Urban Studies

Latin American smart cities: Between worlding infatuation and crawling provincialising

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Abstract
Smart city initiatives in Latin America aim to harness information and communication technologies to make urban service provision and management more efficient, transparent and user-friendly. Latin American cities have been relatively slow to adopt such initiatives, but there is inter- and intra-urban variety in the region. We offer illustrative vignettes of Rio de Janeiro, Santiago and Medellín, which have experimented with different formats for smart city programme design, implementation and management. While top-down and flashier smart city projects in these cities reflect worlding aspirations on the part of urban elites, mixed and bottom-up approaches serve to provincialise and often informalise the initiatives in manners that destabilise elitism and more equitably distribute costs and benefits. One of the biggest challenges these cities share in developing smarter initiatives is inequality, given that most interventions are located in or benefit higher-income areas and actors. As instruments to provincialise the discourses and practices of smart cityness in the region, we propose that cities adopt the '6-Es smart cities framework' (efficiency, economy, ecology, equity, education and engagement) and mobilise public–private–*people* partnerships within city plans and implementation processes.

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摘要

拉丁美洲的智慧城市倡议旨在利用信息和通信技术，使城市服务的提供和管理更加高效、透明和方便用户。拉丁美洲城市采取此类举措的速度相对较慢，但该区域的城市之间和城市内部存在差异。我们提供里约热内卢、圣地亚哥和麦德林的例证，这些城市在智慧城市方案设计、实施和管理方面尝试了不同的模式。尽管这些城市中那些自上而下、更为光鲜的智慧城市项目反映了城市精英的世界化愿望，但混合和自下而上的方法有助于使这些举措本地化（而且通常能使它们非正式化），从而打破精英主义的固化、更公平地分配成本和收益。这些城市在制定智慧城市举措时面临的最大挑战之一是不平等，因为大多数干预措施都位于或有利于高收入地区和行为者。作为在该地区促进智慧城市话语和实践本地化的工具，我们建议各城市采用"**6-E智慧城市框架**"（**6E**代表效率、经济、生态、公平、教育和参与），并在城市规划和实施过程中动员公私伙伴关系。

关键词

拉丁美洲城市、麦德林、本地化、公私伙伴关系、里约热内卢、圣地亚哥、智慧城市、智慧城市框架、世界化

True smart city (SC) agendas integrate and advance economic, social and environmental goals in tandem. In Latin America, however, cities have been relatively slow to adopt SC initiatives, and existing ones mainly aim to harness information and communication technologies (ICTs) to make urban service provision and management more efficient, transparent and user-friendly. There is inter- and intra-urban variety in the extent and effectiveness of these programmes in the region. Through literature review and a closer illustration of particular initiatives in Rio de Janeiro, Brazil; Santiago, Chile; and Medellín, Colombia, we provide a critical overview of conditions in the region and recommend improvements for the future.

The cities have experimented with different formats of public–private partnerships (PPPs) for SC programme design, implementation and management. While top-down and flashier SC projects in these cities reflect worlding aspirations on the part of urban elites, mixed and bottom-up approaches serve to provincialise and often informalise the initiatives in manners that destabilise elitism and more equitably distribute costs and benefits. Critically, one of the biggest challenges these cities share in developing smarter initiatives is inequality, given that most interventions are located in higher-income areas and/or benefit them and higher-income actors.

Moving forward, we propose that, in addition to the SC's conventionally emphasised pillars of efficiency and economy in Latin America, attention to ecology, equity, education and engagement also become paramount in their planning, implementation and management. This proposed '6-Es smart cities framework' would provide a robust and comprehensive way to attain more sustainable and just cities using smartness emanating from both technology and citizens. We also advocate for attention to the participation of and benefits to people through the mobilisation of public–private–*people* partnerships (PPPPs), as opposed to the traditional PPPs most SC plans and implementation processes use. The 6-Es and PPPP frameworks are offered as instruments to provincialise the discourses and practices

of smart cityness in the region. We illustrate how the adoption of these frameworks could transform the SC approaches of Rio de Janeiro, Santiago and Medellín.

Smart cities in Latin America: An overview

Smart and sustainable cities are traditionally understood as innovative cities that use ICT and other means to improve quality of life and the efficiency of urban operation and services, while ensuring the needs are met of present and future generations concerning economic, social and environmental aspects. Smart cities are meant to be attractive to citizens, entrepreneurs and workers, and to generate safer spaces, better services and innovative environments, creating jobs and reducing inequality. Smart cities can promote virtuous cycles that not only produce economic and social well-being, but also secure the sustainable use of resources in the long run. Smart cities use connectivity, sensors distributed throughout the environment and computerised management systems to solve problems, organise complex urban settings and create innovative responses pertinent to the needs of residents. SC technologies also integrate and analyse large amounts of data captured from multiple sources to prevent, mitigate and foresee crises (Bouskela et al., 2016).

However, definitions and deployment of SC programmes tend to diverge. On the one hand, smart cities are depicted as 'increasingly composed of and monitored by pervasive and ubiquitous computing' (Kitchin, 2014: 1). On the other, they are cities 'whose economy and governance is being driven by innovation, creativity and entrepreneurship, enacted by smart people' (Melgaço and Willis, 2017: 5). The former definition reveals a technocratic and neoliberal paradigm of technology-driven urban change, whereas the latter one of more positive

socio-ecological impacts of technology-supported transformations in urban space. Overcoming this duality, Melgaço and Willis (2017: 6) claim that 'the "smart city" as such should be understood as a socio-technical ensemble … formed by the interrelations of individuals and groups, technology and the space they produce'.

The initial interest in smart cities focused on the benefits that ICT corporations offered contemporary cities (Dodgson and Gann, 2011) for their efficient management, innovation and optimisation (Naphade et al., 2011). 'Smart cities' were the newest trend where corporations could invest, complementing or superseding creative, global, liveable, sustainable, green and resilient city approaches. SC discussions mainly focused on cities 'in which cutting-edge technology ostensibly assimilates diverse streams of data in "real-time" and this informs automated interventions' (Schindler and Marvin, 2018: 1) and the need to apprehend and manage organisational complexity (Pierce et al., 2017). However, scholarly scrutiny regarding smart cities has intensified over the past couple of years. Critiques have emerged by smart sceptics, as Söderström et al. (2014: 317) convey regarding the utopian promise of smart cities as:

> discourse that promotes an informational and technocratic conception of urban management where data and software seem to suffice and where as a consequence, knowledge, interpretation and specific thematic expertise appear as superfluous […], and as promoting a mentality where urban affairs are framed as apolitical.

Other SC critiques address its entrepreneurial dominance (Hollands, 2008), governance (Meijer and Bolivar, 2016; Wiig, 2015), absence of citizen inclusion (Kitchin, 2014), 'Smartmentality' (Vanolo, 2014) and uneven development (Datta, 2015), and the entanglement of neoliberal ideas with technocratic

government (Grossi and Pianezzi, 2017). Main critiques focus on technocratic positivism, or the excessive belief and reliance on technology for solving city problems, and on the pretence of smart cities as being apolitical or politically neutral (Dodgson and Gann, 2011; Grossi and Pianezzi, 2017; Kaika, 2017; Shelton et al., 2015; Wiig, 2015).

Authors have presented alternative frameworks for overcoming SC conceptual pitfalls (McFarlane and Söderström, 2017) and ahistorical contextualisation (Wyly et al., 2018). For Shelton et al. (2015: 22), 'the problem is less with data, per se, and more with the uncritical, ahistorical and aspatial understandings of data often promoted within smart city imaginaries, themselves recycled from earlier attempts to make urban studies and planning "more scientific"'. These frameworks include proposals from organisational theory (Pierce et al., 2017), ecological wisdom (Young and Lieberknecht, 2018), collaboration or urban sharing (Gil-Garcia et al., 2019; Zyoska et al., 2019), open data (Pinheiro, 2017) and living indicators (Kaika, 2017). They have in common the notion that technology should be subservient to particular places and communities (Kitchin, 2014; McFarlane and Söderström, 2017), and emphasise the need to look at both grounded experiences and the materiality of interventions (Schindler and Marvin, 2018; Shelton et al., 2015; Wiig, 2015).

SC studies from the Global South, including from Latin America, have joined the debate, discussing exemplary cases like São Paulo and Medellín (Flórez, 2016; Pierce et al., 2017; Wyly et al., 2018). The improvement of urban management through the technologisation of the city – without the need to involve many actors – has been attractive to cities in Latin America. One of the most popular initiatives is the implementation of e-government to inform citizens of public initiatives (Patiño, 2014). Over the years, it has become apparent that SC interventions require a complex coordination of collaboration, funding and fine-tuning to specific contexts. As the SC case of Buzios, Brazil indicates, there is a need to consciously articulate the various sectors involved in technological interventions (Batista and Fribiuk, 2017). The SC case of Tandil, Argentina exemplifies the importance of national, provincial and municipal governments in the implementation of technological innovation and territorial interventions (Finquelievich et al., 2017). The cases emphasise the various roles played by the local government and the need to include citizens in the articulation of SC initiatives, as an added element to the public, private and academic sectors considered.

Prototyping SC initiatives is common in Latin America (Tironi and Criado, 2015). Most SC projects in Chilean cities are prototypes – experiments of ideas that could potentially be implementable elsewhere, yet are seldom carried out as full city-wide policy or implementation. Latin American scholars question the dichotomy of smart experts equipped with methodologies on the one side and lay users as simple validators of products and services on the other (Tironi, 2016a; Tironi and Criado, 2015). In the region, SC assemblages circulate, moving desires, policies, ventures, technologies, devices, prototypes, data and associations between actors and strategies seldom aligned otherwise (Tironi, 2016b). Scholars also argue that cities need to be more responsive to the needs of informal workers. Chen's (2016) study on the uses of technology by informal workers in Lima demonstrates the creative ways in which informal workers use technology and their wealth of knowledge about the city, which could shape better SC initiatives yet go unrecognised (Chen, 2016). The experiences of Bogotá and Medellín demonstrate SC policies circulating

worldwide, creating performances as a way of making the ideas visible (Duque, 2016; Franco, 2011). Thus, the importance of situated ways of analysing how SC discourses materialise in cities in the Global South.

Urban management in Latin America is under increasing pressure to transform 'traditional cities' into smart cities. However, the SC discourse has reframed 'urban problems into technological problems, to be addressed by technological solutions' (Alvarez León and Rosen, 2019: 1). The first ideas on smart cities came around 2007 from technological companies aiming to sell their products and insert their systems in cities (Patiño, 2014). Mobilised by multinationals, SC initiatives have been criticised for their commercial and competitive character, pushing cities to adopt an SC discourse as a rite of passage to attain worldly recognition for their modernising path. This worlding ambition and discourse is adapted by the city elites in the public, private and sometimes the academic sectors of society with decision-making power to define urban agendas and budgets (Simone, 2001). The aims behind the initiatives in Latin America are efficiency and economy. IBM was the company that best managed to bring the idea of smart cities to Latin America (Harrison et al., 2010). In Brazil, it set up its largest monitoring system in Rio de Janeiro. In Chile, the concept began to be articulated in 2012 by the electricity company Chilectra[1] through the prototyping of the electricity-driven project 'Smartcity Santiago', integrating mobility, solar energy provision, tele-measurement and televigilance, network automatising and LED public lighting.

Boyd Cohen (2012, 2013, 2015), an academic at a Chilean university, developed a 'Smart City Wheel' methodology, ranking the eight smartest cities in Latin America (see Figure 1) in the magazine *Fast Company* in 2013. The index includes 62 indicators under six axes (environment, mobility, government, economy, people and quality of life), referencing the European Smart Cities project indicators (Duque, 2016). The 'Wheel' has had significant policy impact, circulating in policy circles and determining city rankings and thus access to worlding recognition and resources for cities. The ranking helped instil the importance of the SC concept in the public sphere, positioning Santiago de Chile on top, followed by Mexico City, Bogotá, Buenos Aires, Rio de Janeiro, Medellín and Montevideo. The main highlights in most cities involved mobility issues (bus rapid transit (BRT), bicycle and public transit systems) and e-government. The ranking is based on questions suggesting the application of digital technologies – for example, 'how can intelligent systems be incorporated in cities?' – revealing that what is understood as intelligent in the context of smart cities is based on digital technological adoption.

Multinationals in the ICT business (Telefónica, AT&T, IBM, CISCO, Entel, Huawei, Siemens, Entel, among others) are the loudest promoters of the smart concept (Tironi and Sánchez Criado, 2015). Their know-how and devices are increasingly demanded by local governments for managing and optimising urban services and for gathering data on users' behaviours and consumer preferences. In Latin America, citizen participation through technology is utilitarian, using citizens as sensing nodes of information but not as participants in a democratising process (Tironi and Sanchez Criado, 2015), and favouring cybernetic instead of republican citizenship (Zandbergen and Uitermark, 2019). SC's panoptical ideal of homogenisation and optimisation essentialises the multiplicity of urban experiences. Citizen participation through technology rests on technological reductionism and short-termism, whereby
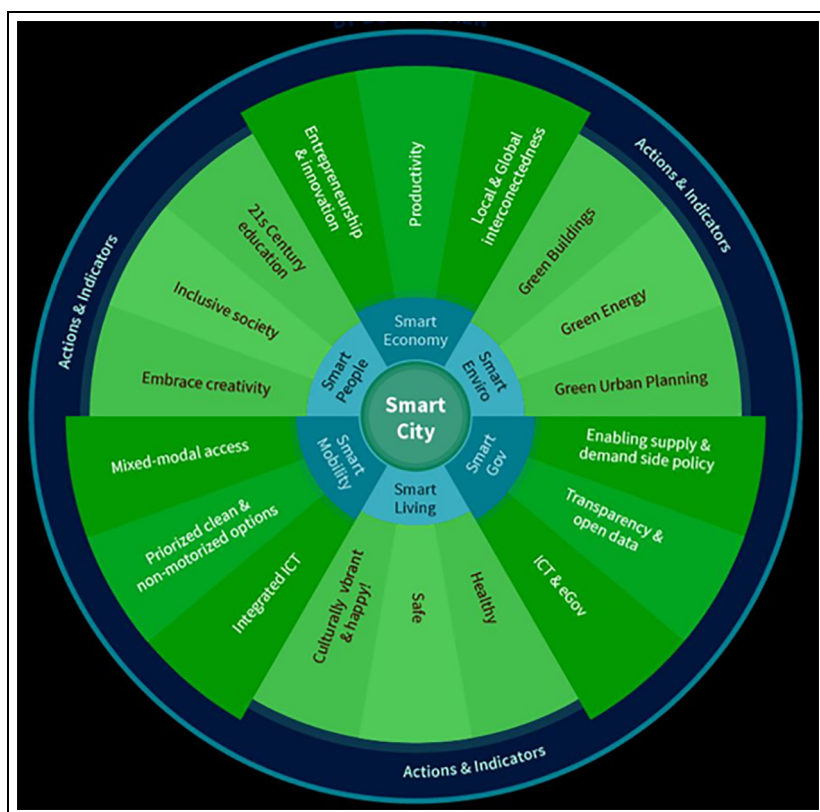
Figure 1. Smart City Wheel.
Source: Cohen (2012).

city problems are expected to be solved through the use of apps, depoliticising citizens.

Between worlding infatuation and crawling provincialising

Manalansan (2015: 571) equates worlding to 'gestures that variously conjure up worlds beyond current conditions of urban living'. Smart city-ing is itself 'a worlding practice, such that models, best practices, expertise and capital circulate in transnational fashion, creating new worlds of planning common sense' (McCann et al., 2013; Roy, 2011a: 6). Through the discourses and practices of smart city-ness, Latin American cities aim to become 'global' (Binnie, 2014; Ong, 2011; Roy and Ong, 2011). Sotoudehnia and Rose-Redwood (2019: 10–11) remind us that '"worldings" are relational—that is, that they take place, in part, through spatial inscription practices that reference one another. These references can be made, unmade and remade by various acts of globality'. As Baker and Ruming (2015: 62) argue in their analysis of 'Global Sydney', the spatial imaginary that informs the SC approaches in Latin America also articulates 'three interrelated elements: global city standards, comparative techniques and extra-local policy models'. Following

Roy (2011a: 6), 'the production of the urban', and in this case of smart citying, 'takes place in the crucible of modernising projects of development, regimes of immigration and governance and experiments with neoliberalism and market rule'.

Cities in Latin America, particularly the ones in this article's vignettes (Rio, Santiago and Medellín) and Barcelona, Spain, have a 'twinning' relationship, a worlding 'practice that creates formal and informal political, economic, social and cultural relationships between cities throughout the world' (Jayne et al., 2011: 25). Barcelona's twinning has expanded in Latin America, impacting emerging SC practices. While the worlding 'Barcelona Model' is 'over-referenced' (Charnock et al., 2019, this issue) in Latin America concerning its technologies of public space production, its 'radical synthesis of spatial, social, and glocal innovation' remains elusive to policy mobility capture (Irazábal, 2019: 126).

SC approaches in Latin America are young and infatuated with worlding trends, provincialising advances at a painfully crawling pace. Academic and policy debates have not yet adequately captured the diversity in city experiences, challenges and responses elicited through emerging SC experimentation. The region needs more situated ethnographic research that 'mobilises assemblage urbanism as a set of methodological sensibilities towards issues of knowledge, materiality, multiplicity and scale-making within situated and contested processes' (Blok, 2014: 269). A vital research aim should be to uncover and foster the provincialising of SC efforts, 'potentially opening up new microarenas for the articulation of more attractive, sustainable and just urban futures' (Blok, 2014: 269).

There are three salient issues concerning the implementation of smart cities as a way of worlding in the region: 1) the definition of smartness; 2) the digital technologising and networking of urban governance, projects and infrastructures; and 3) the policy mobilities of smart cities.

1) The definition of smartness

The type of intelligence inspiring many smart cities in Latin America is that expressed by William Mitchell, MIT's Ex-Media Lab Director. Mitchell (2007) conceives the city as a living organism, whereby smartness is based on ubiquitous integrated intelligence (the brains), an effective combination of different digital telecommunication networks (the nerves), sensors and indicators (sensorial organs) and software (knowledge and cognitive competence). In this approach, private-sector smartness is highly valued, oftentimes invisibilising or disregarding other knowledges.

The implicit assumption is that urban restructuring is imperative to avoid socioeconomic collapse and environmental disaster, given the ongoing growth of population in increasingly complex cities. ICTs are critical tools to contribute to this change, but no SC is possible without smart citizens. Citizen participation is crucial for any just and sustainable city smartness. Citizens sensoring the city – gathering information from the surroundings, highlighting anomalies and mapping them – are useful. Nevertheless, citizens can and should do much more. Collaborative initiatives for the interpretation of data and making decisions over policy, design, management, evaluation and retrofitting of SC initiatives would not only promote participation and civic commitment but also increase the trust of citizens in public institutions.

To be considered smart, a city needs to generate information for decision-making and budget management; optimise resource allocation; improve customer service; improve government efficiency; allow for citizen involvement in the administration

through the use of technology; and produce performance indicators to measure, benchmark and improve public policy. Context matters – conceiving of smart cities without taking into account the historical, urban, social, human, economic, cultural and environmental aspects of urban settlements would miss the purpose of improving the quality of life of people and the sustainability of their urban ecosystems.

2) The digital technologising and networking of urban governance, projects and infrastructures

The support of SC initiatives by international organisations like Santiago-based United Nations' Economic Commission for Latin America and the Caribbean (ECLAC) is based on the technologising of processes, particularly e-government (Naser and Concha, 2014). The initial objective of e-government was to solve citizens' problems through a single, one-stop window, simplifying errands through the Internet via centralised access to data processing in a shared platform for relevant agencies. ICTs play a significant role in e-governance, including in its integration into services comprising energy, health, transportation and communication. For ECLAC (www.cepal.org/en), smart cities increase efficiency and sustainability in both environmental and economic terms.

Another international organisation supporting SC initiatives in Latin America is the Inter-American Development Bank (IADB, www.iadb.org/en), whose Emerging and Sustainable Cities Initiative (ESCI) programme was launched in 2012. This supports medium-sized cities (of 100,000 to 2 million people) in Latin America and the Caribbean, which have economic and demographic growth above their countries' average, to address sustainability challenges. The initiative aims to provide an integrated and comprehensive development strategy expanding

the use of technology to improve the management of cities and the provision of services. The programme, applied in over 70 cities, has revealed insufficient public-sector knowledge on technology use to improve city management. It is too early to assess the transformations the programme has produced and their sustainability in time (Office of Evaluation and Oversight, 2016).

Another example of a knowledge-based initiative is the 100 Resilient Cities (100RC) project, a network to share knowledge and best practices with other member cities, supported by the Rockefeller Foundation. The 100RC Latin American cities are: Buenos Aires and Santa Fe in Argentina; Cali and Medellín in Colombia; Juarez, Mexico City and Colima in Mexico; Montevideo in Uruguay; Panama City in Panama; Porto Alegre, Rio de Janeiro and Salvador in Brazil; Quito in Ecuador; San Juan in Puerto Rico; Santiago de los Caballeros in the Dominican Republic; and Santiago in Chile (www.100resilientcities.org). Both the ESCI and 100RC projects have been recently withdrawn, which reveals the challenge of lack of continuity for some SC initiatives.

Lessons have been learned from experiences in other cities, like Santander in Spain, where the city became dependent on Siemens technology. A similar problem is seen in Chile concerning traffic-light infrastructure. The Traffic Control Operations Unit (UOCT in Spanish) is a citywide unit responsible for coordinating traffic for efficient vehicle flow. However, jurisdiction over the traffic units in Santiago is local, with 34 separate urban districts managing traffic infrastructure platforms. Siemens and Auter are the only local market providers, with null compatibility between their systems, causing difficulty in both coordination and changing systems. Replacing a provider involves replacing the whole system due to incompatibility, with previous investment discarded even if the technology is still useful. Such dependency

becomes more severe as the intervention scale increases. In settlements with inequality and inadequate infrastructure provision, as in many Latin American cities, this challenge becomes even more salient.

3) The policy mobilities of smart cities

Another prominent aspect characterising the implementation of SC initiatives in Latin America is the role played by policy mobilities, that is, the channels, networks and flows through which the urban technological vision travels through discourses and tech repertoires (Angotti and Irazábal, 2017). Through summits, congresses or fairs, in many cases organised or sponsored by international organisations including the World Bank, IADB or United Nations, experts and consulting firms offered cities packages of easily consumed SC rankings, programmes, marketing, courses and policy tourism programmes from cities and projects considered auspicious (Bunnell and Das, 2010; Duque, 2016). International events, courses, rankings, awards and recognitions have contributed to the dissemination and standardisation of smart cities' concepts and packages, attracting the attention of private companies, governments, the media and some academics.

For Bogotá and Medellín (as well as for many other cities), the Smart City Expo World Congress (SCEWC) has been one of the platforms for learning and for projecting themselves as smart cities. The SCEWC is celebrated annually in Barcelona, Spain, and is self-defined as the most important event worldwide for the SC industry, to generate inspiration among all those involved, share experiences and knowledge, and promote innovation, networking and business. SCEWC started in 2011 as an initiative organised by the Barcelona Fair in association with a network of institutions (World Bank, UN Habitat, Barcelona Mairie and

Barcelona Municipality and Metropolitan Area) and technological companies (Cisco, IBM, Microsoft, Engie and Amazon). Coinciding with this congress, ESADE (the Centre for Innovation in Cities) organises the course 'City as a Lab', with most participants from Latin America. The congress and course are part of the supply of events and training related to smart cities in Spain and increasingly in Latin America, making these centres the main SC know-how circulation and transfer channels in Spanish.

SCEWC has also gone global, with Bogotá as the first city in Latin America to organise an international event on smart cities in 2003. The local government promoted the event, placing Bogotá as an international reference in innovative urban development, environmental sustainability and technologies, and as a business hub in the region. Another event is TIKAL (the Latin American Technology, Innovation and Knowledge Forum), organised by the municipality of Málaga and the Spanish Network of Smart Cities. The event is co-sponsored by IBM and defined as an entrepreneurial and institutional collaborative space to present projects related to smart cities and identify collaborative opportunities between Spain and Latin America.

The Interamerican Association of Research Centers and Telecommunication Companies (AHCIET) – more than 50 companies operating in telecommunications in Latin America, including public, private, multinational and local companies – also organises meetings and awards in cities in Latin America. The organisation and a Colombian university produced in 2012 the Guide for Smart Territories and Cities (*Guía de Territorios y Ciudades Inteligentes*) as a tool for the planning of smart cities in developing countries (Universidad Externado de Colombia and AHCIET, 2012).

The channels where discourses and practices circulate create a global SC market that

involves technology and innovation companies as well as cities (Duque, 2016). In Santiago, the number of SC events sometimes amounts to two to three per week. Companies, on the one hand, are interested in selling their services as consultants, along with their technological devices and solutions. Cities, on the other hand, display their entrepreneurial strategies in a worlding process of presenting themselves as competitive and capable of attracting companies, investors, tourists and qualified professionals (the so-called 'creative class' (Florida, 2003)), and sell consultancies, bilateral cooperation and study tours – a type of policy tourism (Duque, 2016).

As seen, smart cities have been incorporated in Latin America in varied ways. The SC concept carries tracking, particularly in Latin American cities aiming to become leaders and not just followers in the worlding of current urban trends. As SC interest and adoption rates are growing, we propose mobilising new conceptual frameworks to guide trends: a 6-Es smart cities framework and public–private–people partnerships.

The 6-Es smart cities framework and public–private–people partnerships

SC initiatives in Latin America emphasise efficiency and economy as their main benchmarks. Programmes and projects that improve the time of data collection and response for operation or service provision, and make both data and services more accessible, user-friendly and cost-effective, receive SC designation. A myopic focus on efficiency and economy obscures integration of other knowledges, besides those produced by high-tech, into urban decision-making and project/programme/policy designs and operations. The dismissal of other smartness leads to unfit SC interventions and unequal distribution of costs and benefits, perpetuating or exacerbating socio-spatial injustices.

In order to avoid those pitfalls, we propose that in addition to the smart city's conventionally emphasised pillars of efficiency and economy – which make sense to preserve as foci of interest concerning SC initiatives – attention to ecology, equity, education and engagement also become paramount in the planning, implementation and management of well-rounded SC initiatives (Figure 2).

- *Ecology* is the relation of living things to biotic and abiotic components of their environment and each other, and the scientific study of these dynamics. The systemic view of urban agents, structures and dynamics from an ecological perspective places human beings and their technologies as part of larger ecosystems with complex and fragile balances. Urban ecosystems should be life-supporting for all people and species involved; thus, economicist valuation methods cannot fully capture their value. Ecosystems (re)produce, regulate, maintain and supply services necessary to humans and other species' health and economies. Reforms and novelties introduced through SC technologies can upset urban ecosystems in positive or negative ways. The SC literature pays increasing attention to this issue. Bhattacharya et al. (2018: 1) developed the Smart Sustainable City Development Index (SSCDI) for three Indian smart cities. A hierarchical method 'with multiple layers of indicators capturing characteristics of the dimensions such as social, economic, environment, culture and lifestyle', the index is particularly useful for developing countries. Others advocate for a transition from smart cities to wise cities based on ecological wisdom (EW), arguing that '[w]here SC's central focus is on deploying new digital technology
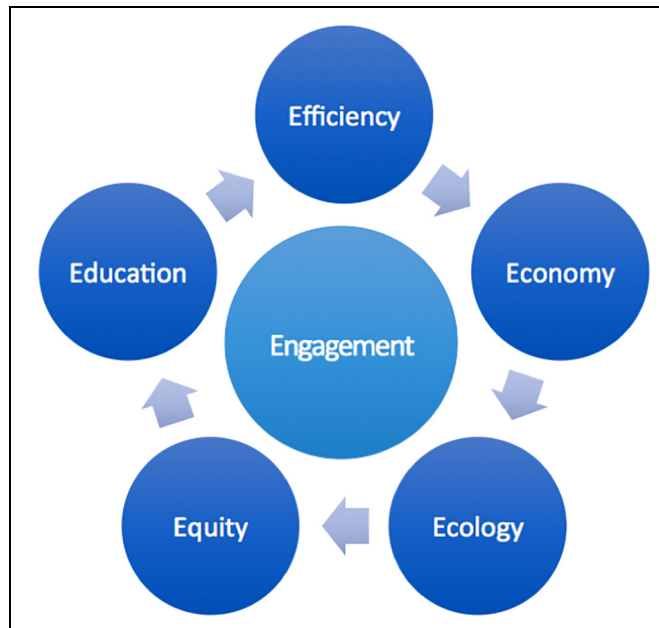
Figure 2. The 6-Es smart cities framework.

networks, EW strengthens contemporary scientific inquiry by drawing upon historically demonstrated precedents and insights emphasising place-based, life-centred systems' (Young and Lieberknecht, 2018: 10). Attention to this dimension prompts the question: do SC novelties or system disturbances enhance the established urban capacities for ecosystem management, resilience and restoration in sustainable and equitable manners?

- *Equity* equates to social and spatial justice according to natural and right law. This translates into freedom from bias or favouritism, which in the urban context manifests as freedom from class and ethno-racial discrimination for humans (other axes of privilege or oppressions susceptible to be impacted by smart cities are age, sex, disability and language proficiency) and anthropocentric

discrimination of other species. In contexts where there is historical debt accrued through accumulated disadvantage of particular social groups or areas of the city, positive discrimination (i.e. affirmative action) may be necessary to redress this. The incorporation of the equity dimension in SC design, monitoring and evaluation is critical because growing SC research suggests that 'the emergent smart city is reproducing actual as well as perceived urban inequities: Wealthy residential neighbourhoods and spaces of the new economy become "smart", but much of the city remains left behind' (Masucci et al., 2019: 1). We should ask: where do SC technologies come from? Who decides about them, controls them, has access to them? How, where and to what effects are they deployed? Who do these technologies control or exercise power over? How are

the costs and benefits of such technologies distributed across social groups and areas in the city?

- *Education* represents the process of learning – the gaining of knowledge, skills, beliefs, habits and values. In order for people to reach maximum participation in and benefit from SC technologies, they need to be integrated into educational experiences and processes that have formative effects on their thinking, feeling and acting. Age- and stage-appropriate formal education from preschool to college and beyond (lifelong, continuous education) is a necessary but insufficient component of the educational strategy that smart cities ought to pursue. A holistic strategy should aim to bring all population groups on board for SC readiness in ways that respond to the 6-Es framework proposed here. Education within other social institutions (i.e. family, neighbourhood or cultural groups, religious and political organisations) also need to advance in sync the values and habits that support good citizenship with the use and development of technology. Besides, SC scholarship urges attention to 'the multiple forms of intelligence made possible by innovations in information processing and to the ways in which particular intelligences are prioritised – as others might be neglected or suppressed – through the production of smart spaces' (Lynch and Del Casino, 2019: 1). This encourages a shift 'from a technology-intensive to a knowledge-intensive smart urbanism' (McFarlane and Söderström, 2017: 1). Are apprenticeships and educational opportunities and settings abundant, even redundant? Do they propitiate an immersive, ubiquitous urban learning environment for the gaining and practising of knowledge, skills, beliefs, habits and values to propel the city towards more justice and sustainability, supported by technology?

- Lastly, *engagement*. The aforementioned '5 Es' (efficiency, economy, ecology, equity and education) would not get far lacking personal and communal engagement. Social engagement refers to one's degree of participation in a community or society to address public concerns and promote the public good and quality of the community. In the context of the 6-Es framework, engagement is the E at the centre of the wheel, around which the other Es revolve. Engagement is the degree of community buy-in for a value-driven, behaviourally supported SC approach to urban governance. Growing research evidence on smart cities shows that 'the vision of data-driven efficiency outlined in the roadmaps is not universally compelling, and that different approaches to the sensing and optimisation of urban flows have potential for empowering or disempowering different actors' (Valdez et al., 2018: 3385). Thus, proper engagement would mean 'foregrounding the knowledges, political priorities and needs of those either actively excluded or included in damaging ways in mainstream smart urban discourses' (McFarlane and Söderström, 2017: 1). How can engagement increase and democratise the use of tech and how can tech increase engagement?

Indicators and metrics can be developed for each of the E criteria. For example, for education, percentages of the total population that know about SC initiatives and their awareness level with regards to knowledge, adoption and critical appreciation/usage of such programmes/projects can be measured, compared against benchmarks and then used to design and implement tailored campaigns. Deciding on and adopting indicators and metrics is a desirable step for cities that aim

to develop systemic, long-lasting and transformational processes towards becoming smarter. However, in this article, we abstain by principle from proposing indicators or metrics for the 6-Es criteria. Instead, following the principles of co-design and co-production, we leave open the opportunity for urban practitioners, politicians and the public to interpret the '6 Es' as design principles to:

> shape urban planning and policy in a way that retains the flexibility to local needs and attention to the human dimension of urban success. In this way, success could be defined through co-production, as local actors explore what liveability [and in this case smart cityness] means to them and how it could be enhanced and monitored (not necessarily [or solely] through quantitative assessments). (McArthur and Robin, 2019: 1724)

An additional concept of increasing relevance for designing, monitoring and evaluating SC initiatives is that of a public–private–people partnership (PPPP or P4). This would be an enhancement over conventional PPPs, which have been exalted as effective and adopted in many areas that used to be public domains, from urban service provision to SC programmes. In many cases, however, the participation of the public sector in PPPs has been insufficient to bring about desired and expected public outcomes, given that public-sector actors have often focused on serving and supporting private interests to the detriment of public interests. Conversely, the private sector's participation in PPPs has generally been insufficient to bring about public and lasting good, given its focus on profit-making. As a result, people and communities have been vulnerable actors in PPP scenarios – and often altogether excluded from them (Irazábal, 2016: 192). Too often, existing PPPs in Latin America created around SC initiatives have segregated sectors of society from the partnerships, such as

collectives of individuals, third-sector actors and informal institutions (residents, NGOs, neighbourhood associations and interest groups) (United Nations Economic Commission for Europe, 2008).

To counter this, 'a model of public, private, and people partnership (PPPP) is proposed, in which both the government and private players work together with communities for social welfare ends' (Irazábal, 2016: 211). Institutionalising the 'P' for 'people' in these endeavours would critically and explicitly examine the distribution of costs and benefits of partnerships (Irazábal, 2016). The PPPP or P4 model is not new. Singapore uses it concerning planning in general and its Smart Nation initiatives more recently (Bunnell and Maringanti, 2010). In India's 100 Smart Cities project recently, many proposals involved 'people' participation (Datta, 2018). Some SC literature focuses on people's creative resistances and agency vis-a-vis SC projects (Jameson et al., 2019), and advocates subverting the 'corporate smart city' though expanding 'capabilities not only to write code, access data, or design a prototype but also to devise diverse sociotechnical arrangements and power relations to disobey, question, and dissent from technocratic visions and practices' (Perng and Sophia Maalsen, 2019: 1). This is mostly not happening in SC projects in Latin America, something that attention to P4 can help remedy.

The 6-Es smart cities and PPPP frameworks would be mutually supportive strategies to construct more just and sustainable cities. The frameworks offer ideal aspirational guides for cities to try to strike a systemic balance in the attainment of equality, efficiency, economy, ecology, education and engagement of public, private and people stakeholders. They would provide a more robust and comprehensive way to attain more sustainable and just cities using smartness emanating from both technology and citizens.

Methodology

This article presents an overview of the state of the art regarding discourses and practices related to the adoption and implementation of smart cities in Latin America. It does so via a literature review about smart cities in general and in the region, and illustrative vignettes of three Latin American cities in which SC discourses and practices are salient.

Used as illustrations, '[a] *vignette* is a verbal sketch – a brief essay or story or any carefully crafted short work of prose. Sometimes called *a slice of life*' (Nordquist, 2018; see also Miles et al., 2014). These vignettes are not fully-fledged case studies, for which more situated ethnography would need to be performed. We constructed the vignettes based on our primary observations in these cities and analysis of journalistic, academic and governmental secondary sources discussing their SC plans and projects.

The 6-Es and P4 frameworks proposed are not meant to be equally present or pursued in each SC initiative that cities engage in. Instead, each programme has a distinct subset of 'Es' and 'Ps' pursued or prioritised. In our analyses, we refer to the specific 'Es' and 'Ps' that are pertinent to each case.

The 'three major issues' explaining SC worlding practices in Latin America come from our literature review and analysis of our illustrative cities, and the 6-Es and P4 frameworks are offered as instruments to provincialise the discourses and practices of smart cityness in the region. They are tied together as the overall analytical framework of the article.

Case studies

Rio de Janeiro, Brazil

Rio de Janeiro strives to be at the forefront of SC innovations in the Latin American region, including top-down, bottom-up and 'fun and function' interventions. To illustrate this, we present three SC initiatives in the city: the IBM-based Rio Operations Centre, the Health Platform (Plataforma Saúde) and the favela Morro da Mineira's football field.

As a prime example of a top-down initiative, the IBM-based Rio Operations Centre, a command and control city centre, allows for multiple city agencies to co-monitor, correlate and manage multidimensional big data about city systems (transit and traffic, water and sanitation, risk management, disaster response and others) at a single site (Figure 3). Technicians from city agencies converge, dressed in a lab uniform, in a space aimed to flatten job hierarchies and favour collaboration. IBM has created similar centres elsewhere for single agencies, such as police organisations, but has not built another citywide system that integrates and processes data from 30 different agencies all under one roof (Singer, 2012). The Rio Operations Centre provides a holistic view of city functions 24/7 (IBM News Room, 2011).

The Centre integrates many functions, including a weather programme that predicts rainfall and potential landslide risks; maps showing emergencies like car accidents, fires and power failures; and improved communication systems with emergency response teams and other government departments. The use of top-down data gathering and management is helping to improve the city's emergency response system and gives citizens access to new information to improve their lives. Rio is an area susceptible to seasonal rainfall that can cause disasters such as landslides. In response, the city has installed sirens in 66 favelas linked wirelessly to the Operations Centre. It has also staged practice drills. In flood conditions or other emergencies, the Centre decides when to set off the sirens. The automated alert system

Figure 3. Part of the Rio Operations Centre.
Source: Author.

notifies officials and emergency personnel when changes occur in the flood and landslide forecast for the city. The alert system reduces the reaction times to emergencies by using mobile communication such as instant messaging, email and text to reach personnel and citizens (IBM News Room, 2011).

As an example of how it works, the Operations Centre was called into action when a 20-story office building suddenly collapsed in Rio in January 2012. The Centre sprang into action by alerting fire and civil defence departments, shutting down gas and electric services in the area, closing subway lines and blocking off streets, dispatching ambulances and alerting hospitals and notifying people via social media (Singer, 2012). This prevented the escalation of the tragedy, reducing the number of fatalities, accelerating the treatment of injured people and keeping people safe around the area of the incident.

In a socio-spatially segregated city like Rio de Janeiro, where rich people generally live in gated buildings and communities and poor people in favelas, the Centre has tackled crime prevention. An example of this is the special police units (3000 officers) deployed to about 20 favelas to assert government control and combat crime (Romero, 2011). Approaches like this are controversial, however. While some forms of crime (e.g. gang- and drug trafficking-related) tend to concentrate in some favelas in the city, the targeting of those communities can exacerbate negative stereotyping of their majority law-abiding residents and invisibilise other types of crime (i.e. white-collar), ultimately perpetuating and intensifying socio-spatial inequities and violence.

In contrast to the top-down approach of the Operations Centre, a salient bottom-up SC intervention in Rio is the initiative Health Platform (Plataforma Saúde), which brings cost-effective health prevention and treatment opportunities to favela residents that lack them. The leading cause of deaths in Brazil is chronic non-communicable diseases (NCDs) – diabetes, heart disease and hypertension. Plataforma Saúde utilises mobile technology to test patients' risks of NCDs. Test results are given to the patient within 20 minutes, contrasting with the seven- to eight-month national average

waiting time in the country (www.plataforma-saude.com.br). This programme offers affordable, preventative health care (each test costs around US$8) delivered to patients in their neighbourhoods. The initiative empowers people through knowledge, self-care autonomy and affordable health care prevention and treatment. The tech entrepreneurs of Plataforma Saúde built relationships with the communities to perfect and tailor their platform and broaden the communities' appropriation and reach. Plataforma Saúde received the Award for the Most Creative Company in the Americas by the IADB, and the Social Innovation Award in TIC Americas (Talent and Innovation Competition) 2015.

Another example regarding SC programmes in Rio de Janeiro is of a different kind and more modest scale – a football field at the favela Morro da Mineira, an impoverished area in Rio de Janeiro. In this case, the UK tech start-up Pavegen partnered with Shell Corporation to create a kinetic football field in the middle of Morro da Mineira. The goal was to inspire the community through sports while supporting a #makethefuture energy campaign (Pavegen, n.d.). The children and youth playing on the 200-tile people-powered football field create energy that is stored in batteries that power the lighting system for the field after sunset. Brazilian football legend Pelé supported the initiative, stating in an interview that he hoped the new field would help spark local children's interest not only in football but also in science (O'Callaghan, 2014). With the project in operation, Shell saw an increase of 500% positive engagement, and the head of Pavegen, Laurence Kemball-Cook, said, 'I believe this technology can be one of the future ways we illuminate our cities' (O'Callaghan, 2014). This is an experimental pilot project with scaling potential. Tiles like the ones used in the football field have been installed in buildings and cities

around the world. A project like this one also reminds us that technology can bring people together, building on the culture of particular communities. It brings together Brazilians' love of football with technology to bring about positive change within the community it serves. It attracts youth to a sport they love to cultivate self-esteem and collaborative skills, while discouraging their participation in gangs and crime. It lights the entrance to the favela and a social gathering place at night, and brings 'eyes on the street', improving safety for residents and deterring crime.

Integrating and balancing the '6 Es' in Rio can come about through adequate public–private–people partnerships. These partnerships would expand the reach, effectiveness and durability of programmes such as the ones discussed here. For instance, the Operations Centre currently functions as a 'black box' for the public, where technocrats manage their own 'piece of the urban puzzle' and coordinate with others in charge of other pieces. This black box could be made more transparent and effective through several interventions, including: 1) instructing community members to become active data collectors and monitors in their communities, that is, citizen-scientists. This can educate and empower people in vulnerable communities and make data collection and analysis more robust and accessible, in turn contributing to risk reduction. 2) Promoting pedagogical tours of the Operations Centre. By inviting students to partake in age-tailored guided tours of the facility, community members can appreciate the 'big picture', that is, how these disparate systems of data collection and management of the city, for which they may have independent experiences (e.g. police forces, firefighters, traffic lights, emergency systems), are interconnected with each other. They can learn about the specific roles that different bureaucrats and technicians play in producing and coordinating the

operations of the city, which in turn may open up career possibilities previously unconsidered. Through these examples or similar approaches, a top-down SC initiative such as the Operations Centre could evolve into a PPPP with multifaceted benefits for the people of Rio.

Plataforma Saúde, initially conceived to operate between a small private company and the people of self-built communities, would benefit from higher funding and institutional support from the local (and even state and national) government. This proposed PPPP approach would enhance the replicability, adaptability and scalability of the programme, expanding its capacity to train, hire and service more people in need. Additionally, the Es for ecology (sustaining lives through health), equity, education and engagement, already robust in the original project, would be further strengthened.

Lastly, the energy-creating football field is an experiment driven by a partnership between large private companies with the blessing of the local government and the favela residents. This project can also be brought to the next level concerning effectiveness, equity and engagement, with expanded partnerships with the government and the community. With the provision of modest coaching and funding (supported by the public, private, not-for-profit or all sectors), programming for the use of the field can be expanded to include not only football, but also multiple sports and other individual and team-building activities, such as arts and crafts, music and dance, which have proven effective for youth engagement in Rio. By operating the amenity in this multifunctional and full-scheduled fashion, more youth can be serviced in multiple ways, having options to select more diverse activities, crowding out the attraction of gangs and crime, and opening up more productive, fulfilling and law-abiding futures. More activity on the field would translate into more energy created, expanding the reach of public lighting in the favela, making it safer and friendlier for residents and visitors alike.

Santiago de Chile, Chile

SC projects in Chile concentrate in Santiago, the country's capital. Santiago ranks at the top of the Latin American list of smart cities according to the Cities in Motion Index (Berrone et al., 2019). Only three Latin American cities ranked within the first 100: Santiago (66), Buenos Aires (77) and Montevideo (92). Santiago stands out within the top 30 cities worldwide in the dimensions of urban planning and environment (Berrone et al., 2019), which is paradoxical considering that urban planning is absent in the debate regarding the future of Chilean cities (López et al., 2013). Within the SC narrative, urban planning is conflated with the visibilisation of fragmented urban project interventions (Rodriguez and Winchester, 2001).

SC initiatives in Santiago are minor in scope, impact, investment and visibility (Jirón et al., 2020). SC is implemented through a narrative of possibilities that smartness can provide to the city in terms of commercial prospects, innovation and citizen participation. Thematically, initiatives are related to mobility, risk and disaster prevention, waste disposal, recycling and reuse and security/safety issues. Recently, smartness has been related to promoting CO_2 reduction, electro-mobility, as well as cargo transport initiatives to improve logistic management in downtown Santiago. Promoting the creation of start-ups linked to smart applications supports entrepreneurship. SC interventions involve installing the city, notably higher-income areas where infrastructures concentrate, as well as installing security cameras and smart lighting systems. Thus, the 6-Es framework would make a significant contribution to conceiving of more

comprehensive interventions, overcoming the SC approach related to disjointed urban interventions.

There have been two major public smart cities initiatives in Santiago over the past few years: the Smart Cities Unit and SE Santiago (the Smart Cities Strategy for Santiago). The Smart Cities Unit, within the Ministry of Transportation and Telecommunications (UCI-MTT in Spanish), formed in 2011. Initially set up as a smart transportation systems unit, it has broadened its scope from one based on sensorisation to promoting new technologies in transportation, moving from measuring and registering information to a broader role of information coordination (Balance de Gestión Integral, 2015, 2016). The Unit's approach has mutated as the SC concept has evolved, from understanding technology as a means to smarter management of transportation, to network management. Over the years, UCI-MTT has implemented internal management within the MTT, as well as communication with other dependencies within government and the private sector. A significant part of this initiative involves participating in SC events taking place in Chile and abroad.

Although the Unit does not materialise interventions, it supports various projects and processes in the country, given its national scope. The initiatives are varied, including studies on mobility inequality, creation of an urban logistic observatory, analysis of SC city ecosystems, collaboration with Waze, transportation hackathons, intelligent bus-stop design, intelligent lighting systems, a pilot walkability application project, a shared-streets initiative and public transportation planning systems in various cities. Most of these initiatives are developed with multiple actors, including private companies, public agencies, NGOs, urban and tech labs and universities.

SE Santiago operates similarly to UCI in terms of network management; however, its service scope is broader, including mobility, waste disposal and security and safety issues (Figure 4). Because it is based in Corfo (Corporación de Fomento, part of the Ministry of Economics) in alliance with the Intendancy of Santiago (a regional administrative agency that implements the projects of national ministries in the Metropolitan Area of Santiago), it operates with an autonomous budget and directly participates in some interventions. Also, as a city-based agency working with the Intendancy, its projects tend to be low-budget yet visible initiatives aiming to impact public opinion. SE Santiago has supported various projects over the years, including bike parks, bike-sharing systems, cycling paths and a course on city technology design and innovation. SE Santiago projects are selected for their scalability and replicability, as they need to show business potential.

Both UCI-MTT and SE Santiago participate in SC events throughout the year that take place in Santiago – including DO!, Smart City Summit and the América Digital Congress – and internationally – MIT Global Startup Workshop in Boston, CAF Conference on Cities in Lima and the Future and Smart City World Congress in Barcelona. The 2020 Smart City World Congress was going to be held in Santiago before the coronavirus pandemic hit.

Many Chilean municipalities are attempting to implement other minor SC initiatives, including security measures, such as cameras, alarms and automatic city lighting; mobility initiatives, including car-sharing and bike systems; and rubbish collection or recycling initiatives. These interventions have limited impact on the districts or cities in which they are implemented. Since 18 October 2019, Chile has experienced ongoing social uprising related to inequalities in the
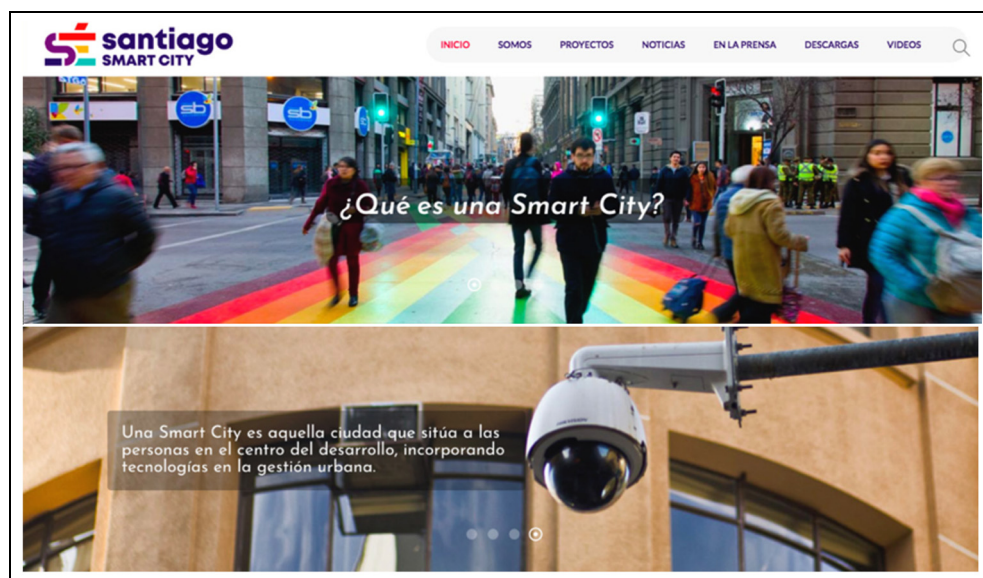
Figure 4. SE Santiago smart city programme, Chile.
Source: SE Santiago, http://www.sesantiago.cl (accessed 10 October 2019). On its website, the programme asks 'What is a smart city?', and states that 'A smart city locates people at the centre of development, incorporating technology in urban management'.

living conditions of its citizens. This generates problematisation of the ways that urban policies and interventions are decided and managed. SC initiatives are no exception, prompting a revision of the ways that the initiatives presented above have been defined and operated.

Santiago smart initiatives show concern for efficiency, economy and ecology, being environmentally aware due to the high levels of air pollution in the city. There is a need for greater institutionality and complexity of urban planning at the district, city and country levels. SC initiatives could benefit from better understanding of their replicability, scalability and impacts. Enhancing replicability and scalability involves a process of education about the cost–benefit analyses of the initiatives and the diffusion of SC initiatives through network linkages, since projects' success depends on the strength of their networks. An educational approach also

involves greater recognition and integration of the various knowledges necessary to transform current initiatives into smart ones. One significant discussion today is how to incorporate citizens' ideas and knowledge of the territories where interventions will operate in decision-making about the SC initiatives. The use of the 6-Es smart cities framework can guide progress in redressing inequalities present in the country and recognising the various types of intelligence present in the processes of city-making.

Engagement of more and diverse actors in the SC process is also paramount in the various initiatives. Carpooling involves understanding the impacts that applications like Uber, for instance, have in cities like Santiago concerning increased and conflictive competition along with expanded transportation choice. In the case of waste disposal, engaging local and visiting populations in downtown Santiago involves more

than the strategic location of rubbish bins. The success of these initiatives requires both ongoing educational programmes as well as engagement from the actors present at various hours of the day, weekdays and weekends, in order to both raise the levels of civic awareness and ameliorate traffic and littering in the capital. Efficiency and economy are not enough for smartness in Santiago's initiatives, and a more purposeful effort on the other four Es could enhance their implementation and interconnectedness.

Factors relating to Santiago's socio-spatial inequalities are at the core of what SC interventions in the city should be looking at, given that most interventions are located in higher-income areas. Experts working on both national and citywide initiatives understand that technology usage per se should not be the main objective in smart cities; yet incorporating the multiple knowledges present in the city is still a distant aspiration. Thus, equity, education and engagement are at the core of what SC interventions in the city should be emphasising, as harnessing residents' intelligence and citizen involvement in SC decision-making using collaborative initiatives remains challenging.

Another challenge, not only in Chile but also in several other countries trying to implement SC approaches, is the strengthening of urban planning and governance; for instance, focusing more on public transportation, urban accessibility and multi-modal plans and not just in isolated technological fixes such as electro-mobility for better mobility and reduction of emissions. Issues like the appropriate rate of private vehicle ownership per population or the strengthening of public transportation systems remain unaddressed in the SC approach. Equity, education and engagement can help to address these planning and governance challenges.

Medellín, Colombia

In the last decade, Medellín, Colombia endeavoured to become one of the smarter cities in the region. The *Wall Street Journal* and Citi Group named it 'Innovative City of the Year' in 2013 (Moreno, 2013). In Medellín, most interventions relate to citizens' access to technology; the promotion of e-government; and spaces for urban co-creation in environmental innovation and security issues. For example, the integrated transportation system allows people to access other urban services with the use of their transit card. Also, the city consolidated an innovation cluster around Ruta N, a centrally located building where a PPP supports research innovation for sustainability and entrepreneurship (Figure 5). Some regional networking is also happening, particularly through the *Grupo de los 8* or G8, which brings together representatives of eight universities in the metropolitan area committed to building synergies of research, innovation and entrepreneurship.

Ruta N leads many SC initiatives and programmes, aiming to 'facilitate the economic development of the city towards intensive businesses in science, technology, and innovation, in an inclusive and sustainable way' (Ruta N, n.d.). Ruta N group's vision is to make Medellín one of the leading smart cities in Latin America, emphasising four foci: talent training, capital access, infrastructure generation and development of innovative businesses (Ruta N, n.d.).

Ruta N Corporation leads a platform called Mi Medellín, which takes a citizens-first approach, with membership open to all residents of the city. It is a citizen co-creation platform where the ideas of participating citizens are part of the transformation of Medellín (Ruta N, n.d.). The co-creators of Mi Medellín can bring up issues they feel need to be addressed. Those issues are discussed, voted on and shared by the co-creators with the city's government and

Figure 5. Business and innovation centre Ruta N in Medellín.
Source: https://www.rutanmedel.

other citizens. The projects that receive the most votes are passed to the city government, which may choose to address them. Thus, Mi Medellín is a platform that involves citizens, corporations and government working together to tackle issues facing their community via the exchange of ideas and possible solutions. It gives a voice to those traditionally not heard in the corporate- or government-run circles. Mi Medellín has tackled issues such as citizen–government relations, community carpooling and homelessness. However, a challenge with this tech-based participatory programme, as with others like it, is breaching the digital gap. Even though participation is theoretically open to all, it mostly comes from young people and from people with relative high-tech literacy and access to electronic devices and the Internet (Distrito Medellín, 2017).

Medellín has also implemented a participatory budgeting system promoted through platforms such as Mi Medellín. Citizens define priorities for a portion of the public budget, and public funding is allocated accordingly (Schmidt, 2011). Aside from basic infrastructure, participatory budgeting has supported diversity and inclusion in the city. Son Batá, a cultural programme promoting Chocano music and dance founded by young Afro-Colombian migrants from the Chocó region of the country, is one of the social programmes that has benefited from participatory budgeting (Kimmelman, 2012). With its headquarters situated in an impoverished area of Medellín, hundreds of low-income and Afro-Colombian children find an escape through free music classes, and musicians get help finding performing jobs (Schmidt, 2011). Residents of the area in which Son Batá is located digitally voted to direct a share of government financing to new schools, clinics and college scholarships, resulting in Son Batá's ability to hire music teachers, buy instruments and equip a recording studio (Kimmelman, 2012).

Medellín Ciudad Inteligente is another initiative that uses digital technology to empower public participation. Through it, the city government set goals to make Wi-Fi available in the perimeter of 33 public parks and citywide open spaces, to open intelligent classrooms in more than 200 public schools

and to provide computers for schools and libraries and new libraries and community centres for residents, ensuring that many people can use digital technologies. The initiative includes the digital literacy training of 10,000 people per year from the city's most deprived areas, including courses on Internet safety as well as the use of mobile devices and online services (IEEE, n.d.).

The city planned the Medellínnovation District – a district to facilitate an ongoing process of social, urban and economic innovation (Morisson and Bevilacqua, 2019). It seeks to convert the area into an ecosystem that concentrates citizens, entrepreneurs, companies and institutions around a knowledge economy, co-participating in projects to promote innovation (Distrito Medellín, n.d.). The goal is to turn Medellín into the capital of innovation in Latin America by the year 2021 (IEEE, n.d.). According to Ruta N, the conceptual architects of the District, one of its objectives is promoting 'the processes of broad and democratic citizen participation' (Distrito Medellín, n.d.). Ruta N seeks to collaborate with institutions and inhabitants of the District to achieve collective construction and training processes, including generating science, technology and inter-institutional health and welfare initiatives for children, young people and adults (Distrito Medellín, n.d.).This is possible using the citizen-first approach to highlight the issues that people prioritise, instead of having corporations and governments design and manage everything.

Barcelona and Medellín have, for a long time, had a sister-city relationship of development collaboration and cooperation, recently including SC-related exchanges. In 2014, Medellín was the special guest to the Smart City Expo World Congress (SCEWC) in Barcelona in order to present its SC initiatives. This invitation was formalised in the 7th World Urban Forum in Medellín, in April 2014, when Barcelona Activa and Ruta N Medellín signed an alliance to generate business based on the knowledge and synergies of the institutions, companies and research centres of both cities.

Sustainable and equitable urban planning should be the cornerstone of SC plans. Beyond the digital realm, Medellín's focus on community development and sustainability has created programmes and spaces for people to enjoy, enhancing their access to public spaces and services and, with that, their right to the city. Medellín's recent investments in Social Urbanism and Civic Pedagogical Urbanism (Sotomayor, 2017) should also be considered SC developments, whereby the city invests in some of the poorest neighbourhoods through integral barrio rehabilitation programmes bringing and retrofitting infrastructure, housing and amenities such as schools, libraries, community centres, health clinics, parks and supportive social programmes. Effective planning and management of transportation infrastructure is crucial to SC plans. In Medellín, efforts to complete the transit network and increase multimodality (combining metro, buses, streetcars, cable cars, bicycle lanes and pedestrian-friendly streets) have expanded both physical and socio-economic accessibility and mobility for many that previously confronted mobility challenges (Angueloski et al., 2018). This multimodal system expands its digital management and information base, making it smarter and more accessible.

Building on the social-mindedness and accomplishments of its social urbanism trajectory, Medellín would expand its smartness by focusing attention on the '6 Es' for systemic and well-balanced design, implementation, monitoring, evaluation and retrofitting of all its programmes, projects and plans, both for those labelled smart city and for others. The city has demonstrated its ability to deliver rapid and cost-effective urban interventions (achievements in the

areas of efficiency and economy), and while many city managers and planners have tried to be purposeful in the areas of ecology and equity, and to accompany all interventions with explicit programmes to foster the education and engagement of city residents, much remains to be done in these areas. Recent urban planning literature on the 'most innovative city' (Medellín's award organised by the Urban Land Institute) offers constructive criticism of both its purported accomplishments and its city marketing discourses (Angueloski et al., 2018; Franz, 2017; Sotomayor, 2017).

Medellín has also been among the most innovative and efficient cities in Latin America with regards to PPPs for urban management. However, its PPPs' biased emphases on economic goals have sometimes trumped ecological, equity and engagement marks, which have moved some analysts to debunk the notion of the city's 'miraculous' development (Franz, 2017). Hence, we also recommend a restructuring of working PPPs as PPPPs to more meaningfully integrate a *people*'s perspective, particularly lower-income and historically disenfranchised communities, such as Afro-Colombians, people involuntarily displaced due to armed conflict and demobilised guerrilla members reintegrated into society – the most alienated groups vis-a-vis high tech-based SC notions.

Along those lines, Ruta N should expand opportunities for collaboration across disciplines and sectors of society. The G8 is a promising platform to expand collaboration, innovation and multi-disciplinarity, as long as it includes work with communities in need. Likewise, expanding public instruction and innovation in science, technology, engineering, arts and mathematics (STEAM), and funding opportunities at all levels of schooling, can nurture the newer generations in the needed fields of development innovation while breaching the class, race, ethnicity and sex gaps that hinder marginalised people's and women's access to STEAM fields. Lastly, coaching and micro-loans for small- and medium-scaled entrepreneurs, and more co-working, flexible, multi-use and affordable space, can help jumpstart and stabilise new and non-traditional members of the entrepreneurial, creative and sharing economies in the city.

Conclusion: Towards smarter Latin American cities

From the literature review and vignettes presented, central to the provincialisation of smart cities in Latin America is the expansion of smartness inclusivity. It is insufficient to focus only on information gathering, tracking and processing, or technology implementation. Although these elements help shape efficient and competitive cities, smartness inclusivity is crucial in unequal cities like those in Latin America. Multiple, local and situated knowledges are indispensable for constructing smart cities in terms of efficiency, economy and ecology, but also in terms of equity, education and engagement, as part of democratic and contextual interventions.

We also need to examine SC partnerships in Latin America to assess how public, private and community ('people') agents interact and affect each other, and whether the trade-offs between them shape or hinder equitable and productive partnerships. SC initiatives are becoming ever more popular in cities in the region, and those currently implemented are functioning with conventional PPPs that favour economic and efficiency goals, oftentimes in detriment of ecological, equity, educational or engagement goals.

To counter this, we propose a framework of '6-Es' to design, implement, manage, monitor, evaluate and retrofit SC projects, programmes and plans in combination with public, private and people partnerships, in

which both the government and private stakeholders work together with communities for social welfare ends, particularly for those in need and left behind by the digital gap (Irazábal, 2016). Institutionalising the 4th 'P' for 'people' in these endeavours would help examine and balance the distribution of costs and benefits of partnerships. In complement, the 6-Es smart cities framework would provide a more robust and comprehensive way to attain more sustainable and just cities using smartness emanating from both technology and citizens. The 6-Es smart cities and PPPP frameworks are mutually supportive, synergistic SC strategies. They would help cities in Latin America to reassess their emphasis on worlding ambitions for notoriety in the global SC marketplace in favour of provincialising smartness, thus situating it where the most pressing urban challenges and creative opportunities for innovation lie.

We hope that Latin American cities further their processes of provincialising their worlding SC developmental trends, 'to challenge urban theories that treat "northern" urbanisation as the norm, to incorporate the expertise and perspectives of urban majorities, and to imagine and enact alternative urban futures' (Sheppard et al., 2013: 893). Both the 6-Es and the PPPP frameworks are critical in the context of Latin America where worlding aspirations, technological determinism and inequality still prevail regarding city smartness. The frameworks are also generalisable in the sense that they offer ideal aspirational guides for cities trying to strike a systemic balance in the attainment of equality, efficiency, economy, ecology, education and the engagement of public, private and people stakeholders.

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Note

1. Renamed ENEL and part of the Spanish-based multinational ENDESA.

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