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Smart City Strategies – A Driver for the Localization of the Sustainable Development

Goals?

Abstract:

To achieve the United Nations Sustainable Development Goals (UN SDGs), urgent action is needed across all scales, with an increased importance being placed on local initiatives. In this context, the notion of localizing the SDGs is highlighted as essential. Simultaneously, the smart city concept is promoted to address local sustainability challenges, and smart city strategies are used to support urban sustainability transitions. Despite the extensive literature on smart city transitions, no work was found that studies how such strategies may concretely support the localization of the SDGs. In response, we analyze 57 smart city strategies across 29 countries using the SDG framework to pinpoint which SDGs and accompanying Targets are localized through smart city initiatives. The results indicate that strategies strongly support the localization of four Goals (SDGs 7, 8, 9, and 11) along with several individual Targets. While the SDGs treated by the strategies depend on the local context, smart city strategy documents promote sustainable development initiatives across a spectrum of themes. However, for cities that use smart city strategies to encourage a fundamental shift toward a more sustainable urban model, careful attention must be paid to include initiatives on often untreated topics (SDGs 2, 5, and 15).

Key words: Smart Cities, Sustainable Development Goals, Localization, Urban Transitions, Strategies

1. Introduction

Urban environments are hubs of innovation and drivers of economic development, with cities producing over 80% of Gross Domestic Product (GDP) while only housing around 55% of the global population (World Bank, 2020). This, however, comes at a social and an environmental cost. Among other challenges, growing inequalities are a widespread feature for cities, which became more apparent during the Covid-19 pandemic (UNEP & UN-Habitat, 2021). Moreover, cities produce around 75% of carbon-dioxide emissions and consume 60-80% of the energy and 75% of the natural resources around the world (IRP, 2013; Wendling et al., 2018). These social and environmental issues are tightly related, and therefore it is necessary to work simultaneously on them to find solutions (UNEP & UN-Habitat, 2021).

For this reason, cities have been cited as places where the “opportunities and threats to sustainable development come together” (EC, 2014: 1) and are seen as a key part of achieving the Sustainable Development Goals (SDGs) (Corbett & Mellouli, 2017; Giles-Corti et al., 2020; Oosterhof, 2018). Released in 2015 by the United Nations (UN), the SDGs aim to engage governments, businesses, and civil society in setting the world on a sustainable pathway (UN, 2015). The SDG framework is composed of 17 individual Goals, each with a set of associated Targets and corresponding indicators to measure progress. The Goals cover a variety of ambitions, notably to eliminate both poverty in all its forms and inequalities of various types, while simultaneously addressing climate change, natural resources, and biodiversity. The SDG framework also aims to support peace and justice across and between countries (Feeny, 2020), and is increasingly used by non-state actors, such as private businesses, to guide sustainable actions (Yamane & Kaneko, 2022).

To achieve the SDGs, action is required across scales (Szetey et al., 2021). Emerging research highlights the importance of localizing the SDGs, or the process of adapting strategies and monitoring and evaluation tools to sub-national territories to promote ‘bottom-up’ advancement of the SDGs (ElMassah & Mohieldin, 2020; Szetey et al., 2021). Local knowledge has moreover been identified as essential for the implementation of the SDGs (Laumann et al., 2022).

In this context, we increasingly see in the literature that smart cities are being related to sustainability. The literature suggests that smart cities may be drivers of sustainable change at the local level (Manjon & Crutzen, 2021; Talari et al., 2017) and that digital transformations increase the likelihood of localizing the SDGs (ElMassah & Mohieldin, 2020). In fact, the notion of sustainable smart cities (SSC) has recently been suggested by both academics and policymakers to address sustainability challenges (Mora et al., 2021). A SSC is defined as an “innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental, as well as cultural aspects” (ITU, 2016: 2). There is still, however, a debate over whether smart cities can drive long-term sustainability (Mora et al., 2023).

Local government strategies for developing smart cities have been highlighted as a factor that supports such initiatives, since strategies define a commonly shared vision and promote the concept as a legitimate one (Brorström, 2017). Despite this interest across both the academic and policy sectors, no research was found about how smart city strategies effectively address

SDGs at the local level. This paper aims to address this gap by asking: How do current smart city strategies contribute to the localization of the SDGs? To respond, we conduct an in-depth content analysis of 57 smart city strategies to study how they are contributing to SDG localization. In addition to providing insight to our research question, we use our findings to suggest policy recommendations that may support the localization of SDGs that are currently under-treated by city strategies, and moreover make the link between smart city strategies and the SSC transition.

The rest of the paper is organized in the following way. The second section provides an overview of the literature on SDG localization and the role that smart city strategies may play in advancing such an objective. The third section describes the methodology for the analysis used in this paper. The fourth section provides the results. The fifth section discusses the implications of our findings, and the sixth section concludes.

2. Literature review

2.1. Sustainability in the smart city

Sustainable cities have been defined as urban areas whose needs fall within the capacity of its hinterlands (Kennedy et al. 2007). This has been refined through consideration of a global perspective, which considers a consumption-based approach to account for negative impacts of city life that go beyond the borders of urban boundaries (Höjer & Wangel, 2014). As a result, urban sustainable development aims to simultaneously develop urban areas and protect the environment, while paying attention to income equality, physical and social infrastructure, and the economy (Hiremath et al., 2013). The smart city has been suggested as a way to develop sustainable cities through improved efficiency and better optimization of

processes in the urban system (Batty et al., 2012; Bibri & Krogstie, 2017). However, while similarities exist between the smart city and the sustainable city, these are two distinct areas of study (Ahvenniemi et al., 2017).

Moreover, the definition of a smart city is not agreed-upon (Drapalova & Wegrich, 2020). While the concept has been historically tightly tied to technology use, the smart city literature indicates the concept is shifting from a technology-led focus to a holistic one (Meijer & Bolívar, 2016; Mora, Deakin, Reid, et al., 2019; Sharifi, 2019). In parallel, sustainable smart cities are emerging as a response to the ambiguity and criticisms around smart cities (Ahvenniemi et al., 2017; Bibri & Krogstie, 2017; Huovila et al., 2019). SSCs aim to embody concern for the environment, increased urbanization, and advances in the use of technology to solve problems (Höjer & Wangel, 2014). There is still, however, an active debate in the literature about the ability of the smart city concept to promote sustainability in a concrete way (Yigitcanlar, 2018), and that local governments often do not yet manage to create enduring sustainability improvements in their territory (Mora et al., 2023). We therefore do not know to what extent SSCs exist in practice.

2.2. Localizing the SDGs and the potential for smart city strategies

While the SDGs were signed by national leaders, they recognize the urgency to act across all scales (UN, 2015). To this effect, certain Goals or Targets focus explicitly on the local level, such as SDG 11 on 'Sustainable Cities and Communities' or Target 15.9 that aims to embed biodiversity values into local planning and strategies. However, in addition to these specific mentions of local action, the implementation of the overall SDG framework is increasingly being promoted at the sub-national level.

In this context, the notion of 'localizing' the SDGs is underscored as relevant. While this concept has its roots in the 1992 Local Agenda 21 (Macdonald et al., 2019), it has been gaining attention in both academic dialogues (for instance, see Biggeri (2021) that overviews a special issue on the subject) and in policy (for example, see UCLG, 2020). Localization is a flexible process that involves downscaling the SDGs to the local level for the purposes of developing context appropriate pathways toward sustainability. This entails that, depending on local conditions, communities may only focus on a sub-set of the 17 Goals and 169 associated Targets (Szetey et al., 2021) and that SDG localization will occur differently for different areas (Valencia et al., 2019).

While localization is seen as essential to achieving progress at the global level (Corbett & Mellouli, 2017; Jones & Comfort, 2020), several barriers are highlighted throughout the literature. The first barrier noted is financing. It is seen as a necessary aspect of localization (Oosterhof, 2018), but remains a challenge for local areas to raise the needed resources (Jönsson & Bexell, 2021).

Another barrier to implementation is raising awareness (Jönsson & Bexell, 2021). In one study in England that focused on local level implementation of the SDGs, many stakeholders had never heard of the SDG initiative at all, while others were only vaguely aware of it (Perry et al., 2021). In another study involving youth participation for achieving sustainability, 86% of the local participants were not aware of the SDGs and no one signaled that they were 'extremely aware' (Bonsu et al., 2020).

Data availability and related monitoring challenges were also mentioned throughout the literature as a barrier. Specifically, it was noted that there is often an insufficient capacity to collect data (Fox & Macleod, 2021). The resulting poor data availability makes it difficult to assess progress on SDG localization (Klopp & Petretta, 2017). In response, there is a wealth of literature on the subject of developing appropriate indicators at the local level and building capacity to track them (Giles-Corti et al., 2020; Grossi & Trunova, 2021; Klopp & Petretta, 2017; Wendling et al., 2018).

To help overcome the above noted barriers, city planning is recognized as essential for reaching the SDGs (Giles-Corti et al., 2020). To facilitate this, the literature acknowledges the need to reconcile the localization process with other city-level plans and strategies (Klopp & Petretta, 2017). This indicates that the process may be facilitated by bridging the smart city concept with existing initiatives (Grossi & Trunova, 2021) and that local governments can promote localization by coordinating their current plans with the SDGs (Oosterhof, 2018). In the same line, localization requires time and resources, and previous literature suggests that pairing SDGs within strategies is an efficient approach (Perry et al., 2021).

In addition to the value of strategies to guide smart city development, several studies have highlighted the beneficial nexus between digitalization and sustainability (Gouvea et al., 2018; Sachs et al., 2019). Potential synergies are further emphasized at the local level (Balogun et al., 2020; Del Río Castro et al., 2021). In this context digitalization is understood to support the achievement of localizing the SDGs through initiatives like e-government and big data for evidence-based policy making (ElMassah & Mohieldin, 2020), to provide some examples.

At the same time, several critics claim that the linkage between digital technologies and sustainability is far from assured (Bibri & Krogstie, 2017; Lange et al., 2020). Moreover, the implementation of global objectives like the SDGs at the local level remains poorly understood (Croese et al., 2020). It is for this reason that we hypothesize that local strategy documents that specifically aim to address the vision behind digital technology use at the local level, or smart city strategies, could support the localization process, yet no literature was found that evaluates this.

2.3. Strategies for the Implementation of Smart Cities

There exists a rich literature on the importance of strategies for smart city development, with several articles and reviews having covered the literature on smart city strategies in depth (for examples, see Mora et al. (2019) or Schiavone et al. (2020)). This literature both speaks to a broader definition of ‘strategy,’ which considers an assembly of actions, projects, and initiatives that, taken together, shape the advancement of a smart city, as well as the concrete strategy documents, roadmaps, or plans that cities use specifically to drive smart city development.

As a key part of the overall development strategy of smart cities, a narrower view of ‘strategy’ as a specific document is highlighted. Indeed, each of the above papers acknowledge some sort of concrete document – a strategy, plan, or roadmap – as a focal point of the overall development processes. This is supported by complementary research that considers a formalized strategy as important for running effective smart cities (Lee et al., 2014) and that suggests smart city strategies are important for guiding the transition to a smart city (Komninos, 2016; Yigitcanlar & Kamruzzaman, 2018).

In addition, smart city strategy documents have also been viewed as a key policy document, which moreover support, to a certain extent, sustainability (Ahvenniemi & Huovila, 2021). Kramers et al. (2014) suggest that there is potential for the smart city to support certain environmental objectives, but strategic planning is necessary. Moreover, Yadav et al. (2019) found that in India, strategy was crucial for the overall development of smart city initiatives at local levels. However, despite the importance of these strategies, and notably their role in guiding local objectives and supporting corresponding sustainability objectives, no literature was found that assess if and how strategy documents are supporting the localization of SDGs in cities.

3. Methodology

3.1. Data collection

To begin our study, we first selected the sample of smart city strategies. To do this, we considered several international rankings of smart cities, including the 50 Smart Governments ranking (Eden Strategy Institute, 2021), the IMD smart city ranking (IMD, 2021), and the IESE smart city ranking (IESE, 2020). Our principal reliance on these rankings is because they enable a benchmarking system to measure smart city progress (Giffinger & Gudrun, 2010). These rankings have a tested methodology and have been used in several studies on smart cities (for examples, see: Clement & Crutzen, 2021; Mak & Lam, 2021; Šulyová & Vodák, 2020). It should be noted that for the 50 Smart City governments ranking, we considered the ranked cities, as well as the 'runner up' cities in a Regional Spotlight section that did not make the official list. This was to increase diversity of cases, and notably increase the number of cities from the Global South. The complete list of cities and their smart city strategies, which are all

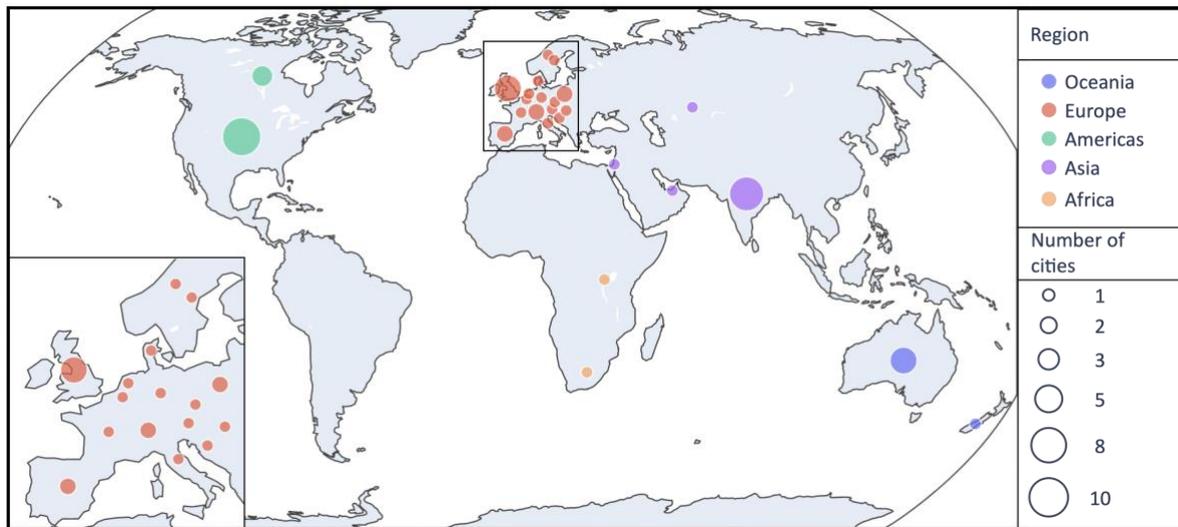
publicly available, is found in the Appendix. We also include information on the year of the strategy, which department developed the strategy, and the income-level of the country for each city.

While a total of 216 cities were featured in at least one of these rankings (including the ‘runner up’ cities), we only found copies for 44 of their official smart city strategies (20.4%).¹ Moreover, while rankings are indeed advantageous since they offer a benchmark for smart cities, they do not capture all the various perspectives of smart cities that may exist since they are based on a standardized formula (Aleksandrov et al., 2022). For this reason, we complemented our sample by considering cities for which we could find strategies from countries driving smart city initiatives, such as Australia, Canada, and India, among others. These examples are taken from the literature as countries with strong guidelines for developing smart cities, generating numerous initiatives in the national territories (Angelidou, 2017; Tang et al., 2019; Yigitcanlar, 2018). In this way, we collected 57 smart city strategy documents from 29 countries. These documents take the form of official smart city strategies, plans, or roadmaps published by local governments. In a few instances, we also consider digital strategies, but only if they explicitly stated that their mission in the digital strategy was to develop a smart city. The locations of the cities in our sample are shown in Figure 1.

Figure 1: Map of cities. The bubble size indicates the number of cities per country, with a bigger bubble indicating a higher number of cities. The colour indicates the region of each country. A focus of the European continent is presented in the

¹ Due to the language abilities of the authors, we could consider cities with strategies available English, French, or Dutch.

bottom left-hand corner to facilitate reading. Figure made using Plotly (Plotly Technologies Inc., 2015).



3.2. Method and analysis for coding strategies

After we identified our sample, we analyze the strategies using the SDG framework. We first use insights from a methodology adopted by several previous studies that aimed to understand how a given sector contributes to the SDGs (Nerini et al., 2018; Thacker et al., 2019), including a study focused on urban ecosystems (Maes et al., 2019). However, in these previous studies, the researchers used extensive literature reviews to find evidence to support each Target. Using the smart city strategy documents instead of a literature review enables a more specific understanding of how cities are presently contributing through such initiatives to the localization of the SDGs.

Due to our use of the strategy documents, we complement this approach with a content analysis. Content analysis can be defined as “a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use” (Krippendorff, 2004: 18) that aims to reduce text into categories based on defined coding rules (Stemler, 2000). It has been used in similar studies, such as by Biscotti and D’Amico

(2016) who use content analysis to study the narratives of political leaders addressing certain environmental topics and Lam and Conway (2018) who assess if, to what extent, and why different ecosystem services are used in land use plans across 10 Canadian municipalities.

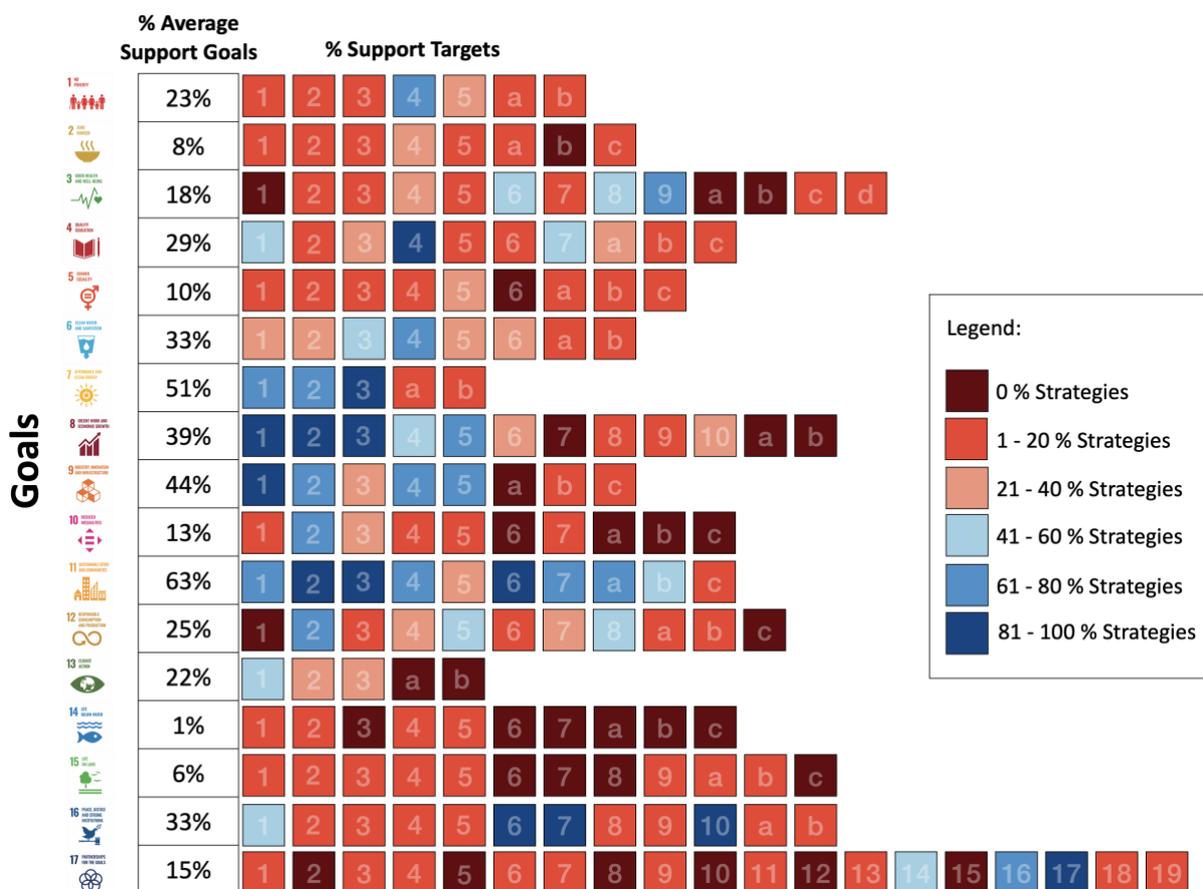
Our analysis was conducted through seven steps. First, we refer to the SDG framework and created a template from the 17 SDGs and their 169 individual Targets. We focused on the Targets, which we selected as the categories to guide our coding in the content analysis. Second, with this framework in mind, two researchers reviewed a selection of strategies, applying content analysis to identify local actions (including visions, programs, projects, initiatives, etc.), that could be linked to the Targets. The resulting coding captures the implications of a given smart city action for a Target, without necessarily replicating its exact language. This is consistent with real-life practices where localization processes modify Target language to better fit the global SDG framework to a local context (OECD, 2022). Third, the researchers compared results and, through discussing any discrepancies, developed a thorough set of guidelines to finalize the coding. Fourth, all strategies were (re-) assessed using the guidelines. Fifth, one researcher reviewed selected strategies to ensure consistency. Sixth, once all strategies were coded using the SDG framework, the Targets were counted across all cities. This ultimately gives a percentage of the strategies that would support the localization of each Target. Finally, the individual Target percentages were added up for each Goal, and then divided by the total number of Targets per Goal. This gives an indication of the average level of support by the strategies for each SDG. Despite the tools put in place to ensure a rigorous treatment of the strategies, we acknowledge that some subjectivity will exist in our results.

4. Results

4.1. Strategies and the localization of the SDGs

From the analysis, some key results emerge about how smart cities are – through the development and implementation of related strategies – contributing to the localization of the SDGs. As previously described, our primary findings consist of the percentage of strategies that support the localization of each Target and an average level of support by the strategies for each overall Goal. Figure 2 provides an overview of these findings.

Figure 2: The figure first shows the average percentage of strategies that support a SDG (left). This is calculated by adding the percentage for each Target, and then dividing by the number of Targets for a given Goal. Then, it shows the percentage of strategies that address a given Target of a SDG (right).



The first main result is that smart city strategies are extensively addressing SDG 11 on ‘Sustainable Cities and Communities,’ seen through an average support of 63%. This is especially the case for Targets 11.2, 11.3, and 11.6, which center on sustainable transport, sustainable urbanization planning, and reduction of the environmental impacts related to cities, respectively. These three Targets were supported by 93%, 86%, and 89% of the city strategies, respectively. Targets 11.1, 11.4, 11.7, and 11.a were moreover supported by 63%, 61%, 72%, and 74% of strategies, respectively.

A second Goal strongly implicated in our analysis is SDG 7 on ‘Affordable and Clean Energy’ with an average support of 51%. Targets 7.1., 7.2, and 7.3 are particularly treated by the strategies. Respectively, this accounts for improved access to modern energy services, for 63% of strategies, increasing renewable energy, found in 70% of strategies, and doubling the global rate of energy efficiency, supported by 86% of the strategies.

The third relevant Goal identified in our analysis is SDG 9 related to ‘Industry, Innovation, and Infrastructure,’ which had an average support of 44%. Here, evidence that would support reaching SDG Targets 9.2, 9.4, and 9.5 were found in 68%, 75%, and 70% of the strategies, respectively. Target 9.2 refers to inclusive and sustainable industrialization, Target 9.4 to upgrading infrastructure and retrofitting industries to be more sustainable, and Target 9.5 to enhancing scientific research and upgrading technological capabilities to encourage innovation. Moreover, Target 9.1 on developing sustainable and resilient infrastructure was found across 98% of the strategies.

After, SDG 8 representing ‘Decent Work and Economic Growth’ had a 39% average support level. Targets 8.1, 8.2, and 8.3 were in fact found in 88%, 81%, and 89% of the strategies, respectively. Target 8.1 refers to economic growth, while 8.2 focuses on economic productivity, notably through technological upgrading and innovation, and 8.3 promotes development-oriented policies that support job creation, entrepreneurship and small- and medium-sized enterprises, and innovation. Additionally, Target 8.5 that aims to achieve full and productive employment was supported by 67% of the strategies.

Apart from these Goals, the strategies showed strong support for some individual Targets (greater than 60%), displayed in Table 1.

Table 1: Individual Targets identified as relevant through the analysis due to the strategies supporting their localization.

Target	Description	% Strategies
1.4	Equal rights to economic resources, basic services, ... and technology	79%
3.9	Reduce deaths and illnesses from chemicals and pollution	61%
4.4	Increase the number of youth and adults with skills for employment and entrepreneurship	82%
6.4	Increase water-use efficiency and ensure sustainable withdrawals and supply of freshwater	67%
10.2	Promote social, economic, and political inclusion	74%
12.2	Achieve the sustainable management of natural resources	63%
16.6	Develop effective, accountable, and transparent institutions	82%
16.7	Ensure responsive, inclusive, participatory, and representative decision making	84%
16.10	Ensure public access to information and protect fundamental freedoms	91%
17.16	Enhance the global partnership for sustainable development	74%
17.17	Encourage and promote effective public, public-private, and civil society partnerships	100%

4.2. A nexus viewpoint

After considering how strategies may contribute to specific Targets and SDGs, we assessed how the strategies may also contribute to achieving a nexus of SDGs. A nexus approach aims

to highlight the interlinkages across the different Goals and their Targets. It thus aims to consider the effects of achieving one Goal, both positive and negative, on the others (Bleischwitz et al., 2018) and enables the consideration of multiple sustainability goals related to the environment, economy, and society in cities (Ramaswami, 2020).

To do this, we counted how many Targets per SDG each city strategy supported, and then ran a factor analysis on this data. This approach is inspired by Huang-Lachmann et al. (2018) who used factor analysis to, among other objectives, reduce the number of categories of climate actions used by cities to identify different adaptation action groups. In effect, factor analysis reduces the observed variables to identify patterns in data, and ultimately groups of inter-related variables based on similar profile values (Rummel, 1970). Before running the factor analysis, we performed the Bartlett test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Bartlett, 1950) to verify the factorability of the data. As needed to perform the factor analysis, the Bartlett test is significant (p -value < 0.05) and the KMO measure is appropriate at 0.75.

The first factor, which has the greatest explanatory value, is comprised of SDGs 3, 6, 7, 11, 16, and 17, and therefore described as focusing on wellbeing and access to basic resources (water, energy, as well as access to social and political participation) in cities. The second factor incorporates SDGs 1, 8, 9, and 10, and is considered as a factor focusing on economic, infrastructure, and innovation development for reducing poverty and inequalities. The third factor is made up of two SDGs, 1 and 5. As a result, we conclude it represents the link between poverty and gender inequalities. The fourth factor encompasses SDGs 2, 12, and 13, which indicates its focus on sustainable (urban, peri-urban) agriculture and production for an

improved climate. Finally, the fifth factor contains SDGs 14 and 15, and is related to biodiversity and conservation on both the land and in the water. Table 2 describes the factors, as well as the sum of square (SS) loadings, the proportion of variance (POV), and cumulative variance (CV).

SS loadings are relevant for acquiring information on which factors to keep (Braeken & Van Assen, 2017) and factors having a SS loading over one are treated as significant (Hair et al., 2019). POV indicates the variance explained by each individual factor, while the COV is found by cumulating the individual variance of all selected factors. Taken together, these results indicate which factors to keep and how much variance they explain out of the total possible (100%). An acceptable threshold in social sciences is to account for around 60% of the total variance (Hair et al., 2019), and in our analysis we capture 58%.

Table 2: Factor analysis for SDGs treated by strategies, with sum of square (SS) loadings, the proportion of variance (POV), and cumulative variance (CV).

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
SDGs	3	1	1	2	14
	6	8	5	12	15
	7	9		13	
	11	10			
	16				
	17				
SS Loadings	2.98	2.12	1.89	1.57	1.32
POV	0.18	0.12	0.11	0.09	0.08
CV	0.18	0.30	0.41	0.50	0.58

5. Discussion

The overall results showed that smart city strategies support the localization of several SDGs, notably Goals 7, 8, 9, and 11. However, the results also indicate that strategies may not be currently effective in driving sustainability in other key areas for city-wide transitions (e.g., SDG Target 15.9). We discuss the main findings of our results using both examples from strategies in our study and smart city literature to assess how strategies can support the localization of the SDGs towards more sustainable smart cities. After, we discuss how local decision makers can improve strategy making and implementation in the future to create sustainable smart cities.

5.1. Strong drivers for localizing SDGs through a smart city strategy

There are several key Targets whose localization was supported by the smart city strategies, summarized in Figure 3. We view the Targets supported by 61-100% of the strategies as the most relevant, and moreover discuss in depth here the Targets that are supported by 81-100% of the strategies. To begin, the strategies evaluated in this paper largely supported the localization of SDG 11 regarding 'Sustainable Cities and Communities.' Every strategy evaluated contributed to at least two of the Targets. A significant contributing factor to our findings is the role of sustainable and safe transport (Target 11.2). Sustainable transport was often seen through proposed improvements to public transport. For instance, Wellington envisions supporting a low-carbon footprint using public transport. Moreover, in the literature, 'Smart Mobility' is noted as a key dimension of smart cities (Contreras & Platania, 2019; Fryszman et al., 2019), which refers to local and international accessibility and sustainable transport systems (Giffinger et al., 2007). Emerging technologies such as fifth generation (5G) network technology can be integrated with behavioural intelligence and

research to facilitate the roll out of new transportation methods that align with SDG Target 11.2 (Goel et al., 2021). Moreover, policies and strategies that support electric mobility tend to reduce particulate matter (PM) pollutants, which leads to improved urban air quality, corresponding with support for Target 11.6 (reduction of adverse environmental impacts in cities) (Ruggieri et al., 2021). We can thus see positive spillover effects when localizing one Target on another.

The localization of SDG Target 11.3 that aims to enhance inclusive and sustainable urbanization and participatory practices by 2030 was also supported by the strategies analyzed. From the results, evidence for this Target was found through a commitment to sustainable urbanization practices in cities such as Agartala, Johannesburg, and Stockholm, while Brussels emphasized a citizen participatory approach, in partnership with bodies such as Brussels Environment, to develop the smart city.

The last Target of SDG 11 we consider in depth is 11.6, which aims to reduce the adverse per capita environmental impact of cities by 2030, with a special consideration to improving air quality and better managing wastes. The strategies addressed this target through the utilization of air quality monitoring, seen in the cities Chandigarh and Chula Vista. Localizing Target 11.6 also may be addressed by improved waste management systems, proposed in Edinburgh and Los Angeles, which emphasized the improved treatment of electronic waste and aimed to reuse computers to both minimize electronic waste while increasing technology access to students, respectively, and Edmonton, which focused rather on construction wastes. In the literature, lighting solutions or 'smart lighting' promoted in smart cities were found to also address this Target, as well as SDG Targets 11.3 and 11.7 (Tavares et al., 2021),

as it is linked to energy reduction and corresponding benefits. Another way found that smart cities can support Target 11.6 is through the ability of certain smart solutions, when paired with appropriate institutional and political support, to improve urban waste management (Whiteman et al., 2021). Finally, Allam & Jones (2021) foresee the beneficial impacts of 6G and other technologies enabled by 6G, such as Digital Twins, on SDG Target 11.6 due to its promise to support the visualization of a given project and better anticipate its impacts. A similar initiative is already seen in Melbourne with a digital urban forest dataset, supporting an understanding of biodiversity, solar reflectivity, and water drainage.

Smart city strategies also support the localization of SDG 7 related to 'Affordable and Clean Energy,' and especially Targets 7.1, 7.2, and 7.3. Target 7.1 aims to secure universal access to affordable, reliable, and modern energy services by 2030. From both our study and the literature, there is evidence suggesting that smart cities may act as powerful vehicles to advance renewable energy (Target 7.2) (Farmanbar et al., 2019; Niemi et al., 2012). As an example from the cities studied here, Kigali aims to design microgrids to run on renewable energy. In a different context, Vienna is considering wind turbines, solar installations, and hydro-electric renewable energy sources.

With respect to energy efficiency (Target 7.3), Berlin and Singapore aim to improve energy efficiency through optimizing operations in the territory, while Birmingham uses smart meters, amongst other technologies. Another solution seen in the strategy adopted by Budapest is energy efficient lighting. Looking to the literature, as previously mentioned, there seems to be a nexus of solutions that help localize both SDG 11 and 7, as, for example, 'smart

lighting’ was purported to also address energy efficiency (Target 7.3), and thus multiple Targets (Tavares et al., 2021).

SDG 8 on ‘Decent Work and Economic Growth’ is the third Goal studied here due to the envisioned impact that smart city strategies have on its localization processes, with Targets 8.1, 8.2, and 8.3 found as important elements of the strategies. With regards to the first Target on economic growth, it was supported, for example, through innovation related to the smart city in Berlin to improve the quality of life for citizens. Additionally, Warsaw has delineated sustainable economic growth as one of their foundational pillars for the smart city. In some cities the means to achieving economic growth foreseen in the strategy come through the localization of other Goals and their specific Targets. Indeed, in Lucknow, the way to enhance local economic growth comes from improving mobility (SDG 11.2), both physical and social infrastructure (SDG 9.1), and sanitation (SDG 6.2). In agreement with our analysis, the literature also suggest that smart cities have the potential to drive local economic growth through innovation that smart city transitions may bring (Li et al., 2019).

Another Target identified in this context is SDG 8.2, which aims to augment productivity, notably through technological upgrading and innovation. Evidence from the analysis of the strategies suggests that smart cities may support the localization of this Target through innovative data instruments backed through cross-sectoral partnerships, as described in the strategy by Florence, or using technologies to increase local administration productivity, like in Edinburgh. From the literature, moreover, the notion of ‘Smart Economy,’ an often cited characteristic of the smart city, focuses on improving productivity (Giffinger et al., 2007; Li et al., 2019; Silva et al., 2018).

The final Target highlighted due to the influence that smart cities may have on its localization process is 8.3, which endeavors to support development-oriented policies that would work to improve several economic objectives, such as job creation, entrepreneurship, and the growth of small- and medium-sized enterprises (SMEs). In the strategy adopted by Stavanger, the smart city is seen as a vehicle for economic transformation that creates jobs (SDG 8.3), which is moreover a theme found throughout past studies that have shown how smart cities may increase entrepreneurship and job creation (Manjon et al., 2021). Moreover, the strategies by Ottawa and Kigali, among many other cities, have initiatives that aim to support SMEs. Ottawa envisions to create new public-private procurement opportunities for start-ups and SMEs, while Kigali supports collaboration and co-working spaces to increase service access to entrepreneurs. Attention to this specific issue in the strategies evaluated in this study is noted as important, since previous literature has found weaknesses in the way that cities may strategize the support of SMEs in the smart city (Ben Letaifa, 2015).

The last goal covered in detail here due to how the strategies may support its localization is SDG 9 on 'Industry, Innovation, and Infrastructure.' SDG 9.1, the main Target from SDG 9 found in this context focuses on developing sustainable and resilient infrastructure. In the study, infrastructure was envisioned differently across cities. In Chicago, Copenhagen, and Johannesburg there was a focus on digital infrastructure, in London there was an emphasis on green infrastructure, and Budapest aimed to implement both soft and hard mobility infrastructure. Despite the different ways across the cities that smart city transitions may support the localization of SDG Target 9.1, the results indicate that the smart city is seen by local administrations as an appropriate paradigm for advancing sustainable infrastructure

changes at the local level. The literature also acknowledges that digital infrastructures facilitate the delivery of a wide range of services, which has both direct and indirect impacts on the achievement of the SDGs (Thacker et al., 2019). The role smart cities have in advancing other types of infrastructure, such as green infrastructure (Silva et al., 2018) and energy infrastructure that supports urban energy conservation (Kim et al., 2021), is further noted.

Figure 3: Primary SDGs and their key Targets supported through strategies. Primary SDGs are those that found an average support of 40% or more and the Targets are those that were supported by 61% or more of the strategies. Targets are paraphrased for brevity. Source: <https://sdgs.un.org/goals>

SDGs	Targets		
 7 AFFORDABLE AND CLEAN ENERGY	<ul style="list-style-type: none"> 1 Ensure universal access to affordable, reliable, and modern energy services 2 Increased share of renewable energy in the global energy mix 3 Double the global rate of improvement in energy efficiency 		
	 8 DECENT WORK AND ECONOMIC GROWTH	<ul style="list-style-type: none"> 1 Sustain per capita economic growth in accordance with national circumstances 2 Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation 3 Promote development-oriented policies that support decent job creation, entrepreneurship, creativity and innovation 5 Achieve full and productive employment and decent work for all women and men 	
		 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	<ul style="list-style-type: none"> 1 Develop quality, reliable, sustainable, and resilient infrastructure 2 Promote inclusive and sustainable industrialization and raise industry's share of employment 4 Upgrade infrastructure and industries to make them sustainable, with increased resource-use efficiency and clean technologies 5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries
 11 SUSTAINABLE CITIES AND COMMUNITIES			<ul style="list-style-type: none"> 1 Access for all to adequate, safe, and affordable housing and basic services and upgrade slums 2 Access to safe, affordable, accessible, and sustainable transport systems for all 3 Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning 4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage 6 Reduce the adverse per capita environmental impact of cities 7 Provide universal access to safe, inclusive and accessible, green and public spaces a Support positive economic, social and environmental links between urban, per-urban and rural areas

Certain individual Targets from SDGs 1, 3, 4, 6, 10, 12, 16, and 17 were supported by the strategies (Figure 4). To begin, Target 1.4 focuses on ensuring all people have equal rights to economic resources and access to basic services, as well as a selection of other resources, such as appropriate new technologies. This was seen across the strategies in a variety of forms, such as a direct provision of new technologies, such as in Los Angeles where the strategy includes equipping homeless individuals with mobile devices to increase access to

digital resources and using digital technologies to increase access to basic services, seen in Edinburgh and Brussels.

After, SDG Target 3.9 aims to reduce death and illnesses from pollution. In the strategies, this was often related to the use of sensors that would monitor air pollution. In certain cases, such as Barcelona, this data would be used to warn citizens of air quality. Other initiatives involved using electrified modes of transport or increased use of soft mobility to reduce air pollution, like in Bengaluru and Hong Kong, respectively. The literature echoes the promise of such initiatives, since there may be positive effects of smart initiatives on air quality (Manjon & Crutzen, 2021), and that evidence suggests sensors tracking local pollution support solutions to improve the environment (Talari et al., 2017) while smart city policies promoting electric mobility has reduced air pollutants in certain cities (Ruggieri et al., 2021).

Next, Target 4.4 has the ambition to increase skills among the youth and adult population. The localization of this Target was seen in the strategies through using digital tools to increase access to education in Montreal and attempting to increase access to ICT skills in Barcelona and Kigali, to provide some examples. For Target 6.4, which aims to increase water-use efficiency, localization was namely seen through improved water management, including from using sensors, as seen in Barcelona.

The strategies also supported the localization of SDG Target 10.2, which aims to promote the social, economic, and political inclusion of all. In the strategies, this is exemplified by promoting urban management practices that ensured the inclusion of all stakeholder groups in Berlin. Relatedly, in Edmonton, the strategy aims to drive inclusion amongst indigenous

populations. To provide another example, in Agartala, the smart city strategy included measures to promote the inclusion of individuals and families living in slums and aimed to diversify housing types to make housing more inclusive. Inclusion and related objectives such as developing collaborative, participatory environments are furthermore noted in the literature as key principles for smart city development (Mora, Deakin, & Reid, 2019).

The localization of Target 12.2, which aims to achieve the sustainable management and efficient use of natural resources, was also supported by the strategies evaluated. In Krakow, the strategy entails a sustainable management of water, energy, and waste resources, while in Paris, there is a focus on reducing resource use and its associated negative impacts on the environment. This is supported in the literature, which highlights the resource optimization benefits that smart city transitions may bring (Bibri & Krogstie, 2017). Despite the support for Target 12.2 seen from the strategies and literature, issues related to critical raw materials, which fall under the purview of 12.2, are largely absent from the current smart city debate yet are relevant as smart city transitions and the technologies that accompany them embody such materials (David & Koch, 2019).

Open data policies and frameworks across the strategies largely contributed to the importance of SDG 16.6 that aims to promote accountability and transparency in institutions across all levels, as well as 16.10 that ensures public access to information. As is captured in the literature, due to the strong emphasis on partnerships (Estevez et al., 2016), multi-stakeholder collaboration (Clement et al., 2022), and citizen participation (van Waart et al., 2016), the smart city strategies we evaluated here also contributed to SDG Target 16.7 (participatory decision-making at all levels), 17.16 (enhance partnerships for sustainable

development), and 17.17 (encourage partnerships among different actors with the public sector). In relation to SDG 17.17, several Public-Private Partnerships (PPPs) were mentioned as models for implementing projects. This finding was especially prominent in the Indian cities, where PPPs were used in Agartala for a solar farm, Bengaluru for infrastructure projects, and Coimbatore for sewage treatment facilities, to provide some examples.

Figure 4: Other key SDG Targets supported by the strategies (61-100%). Targets are paraphrased for brevity. Source: <https://sdgs.un.org/goals>

Targets

- 1.4 Equal rights to economic resources and basic services, ..., and appropriate new technology
- 3.9 Reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution
- 4.4 Increase the number of youth and adults who have relevant skills for employment and entrepreneurship
- 6.4 Increase water-use efficiency and ensure sustainable withdrawals and supply of freshwater
- 10.2 Empower and promote the social, economic and political inclusion of all
- 12.2 Achieve the sustainable management and efficient use of natural resources
- 16.6 Develop effective, accountable, and transparent institutions at all levels
- 16.7 Ensure responsive, inclusive, participatory, and representative decision-making at all levels
- 16.10 Ensure public access to information and protect fundamental freedoms
- 17.16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships
- 17.17 Encourage and promote effective public, public-private, and civil society partnerships

5.2. Overcoming smart city barriers to better localize the SDGs

The purpose of this analysis was to evaluate how current smart city strategies address the localization of SDGs. Therefore, this paper is not aimed at making normative remarks about what strategies must address, as each city operates in their own unique local context and territories focus therefore on Goals relevant to their situation (Szetey et al., 2021). In a similar way, smart city agendas are set in line with the local priorities of an urban environment (Clement & Crutzen, 2021). With this in mind, the analysis points to several SDGs that were

largely not treated by the smart city strategies, which coincide with commonly cited urban problems. Three main Goals that emerge in this context are SDGs 2 ('Zero Hunger') with an average support level of 8%, 5 ('Gender Equality') with 10% support, and 15 ('Life on Land') with 6% support.² Certain Targets across a selection of Goals that relate to sharing of resources and/or knowledge between the Global North and South (e.g., Targets 17.6 and 17.9, among others) are furthermore weakly addressed by the strategies.

First, SDG 2 support for 'Zero Hunger' was found in very few instances in the study. Yet, there is extensive literature that supports the notion cities have an essential role to play in addressing access to food and sustainable agriculture (Barthel & Isendahl, 2013; O'Hara & Toussaint, 2021). The role of 'smart solutions' or technology is not always relevant, but there are several initiatives – such as rooftop gardens and vertical farms – that involve higher levels of technology (IRP, 2021), and thus here it is seen as an opportunity to consider such initiatives in smart city strategies depending on the realities of the territory.

After, the localization of SDG 5 on 'Gender Equality' was largely not supported by the smart city strategies studied in this paper. This is recognized as a priority, since, despite gender equality representing an important aspect of sustainable transitions (Xiao et al., 2017), the scant literature on this subject agrees that gender issues are largely excluded from smart city governance and the strategies developed to implement smart city initiatives (Beck et al., 2023; Nesti, 2019). It is therefore viewed as an opportunity for policy- and decision-makers

² SDG 14 ('Life Under Water') only had a 1% average support from the analysis, although here we argue that as this Goal relates to oceans, seas, and marine resources, it may be relevant for fewer cities.

to not only better address gender equality when developing future strategies to guide the smart city transition.

There was also a low indication that the smart city strategies are currently supporting the localization of SDG 15 representing the ambitions to improve 'Life on Land.' Notably, there is a specific Target, 15.9, that aims to integrate biodiversity values into local strategies, however it was found as relevant for only 8 strategies (14%). In response, it is recommended that, to ensure objectives such as the conservation of natural ecosystems and biodiversity coexist with urban transitions, smart city strategies include complementary initiatives focused on these challenges. One example that has already been noted in the literature is nature-based solutions. These solutions, defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits"³, have been recognized as appropriate for local smart city frameworks (Wendling et al., 2018). Yet, as suggested by our study, nature-based solutions and other similar initiatives have not become widespread in the consideration of how to support smart city transitions.

Finally, there were a few best practices that enabled the transfer of technologies and capacities across cities or countries found in our study that would support smart city transitions in the Global South. Notably, the Dubai approach involves participation in international initiatives that support capacity building efforts related to smart cities. One of which is the United for Smart Sustainable Cities (U4SSC) initiative, which is supported by

³ <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions>

various United Nations agencies and has the ambition to build partnerships across cities to achieve the SDGs.

While there is little literature on the subject, our results align well with studies on other types of relationships between smart city management techniques and the SDGs. Namely, Beck et al. (2023) found that urban stakeholder value creation strongly supports achieving SDGs 8, 9, and 11, and that stakeholder value creation weakly supported SDGs 4, 5, and 15. Our results thus strengthen the messages found in previous literature that recommend city decision-makers to focus on “including non-human stakeholders, the environment, and gender diversity in their organizational processes and systems, and core values of partnerships” (Beck et al., 2023: 7).

5.3. Next steps for gearing smart cities towards SDG localization

After identifying the SDGs that are being localized – or not – by smart city strategies, we discuss how policymakers and public administrations can support the development of new sustainable and smart city strategies in the future and put written strategies into practice. Certain studies demonstrate how cities can be evaluated according to indicators that track their contribution to the SDGs, identifying corresponding sustainable development plans to help them progress even further (D’Adamo et al., 2022). This approach can be finetuned for sustainable smart cities as well. However, in our sample, only 30 strategies (53%) mentioned at least one indicator to measure progress. Among these strategies, there were very few with extensive indicator sets.

We therefore first comment on the role of data to populate indicators and indicator sets that can track progress. For example, less than half of the data needed to track progress on SDG 5 exist at the national level (UN, 2022), and community level data availability is a widespread issue for assessing the achievement of SDGs (UNDP, 2023). Technology can support data collection, although to ensure data privacy and citizen consent, governments can benefit from listening to citizens to understand their willingness to participate at the start of any initiative that may rely on data collection in the city. Some best practices like OASIS⁴ in Paris are rooted in collaboration with citizens to co-create data-based solutions for sustainability.

Relatedly, we echo the importance to develop corresponding monitoring and evaluation frameworks alongside smart city strategies to better guide progress throughout transitions and, where appropriate, support SDG localization (Mora et al., 2023). This is seen as essential since existing assessment schemes for smart cities fail to capture the full spectrum of economic opportunities, governance transparency, and participation, among others (Hajek et al., 2022). To optimize their functionality, indicator sets should be created at the start of any strategic process and adapted throughout implementation. Understanding from the beginning what to track creates a coherent strategic process and facilitates monitoring and evaluation for urban sustainability (Merino-Saum et al., 2020).

Moreover, building on the need for data and collaboration for the development of smart cities in line with sustainable development objectives, we stress the importance for green public investments at the city level. Such investments have been cited as crucial for securing carbon

⁴ <https://www.uia-initiative.eu/en/operational-challenges/paris-oasis>

neutral futures and components of ‘mission-oriented’ policies with a clear societal objective (Mazzucato, 2022). Moreover, recent work has identified that green public investment can bring multiple benefits across territories (Dafermos et al., 2022). City decision makers can be intentional on leveraging mission-oriented smart city policy and strategies to target such investments.

Our findings and the consequent recommendations contribute to the growing body of literature on sustainable smart cities. This study shows that, in line with the messages from recent contributions (Ahvenniemi et al., 2017; Huovila et al., 2019), smart cities are increasingly overlapping with sustainability objectives. Moreover, while indeed the SSC label has been emerging in the literature, our study helps clarify how SSC are emerging in practice. Thus, being a ‘smart’ city not only refers to technology use for the sake of technology, but the notion that cities can use digital tools to tackle current sustainability issues and achieve the SDGs in collaboration with multiple stakeholders.

6. Conclusion

The objective of this paper was to assess how smart city strategies are supporting the localization of the SDGs. To do this, we conducted an in-depth analysis of 57 local smart city or related strategy documents and assessed whether content found within such documents would support the localization of each of the 169 SDG Targets. While evidence for the localization of several Goals or specific Targets was found, our findings suggest these strategies are most relevant for SDGs 7, 8, 9, and 11.

The main implications from this study are that smart city strategy documents promote sustainable development initiatives across a spectrum of themes. Therefore, while SDG localization priorities will depend on the context of each city, developing such documents may support several different objectives (economic, social, and environmental). We thus see that smart city strategies can be a vehicle for localizing SDGs, and evidence for the emergence of the SSC model in practice.

We however note a caveat, if local administrations wish to use smart city strategies as a means for a fundamental shift toward a more sustainable urban model, careful attention must be paid to include initiatives on often untreated topics in such strategies, such as food access and sustainable urban agriculture, gender equality, and biodiversity conservation. To facilitate this, the strategy can be developed with the participation of a vast set of stakeholders and in concert with other local strategy documents. If local administrations or policymakers consider these topics out of scope for their smart city vision, cities would benefit by complementing their smart city initiatives with other strategies to target such unaddressed subjects that are vital for urban sustainability.

Strategies are visions with political backing. However, they are not predictions of the future, and to implement their objectives, it is also necessary to have capable management, financing, political stability, among other factors. Therefore, while this study indicates what cities are intending to do, a limit is that we cannot say from our results that the strategies will certainly achieve the localization of the relevant SDGs. Future studies, which are based on interviews or in-depth qualitative research, could therefore assess if smart city strategies that in writing support the localization of the SDGs reap the related tangible benefits. An additional

reflection for future studies is to consider how smart city strategies contribute to locally defined sustainability goals that fall outside the scope of the SDG framework. These contributions would add considerable knowledge on how the smart city and emerging SSC concepts are advancing in practice, as well as in the literature.

Another limit concerns the lack of possibility to assess potential trade-offs between different Goals and Targets. This field of study would benefit from methodological advancement that enables more critical studies of strategies and how they support SDGs and localization processes. Also, as context was indicated as an important element for which SDGs may be localized via strategies, research can continue to assess which factors (developmental context, socio-economic factors like inequalities, specific local challenges) determine which SDGs are included in city plans. Finally, other avenues for future research include investigating frameworks that ensure more extensive treatment of SDGs 2, 5, and 15 within smart city strategies and their related transitions, consider how to improve city level North-South collaboration on challenges related to the transition, and implement complementary indicator sets to guide progress.

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Appendix

Table A: List of cities and their smart city strategy, country, geographical region, the municipal department that developed the strategy, and the income-level according to the United Nations classification (Source: World Economic Situation and Prospects, Table E: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2021_ANNEX.pdf).

City	Strategy	Year	Country	Region	Municipal Department	UN Income Classification
Agartala	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Almaty	Strategy "Smart Almaty"	2020	Kazakhstan	Asia	Transversal	Upper-middle-income
Baltimore	Inclusive Digital Transformation Strategic Plan	2018	United States	Americas	Technology or digitalization department	High-income
Barcelona	Barcelona Digital City Plan	2015	Spain	Europe	Technology or digitalization department	High-income
Bellevue	Bellevue Smart	2017	United States	Americas	Transversal	High-income
Bengaluru	Smart City Proposal	2017	India	Asia	Transversal	Lower-middle-income
Berlin	Smart City Strategy Berlin	2015	Germany	Europe	Urban development or planning department	High-income
Birmingham	The Roadmap to a Smarter Birmingham	2014	England	Europe	Transversal	High-income
Brisbane	Smart, Connected Brisbane	2019	Australia	Oceania	Dedicated Smart City department	High-income
Brussels	SmartCity.Brussels (White Paper)	2014	Belgium	Europe	Dedicated Smart City department	High-income
Budapest	Smart Budapest	2017	Hungary	Europe	Urban development or planning department	High-income
Chandigarh	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Chattanooga	Chattanooga Smart City Plan	2016	United States	Americas	Transversal	High-income
Chicago	The City of Chicago Technology Plan	2015	United States	Americas	Transversal	High-income
Chula Vista	City of Chula Vista Smart City Strategic Action Plan	2017	United States	Americas	Transversal	High-income
Coimbatore	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Columbus	Smart Columbus Program	2019	United States	Americas	Transversal	High-income
Copenhagen	Copenhagen Connecting	2013	Denmark	Europe	Transversal	High-income
Dubai	Smart Dubai	2021	United Arab Emirates	Asia	Dedicated Smart City department	High-income
Edinburgh	Digital and Smart City Strategy	2020	Scotland	Europe	Transversal	High-income
Edmonton	Smart City Strategy	2017	Canada	Americas	Transversal	High-income
Florence	Smart Florence Plan	2015	Italy	Europe	Transversal	High-income
Geneva	Smart Geneva	2021	Switzerland	Europe	Technology or digitalization department	High-income
Greenwich	Greenwich Smart City Strategy	2015	England	Europe	Department of economics or business	High-income
Hong Kong	Hong Kong 2030+: A Smart, Green and Resilient City Strategy	2016	Hong Kong	Asia	Urban development or planning department	High-income
Johannesburg	City of Johannesburg's Smart City Strategy & Implementation Roadmap	2014	South Africa	Africa	Transversal	Upper-middle-income
Kigali	Smart City Rwanda Master Plan	2017	Rwanda	Africa	Transversal	Low-income

Krakow	Smart_KOM Strategy	2015	Poland	Europe	Transversal	High-income
London	Smarter London Together	2018	England	Europe	Transversal	High-income
Los Angeles	Information Technology Agency Strategic Plan	2019	United States	Americas	Technology or digitalization department	High-income
Lucknow	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Manchester	Manchester Digital Strategy 2021 Consultation	2021	England	Europe	Transversal	High-income
Montreal	Montreal Smart and Digital City	2014	Canada	Americas	Transversal	High-income
New Delhi	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
New York	IoT strategy	2021	United States	Americas	Technology department	High-income
Newcastle	Newcastle City Council Smart City Strategy	2017	Australia	Oceania	Transversal	High-income
Ottawa	Smart City 2.0	2017	Canada	Americas	Urban development or planning department	High-income
Panaji	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Paris	Paris Smart and Sustainable	2020	France	Europe	Transversal	High-income
Parramatta	Smart City Master Plan	2015	Australia	Oceania	Transversal	High-income
Philadelphia	Smart City PHL	2019	United States	Americas	Technology or digitalization department	High-income
Prague	Smart Prague Index	2020	Czech Republic	Europe	Technology or digitalization department	High-income
Pune	Smart City Proposal	2016	India	Asia	Transversal	Lower-middle-income
Seattle	Technology Strategic Agenda	2017	United States	Americas	Technology or digitalization department	High-income
Singapore	National Artificial Intelligence Strategy	2019	Singapore	Asia	Transversal	High-income
Stavanger	Roadmap for the Smart City Stavanger	2016	Norway	Europe	Transversal	High-income
Stockholm	Smart & Connected	2017	Sweden	Europe	Technology or digitalization department	High-income
Sunshine Coast	Sunshine Coast Council Smart City Implementation Plan	2017	Australia	Oceania	Transversal	High-income
Sydney	Smart City Strategic Framework: City of Sydney	2020	Australia	Oceania	Transversal	High-income
Tel Aviv	Tel Aviv Smart City	2016	Israel	Asia	Transversal	High-income
The Hague	Road Map Smart City Den Haag	2014	The Netherlands	Europe	Department of economics or business	High-income
Vienna	Smart City Wien Framework Strategy	2019	Austria	Europe	Dedicated Smart City department	High-income
Warsaw	Warsaw - Towards a Smart City	2018	Poland	Europe	Technology or digitalization department	High-income
Wellington	Wellington Towards 2040: Smart Capital	2011	New Zealand	Oceania	Transversal	High-income
Zagreb	Zagreb Smart City Framework Strategy	2019	Croatia	Europe	Transversal	High-income
Zaragoza	Open Government Strategy in the Digital City	2012	Spain	Europe	Transversal	High-income
Zurich	Strategy Smart City Zurich	2018	Switzerland	Europe	Transversal	High-income