

Behrendt, F. (2016). "Why cycling matters for smart cities. Internet of bicycles for intelligent transport." *Journal of Transport Geography, 56*, 157-164.

Behrendt, F. (2019). "Cycling the smart and sustainable city: Analyzing EC policy documents on internet of things, mobility and transport, and smart cities." *Sustainability,*

11(763), 1-30.

Benevolo, C., Dameri, R. P. & D'Auria, B. (2016). Smart mobility in smart city: Action taxonomy, ICT Intensity and public benefits. In T. Torre, A. M. Braccini, & R. Spinelli, *Empowering Organizations: Enabling Platforms and Artefacts*. Cham, CH: Springer International.

Berrone, P. & Ricart, J. E. (2019). *IESE Cities in Motion Index*. Barcelona, ES: IESE Business School, University of Navarra.

Betancur, M., Restrepo, V., Perez, J., Restrepo, J. A., Agudelo, A. & Cuartas-Ramirez, D. (2019). *An approximation to the construction of pedestrian smart cities*. In IEEE 4th Colombian Conference on Automatic Control, Medellín, Colombia. Institute of Electrical and Electronics Engineers.

Bibri, S. E. (2017). "A foundational framework for smart sustainable city development: Theoretical, disciplinary, and discursive dimensions and their synergies." *Sustainable Cities and Society, 38*, 758-794.

Bibri, S. E. & Krogstie, J. (2017). "On the social shaping dimensions of smart sustainable cities: A study in science, technology, and society." *Sustainable Cities and Society, 29*, 219-246.

Borsma, B. (2017). *A New Digital Deal: Beyond Smart Cities. How to Best Leverage Digitalization for the Benefit of our Communities*. Seost, NL: Boekscout BV.

Bouzguenda, I., Alalouch, C. & Fava, N. (2019). "Towards smart sustainable cities: A review of the role digital citizen participation could play in advancing social sustainability." *Sustainable Cities and Society, 50* (101627), 1-15.

Brcic, D., Slavulj, M., Šojat, D. & Jurak, J. (2018). *The role of smart mobility in smart cities*. Fifth International Conference on Road and Rail Infrastructure (1601-1606), Zadar, Croatia. International Road Federation.

Bris, A., Cabolis, C., Chee, C. H. & Lanvin, B. (2019). Introduction. In A. Bris, C. Cabolis, C. H. Chee, & B. Lanvin (Eds.). *Sixteen Shades of Smart: How Cities Can Shape Their Own Future* (pp. 161-180). Singapore: IMD Publishing.

British Standards Institute (2014). PAS 181 *Smart city framework*. Retrieved from https://www.bsigroup.com/en-GB/smart-cities/Smart-Cities-Standards-and-Publication/PAS-181-smart-cities-framework/.

Broussard, M. (2018). *Artificial Unintelligence: How Computers Misunderstand the World*. Cambridge, MA: MIT Press.

Budhrani, K., Ji, Y. & Lim, J. H. (2018). "Unpacking conceptual elements of smart learning in the Korean scholarly discourse." *Smart Learning Environments, 5*(23), 1-25.

Bifulco, F., Tregua, M. & Amitrano, C. C. (2017). "Co-governing smart cities through living labs: Top evidences from EU." *Transylvanian Review of Administrative Sciences, 50*, 21-37.

Calzada, I. (2018). "(Smart) Citizens from data providers to decision-makers? The case study of Barcelona." *Sustainability, 10*(3252), 1-25.

Caragliu, A., Del Bo, C. & Nijkamp, P. (2009) "Smart cities in Europe." *Journal of Urban Technology, 18*, 65-82.

Carrillo, F.J. (2007). "The coming of age of knowledge-based development." *Journal of Knowledge Management, 11*(3), 3-5.

Carvalho, L. (2015). "Smart cities from scratch? A socio-technical perspective." *Cambridge Journal of Regions, Economy and Society, 8*, 43-60.

Cath, C., Wachter, S., Mittelstadt, B., Taddeo, M. & Floridi, L. (2016). "Artificial intelligence and the 'good society': The US, EU, and UK approach." *Science and Engineering Ethics, 24*, 505-528.

Chang, D. L., Sabatini-Marques, J., da Costa, E. M., Selig, P. M. & Yigitcanlar, T. (2018). "Knowledge-based, smart and sustainable cities: a provocation for a conceptual

framework." *Journal of Open Innovation, 4*(5), 1-17.

Cho, J. (2017). "Growth of sharing economy facilitates smart city development." *Business Korea*. Retrieved http://www.businesskorea.co.kr/news/articleView.html?idxno=19899.

Cho, Y., Jeong, H., Choi, A. & Sung, M. (2019). "Design of a connected security lighting system for pedestrian safety in smart cities." *Sustainability, 11*(1308), 1-11.

Cisco (nd). "What is a smart city?" [web page]. Retrieved from https://www.cisco.com/c/en/us/solutions/industries/smart-connected-communities/what-is-a-smart-city.html.

Cledou, G., Estevez, E. & Barbosa, L. S. (2018). "A taxonomy for planning and designing smart mobility services." *Government Information Quarterly, 35*, 61-76.

Cocchia, A. (2014). "Smart and digital city: A systematic literature review. In R. P. Dameri & C. Rosenthal-Sabroux, (Eds.)." *How to Create Public and Economic Value with High Technology in Urban Space* (pp. 238-269). Cham, CH: Springer International.

Cohen, B. (2012). "What exactly is a smart city?" *Fast Company*. Retrieved from http://www.fastcompany.com.

Colding, J. & Barthel, S. (2017). "An urban ecology critique on the 'smart city' model." *Journal of Cleaner Production, 164*, 95-101.

Congress for New Urbanism (nd). "What is New Urbanism?" [web page]. Retrieved from https://www.cnu.org/resources/what-new-urbanism.

Couclelis, H. (2004). "The construction of the digital city." *Planning and Design, 31*, 5-19.

Dameri, R. P. (2014). Comparing smart and digital city: Initiatives and strategies in Amsterdam and Genoa. Are they digital and/or smart? In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space*. Cham, CH: Springer International.

Dameri, R. P. & Benevolo, C. (2016). "Governing smart cities: An empirical analysis." *Social Science Computer Review, 34*, 693-707.

D'Auria, A., Tregua, M. & Vallejo-Martos, C. V. (2018). "Modern conceptions of cities as smart and sustainable and their commonalities." *Sustainability, 10*(2642), 1-18.

Ding, D., Conti, M. & Solanas, A. (2016). *A smart health application and its related privacy issues*. In Proceedings of the 2016 Smart City Security and Privacy Workshop (SCSP-W), Vienna, Austria. IEEE Computer Society.

Durán-Sánchez, A., Alvarez García, J., Rama, D. & Sarango-Lalangui, P. (2018). "Analysis of the scientific literature published on smart learning." *Espacios, 30*. Retrieved from https://www.researchgate.net/publication/323827346_Analysis_of_the_Scientific_Literature_Published_on_Smart_Learning.

Dustdar, S., Nastić, S. & Šćekić, 0. (2018). *Smart Cities: The Internet of Things, People and Systems*. Cham, CH: Springer International.

Dyer M., Gleeson D. & Grey T. (2017). Framework for collaborative urbanism. In: C. Certomà, M. Dyer, L. Pocatilu, & F. Rizzi (Eds.) *Citizen Empowerment and Innovation in the Data-Rich City. Springer Tracts in Civil Engineering*. Cham, CH: Springer.

Eden Strategy Institute & OXD (2018). *Top 50 Smart City Governments*. Singapore: Eden Strategy Institute and ONG&ONG Pte Ltd.

Eggers, W. D. (2004) *Government 2.0: Using Technology to Improve Education, Cut Red Tape, Reduce Gridlock, and Enhance Democracy*. Lanham, MD: Rowman & Littlefield.

Esmaeilpoorarabi, N., Yigitcanlar, T. Guaralda, M. & Kamruzzaman, Md. (2018). "Does place quality matter for innovation districts? Determining the essential place characteristics from Brisbane's knowledge precincts." *Land Use Policy. 79*, 734-747.

Evans, J., Karvonen, A., Luque-Ayala, A., Martin, C.,

McCormick, K., Raven, R. & Voytenko Palgan, Y. (2019). "Smart and sustainable cities? Pipedreams, practicalities and possibilities." *Local Environment, 24*, 557-564.

Farías, I & Widmer, S. (2017). "Ordinary smart cities: How calculated users, professional citizens, technology companies and city administrations engage in a more-than-digital politics." *Technoscienze: Italian Journal of Science & Technology Studies, 8*(2), 43-60.

Fisher, M. & Choe, S (2020). "How South Korea Flattened the Curve." *The New York Times*. Retrieved from https://www.nytimes.com/2020/03/23/world/asia/coronavirus-south-korea-flatten-curve.html

Gassmann, O, Böhm, J. & Palmié, M. (2019). *Smart Cities: Introducing Digital Innovation to Cities*. Bingley, UK: Emerald.

Gibson, D. V., Kozmetsky, G. & Smilor, R. W. (1992). *The Technopolis Phenomenon: Smart Cities, Fast Systems, Global Networks*. Lanham, MD: Rowman & Littlefield.

Giffinger, R., Fertner, C, Kramar, H., Kalasek, R., Pichler-Milanović, N. & Meijers, E. (2007). "Smart cities: ranking of European medium-sized cities." Retrieved from www.smart-cities.eu/download/smart_cities_final_report.pdf.

Glasmeier, A. & Christopherson, S. (2015). "Thinking about smart cities." *Cambridge Journal of Regions, Economy and Society, 8*, 3-12.

Goldsmith, S. & Crawford, S. (2014). *The Responsive City: Engaging Communities Through Data-Smart Governance*. San Francisco, CA: Jossey Bass.

Graham, S. (2002). "Bridging urban digital divides? Urban polarisation and information and communications technologies (ICTs)." *Urban Studies, 39*, 33-56.

Grand View Research (2019). Smart cities market size worth $237.6 billion by 2025 | CAGR: 18.9% [Press release]. Retrieved from https://www.grandviewresearch.com/press-release/global-smart-cities-market.

Graziano, T. (2020). Citizen e-participation in urban planning: achievements and future challenges in a Mediterranean city. In M. Khosrow-Pour (Ed.) *Megacities and Rapid Urbanization: Breakthroughs in Research and Practice* (pp. 582-600). Hershey, PA: IGI Global.

Green, B. (2019). *The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future*. Cambridge, MA: MIT.

Gremm, J., Barth. J., Fietkiewicz, K.J. & Stock. W.G. (2018). *Transitioning Towards a Knowledge Society: Qatar as a Case Study*. Cham, CH: Springer International.

Gretzel, U., Sigala, M., Xiang C. & Koo Z. (2015). "Smart tourism: foundations and developments." *Electronic Markets, 25*, 179-188.

Gurashi, R. (2020). Smart people and prosumers: The individual challenge to the fourth industrial revolution. In R. Iannone & R. Gurashi, Smart Society: A Sociological Perspective on Smart Living (pp. 30-47). Abingdon, UK: Routledge. Gori, Parcu, & Stasi, 2015.

Haque, A. (2015). *Surveillance, Transparency, and Democracy*. Tuscaloosa. AL: University of Alabama Press.

Harari, Y. N. (2018). "Why technology favors tyranny." *The Atlantic*. Retrieved from https://www.theatlantic.com/magazine/archive/2018/10/yuval-noah-harari-technology-tyranny/568330/.

Hargreaves, T. & Wilson, C. (2017). *Smart Homes and Their Users*. Cham, CH: Springer International.

Hill, S. (2015). *Raw Deal: How the "Uber Economy" and Runaway Capitalism are screwing American Workers*. New York, NY: St. Martin's Press.

Hoel, T. & Mason, J. (2018). "Standards for smart education – towards a development framework." *Smart Learning Environments, 5*(3), 1-15.

Höjer, M. & Wangel, S. (2015). "Smart sustainable cities: Definition and challenges." In L. Hilty & B. Aebischer (Eds.), *ICT Innovations for Sustainability* (pp. 333-349). Berlin, DE: Springer-verlag.

Hollands, R. G. (2008). "Will the real smart city please stand up?" *City, 12*, 303-320.

Hollands, R. G. (2014). "Critical interventions into the corporate smart city." *Cambridge Journal of Regions, Economy and Society, 8*, 61-67.

Holzer, M., Manoharan, A. P. & Melitski, M. (2018). *E-Government and Information Technology Management: Concepts and Best Practices*. Irvine, CA: Melvin & Leigh.

Hong Kong Smart City Blueprint (2017). "Office of the Government Chief Information Officer, The Government of the Hong Kong Special Administrative Region." Retrieved from https://www.smartcity.gov.hk/vision/.

Hossain, M. S., Muhammad, G. & Alamri, A. (2019). "Smart healthcare monitoring: a voice pathology detection paradigm for smart cities." *Multimedia Systems, 25*, 565-575.

Hwang, G. J. (2014). "Definition, framework and research issues of smart learning environments-a context-aware ubiquitous learning perspective." *Smart Learning Environments, 1*(4), 1-14.

International Association of Cultural and Digital Tourism (2018). IACuDiT 5th international conference, 2018 Athens, 28-30 June (Exploring smart tourism: The cultural and sustainability synergies) [web page]. Retrieved from https://iacudit.org/Conference2018/index.html.

International Conference on Tourism, Technology & Systems (2019). ICOTTS '19, 05-07 December, UAI, Buenos Aires [web page]. Retrieved from https://www.icotts.org/.

International Organization for Standardization (2015). *ISO/TS 37151:2015 Smart community infrastructures — Principles and requirements for performance metrics*. Retrieved from https://www.iso.org/standard/61057.html.

Ireland Department of the Taoiseach (2008). *Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal*. Dublin, IE: Stationery Office, Republic of Ireland.

Jang M. & Suh S. T. (2010). U-City: New trends of urban planning in Korea based on pervasive and ubiquitous geotechnology and geoinformation. In: D. Taniar, O. Gervasi, B. Murgante, E. Pardede, & B. O. Apduhan (Eds.), *Computational Science and Its Applications - ICCSA 2010. ICCSA 2010. Lecture Notes in Computer Science*, 6016. Berlin, DE: Springer.

Jasrotia, A. & Gangotia, A. (2018). "Smart cities to smart tourism destinations: A review paper." *Journal of Tourism intelligence and Smartness, 1*, 47-56.

Joss, S., Sengers, F., Schraven, D., Caprotti, F. & Dayot, Y. (2018). "The smart city as global discourse: Storylines and critical junctures across 27 cities." *Journal of Urban Technology, 26*, 3-34.

Juniper Research (2017). Smart Cities - What's in it for Citizens [web page]. Retrieved from https://seoulsolution.kr/sites/default/files/gettoknowus/smart-cities-whats-in-it-for-citizens_Juniper%20Research%282017%29.pdf.

Kim, N. (2020). 'More scary than coronavirus': South Korea's health alerts expose private lives. The Guardian. Retrieved from https://www.theguardian.com/world/2020/mar/06/more-scary-than-coronavirus-south-koreas-health-alerts-expose-private-lives

Kim, T., Cho. J. Y. & Lee, B. G. (2013). *Evolution to smart learning in public education: A case study of Korean public education*. In J. Turner (Ed.), OST 2012: Open and Social Technologies for Networked Learning, International Conference (pp. 17-178), Tallinn, Estonia. International Federation for Information Processing.

Kinshuk, N., Chen, I., Cheng, I. & Chew, S. W. (2016). "Evolution is not enough: Revolutionizing current learning environments to smart learning environments." *International of Journal of Artificial Intelligence in Education, 26*, 561-581.

Kitchin, R., Coletta, C. & Heaphy, L. (2019). Actually existing smart Dublin: Exploring smart city development in history and context. In A. Karvonen, F. Cugurullo, F. Caprotti (Eds.), *Inside Smart Cities Place, Politics and Urban*

Innovation. Abingdon, UK: Routledge.

Kitchin, R., Coletta, C., Evans, L., Heaphy, L. & MacDonncha, D. (2017). "Smart cities, urban technocrats, epistemic communities, advocacy coalitions and the 'last mile' problem." *it - Information Technology, 59*, 275-284.

Komninos, K. (2002). *Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces.* Abingdon-on-Thames: Routledge.

Komninos, K. (2011). "Intelligent cities: Variable geometries of spatial intelligence." *Intelligent Buildings International, 3*(3), 172-188.

Koo, C., Park, J. & Lee, J. (2017). "Smart tourism: Traveler, business, and organizational perspectives [special issue]." *Information & Management, 54*(6).

Koo, C., Ricci, F., Cobanoglu, C. & Okumus, F. (2017). "Smart, connected hospitality and tourism [special issue]." *Information Systems Frontiers, 19*(4).

Koper, R. (2014). "Conditions for effective smart learning environments." *Smart Learning Environments, 1*(5), 1-17.

Kumar, P., Jain, V. K. & Pareek, K. S. (2018). *The Stances of e-Government: Policies, Processes and Technologies.* Boca Raton, FL: CRC Press.

Lara, A., Da Costa, M., Furlani, T. & Yigitcanlar, T. (2016). "Smartness that matters: towards a comprehensive and human-centred characterisation of smart cities." *Journal of Open Innovation, 2*, 1-13.

Lam M. L. & Wong K. (2020). Human flourishing in smart cities. In B. George B & J. Paul (Eds.), *Digital Transformation in Business and Society*. Cham, CH: Palgrave Macmillan.

Lauren (2018). Why smart cities may not be a smart idea just yet. White Mountain IT Services blog. Retrieved from https://www.whitemtn.com/blog/why-smart-cities-may-not-be-a-smart-idea-just-yet.html.

Lee, J. Y. & Chang, J. (2019). The evolution of smart city policy in Korea. In L. Anthopoulos (Ed.) *Smart City Emergence: Cases from Around the World* (pp. 173-193). Amsterdam, NL: Elsevier.

Li, R. Y. M., Li, H. C. Y., Mak, C. K. & Tang, T. B. (2016). "Sustainable smart home and home automation: big data analytics approach." *International Journal of Smart Home, 10*, 177-187.

Li, Y., Hu, C., Huang, C. & Duan, L. (2017). "The concept of smart tourism in the context of tourism information services." *Tourism Management, 58*, 293-300.

Liu, D., Huang, R. & Wosinski, M. (2017). *Smart Learning in Smart Cities*. Singapore: Springer Singapore.

Luque-Ayala, A & Marvin, S. (2015). "Developing a critical understanding of smart urbanism?" *Urban Studies, 52*, 2105-2116.

Lytras, M. D. & Visvizi, A. (2018a). "Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research." *Sustainability, 10*(1998), 1-16.

Lytras, M. D. & Visvizi, A. (2018b). "Rescaling and refocusing smart cities research: from mega cities to smart villages." *Journal of Science and Technology Policy Management, 9*: 134-145.

Ma, X., Wang, Z., Zhou, S., Wen, H. & Zhang, Y. (2018). "Intelligent healthcare systems assisted by data analytics and mobile computing." *Wireless Communications and Mobile Computing, 2018*, 1-16.

Maddox, T. (2019). How 5G will make smart cities a reality. *ZDNet*. Retrieved from https://www.zdnet.com/article/how-5g-will-make-smart-cities-a-reality/.

Maier, S. (2016). "Smart energy systems for smart city districts: case study Reininghaus District." *Energy, Sustainability and Society, 6*(23), 1-20.

Manchester, H. & Cope, G. (2019). "Learning to be a smart citizen." *Oxford Review of Education, 45*, 224-241.

McFarlane, C. & Söderström, O. (2017). "On alternative smart cities: From a technology-intensive to a knowledge-intensive smart

urbanism." *City, 21*, 312-328.

Michelucci, F. & De Marco, A. (2017). "Smart communities inside local governments: a pie in the sky?" *International Journal of Public Sector Management, 30*, 2-14.

Michelucci, F. V., De Marco, A. & Tanda, A. (2016). "Defining the role of the smart-city manager: An analysis of responsibilities and skills." *Journal of Urban Technology, 23*(3), 23-42.

Mitchel, W. (2000). Designing the digital city. In T. Ishida & K Isbister (Eds.), *Digital Cities: Technologies, Experiences and Future Perspectives.* Berlin, DE: Springer-Verlag.

Mordon Intelligence (n.d.) Smart cities market - growth, trends, and forecast (2019 - 2024) [web page]. Retrieved https://www.mordorintelligence.com/industry-reports/smart-cities-market.

Mundoli, S., Unnikrishnan, H., Nagendra, H. (2017). "The 'sustainable' in smart cities: ignoring the importance of urban ecosystems." *Decision, 44*, 103-120.

Nam, T. & Pardo, T. A. (2011). *Conceptualizing smart city with dimensions of technology, people, and institutions*. The Proceedings of the 12th Annual International Conference on Digital Government Research (pp. 282-291), College Park, Maryland, USA. Association for Computing Machinery.

Namiota, D. & Sneps-Sneppe, M. (2019). "On bikes in smart cities." *Automatic Control and Computer Sciences, 53*, 63-71.

Nazir, S., Ali, Y., Ullah, N. & Garcıa-Magariño, I. (2019). "Internet of things for healthcare using effects of mobile computing: A systematic literature review." *Wireless Communications and Mobile Computing, 2019*, 1-20.

Neo, H. (2019). Chongqing: Propelling the "smart" wave in southwest China. In A. Bris, C. Cabolis, C. H. Chee, & B. Lanvin (Eds.). *Sixteen Shades of Smart: How Cities Can Shape Their Own Future* (pp. 161-180). Singapore: IMD Publishing.

Noh, K. S., Ju, S. H. & Jung, J. T. (2014). "An exploratory study on concept and realization conditions of smart learning." *Journal of Digital Convergence, 9*, 79-88.

Obinikpo, A. A. & Kantarci, B. (2017). "Big sensed data meets deep learning for smarter health care in smart cities." *Journal of Sensor and Actuator Networks,* 6(26), 1-22.

Olokesusi, F. & Aiyegbajeje, F. O. (2017). E-Democracy for Smart City Lagos. In T. M. Vinod Kumar (Ed.), *E-Democracy for Smart Cities* (pp. 51-70). Singapore: Springer.

O'Donnell, C. (2017). Smart cities are boring. Give us responsive cities. *TechCruch*. Retrieved from https://techcrunch.com/2017/10/14/smart-cities-are-boring-give-us-responsive-cities/.

O'Reilly, T. (2009). Gov 2.0: The promise of innovation. *Forbes*. Retrieved from https://www.forbes.com/2009/08/10/government-internet-software-technology-breakthroughs-oreilly.html#37bd0df13b7b.

Palanisamy, V. & Thirunavukarasu, R. (2019). "Implications of big data analytics in developing healthcare frameworks - A review." *Journal of King Saud University - Computer and Information Sciences, 31*, 415-425.

Pali, B. & Schuilenburg, M. (2019). "Fear and fantasy in the smart city." *Critical Criminology*, 1-14. Retrieved from https://doi-org.ezproxy.gvsu.edu/10.1007/s10612-019-09447-7.

Pan, Y. (2018). *Strategic Research on Construction and Promotion of China's Intelligent Cities*: General Report. Hangzhou, CN: Zhejiang University Press & Singapore: Springer Nature.

Pelton, J. & Singh, I. (2018). *Smart Cities of Today and Tomorrow: Better Technology, Infrastructure and Security*. Cham, CH: Springer International.

Peprah, C., Amponsah, O. & Oduro, C. (2019). "A system view of smart mobility and its implications for Ghanaian cities." *Sustainable Cities and Society, 44*, 739-747.

Petrova-Antonova, D. & Ilieva, S. (2018). *Smart cities evaluation - a survey of performance and*

sustainability indicators. In 44th Euromicro Conference on Software Engineering and Advanced Applications (486-493), Prague, Czechia. Institute of Electrical and Electronics Engineers.

Pinochet, L. H. C., Romani, G. F., de Souza, C. A. & Rodríguez-Abitia, G. (2019). "Intention to live in a smart city based on its characteristics in the perception by the young public." *Revista de Gestão (REGE), 26*(1), 73-92.

Pramanik, M. I., Lau, R. Y. K., Demirkan, H. M. & Azad, Md. A. K. (2017). "Smart health: Big data enabled health paradigm within smart cities." *Expert Systems with Applications, 87*, 370-383.

Rainie, L., Anderson, J. & Connolly, J. (2014). Cyber attacks likely to increase. Pew Research Center. Retrieved from https://www.pewinternet.org/2014/10/29/cyber-attacks-likely-to-increase/.

Razaghi, M. & Finger, M. (2018). *Smart governance for smart cities*. Proceedings of the IEEE, 106, 680-689.

Ribaudo, M., Torrigiani, C., De Cindio, F. & Palumbo, M. (2016). The university in the polis: An emerging role of democratic intermediary in e-participation? In T. Torre, A. M. Braccini, & R. Spinelli, Empowering Organizations: *Enabling Platforms and Artefacts*. Cham, CH: Springer International.

Rifkin, J. (2011). *The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World*. New York, NY: St. Martin's Press.

Rifkin, J. (2014). *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*. New York, NY: St. Martin's Press.

Rifkin, J. (2016). *Smart regions smart cities: A digitally interconnected and ecologically sustainable third industrial revolution across the European union and China*. In Seventh European Summit of Regions and Cities, Bratislava, Slovakia. European Committee of the Regions.

Rocha, N. P., Dias, A., Santinha, G., Rodrigues, M., Queirós, A. & Rodrigues, C. (2019a). "Smart cities and healthcare: A systematic review." *Technologies, 7*(58), 1-16.

Rocha, N. P., Dias, A., Santinha, G., Rodrigues, M., Queirós, A. & Rodrigues, C. (2019b). *A systematic review of smart cities' applications to support active ageing*. In ICTH 2019: The 9th International Conference on Current and Future Trends of Information and Communication Technologies in Healthcare (pp. 306-313), Coimbra, Portugal. International Conference on Transport & Health.

Rosen College of Hospitality Management (2019). "A great success: 1st international conference on smart tourism, smart cities and enabling technologies" [web page]. University of Central Florida. Retrieved from https://hospitality.ucf.edu/2019/05/17/a-summary-1st-international-conference-on-smart-tourism-smart-cities-and-enabling-technologies/.

Rothkrantz, L. & Mirela, P. (2018). *Routing pedestrians in smart city networks*. In 2018 Smart City Symposium, Prague, Czechia. Institute of Electrical and Electronics Engineers.

Sadowski, J. & Bendor, R. (2019). "Selling smartness: Corporate narratives and the smart city as a sociotechnical imaginary." *Science, Technology, & Human Values, 44*, 540-563.

Satterthwaite, D. (1992). "Sustainable cities: Introduction." *Environment and Urbanization, 4*(2), 3-8.

Semanjski, I., Bellens, R., Gautama, S. & Witlox, F. (2016). "Integrating big data into a sustainable mobility policy 2.0 planning support system." *Sustainability, 8*(1142), 1-19.

Semanjski, I. & Gautama, S. (2016). Sensing human activity for smart cities' mobility management. In I. N. Da Silva & R. A. Flazino (Eds.), *Smart Cities Technologies* (pp. 211-232). London,

UK: IntechOpen.

Sennett R. (2012). No one likes a city that's too smart, *The Guardian*, 4 December. Retrieved from https://www.theguardian.com/commentisfree/2012/dec/04/smart-city-rio-songdo-masdar.

Shahidehpour, M., Li, Z. & Ganji, M. (2018). "Smart cities for a sustainable urbanization: Illuminating the need for establishing smart urban infrastructures." *IEEE Electrification Magazine, 6*(2), 16-33.

Shelton, T., Zook, M. & Wiig, A. (2015). "The 'actually existing smart city'." *Cambridge Journal of Regions, Economy and Society, 8*, 13-25.

Shen, S., Wei, Z., Sun, L. Su, Y., Wang, R. & Jiang, H. (2018). "The shared bicycle and its network-internet of shared bicycle (IoSB): A review and survey." *Sensors, 18*(2581), 1-24.

Shi, B. (2018). E-tourism evolutionary effect: studying e-tourism in China. In J. Zhao (Ed.), *The Hospitality and Tourism Industry in China* (pp. 133-153). Boca Raton, FL: CRC Press.

Shin, D. H. (2009). "Ubiquitous city: Urban technologies, urban infrastructure and urban informatics." *Journal of Information Science, 35*, 515-526.

Simonofski, A., Vanderose, B., Clarinval, A. & Snoeck, M. (2018). "The impact of user participation methods on e-government projects: The case of La Louvière, Belgium." *Media and Communication, 16*(4), 175-186.

Smart City Hub (n.d.). Smart city wheel [web page]. Retrieved from https://www.smartcityhub.ch/smart_city_wheel.120de.html.

Solanas, A., Patsakis, C., Conti, M. Vlachos, I. S., Ramos, V., Falcone, F., ... Martínez-Ballesté, A. (2014) "Smart health: A context-aware health paradigm within smart cities." *IEEE Communications Magazine, 52*(8), 74-81.

Spector, J. M. (2014). "Conceptualizing the emerging field of smart learning environments." *Smart Learning Environments 1*(2), 1-10.

Sterling, B. (2018). "Stop Saying 'Smart Cities': Digital stardust won't magically make future cities more affordable or resilient." *The Atlantic*. Retrieved from https://www.theatlantic.com/technology/archive/2018/02/stupid-cities/553052/.

Swilling, M. (2016). Toward sustainable urban infrastructure for the urban Anthropocene. In A. Allen, A. Lampis, & M. Swilling (Eds.), *Untamed Urbanism*. Abingdon, UK: Routledge.

Thebault-Spieker, J., Terveen, L. & Hecht, B. (2015). *Avoiding the south side and the suburbs: The geography of mobile crowdsourcing markets*. In CSCW 2015 Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (pp. 265-275), Vancouver, Canada. Association of Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction.

Thrift, N. (2014). "The 'sentient' city and what it may portend." *Big Data & Society, 1*, 1-21.

Trickett, T. (2019). "A stride towards sentient cities: Architecture as performance art." *Technoetic Arts: A Journal of Speculative Research, 17*, 119-139.

Vanolo, A. (2014). "Smartmentality: the smart city as disciplinary strategy." *Urban Studies, 51*, 883-898.

Vidiasova, L., Kachurina, P. & Cronemberger, F. (2017). *Smart cities prospects from the results of the world practice expert benchmarking*. In A. limova, A. Bilyatdinova, J. Kortelainen, & A. Boukhanovsky (Eds.) YSC 2017: 6th International Young Scientists Conference in HPC and Simulation (pp. 269-277), Kortka, Finland. University of Amsterdam and ITMO University.

Vinod Kumar, T. M. (2015). E-governance for smart cities. In T. M. V. Kumar (Ed.), *E-Governance for Smart Cities* (pp. 1-41). Singapore: Springer.

Vinod Kumar, T. M. (2017). State of the art of e-democracy for smart cities. In T. M. V. Kumar (Ed.), *E-Democracy for Smart Cities* (pp. 1-50). Singapore: Springer.

Vinod Kumar, T. M. & Dahiya, B. (2015).

E-governance for smart cities. In T. M. Vinod Kumar (Ed.) *E-Governance for Smart Cities* (pp. 1-74). Singapore: Springer.

Visconti, R. M. & Martiniello, L. (2019). Smart hospitals and patient-centered governance. *Corporate Ownership & Control, 16*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3357473.

Yigitcanlar, T. (2018). "Smart city, knowledge city, sustainable city-the brand soup of contemporary cities." *International Journal of Knowledge-Based Development, 9*, 1-5.

Wang, S. J. & Moriarty, P. (2018a). *Big Data for Urban Sustainability: A Human-Centered Perspective*. Cham, CH: Springer International.

Wang, S. J. & Moriarty, P. (2018b). "Energy savings from Smart Cities: A critical analysis." *Energy Procedia, 158*, 3271-3276.

Wiig, A. (2016). "The empty rhetoric of the smart city: from digital inclusion to economic promotion in Philadelphia." *Urban Geography, 37*, 535-553.

Wilhite H. & Diamond R. (2017). *Do smart homes know what people want and allow them to realize it?* Proceedings of the 2017 ECEEE Summer Study (pp. 51-58), Hyeres, France. European Council for an Energy Efficient Economy.

Winkowska, J., Szpilko, D. & Pejić, S. (2019). "Smart city concept in the light of the literature review." *Engineering Management in Production and Services, 11*, 70-86.

White House Office of the Press Secretary, The (2015). FACT SHEET: Administration Announces New "Smart Cities" Initiative to Help Communities Tackle Local Challenges and Improve City Services. Retrieved from https://obamawhitehouse.archives.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-smart-cities-initiative-help.

Woetzel, J., Remes, J., Boland, B., Lv, K., Sinha, S. ··· von der Tann, V. (2018). *Smart Cities: Digital Solutions for a More Livable Future*. New York, NY: McKinsey Global Institute.

World Economic Forum (2019). *Guidelines for AI Procurement* [white paper]. Geneva, CH: World Economic Forum.

Xiang Z., Fesenmaier D.R. (2017). Big data analytics, tourism design and smart tourism. In Z. Xiang & D. Fesenmaier (Eds.), *Analytics in Smart Tourism Design*. Tourism on the Verge. Cham, CH: Springer.

Zelt, T., Narloch, U., Eikmanns, B., Ibel, J., Bastien, P ··· Wang, R. (2019). *The Smart City Breakaway*. Munich, DE: Ronal Berger.

Zhu, Z., Yu, M. & Riezebos, P. (2016). "A research framework of smart education." *Smart Learning Environments, 3*(4), 1-17.

Zion Market Research (2019). Worldwide industry share of smart city market size worth USD 2,700.1 billion by 2024 [Press release]. Retrieved https://www.globenewswire.com/news-release/2019/07/17/1883879/0/en/Worldwide-Industry-Share-of-Smart-City-Market-Size-Worth-USD-2-700-1-Billion-By-2024-Zion-Market-Research.html.