Understanding the trends and characteristics of smart urbanism across continents

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Abstract
Lack of understanding across the global north and global south, and with the need for alternative development paths in smart urbanism discourse are issues highlighted by recent smart urbanism research. Therefore, this paper aims to comprehend the trends of smart urbanism across contrasting geographies and to learn about the alternative direction of the development of smart cities. This study applied the research methods of document analysis and case study on the continents of North America, Europe, and Asia. The study showed that the North America corporations (i.e., IBM smarter city) are leading the approach of technology-driven method (TDM) and corporate smart city concept, European scholars and institutions have strong influence on the human-driven method (HDM) approach (i.e., the Amsterdam smart city), while Asian countries are discursively learning and applying smart city's ideas and practices from North America and Europe. A mixture of approaches are found in Asian countries, such as the TDM approach in China and Malaysia, and the case of a shift of paradigm towards HDM with Singapore. Overall, the authors found that the worldwide trend was dominated by the TDM approach. However, a push towards the HDM approach was also apparent, with the appearance of proposals such as citizen centricity and participation. The results of this study serve as a benchmark on the normative neoliberal politics and an opportunity to nurture humanism aspects. This paper marks a contribution to the phenomenon of contemporary smart urbanism and provides insights for policymakers and stakeholders who wish to work together as co-partners in the quest for a more humanistic smart city.

Keywords: Amsterdam, citizen participation, China, humanistic smart city, IBM, Malaysia, Singapore .

1. Introduction
The use of technology in current urban development has been prolific, being practiced by urban policymakers around the world [1], [2]. Great faith is put in the concept of techno-utopianism; the belief in dependence upon technology as a tool for achieving the vision of a smart city. The view that technologies are capable of dissecting complex issues to sub-parts which are less complex, thus solving various issues, was termed 'technological reductionism' or 'solutionism'. These ideas were applied and being tested in the city of

Pittsburgh, New York and Los Angeles in the 1960s [3]. According to [4],[5], the concept applied at that time was known as 'urban cybernetics', originating from the cybernetics concept coined by [6]. However, as is well known, these projects failed because, according to Goodspeed, humanistic values such as the participation of multi-stakeholders need to be upheld if any future smart city was to be a success.

Smart urbanism is by no means a new concept, originating in the mid-20th Century. As [7] comments; not a new opinion but old wine in new bottles. Also, definitions of smart urbanism vary greatly, with an international workshop held in 2013 with the aim of collecting opinions on the concept from European, North American, South American, African and Australian scholars and practitioners [8]. The obstacles to achieving the goal of a smart urbanism were highlighted by Luque-Ayala & Marvin, such as the lack of critical thinking, lack of understanding across the global north and global south, with the need for alternative development paths in smart city discourse. In the current study, therefore, the trend of smart urbanism across contrasting geographies is discussed, representing an attempt to learn of the alternative directions of development for future smart cities.

The following section discusses the various schools of thought on the matter and, more broadly, the characteristics of humanism generally. This is followed by an outline of the chosen method of document analysis and case study method. Cases from the continents of North America, Europe, and Asia are analysed, with reflections on the different schools of thought which they represent. Finally, the authors provide insights on the implications for future research and conclusions. The paper is supplemented by summary tables of empirical data that are included in an Appendix (Table 4 to 6).

2. The schools of thought in the smart city literature

According to [9], there currently exist two overarching approaches in the smart city literature: the technology-driven method (TDM) and the human-driven method (HDM). TDM views a smart city as, fundamentally, a networked space, where the acceleration of ICT improves the quality of life of inhabitants. This drive is dominated by the giant corporations such as IBM, Cisco, Forrester Research, Siemens, SAP Research, Toshiba, Hitachi, Tata Group, Arup, Deloitte, McKinney, and Frost & Sullivan [10], [11]. HDM, however, believes that one needs to prioritise the humanistic elements such as activities of participation in public life and social justice if urban sustainability is to be properly achieved [12], [13]. Broadly-speaking, the HDM approach is led by European scholars such as [14]–[16]. These two contrasting approaches can, in fact, be divided into four schools of thought: restrictive, reflective, rationalistic, and critical (refer Table 1).

Table 1. The Technology/Human Driven Methods

School of thought	technology-driven method (TDM)			human-driven method (HDM)		
	High	Medium	Low	High	Medium	Low
Restrictive	x					x
Reflective	x				x	
Rationalistic		x		x		
Critical			x			x

Source: Kummitha & Crutzen (2017)

The first Restrictive school of thought stresses importance of technology, with a regard for the importance of the human factor, as experts decide all and need little input from citizens. Its main agenda is the adoption and deployment of technologies for the purpose of collecting data and making accurate decisions for urban control. The second Reflective school follows the Restrictive, but this time with moderate concern for the human factor. Under the Reflective school, a partnership between the private and the public sector (PPP) is encouraged and promoted in order to ensure that corporates continue dominating the smart city markets. Perhaps stating the obvious, according to [9], [17] the potential losers under TDM are the citizens and communities.

The Rationalistic school, on the other hand, view technology as a sub-tool for improving human capital, with citizen participation being an important component in this endeavour [18]. Rationalistic supporters recommend applying the quadruple-helix model, where the government, corporates, academics and civil societies (PPPP) work together as co-partners. They stress investing in people and improving their rights, which includes adopting technologies in everyday life. The Rationalistic trend is the most supported among scholars.

For proponents of the Critical school, as expressed by [19], [20], neither technological nor human factors are important. The smart city is deemed to be under the influence of political power, accompanied by the privatisation of urban space, with technology being manipulated for building the neoliberal utopia. In terms of a growth model, this school of thought are in support of degrowth, where sustainable growth has limits and human activities have to be compatible with nature [1].

All of the above schools have their pros and cons and all provide different insights on the development of smart cities. Table 2 summarises the dichotomies between the different schools of thought. The sub-sections following discuss further on the technological and humanistic characteristics in the development of smart cities.

Table 2. Characteristics of the smart urbanism school of thoughts

	technology-driven method (TDM)		human-driven method (HDM)	
Element	Restrictive	Reflective	Rationalistic	Critical
1) Governance approach	Top-down: citizens are recommended to follow the social algorithm order.	Inclined towards top-down, and privatisation.	Bottom-up, with the citizen's voice prioritised.	Government is a facilitator and power is surrendered to corporates; the techno-utopian vision is in this way sold to citizens.
2) Implementation strategy	Technology-led		Holistic	
3) Collaboration model	Double-helix model		Quadruple-helix model	
4) Typology of activity	Emphasis is on capital gains (i.e., corporate or sponsored smart cities)		Emphasis is on commons-oriented (i.e., resilient or commons-based smart cities)	
5) Growth model	Sustainable growth		Degrowth	

Source: Derived from (Kitchin, 2015; Kummitha & Crutzen, 2017; Luque-Ayala & Marvin, 2015; March, 2018; Mora et al., 2017; Mora et al., 2019, Niaros 2016)

2.1. The technological characteristics of smart city development

As summarised in Table 2 (i.e., the TDM approaches), the technological characteristics are easy to understand because most of them are common practices of the current smart cities development. These technology-led implementation strategies include the top-down governance practices where citizens are mostly recommended to follow the social algorithm order [21], the double-helix model (government and private sectors) to promote the privatisation in smart cities projects [22], emphasis on capital gains activities [23], and placated by the sustainable growth model [1].

These technological characteristics are easily accepted by the public due to its compatibility to the current neoliberal logic [24] and all major actors seem to be in win-win-win situations. This includes, citizens are coined as beneficiaries of technological advances, governments are assisted by private technological sectors in solving urban problems and providing better services to citizens, and of course the private sectors gain repeated profits in these ICT-led techno-consumption cycles.

2.2. The humanistic characteristics of an alternative smart city development

Oh the other side, the alternative paths discussed among scholars tend to side mostly with the HDM approach, i.e., the Rationalistic, and Critical schools. On reviewing such studies, the authors of this paper found an emphasis on humanistic features such as commons-orientation [23], self-organisation [25], contextually sensitive human needs [26], [27], human-centredness [28] and citizen-centric participation [18], [29].

[23] predicted that smart cities would become more commons-oriented, with open-source technologies built by communities, a free software movement, emphasis on public values, smaller scale living labs, DIY cultures and citizens playing an expert role. The term commons carries the meanings of peer production, togetherness, or any solution closer to citizens. The Internet, 3D printers and machine computer-numerical-control are all examples of commons; any technological element which is a means of assisting the

democratisation of production [30]. According to [25], cities are evolving from being welfarist, neoliberal entities towards self-organisation. For example, Amsterdam is moving towards being a self-organising city where citizens produce services which are strategised; i.e., in the process of co-producing public decision making. Self-organising communities can be viewed as products with long evolutions in citizen participation in urban policy, moving from having a reactive to a proactive role. This is through greater engagement, with citizen-led initiatives supported by governments.

[26], [27], alternatively, stress contextually-sensitive as well as internationally-negotiated needs (i.e., global commons), rather than macro-scale and potentially transient visions of a scintillating technological urban future. Contextually sensitivity refers to the uniqueness and variety of local contexts, which also involve citizens' identities. In Caprotti's opinion, activities related to participation are still under-represented and there is more need than ever for locals to participate in the process of urbanisation.

A completely human-centred concept, as advanced by [28], among others, stresses the importance of human and social capital; participatory governance and citizen participation; lifelong learning and encouraging general well-being. Among these humanistic characteristics, the authors conclude that citizen participation is the most important, with the ever-increasing involvement of citizens in urban policymaking. [31] add that this must go beyond tokenism in the form of mock-informing or consultation; citizens being truly involved in decision-making is the essence of authentic participation. This authentic type of participation [32] will, ultimately, lead to the other humanistic characteristics, and benefit the better planning and designing a smart city.

3. The research method

This study employed a qualitative research method through document analysis and case study [33], [34]. The focus of this study is the investigation of the meaning of "smart" cases across contrasting geographies, taking account of the varying contexts in which concept emerges and the importance of the interactions that result from the documents studied. The authors referred to documents available from a variety of websites, mass media, governmental white papers, reports based on official statistics, corporate reports, the academic literature and social media. The multi-sourced nature of these documents will allow the triangulation of data and improve its reliability. The cases obtained were analysed through content analysis and discussed among the authors by comparing and contrasting the manifest and latent meanings of the text [35]. The similar method of document analysis and case study were applied by smart city researchers, such as [36]–[38].

4. Findings and discussion of the empirical cases, globally

In this study, the authors found that smart urbanism, began as a movement in countries in the northern hemisphere: mainly Europe and the United States but with the addition of Australia. However, from the review of [22] on smart city publications, countries in the global south are also showing rapid development with respect to smart urbanism, meaning that smart urbanism is not limited only to developed countries. One interesting difference, according to [39], is that smart urbanism in the West tends to emphasise decentralisation and participation of citizens in projects, while cases in Asia accentuate projects based on

infrastructures. The sub section below analysed cases from North America, Europe, and Asia in order to compare and contrast the trend around the globe.

4.1. North America (and the case of the IBM 'smarter city')

In general, the corporate ICT sectors from North America have been leading the approach of TDM and corporate smart urbanism. This dominant role can be traced from the contributions of IBM and Forrester Research [22], particularly to IBM's 'smarter cities' concept [40]–[42] which has become the most popular smart city application system in the world. After a thorough review of IBM's publications on this matter, the authors found that the publications of the IBM scholars were aimed explicitly at rolling out the future of urban challenges in terms of the company's own interests, by widening the urban governance dilemma. PPP is, therefore, encouraged and the superior sophistication of IBM technology is promoted for urban solutions. The concept of the IBM smarter city is based on 3I urban layer systems, namely instrumentation (the need for instruments such as meters, sensors and RFID tags for data collection), interconnection (to enable data flow networks), and intelligence (to utilise the data for improving urban living). Regarding the detail of these 'layers', the authors found that the 'urban services' layer has barely any focus on e-government, while the 'citizen' layer digresses towards access to information on living, while ignoring the participation element stressed by [14], namely 'participatory governance,' which means authentic participation in public life.

The popularity of IBM's concept can be traced back from their control centre project in the city of Rio de Janeiro. However, [21], [43] critiqued IBM's narrative of 'one size fits all' as impractical because of the slow changes of urban fabrics, in contrast with rapidly changing technological fabrics. In addition to the image of domination of corporate technologies from the continent of North America, other aspects worth mentioning which contribute towards smart urbanism include the smart growth, SmartAmerica Challenge [44], [45] and organizations such as Bloomberg which organise the European Mayor's Challenge, or helping the India Smart City Initiative [46].

5.1. Europe (and the case of the Amsterdam smart city)

Europe, in contrast to the corporate view above, has focused rather on university research, with the publications of European scholars such as [14]–[16], [20] receiving the most citations [22]. Regarding smart city cases, European cities are also among the most popular references for Asian scholars and practitioners. These cities include Amsterdam, Barcelona, Vienna, London, Copenhagen, and Helsinki cities which have won recognition in terms of international awards [47]. Amsterdam is an example of a shift from TDM towards HDM in adopting bottom-up, holistic strategies and through emulating the quadruple-helix model [48]. Amsterdam not only represents a success story in terms of continuous commitment from its government but also in its continued efforts to co-produce with citizens, under the new democracy concept of 'do-ocracy' [49]. A community platform named Amsterdam Smart City (ASC) has been formed and consists of 40% corporates, 15% start-ups, 14% governmental organisations, 5% foundations, and 12% others [50]. This platform illustrates the model of the quadruple-helix and its active partnership programs along with the government. For [51], citizen participation under the ASC platform has been discursively implied and exists under the informal networks of civil

organization. It was observed in this paper that the institutional arrangement under the ASC platform has accentuated the transition from the PPP model to PPPP, with the role of citizens becoming clearly more significant.

In addition to Amsterdam, European influence in the direction of HDM can be traced from the Human Smart Cities Manifesto of 2013 [52]. This manifesto emphasised smaller scale and simple ICT solutions, urban design based on the concept of citizen-centricity and participation [53]. This is not forgetting the significant contribution of the European Union in supporting other energy (i.e, Horizon 2020) and lighthouse projects [54], [55]. Notably, these European experiences are discursively learned and applied across the Asian continent.

5.2. Asia (China, Singapore and Malaysia)

As stated above, smart urbanism in Asia is more influenced by the TDM than HDM (see Table 3). According to [56], the entrepreneurial form of governments from South East Asia and the East, including the UAE, means that mega projects are typically the form which corporate smart cities take. The corporate smart city model which emphasises a technology-led, double-helix model of PPP, has gained substantial support in Asia. A discussion of the specific cases of China, Malaysia and Singapore follows.

Table 3. Examples of Smart Urbanism in Asia

Asia	Observations
Songdo, South Korea	Cisco led Songdo's urban ICT applications. This corporate model was criticised as a technological 'one-size-fits-all'. The local fishermen had been ignored, displaced and social polarisation was evident.
Masdar, UAE	Masdar was developed by GE and Siemens as the world's first carbon-neutral city. This vague vision has criticised for being unrealistic.
India: 100 smart city vision	The corporate leadership by Lodha, IBM, and Tata in developing the Palava smart city was a notable effort but the case of Dholera (a fisherman's village) was criticised for over-emphasising the corporate smart city model, to the detriment of the social justice model.
Japan	Notable for the ample engagement of corporate sectors such as Hitachi, NEC, and Toshiba; all being observed and welcomed by the locals.
China: 12th Five-Year Plan	Inclined towards TDM, China has perceived smart urbanism as a strategy for combatting environmental pollution and upholding the PPP model. The fast pace of smart urbanism in China has been anticipated to overtake the United States.
Cyberjaya, Malaysia	Cyberjaya was envisioned as global tech hub. It was criticised for the lack of local citizens supporting local programs, and failed to developed as the 'Silicon Valley of the East'.
Singapore: Smart Nation	Aspiration from 'Intelligent Island' to 'Smart Nation' which emphasises quality living, Singapore is in transition towards a HDM approach, where the bandwidth of the mind – citizens, and citizen participation are being highlighted.

Source: Derived from (Alusi, Eccles, Edmondson, & Zuzul, 2011; Batty et al., 2012; Bunnell, 2015; Collier, 2016; Datta, 2015; Madakam, Ramaswamy, & Date, 2017; Yu & Xu, 2018)

In China, the earlier version of smart urbanism was called the 'eco city' and, more recently, the 'smart city'. China's smart urbanism has inclined, perhaps unsurprisingly, towards TDM which emphasises ICT application in handling environmental pollution [57] and through the PPP collaboration model. Examples of PPP collaboration include the Dongtan Eco City (jointly developed by Shanghai Industrial Investment Corporation and Arup) and the Sino-Singapore Tianjin Eco City (a 50/50 joint venture between a Chinese consortium and a Singaporean consortium) [58]. As for smart cities, the trend was expended under the 12th Five-Year Plan of the Chinese government [57]. Comparing the first Ningbo smart city

to the Amsterdam smart city platform, the citizen's involvement in Ningbo is limited and separated from the main stakeholder network. As expected, the political thinking in China is still far from allowing for a bottom-up approach towards smart cities.

With the advent in the 1990s of the federal project of the Multimedia Super Corridor (MSC), smart urbanism in Malaysia started earlier than China's efforts. The ICT strategy for building intelligent cities such as Cyberjaya was adopted under the 7th Malaysia Pelan [59]. However, after more than 20 years of slow implementation, Cyberjaya has often being criticised as just another failed 'Silicon Valley in the East' [60], [61]. Therefore, in year 2017, the government injected Cyberjaya with a new blueprint: as the smart and low carbon city of 2030 [62]. Unfortunately, at least according to interviews, the authors found that Cyberjaya has ignored two crucial factors. Firstly, the authorities failed to achieve their planned 200 thousands population by the year 2020. In fact, the current population is only one fourth of this planned target. Secondly, the collaboration of stakeholders has been somehow fragmented. The four main stakeholders in Cyberjaya: the federal-link companies Cyberview, Setia Haruman, Multimedia Development Corporation, and the Sepang Municipality have different roles and work in silos. Grey areas in responsibility are observed among these stakeholders, not to mentioned the lack of support from local communities.

In the year 2018, the federal government initiated its first draft of the Malaysian smart city blueprint. Cities like Kulim, Johor Bahru, Kuala Lumpur, Kota Kinabalu and Kuching were included as pilot projects under this blueprint. While joining the focus group discussion of the blueprint, the authors have yet to observe any evidence of the HDM approach. In short, smart urbanism in Malaysia is entirely government-driven and does not resemble the explicit type of corporate smart cities where corporate sectors hold the city shares, as in the Chinese case. Having said that, collaborations do exist among corporate sectors in support of privatisation in Malaysia. This is evidence, for example, through site engagement in the Petaling Jaya smart city project, where it was noticed by the authors that Petaling Jaya is collaborating with local corporates and is applying the Chinese technologies in its dashboards for the Petaling Jaya Smart Command Centre.

Singapore is an Asian developed nation which is frequently cited in the smart city literature, initiating its intelligent island vision in the 1990s [63]. Under the IT2000 masterplan, this city-state country has vowed to turn its industrial economy into an information economy and priority was placed on human capital and quality living. While the Singapore One broadband network successfully laid the basic ICT infrastructures, [64] comments that the stress in Singapore for decades has been more on 'the bandwidth of the mind' in order to face smart challenges. [20] also outlined two shifts that happened in Singaporian smart urbanism. Firstly, there was a transition from government-funded smart development to privately funded projects. Secondly, there was an ideological shift towards integrating corporate competitions with social well-being. It can be said that under the elite political leadership of Singapore, the ICT infrastructures were ready almost 20 years ago and are now are dealing with the HDM approach, where humanistic elements are necessarily upheld in today's smart urbanism.

6. Conclusion

This paper added new insights into laying the foundation for smart urbanism discussions on contrasting geographies: discussing the leading role of TDM and the corporate smart city concept from the continent of North America (i.e., IBM smarter city); highlighting the strong European influence on HDM approaches (i.e., the Amsterdam smart city); discussing the emerging force of Asian cases dominated by the TDM approach across developing countries such as China and Malaysia; and the case of a shift of paradigm towards HDM with Singapore.

Such dichotomies in smart urbanism that exist in North America, Europe, and Asia were influenced by different school of thoughts, the push by corporate technological sectors worldwide, the scholarly publications and institutions' promotions, the emphasis on governance practices, and the complex socio-technical system of smart cities development (refer Appendix, Table 4 to 6). Understanding these differences is crucial for national leaders seeking a successful smart urbanism which can be more than the normative neoliberal politics and an area to nurture humanistic aspects often lacking, such as citizen centricity and citizen participation.

Theoretically, this paper attempted to address the lack of understanding on smart urbanism raised by [8], and categorised the characteristics of smart urbanism across the continents of North America, Europe, and Asia. This categorisation was made possible mainly based on the dichotomy nature of the smart city development identified by [22].

The limitations of this study are the lack of coverage of other continents such as Africa or South America; in addition to limited document sources available online for the Asian developing nations, except for in the Malaysian cases where the authors had the advantage of being able to visit most of the sites and interview the stakeholders.

Based on the findings and discussion of this study, the authors would like to suggest that future study, while exploring the abovementioned continents further, should also apply other quantitative methods in order to assess the humanistic characteristics of this field. In conclusion, smart urbanism is the contemporary major global paradigm of urban policy, planning and development. It is vital that all stakeholders should attempt to understand and address quality of life and sustainability, adhere to authentic citizen participation, and avoid being over-reliant upon techno-reductionism.

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Appendix

Table 4. Characteristics of smart urbanism in North America

Element	North America
1) Governance approach	Top-down governance practices. Corporate ICT sectors such as IBM and Forrester Research, have been leading the approach of TDM and corporate smart urbanism in the world since the early 2010s.
2) Implementation strategy	Widening the urban governance dilemma, and suggesting superior sophistication of technologies for urban solutions.
3) Collaboration model	Double-helix model where public private partnerships are emphasised.
4) Typology of activity	Emphasis on top-down and proprietary technologies, and capital gains.
5) Growth model	Sustainable model with emphasis on the pillar of economic sustainability, neoliberal logic, continuous consumptions, and endless growth.

Table 5. Characteristics of smart urbanism in Europe

Element	Europe
1) Governance approach	Shifting from TDM towards HDM in adopting bottom-up governance practices. Most of the European scholars such as Giffinger et al. (2007) and institutions such as the European Union are leading the world in smart city scholarships. The governments such as the Amsterdam Authority is adopting the new democracy concept of 'do-ocracy' where citizens are viewed as co-producers.
2) Implementation strategy	Holistic strategies in viewing cities as a complex socio-technical system, not just technological object. Under such socio-technical systems, the government's strategy should include elements such as human (as stakeholder), social, culture, economy, and environment factors.
3) Collaboration model	Quadruple-helix model where the government, corporates, academics and civil societies partnership work together as co-partners.
4) Typology of activity	Emphasis on commons-oriented, public values, public participation, peer production, smaller scale, and simple ICT solutions.
5) Growth model	Degrowth model with the emphasis on the pillar of environment and social sustainability, uphold the philosophy on limits of growth, human as 'part' but not 'owner' of nature and land, and aware and deliberate public participation.

Table 6. Characteristics of smart urbanism in Asia

Element	Asia
1) Governance approach	Discursively learning and applying smart city's ideas and practices from North America and Europe. Major trend seeing the top-down governance practices emphasis on ICT-related infrastructure development, such as in Songdo, Masdar, Japan, India, Malaysia and China's smart cities. Also, some signs of shifting from TDM towards HDM in adopting bottom-up governance practices, such as in Singapore.
2) Implementation strategy	A mixture of technology-led and holistic strategies, but with less emphasis on human capital and quality living.
3) Collaboration model	Double-helix model of public-private partnership is dominating, but also some signs on promoting quadruple-helix model of civil societies partnership.
4) Typology of activity	Capital gains and economic growth activities are the major concerns in most of Asia developing countries.
5) Growth model	Do not appear in any specific Asia growth model, only seeing the trend of being subjugated by the western's sustainable growth model.

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