

Crowdsourced Smart Cities versus Corporate Smart Cities

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Abstract. Considering the speedy growth of smart-city promises and practices, there is an urgent need to take a critical approach and offer an integrated vision for an otherwise fragmented and sectoral concept. In particular, the literature warns about a critical deficit around the theorization of the smart city because discussions of relevant smart city theories or frameworks are few and fall short of offering alternative practical resolutions to the dominant discourse. In developing a response to such a deficit, this paper takes up the challenge to broaden theoretical insights into smart cities, by offering a bottom-up understanding of the ‘smart city’ concept with special attention to the potential of passive crowdsourcing based on the ocean of mostly untapped and unutilized available data in the public domain. Crowdsourced smart cities are proposed as an alternative to enable public engagement in smart city debates and decision-making – especially when dealing with global digital corporations.

1. Introduction

The concept of the smart city has emerged at the intersection of debates on the future of urban places, new technologies, and infrastructures – as a solution to offer clean, livable, technologically advanced, economically robust cities [1, 2]. The popularity of the concept is based on a mix of various factors, including the availability of substantial public financial resources (such as the EU Strategic Energy Technology Plan) to fund smart city initiatives; the tendency of global corporations (such as Cisco, Google and IBM) to heavily invest in urban digitization projects [3, 4]; and, finally, a growing range of complex urban challenges that need advanced technology-enabled solutions [5-7].

Nevertheless, the literature warns about the lack of both theoretical insights and empirical evidence required to fully understand the opportunities, challenges, and implications of smart cities. Research in this field is in its infancy [1, 4], fragmented along disciplinary lines [8, 9] and based on limited city case studies [6, 10].

Given the fast growing global attention given to smart cities and significant practical implications in the form of smart city initiatives and projects, there is an urgent need to take a critical approach and offer an integrated vision for this otherwise fragmented and sectoral concept [1, 2]. Here, the danger is that urban visioning is increasingly reduced to a single technology-centric vision that is simplistic and does not account for the socio-economic and spatial complexity of cities [3, 11, 12].

The literature specifically puts an emphasis on the critical deficit around theorization of the smart city [1, 12, 13]. Discussions of relevant smart city theories or frameworks are few; analyses lag behind actual practice and then fall short of offering alternative practical resolutions to the dominant discourse.

In developing a response to this deficit, this paper takes up the challenge of broadening theoretical insights into smart cities by offering a bottom-up understanding of the concept. Firstly, it examines how the smart city is currently defined in the literature and points out different – and sometimes contradictory – approaches taken towards smart city practice around the world. Secondly, it focuses on the definition and evolution of crowdsourcing during its relatively short existence. Thirdly, it brings the two earlier parts together by proposing the ‘crowdsourced smart city’ as an alternative theoretical perspective that has practical means of enabling people’s voices to be heard in smart city decision-making and evaluation processes. This alternative theoretical perspective also has the capacity to empower informed



smart city policy development for governments of all levels and guide them in their dealings with global corporations' increasing interest in the concept of the smart city.

2. Smart cities

2.1. *The issue of definition*

Despite their ongoing popularity and influence, there is no universal definition for smart cities [3, 14]. Indeed a number of related terms such as 'intelligent city', 'knowledge city', 'digital city', and 'eco-city' are used interchangeably in the literature [15-17]. All of these terms seem to stem from an earlier fascination with the technological aspect of the smart city concept, promising a new kind of technology-led urban utopia, which in turn has been criticized for being overly simplistic and ambiguous [10, 18]. Nevertheless, a growing stream in the literature has attempted to address the over-simplification of the smart city concept by offering holistic, multidisciplinary perspectives around key areas of smart infrastructure, smart economy, smart mobility, smart governance, smart environment, smart living, and smart people [2, 19]. This broad approach of defining the smart city has in turn been criticized for being out of reach and unattainable [20].

Amidst ongoing efforts to reach a comprehensive shared definition for smart cities, there is also a trend of making people's voices be heard in smart city design and decision-making processes, calling for direct participation of local actors and multi-stakeholders in planning and executing social, technological and urban transformation for smart cities [12, 14]. There are, however, serious questions about how this alternative approach – of giving a voice to citizens in the smart city discourse – can be implemented in urban development processes already in place and using technological advances already at hand. In order to contribute to the ongoing dialogue around such questions, this paper undertakes a review of the existing, diverse and sometimes contrary smart city practices and approaches to shed light on how smart technologies can be used to enable citizens' voices to be heard. This could then promote an alternative vision on smart cities in which citizens' voices are taken into account – a vision that is not compromised and yet attainable.

2.2. *Smart city practice*

Despite the lack of a shared definition, the smart city practice has been spreading around the world. The spread is important for a number of reasons, including:

- It is not limited to specific geographies, as smart city projects and initiatives now extend across the Global North and South [6]. There is, however, a far more limited understanding of the different ways in which smart cities are being rolled out in cities of the Global South [1, 21, 22].
- It is not limited to global cities, as medium-sized cities in different parts of the world have actively engaged with and invested in smart city projects and initiatives [23, 24].
- Smart city practice covers an incredibly diverse ranges of topics, including e-governance [25, 26], smart transport [27, 28], efficient production of urban services [29], and open data in cities [30].
- Smart city practice comes in various sizes: examples of large-size city-wide plans include Singapore's iN2015 (intelligent nation) project, South Korea's Songdo, Guangzhou Knowledge City in China, Masdar City in the UAE, and Barcelona in Spain [9, 31]. Among the large-scale city-wide initiatives, Barcelona is of special interest due to its apparent desire to integrate smart city efforts with the city's urban planning and policy thinking under the four main topics of smart governance, smart economy, smart living and smart people. More importantly, Smart City Barcelona is a collaborative movement among its corporations, universities, government, and the residents of Barcelona [9]. In contrast, some of the out of scratch smart city projects in Asia have attracted wide criticism as top-down practices with little room for people's voices in the process [32, 33].
- Smart city practice is funded by quite different private and/or public sources around the world. Over the last few years, the European Union (EU), in particular, has devoted constant efforts to support smart city initiatives – investing millions of euros in research, development and pioneer projects that try to link smart city initiatives to environmental targets (such as reduction in greenhouse gas emissions) and economic development (such as innovation and

employment) [2, 3, 11]. Smart city practices around the world have opened up new horizons in the problematic relationship between the public and private sectors in the management of cities [3, 34]. A critical line of scholarship has emerged around the role of global technology corporations in developing smart cities; and how they have tried to manipulate urban governments while engaging in providing philanthropic smart city services [7, 10, 35, 36].

Finally, the literature notes that the utmost majority of smart city projects and initiatives around the world are still in the planning phases or early phases of implementation [15, 23] and no city claims to be fully-fledged smart [12]. This means further research is required to assess progress of smart city projects and their implications on the overall success or failure of cities over time.

2.3. A critique of smart cities: corporate smart cities

Despite the lack of a universal definition for the smart city, which has resulted in heterogeneous smart city practices worldwide, the critiques of the concept seem to be quite focused on what is labeled as ‘corporate smart cities’ [3, 37-39]. From a critical perspective, we are reminded that the term ‘smart city’ was coined in the US inside two global high-technology corporations, IBM and Cisco. This indicates a point of view in which a combination of the profit motive for global corporations, on the one hand, and entrepreneurial governance – as coined by urban geographer Harvey [40] – on the other hand, drives the leading narrative of the smart city discourse [11, 31]. According to this view, the smart city has crystallized into an image of a technology-led urban utopia permeated with top-down and centrally controlled technological infrastructure, with the aim to improve the urban environment in terms of efficiency, security and sustainability [14, 41].

As noted earlier in this paper, critiques of the corporate smart city [2, 42] vigorously warn against the new smart cities being constructed from scratch in Asia, the Arab world and even Europe led by giant corporations (e.g. Cisco, IBM, and Siemens) using examples such as Masdar in the United Arab Emirates (UAE), Songdo in South Korea, and PlanIT Valley in Portugal. The underlying assumption with these cities – which is strongly questioned in the literature [33, 43] – is that IT can automatically make cities more economically prosperous and equal, more efficiently governed, and less environmentally wasteful – with little room for ordinary people to participate [22, 37]. The corporate vision of smart cities has promoted a trend towards cities selling themselves, being ‘open for business’, and increasingly becoming a backdrop to corporate advertising and the privatization of public space [3, 35].

In fact, it might be argued that in the corporate vision of smart cities, citizens are seen as barriers in the race towards smartness and that they need to be educated as to the benefits IT can bring. This lack of concern with democratic decision-making, and real citizen involvement and participation has encouraged a new trend in the literature to search for an alternative version of smart cities and provide a counter-point to the corporate vision [31]. This alternative vision has emanated from small-scale and fledgling examples of participatory community-based types of smart initiatives [44, 45].

2.4. Alternative smart cities and their shortcomings

In response to the lack of people’s voices in the corporate vision of the smart city, a new trend both in academia and practice has started to offer alternative visions. Examples can be identified mostly in the US and Europe in the last few years: Metalab is a non-profit innovation center based in Vienna offering a physical space for free exchange of information and collaboration between technology enthusiasts, hobbyists and hackers. Another initiative that can be linked to the alternative smart city paradigm is the Medialab-Prado – a collective innovation laboratory in Madrid – interested in the production, research and dissemination of cultural projects to sustain an active community of engaged citizens [14]. Similar initiatives have been developed in Amsterdam and Barcelona [2] to encourage bottom-up initiatives.

Amidst the excitement and flashy titles for the alternative visions of the smart city, the characteristics below give a united front against the corporate vision of the smart city [2, 13, 14, 46]:

- A democratic bottom-up approach: to promote participatory urban technologies, greater social inclusion and a substantial shift in power from corporations to ordinary people and their communities.
- Reliance on dynamic public-private partnership: with an emphasis on participatory governance rather than entrepreneurial governance.

- A tendency to identifying the urban problem first and only then reaching out for the relevant technological solutions: with emphasis on the capacities of each city and its distinct cultures, histories and political economies.
- Associated with the free-software and open-access movement.
- In the preliminary phase: far from being mature and mainly existing in seed form.

In other words, alternative visions of the smart city put strong emphasis on multidisciplinary smart city investments in human and social capital, traditional (transport) and modern (ICT) communication infrastructure to fuel sustainable economic development and a high quality of life with a wise management of natural resources through participatory governance [12, 14, 47]. An essential element of these alternative visions is the emphasis on citizen engagement beyond the simple delivery of services [2, 13].

The problem with the alternative smart city visions offered in the literature is the distinct lack of attention to implementation. Rather, the core mission of giving a voice to the people seems to fall short, as implemented successful examples are scattered, very small in scale and get lost against the scale and fast spread of the corporate smart city vision [31, 48]. This core problem in part stems from the difficulty involved in gathering people's voices and identifying urban issues that are indeed important to citizens and not just corporations.

3. Crowdsourcing as a solution?

Given the issues around the practicality of gathering people's voices in smart city decision-making processes and practices, this section examines the relatively new concept of crowdsourcing. Here, crowdsourcing is seen as an alternative technologically-enabled way of making people's voices be heard in decision-making. It should be highlighted that the aim is not to offer an all-inclusive account of the ever-growing concept but rather to provoke further discussion around the concept of the crowdsourced smart city.

Below we offer an account of how crowdsourcing has evolved in a short period of time. A brief review of the current landscape of crowdsourcing with a focus on urban problems then follows. Combining these two will then provide the foundation for the articulation of the crowdsourced smart city as an alternative vision later in this paper.

3.1. Crowdsourcing: Evolution of a concept

Howe [49] first coined the term crowdsourcing in a Wired Magazine article as "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call". Since then there have been many attempts to define crowdsourcing based on the diversity of its practice and different theoretical models [50]. In search for a common definition of crowdsourcing, Estellés-Arolas [51] found eight common characteristics of crowdsourcing: the task at hand; the recompense obtained; the crowdsourcer or initiator of the crowdsourcing activity; what is obtained by them following the crowdsourcing process; the type of process; the call to participate; and the medium. Based on these common characteristics he proposed the following definition [51]:

"Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task."

This 'task-oriented' definition of crowdsourcing has been revised several times. Revisions were proposed in response to emergent crowdsourcing models based on the prominence of social media and support by ubiquitous mobile devices [52]. For example, Thapa et al. [53] introduced two types of crowdsourcing: 'selective' and 'integrative' (task-oriented), based on different types of citizens involved. In an integrative crowdsourcing non-professionals are able to participate due to the simplicity of the tasks. In contrast, in selective crowdsourcing the complexity of the problem reduces the target group to professionals with special expertise.

However, the most significant evolution of the crowdsourcing concept stems from a shift from a task-oriented approach to what can be described as the crowdsourcing of opinions [54]. In this second approach, crowdsourcing is no longer about getting a certain task done with the help of the public. Instead, crowdsourcing of opinions is used to gauge opinions, ideas or perceptions of the public in different forms of polling, sentiment analysis, and opinion mining. Sentiment analysis uses language

processing and machine learning to identify which topics different groups talk and care about the most. Social media in general, and Twitter in particular, are rich sources of opinions; and have been used by both private and public sector in the crowdsourcing of opinions. There are numerous examples of companies using crowdsourcing of opinions – via social media – in their marketing efforts [55, 56]. More importantly, the crowdsourcing of opinions also serves governance and participatory planning and decision-making processes in different forms [57].

The crowdsourcing of opinions, in turn, is then categorized in two broad categories, namely active and passive. In terms of the difference between active and passive crowdsourcing, Loukis and Charalabidis [58] argue that the active crowdsourcing of opinions is more like mainstream private-sector crowdsourcing, which actively stimulates discussion and content generation by citizens on specific topics. Meanwhile, passive crowdsourcing is more compatible with the public sector; it passively collects information, knowledge, opinions and ideas concerning hot topics of the day and important public policies created by citizens without any initiation, stimulation or moderation from government postings [57-59]. Social media monitoring (SMM), as systematic, continuous observation and analysis of the ocean of data already available and mostly untapped, is the main source of passive crowdsourcing in the public sector [60].

In this paper, we acknowledge the evolution of crowdsourcing as a concept and yet mainly focus on passive crowdsourcing of opinions as a way to inform and evaluate smart city decision-making processes and plans. However, this requires a better understanding of the current landscape of crowdsourcing elaborated in the following section.

3.2. Crowdsourcing: Current Landscape

Several studies [56, 61, 62] have tried to make sense of the rapidly evolving crowdsourcing landscape. Different categorizations have been offered to articulate the variety of directions crowdsourcing has been taking in the public, private and non-for profit sectors. Dawson and Bynghal [56], for example, summarize the current landscape of crowdsourcing in eight crowdsourcing models that cover 22 categories. Table 1 shows a summary of the current landscape of crowdsourcing as articulated by Dawson and Bynghal [56]. The models include Crowd Service, Crowd Ventures, Media and Content, Marketplaces, Crowd Platforms, Crowd Processes, Content and Products Markets, Non-profit. Crowd Service refers to services that are delivered fully or partially by crowds and includes Managed Crowds and Labor Pools. Crowd Venture refers to ventures predominantly driven by crowds, including idea selection, development, and commercialization. Media and Content is another model, focusing on the creation of media, content, data and knowledge shared by crowds. Non-profit models include citizen engagement for governance purposes, volunteering for disaster management and crowd contribution to science. Marketplaces match buyers and sellers of services and financing through mechanisms, including bidding and competitions. The Marketplace model covers crowd-funding, microtasking, innovation markets, innovation prizes, services marketplaces and competition markets. Platforms are software and processes to run crowd works and crowd projects for use with internal or external crowds, including idea management, prediction markets and crowd platforms. Crowd processes are services that provide value-added processes or aggregation to existing crowds or marketplaces. Content and Product refers to sale of content or products that are created, developed or selected by crowds.

Table 1. Summary of the current landscape of crowdsourcing as articulated by Dawson and Bynghal [56]

Crowdsourcing Models	Crowdsourcing Categories	Examples
Crowd Services	Managed crowds	Thinkspeed, GeniusRocket
	Labor pools	BzzAgent, UTest
Crowd Ventures		Globumbus, SENSORICA
Media and Content	Data	Data.com, Rootwireless
	Content	Wikipedia, DemandMedia
	Knowledge sharing	Quora, ChaCha
Marketplaces	Equity crowd-funding	SeedUps, CrowdCube
	Crowd-funding	IndieGoGo, Fundedbyme
	Microtasking	Mechanical Turk, CloudFactory

Crowdsourcing Models	Crowdsourcing Categories	Examples
	Innovation markets	IdeaConnection, Innocentive
	Innovation prizes	Cisco i-Prize, DARPA
	Services marketplaces	Freelancer.com, Guru
	Competition markets	Zooppa, TopCoder
Crowd Platforms	Idea management	IdeaScale, BrightIdea
	Prediction markets	CrowdWorx, ConsensusPoint
	Crowd platforms	Crowdicity, CrowdEngineering
Crowd Processes		CrowdFlower, Smartsheet
Content and Product Markets	Content markets	Threadless, Shapeways
	Crowd design	Ponoko, Quirky
Non-profit	Contribution	Kiva, Crowdrise, Causes
	Science	GalaxyZoo, Phylo
	Citizen engagement	CrisisCommons, Ushahidi

While elaborating the diversity of the ever-growing crowdsourcing models in the current landscape is beyond the scope of this paper, below we offer a few examples of the different types of crowdsourcing used to tackle urban problems.

3.2.1. Crowdsourcing in emergency/disaster management. There have been several cases around the world where crowdsourcing has been used as an additional, complementing tool in emergency/disaster management [63-65]. Emergency responses in several cases – including but not limited to the recent earthquakes in Nepal and Haiti, and floods in Myanmar and India – have shown that different crowds with different skills and expertise can get involved differently in crisis management. Disaster-affected people can bring local and directly observed information and detect precise location (crowd as sensors); diasporas can offer their implicit socio-cultural knowledge in detecting needs within the affected area (crowd as a reporter); and, digital GIS volunteers contribute to processing and managing crisis data (crowd as a micro-tasker) [66, 67].

3.2.2. Active crowdsourcing of opinions in strategic planning. There is a growing number of planning departments at different levels (e.g. local and state) that use crowdsourcing to seek public opinions, ideas and feedback on their – mostly strategic – draft planning documents; to promote public participation in policy making and decision-making processes [68, 69]. In most cases, specially designed digital platforms are used to facilitate active crowdsourcing of ideas, which are often expensive to design and maintain and more importantly have to compete with the well-established social media platforms (i.e. Facebook and more aggressively Twitter). For instance, the City of Vancouver used an online platform to seek feedback as part of the participatory process involved in the development of its first urban digital strategy document [17, 70].

3.2.3. Active crowdsourcing of data in local planning/development. The most widespread form of crowdsourcing used in response to urban challenges is when data are crowdsourced from citizens to have a better understanding of the community conditions to facilitate better evidence-based decision-making [71]. For example, Street Bump is a crowdsourcing platform, produced by the Mayor's Office in Boston, which collects real-time road condition data from residents while they drive to improve their neighbourhood streets by fixing problems or planning long-term investments [72].

3.2.4. Passive crowdsourcing of opinions by government. There is a relatively new approach that calls for governments to exploit the extensive political content continuously created in numerous social-media platforms by citizens – without government stimulation – to better understand public needs, issues, opinions and arguments concerning a particular domain of government activity or public policy. [57]. This novel approach towards e-participation based on passive crowdsourcing of data is rarely used by urban governments [73, 74].

4. Crowdsourcing and smart cities

In principle, crowdsourcing has great potential in participatory planning; promotes many elements of smart cities including open government; and can be used as expansion of e-governance to we-governance by facilitating citizen-to-government support, citizen reporting, and citizen-government co-production of cities [75-77].

Nevertheless, the problem is the scale of uptake of crowdsourcing in urban governments. Previous studies have pointed out that the slow uptake of technologically-enabled solutions in e-governance at the urban level, in part, is related to the lag in technical skills at the local government [25, 78, 79]. It is argued that staff and organization structure of urban governance lack technical readiness and some of the well-established technical advances are missing at the local level [80]. In the last few years, however, we have witnessed an influx of technologically advanced smart city projects and plans around the world and cities of all sizes have shown interest to jump on the smart city wagon [6, 81]. Such a trend suggests that urban governments are catching up on technological issues somehow – or at least join forces with those (companies) who have the technical skills required [11, 31].

Moreover, financial restrictions and resourcing issues at the local government level have been pointed out as another set of reasons slowing down the rate of technologically-enabled solutions in e-governance and we-governance [75]. However, passive crowdsourcing requires less preparation and financial resources in comparison to many other smart solutions around that require sophisticated advanced equipment [58, 82]. So the problem must be somewhere else.

In this paper, we argue that the slow uptake of passive crowdsourcing capabilities to promote citizen's voices in urban decision-making is mainly a conceptual problem at the core of how the smart city is defined. Therefore we argue that the slow uptake of passive crowdsourcing capabilities, at least in part, is because it is seen as a side issue and not integrated with the popular smart city concept.

In the next section, we identify and respond to two reasons that have limited the role crowdsourcing has played in the smart city discourse so far.

4.1. Inclusionary concerns

Over the last few decades, a stream in the literature has consistently raised concerns about the inclusionary limitations of any online platforms, with reference to the digital divide [83, 84]. More specifically, it has been argued that there are limitations to how citizens can systematically, reliably and consistently get involved with crowdsourcing [85, 86]. One of the important challenges of crowdsourcing is finding, motivating and retaining participants. It has been noted that to prevent bias in results, participation in crowdsourcing should be inclusive and take in people from all walks of life and sectors of society affected by a problem [73, 87-89].

Having said this, we argue that inclusionary concerns over the use of crowdsourcing in urban decision-making seem to be mitigated. This, by no means, is to suggest that the digital divide between urban vs. rural at any national level, or Global North vs. Global South at the international level does not exist [90-92]. However, participatory technologies at the local level have been growing in popularity with an increasing number of cities and planning agencies using technology to engage the public in planning processes [93, 94]. This is partly due to the enormous popularity of the social-media platforms, which are no longer limited to a limited elite and educated sector of society [73, 95]. The popularity of social media basically paves the way for passive crowdsourcing by the public sector [68] as the voices captured are quite diverse [55, 87].

4.2. Corporate agenda

Socio-technological advances in the last decade or so have mitigated some of the inclusionary concerns around the role that crowdsourcing could play in the smart city discourse. We, however, argue that corporate agendas [31, 38] at the center of the dominant smart city discourse is the main barrier against crowdsourced cities. In other words, the dominant corporate smart city discourse mainly holds its power by claiming that the digital corporations have the solutions and the skills required in a complex urban world [35, 96]. In contrast, in this paper, we join the stream in the literature arguing that smart cities should build on democratic decision-making [20] and contribute to transparency [93, 97] through public participation. Participatory processes enabled by crowdsourcing help urban governments to identify and respond to wicked problems [43, 98], democratize decision-making, and increase social capital [99].

This focus on the citizen-centricity of the crowdsourced smart city [41, 100] emphasizes the potential of online participatory technologies to allow citizens to actively engage in shaping their city.

Empowered citizens, in turn, then empower local governments in their negotiations with digital corporations that have clear vested interests in running the show in the smart city discourse. As a first step in dealing with the dominant corporate smart city vision, passive crowdsourcing has the potential to evaluate some of the smart city projects already in place to assess their success based on public opinion. In other words, the crowdsourced smart city can shift the power from corporations to citizens, help local governments to avoid undervaluing their skills and expertise, make more strategic investments informed by public opinions, and ensure that smart city projects and initiatives have equitable outcomes for all citizens.

5. Conclusion: crowdsourced smart city vs. corporate smart city

This paper started by acknowledging an urgent need to take a critical approach to the concept of the smart city [1, 3]. In particular, it pointed out the deficit around theorization of the concept [12, 13]. In developing a response to such a deficit, we took up the challenge of broadening theoretical insights into smart cities by redefining the concept of the smart city with special attention to data that are available in the public domain.

In so doing, we examined both 1) the current dominant – yet mostly exclusive and technocratic – and also 2) the alternative – yet mostly limited and not comprehensive – definitions of the smart city. This paper then discussed the evolution of the crowdsourcing concept and its practices since it was introduced and built upon its latest definition to tap into the streams of underutilized urban data, as citizens are using online channels to engage on topics that they feel passionate about.

In conclusion, we propose the crowdsourced smart city as an alternative to the corporate smart city. The crowdsourced smart city provides the response so desperately sought in the literature to shift from the corporate smart city paradigm to a bottom-up, socio-technological inclusive approach that produces non-planned forms of citizen empowerment in urban governance [61]. Passive crowdsourcing has the capability to harnesses the ocean of untapped data already available in social-media platforms to generate collective intelligence [101] and improve planning, evaluation and functioning of smart cities. At this stage, we call for urban governments around the world – interested and invested in smart cities – to verify any smart projects and initiatives already in place; to use passive crowdsourcing to evaluate the impact of their earlier and ongoing smart city efforts; and to modify any future smart city projects and plans based on public needs, opinions, and priorities.

References

- [1] Luque-Ayala A, Marvin S. Developing a critical understanding of smart urbanism? *Urban Studies* 2015;52(12):2105-16.
- [2] Papa R, Gargiulo C, Galderisi A. Towards an urban planners' perspective on Smart City. *TeMA J. of Land Use, Mobility and Environment*. 2013;6(1):5-17.
- [3] Vanolo A. Smartmentality: the Smart City as disciplinary strategy *Urban Studies*. 2014;51:883-98.
- [4] Luque A. The smart grid and the interface between energy, ICT and the city. In: Dixon T, Eames M, Hunt M, and Lannon S, editors. *Urban Retrofitting for Sustainability*. London: Earthscan; 2014. p. 159-73.
- [5] Alizadeh T, Irajifar L. Towards Gold Coast Smart City: A Combination of Local Planning Priorities and International Best Practices. State of Australian Cities National Conf.; 28-30 November; Adelaide, Australia 2017.
- [6] Alizadeh T. An investigation of IBM's Smarter Cites Challenge: What do participating cities want? *Cities*. 2017;63:70-80.
- [7] Paroutis S, Bennett M, Heracleous L. A strategic view on smart city technology: The case of IBM Smarter Cities during a recession. *Technological Forecasting and Social Change*. 2014;89:262-72.
- [8] Alawadhi S, Aldama-Nalda A, Chourabi H, Gil-Garcia JR, Leung S, Mellouli S, et al. Building Understanding of Smart City Initiatives. In: Scholl HJ, Janssen M, Wimmer MA, Moe CE, Flak LS, editors. *Electronic Government: 11th IFIP WG 85 International Conf., EGOV 2012*, Kristiansand, Norway, September 3-6, 2012 Proc. Berlin, Heidelberg: Springer Berlin Heidelberg; 2012. p. 40-53.

- [9] Bakıç T, Almirall E, Wareham J. A Smart City Initiative: the Case of Barcelona. *J. of the Knowledge Economy*. 2013;4(2):135-48.
- [10] Kitchin R. Making sense of smart cities: addressing present shortcomings. *Cambridge J. of Regions, Economy and Society*. 2015;8:131-6.
- [11] Rosati U, Conti S. What is a Smart City Project? An Urban Model or A Corporate Business Plan? *Procedia - Social and Behavioral Sciences*. 2016;223:968-73.
- [12] Lara AP, Costa EMD, Furlani TZ, Yigitcanlar T. Smartness that matters: towards a comprehensive and human-centred characterisation of smart cities. *J. of Open Innovation: Technology, Market, and Complexity*. 2016;2(8).
- [13] Lee JH, Hancock MG, Hu M-C. Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*. 2014;89:80-99.
- [14] Niaros V. Introducing a Taxonomy of the “Smart City”: Towards a Commons-Oriented Approach? *tripleC*. 2016;14(1).
- [15] Manville C, Cochrane G, Cave J, Millard J, Pederson JK, Thaarup RK, et al. Mapping Smart Cities in the EU. Brussels: European Parliament, Directorate-General for Internal Policies; 2014.
- [16] Cocchia A. Smart and Digital City: A Systematic Literature Review. In: Dameri RP, Rosenthal-Sabroux C, editors. *Smart City: How to Create Public and Economic Value with High Technology in Urban Space*. New York: Springer; 2014. p. 13-44.
- [17] Alizadeh T. A policy analysis of digital strategies: Brisbane vs. Vancouver. *Int. J. of Knowledge-Based Development*. 2015;6(2):85-103.
- [18] Townsend AM. *Smart cities: big data, civic hackers, and the quest for a new utopia*. New York: W.W. Norton; 2013.
- [19] Yigitcanlar T, Inkinen T, Makkonen T. Does size matter? Knowledge-based development of second-order cityregions in Finland. *disP-The Planning Review*. 2015;51(3):62–77.
- [20] Neirotti P, Marco AD, Cagliano AC, Mangano G, Scorrano F. Current trends in Smart City initiatives: Some stylised facts *Cities*. 2014;38:25-36.
- [21] Kavta K, Yadav PK. Indian Smart Cities and Their Financing: A First Look. In: Seta F, Sen J, Biswas A, Khare A, editors. *From Poverty, Inequality to Smart City Singapore*: Springer; 2017. p. 123-41.
- [22] Watson V. The allure of ‘smart city’ rhetoric: India and Africa. *Dialogues in Human Geography*. 2015;5(1):36-9.
- [23] Sanseverino ER, Sanseverino RR, Vaccaro V, Macaione I, Anello E. Smart Cities: Case Studies. In: Sanseverino IR, Sanseverino RR, Vaccaro V, editors. *Smart Cities Atlas*. London: Springer; 2016. p. 47-140.
- [24] Giffinger R, Fertner C, Kramar H, Kalasek R, Pichler-Milanović N, Meijers E. *Smart cities: Ranking of European medium-sized cities*. Vienna: Centre of Regional Science; 2007.
- [25] Bertot JC, Gorham U, Jaeger PT, Sarin LC, Choi H. Big data, open government and e-government: Issues, policies and recommendations. *Information Polity*. 2014;19(1):5-16.
- [26] Kumar TMV. E-Governance for Smart Cities. In: Kumar TMV, editor. *E-Governance for Smart Cities*. Singapore: Springer Singapore; 2015. p. 1-43.
- [27] Bodhani A. Smart transport. *Engineering & Technology*. 2012;7(6):70-3.
- [28] Debnath AK, Chin HC, Haque MM, Yuen B. A methodological framework for benchmarking smart transport cities *Cities*. 2014;37:47-56.
- [29] Lee SW, Sarp S, Jeon DJ, Kim JH. Smart water grid: the future water management platform. *Desalination and Water Treatment*. 2015;55(2):339-46.
- [30] Al-Ani A. Government as a Platform: Services, Participation and Policies. In: Friedrichsen M, Kamalipour Y, editors. *Digital Transformation in Journalism and News Media*. Berlin, Germany: Springer; 2017. p. 179-96.
- [31] Hollands RG. Critical interventions into the corporate smart city. *Cambridge J. of Regions, Economy and Society*. 2015;8(1):61-77.
- [32] Datta A. India's smart city craze: big, green and doomed from the start? 2014 [cited 2017 Oct 23]. Available from: <https://www.theguardian.com/cities/2014/apr/17/india-smart-city-dholera-flood-farmers-investors>.

- [33] Carvalho L. Smart Cities From Scratch? A Socio-Technical Perspective. *Cambridge J. of Regions, Economy and Society*. 2015;8(1):43-60.
- [34] Datta A. New Urban Utopias of Postcolonial India: Entrepreneurial urbanization in Dholera smart city, Gujarat. *Dialogues in Human Geography*. 2015;5(1):3-22.
- [35] McNeill D. Global firms and smart technologies: IBM and the reduction of cities. *Transactions of the Institute of British Geographers*. 2015;40(4):562-74.
- [36] Alizadeh T, Grubestic T, Helderop E. Urban governance and big corporations in the digital economy: An investigation of socio-spatial implications of Google Fiber in Kansas City. *Telematics and Informatics*. 2017;https://doi.org/10.1016/j.tele.2017.04.007.
- [37] Hollands R. Beyond the corporate smart city: glimps of other possibilities of smartness. In: Marvin S, Luque-Ayala A, McFarlane C, editors. *Smart Urbanism: Utopian Vision Or False Dawn?* London: Routledge; 2015. p. 168-84.
- [38] Söderström O, Paasche T, Klauser F. Smart cities as corporate storytelling. *City: analysis of urban trends, culture, theory, policy, action*. 2014;18(3):307-20.
- [39] McNeill D. IBM and the visual formation of smart cities In: Marvin S, Luque-Ayala A, McFarlane C, editors. *Smart Urbanism: Utopian Vision or False Dawn?* London: Routledge 2016. p. 34-52.
- [40] Harvey D. From Managerialism to Entrepreneurialism: The Transformation in Urban Governance in Late Capitalism. *Geografiska Annaler Series B, Human Geography*. 1989;71(1):3-17.
- [41] Albino V, Berardi U, Dangelico RM. Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*. 2015;22(1):3-21.
- [42] Gabrys J. Programming environments: environmentality and citizen sensing in the smart city. *Environment and Planning D: Society and Space*. 2014;32(1):30-48.
- [43] Kitchin R. The real-time city? Big data and smart urbanism. *GeoJournal*. 2014;79(1):1-14.
- [44] Chatterton P. Towards an agenda for postcarbon cities: lessons from LILAC, the UK's first ecological, affordable, cohousing community. *Int. J. of Urban and Regional Research*. 2013;37(5):1654-74.
- [45] Radywyla N, Biggs C. Reclaiming the commons for urban transformation. *J. of Cleaner Production*. 2013;50:159-70.
- [46] Kostakis V, Bauwens M, Niaros V. Urban Reconfiguration after the Emergence of Peer-to-Peer Infrastructures: Four Future Scenarios with an Impact on Smart Cities. In: Araya D, editor. *Smart Cities as Democratic Ecologies*. New York, NY: Palgrave Macmillan; 2015. p. 116-24.
- [47] Giffinger R, Gurdum H. Smart cities ranking: an effective instrument for the positioning of cities? *ACE: Archit City and Environ*. 2010;4(12):7-25.
- [48] Anttiroiko A-V. U-cities reshaping our future: reflections on ubiquitous infrastructure as an enabler of smart urban development. *Artificial Intelligence and Society*. 2013;28(4):491-507.
- [49] Howe J. The Rise of Crowdsourcing *Wired Magazine*. 2006;14(6):1-5.
- [50] Zhao Y, Zhu Q. Evaluation on crowdsourcing research: Current status and future direction. *Information Systems Frontiers*. 2014;16(3):417-34.
- [51] Estellés-Arolas E, González-Ladrón-De-Guevara F. Towards an integrated crowdsourcing definition. *J. of Information science*. 2012;38(2):189-200.
- [52] Kietzmann JH. *Crowdsourcing: A revised definition and introduction to new research*. Elsevier; 2017.
- [53] Thapa BE, Niehaves B, Seidel C, Plattfaut R. Citizen involvement in public sector innovation: Government and citizen perspectives *Information Polity*. 2015;20(1):3-17.
- [54] Noveck B. *Smart citizens, smarter state: The technologies of expertise and the future of governing*. Cambridge: Harvard University Press; 2015.
- [55] Willems LG, Alizadeh T. Social Media for Public Involvement and Sustainability in International Planning and Development. *Int. J. of E-Planning Research (IJEPR)*. 2015;4(4):1-17.
- [56] Dowson R, Bynghal S. *Getting Results From Crowds: The definitive guide to using crowdsourcing to grow your business*. San Francisco: Advanced Human Technologies Inc; 2011.
- [57] Charalabidis Y, Loukis EN, Androutsopoulou A, Karkaletsis V, Triantafyllou A. Passive crowdsourcing in government using social media. *Transforming Government: People, Process and Policy*. 2014;8(2):283-308.

- [58] Loukis E, Charalabidis Y. Active and passive crowdsourcing in government. *Policy Practice and Digital Science*: Springer; 2015. p. 261-89.
- [59] Charalabidis Y, Triantafillou A, Karkaletsis V, Loukis E. Public Policy Formulation through Non Moderated Crowdsourcing in Social Media. *Int. Conf. on Electronic Participation*; September 3-5; Kristiansand, Norway 2012.
- [60] Loukis E, Charalabidis Y, Androutopoulou A. Promoting open innovation in the public sector through social media monitoring. *Government Information Quarterly*. 2017;34(1):99-109.
- [61] Certomà C, Dyer M, Pocatilu L, Rizzi F. *Citizen Empowerment and Innovation in the Data-Rich City*. Springer; 2017.
- [62] Brabham DC. Using crowdsourcing in government. *IBM Center for the Business of Government*. 2013:1-42.
- [63] See L, Mooney P, Foody G, Bastin L, Comber A, Estima J, et al. Crowdsourcing, Citizen Science or Volunteered Geographic Information? The Current State of Crowdsourced Geographic Information. *Int. J. of Geo Information*. 2016;5(5).
- [64] McLennan B, Whittaker J, Handmer J. The changing landscape of disaster volunteering: opportunities, responses and gaps in Australia. *Natural Hazards* 2016;10.1007/s11069-016-2532-5:1-18.
- [65] Horita FEA, Degrossi LC, Assis LFGd, Zipf A, Albuquerque JPd. The use of Volunteered Geographic Information (VGI) and Crowdsourcing in Disaster Management: a Systematic Literature Review. *AMCIS2013*.
- [66] Poblet M, García-Cuesta E, Casanovas P. Crowdsourcing roles, methods and tools for data-intensive disaster management. *Information Systems Frontiers*. 2017. p. 1-17.
- [67] Liu SB. Crisis Crowdsourcing Framework: Designing Strategic Configurations of Crowdsourcing for the Emergency Management Domain. *Computer Supported Cooperative Work*. 2014;23(4-6):389-443.
- [68] Afzalan N, Sanchez TW, Evans-Cowley J. Creating smarter cities: Considerations for selecting online participatory tools. *Cities*. 2017;67:21-30.
- [69] Panagiotopoulos P, Bowen F, editors. Conceptualising the digital public in government crowdsourcing: Social media and the imagined audience. *Int. Conf. on Electronic Government*; 2015; Cham: Springer.
- [70] Alizadeh T, Sipe N. Vancouver's Digital Strategy: Disruption, new direction, or business as usual? *Int. J. of E-Planning Research (IJEPR)*. 2016;5(4):1-15.
- [71] Brabham D. The four urban governance problem types suitable for crowdsourcing citizen participation. In: Silva CN, editor. *Citizen E-Participation in Urban Governance: Crowdsourcing and Collaborative Creativity*. New York: IGI Global; 2013.
- [72] Harford T. Big data: A big mistake? *Significance*. 2014;11(5):14-9.
- [73] Kleinhans R, Ham MV, Evans-Cowley J. Using Social Media and Mobile Technologies to Foster Engagement and Self-Organization in Participatory Urban Planning and Neighbourhood Governance. *Planning Practice & Research*. 2015;30(3):237-47.
- [74] Schweitzer L. Planning and social media: a case study of public transit and stigma on Twitter. *J. of the American Planning Association*. 2014;80(3):218-38.
- [75] Linders D. From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*. 2012;29(4):446-54.
- [76] Schmidhuber L, Hilgers D. Unleashing Innovation beyond Organizational Boundaries: Exploring Citizensourcing Projects. *Int. J. of Public Administration*. 2017:1-16.
- [77] Castelnovo W. Co-production Makes Cities Smarter: Citizens' Participation in Smart City Initiatives. In: Fugini M, Bracci E, Sicilia M, editors. *Co-production in the Public Sector*. Milan: Springer; 2016. p. 97-117.
- [78] Berst J, Enbysk L, Williams C. *Smart Cities Readiness Guide: The planning manual for building tomorrow's cities today*. Seattle: Smart Cities Council; 2014.
- [79] Norris DF, Reddick CG. Local E-Government in the United States: Transformation or Incremental Change? *Public Administration Review*. 2013;73(1):165-75.
- [80] Pardo T, Nam T, Burke B. E-government interoperability: Interaction of policy, management, and technology dimensions. *Social Science Computer Review*. 2012;30:7-23.

- [81] Arroub A, Zahi B, Sabir E, Sadik M, editors. A literature review on Smart Cities: Paradigms, opportunities and open problems. *Wireless Networks and Mobile Communications (WINCOM)*, 2016 Int. Conf. on; 2016: IEEE.
- [82] Certomà C, Rizzi F. Crowdsourcing Processes for Citizen-Driven Governance. In: Certomà C, Dyer M, Pocatilu L, Rizzi F, editors. *Citizen Empowerment and Innovation in the Data-Rich City*. London: Springer International Publishing; 2017. p. 57-77.
- [83] Pick JB, Sarkar A. *The Global Digital Divides*. London: Springer; 2015.
- [84] Mossberger K. Toward digital citizenship. Addressing inequality in the information age. In: Chadwick A, Chadwick A, Howard PN, editors. *Routledge Handbook of Internet Politics*. New York: Routledge; 2009.
- [85] Hossain M, Kauranen I. Crowdsourcing: a comprehensive literature review. *J. of Global Operations and Strategic Sourcing*. 2015;8(1):2-22.
- [86] Bozzon A, Houtkamp JM, Kresin F, de Sena NHHA, de Weerd M. From Needs to Knowledge. A reference framework for smart citizens initiatives. 2016.
- [87] Fieseler C, Fleck M. The pursuit of empowerment through social media: structural social capital dynamics in CSR-blogging. *J. of Business Ethics*. 2013;118(4):759-75.
- [88] Panagiotopoulos P, Bowen F. Social media for government crowdsourcing: An exploratory study of challenges and opportunities. the 29th Annual BAM Conference 8-10 September Portsmouth, UK2015.
- [89] Panagiotopoulos P, Bowen F. Conceptualising the Digital Public in Government Crowdsourcing: Social Media and the Imagined Audience. Int. Conf. on Electronic Government; 30th August - 2nd September; Thessaloniki, Greece 2015.
- [90] Warf B. Contemporary digital divides in the United States. *Tijdschrift voor Economische en Sociale Geografie*. 2013;104(1):1-17.
- [91] Alizadeh T. The spatial justice implications of telecommunication infrastructure: the socio-economic status of early national broadband network rollout in Australia. *Int. J. of Critical Infrastructures*. 2015;11(3):278-96.
- [92] Grubestic TH. Future Shock: Telecommunications Technology and Infrastructure in Regional Research. In: Jackson R, Shaeffer PV, editors. *Regional Research Frontiers*. New York: Springer; 2017.
- [93] Angelidou M. Smart city policies: A spatial approach. *Cities*. 2014;41(1):S3-S11.
- [94] Schweitzer L. Planning and social media: A case study of public transit and stigma on twitter. *J. of the American Planning Association*. 2014;80(3):218-38.
- [95] Kavada A. Creating the collective: social media, the Occupy Movement and its constitution as a collective actor. *Information, Communication & Society*. 2015;18(8):872-86.
- [96] Swabey P. IBM, Cisco and the Business of Smart Cities 2012 [cited 2016 20 Sept]. Available from: <http://www.information-age.com/channels/comms-and-networking/company-analysis/2087993/ibm-cisco-and-the-business-of-smartcities.Thml>
- [97] Viitanen J, Kingston R. Smart Cities and Green Growth: Outsourcing Democratic and Environmental Resilience to the Global Technology Sector. *Environment and Planning A*. 2014;46:803-19.
- [98] Goodspeed R. Smart cities: Moving beyond urban cybernetics to tackle wicked problems. *Cambridge J. of Regions, Economy and Society*. 2015;8(1):79-92.
- [99] Lombardi P, Giordano S, Farouh H, Yousef W. Modelling the smart city performance. *Innovation: The European J. of Social Science Research*. 2012 25(2).
- [100] Caragliu A, Bo CD, Nijkamp P. Smart Cities in Europe. *J. of Urban Technology*. 2011;18(2):65-82.
- [101] Certoma C, Corsini F, Rizzi F. Crowdsourcing urban sustainability. Data, people and technologies in participatory governance. *Futures*. 2015;74:93-106.