

# Managing smart city governance

A playbook for local and regional governments





UN-HABITAT

## MANAGING SMART CITY GOVERNANCE

### A Playbook for local and regional governments

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# INTRODUCTION

Digital technologies present a wealth of invaluable opportunities for sustainable urban development. They seamlessly integrate into traditional urban processes and activities, enhancing their efficiency and quality, while serving as the foundation for the creation of new services and applications that can revolutionize city life. A prime example of this transformation is the utilization of real-time data to optimize traffic management, alleviate road congestion, and enhance air quality in urban areas. Concurrently, smart mobility services, including car sharing and demand-responsive local transport, are undergoing substantial transformations to offer more sustainable alternatives to both private vehicles and conventional public transportation systems. In addition, digital technologies open doors to enhance civic participation and democracy. Online platforms are emerging as powerful tools that facilitate citizen engagement with the political and social aspects of their cities. Meanwhile, promising technologies such as artificial intelligence and blockchain hold the potential to revolutionize urban processes, leading to more responsive, efficient, and personalized public services.

These are merely a handful of examples, but the potentialities are almost limitless, underscoring the profound influence of digital technologies on our urban environments. However, the mere application of these technologies within urban settings falls short of rendering them truly smart. Successful smart city initiatives necessitate the harmonization of resources and involvement from a wide array of economic and societal sectors, and they must be accompanied by substantial changes within the public sector. The unpredictability surrounding emerging technologies also raises sustainability concerns and ethical dilemmas that can only be tackled through collective endeavors. Moreover, the development of smart city initiatives entails the synchronization of governmental bodies at various administrative tiers, as well as the exchange of knowledge across a range of disciplinary domains.

Given the complexity and variability of smart city initiatives, it comes as no surprise that their governance remains one of the biggest challenges for municipal governments worldwide. The existence of this critical challenge is comprehensively documented and validated in the United Nations report entitled *Global Review of Smart City Governance Practices*, which was released in 2022 by UN-Habitat, CAF, Edinburgh Napier University, and Tallinn University of Technology. This study involved active participation from administrative personnel and leaders in municipal governments. Together, these individuals played a pivotal role in supporting a wide data collection process that spanned more than 250 urban areas across five continents.

The findings of this study corroborate the fact that governance issues encountered by municipal administrators steering smart city initiatives are multifaceted. These issues stem from various sources, such as regulatory ambiguities linked to emerging technologies and inherent structural constraints within the public sector. For instance, 84% of the survey respondents acknowledged that their cities continue to grapple with ethical concerns associated with digital technologies. This challenge may be attributed to the absence of robust regulatory frameworks at both the national and international levels, coupled with competency gaps within municipal governments, a reality affirmed by nearly half of the surveyed sample.

Furthermore, there are additional governance hurdles that manifest as intricate and occasionally contentious dynamics between municipal governments and their collaborators in smart city initiatives. To illustrate, 78% of respondents in this study lamented the limited involvement of residents in their smart city efforts, while only one-third of respondents reported instances of data-sharing practices between their municipal government and private entities.

By acknowledging the multifaceted challenges posed by digital transformation processes in urban contexts, this playbook complements the previous review of governance practices with new evidence-based guidance for local government leaders and municipal administrations involved in smart city initiatives. For each component of the governance framework developed in the *Global Review*, the following sections introduce a set of practical recommendations, supported by examples from urban areas around the world. These recommendations build on a rich knowledge base that integrates best practices highlighted in the smart city literature with evidence emerging from data collected through an online survey and expert interviews.

This playbook and its recommendations are primarily aimed at municipal governments and their political leaders, local administrators, and public officials who are involved in smart city initiatives. The recommendations, which are delineated in the subsequent sections of this playbook, are intended to help develop more effective, inclusive, and sustainable governance practices for urban digital transformations. The guidance offered on these pages could also be useful for national agencies, private companies, non-governmental organizations, and all stakeholders committed to promoting the sustainable development of urban communities through the implementation of smart city initiatives.



## METHODOLOGY

This playbook relies on the dataset that was employed in the Global Review of Smart City Governance Practices. The report's findings were derived from an analytical process characterized by a two-stage approach. This approach was instrumental in exploring how the conceptualization of smart city governance is discussed within the academic debate

and how municipalities across different regions are actively implementing smart city governance. In the development of this playbook, we reused this data, which was subsequently augmented by the introduction of a third stage encompassing the integration of supplementary information.



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### Stage 1



#### Systematic review

A systematic review of approximately 150 scientific publications (covering three decades of smart city literature) led to the development of a smart city governance framework highlighting the key governance areas to be considered when planning and implementing smart city initiatives.

### Stage 2



#### Online survey

The framework deriving from the literature review was used to structure an online survey investigating how municipalities across the world are dealing with the governance of their smart city initiatives. The survey was available in nine languages and collected the views of 300 respondents, from more than 250 municipalities in Africa, Asia, Europe, Latin America, and North America.

### Stage 3



#### Interviews

Interviews involving 131 experts hailing from 37 different countries. Interviewees were selected based on their demonstrated experience in the governance of urban digital transformations. The experts were also selected to include diverse perspectives and provide comprehensive guidance based on experiences from diverse geographic and political contexts. This group of experts included public officials, managers of smart city units, academic researchers, spokespeople of non-governmental organizations, private consultants, and leaders of public sector organizations.





# THE SMART CITY GOVERNANCE FRAMEWORK

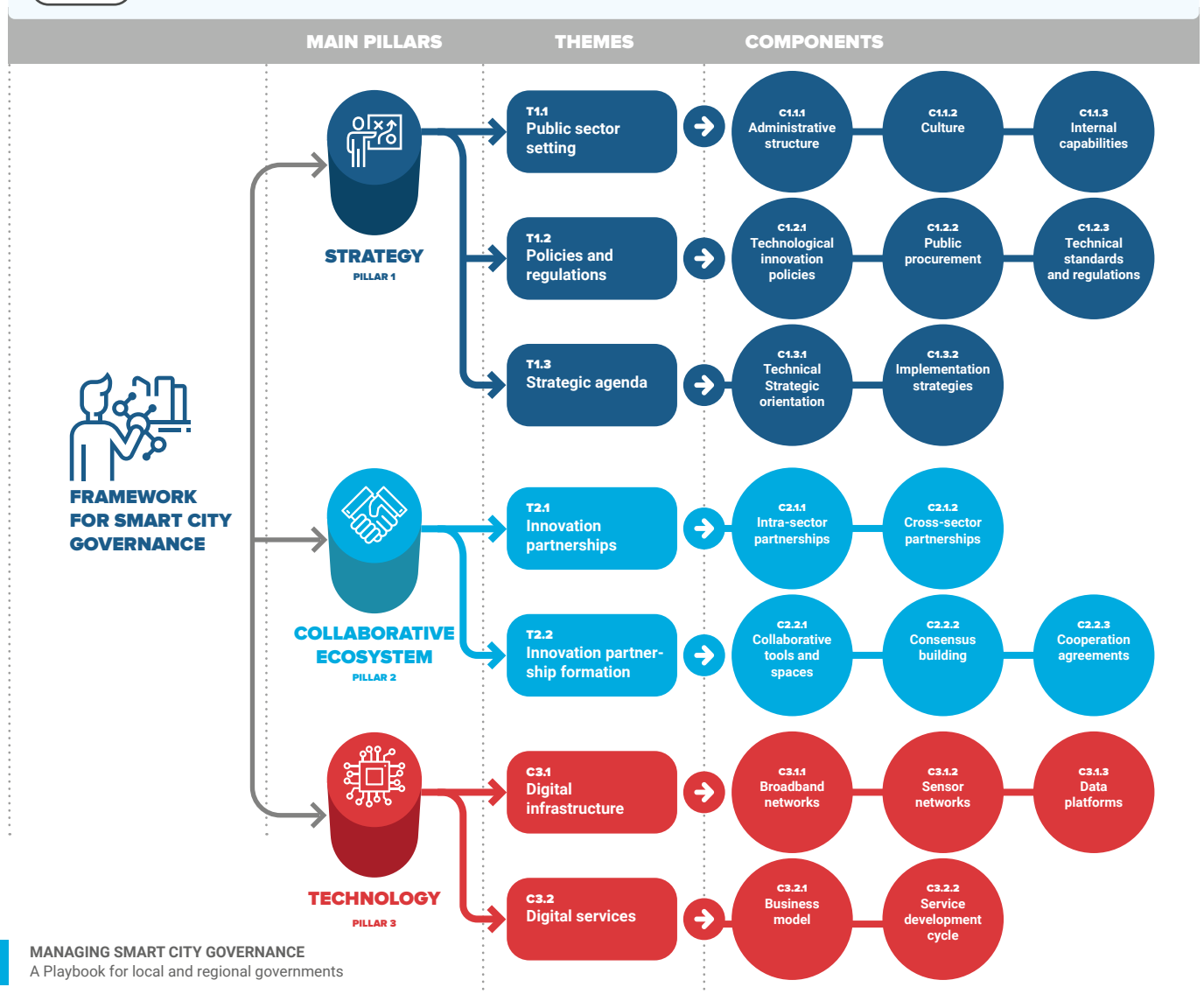
This playbook is organized into three sections, each dedicated to one of the key pillars that form the foundation of the governance of smart city initiatives:

- **Strategy:** this pillar refers to the administrative, legal, organizational, and strategic arrangements shaping the context in which digital transformation processes take place.
- **Collaborative ecosystem:** this pillar comprises the governance mechanisms that are needed to coordinate the networks of stakeholders involved in smart city initiatives.
- **Technology:** this pillar reflects the governance efforts required to steer the design and provision of the digital infrastructures and digital services underpinning smart city initiatives.

Each pillar is comprised by multiple thematic areas and components (see Figure 1).

In the following sections of the playbook, the themes and components falling under each pillar will be introduced and discussed. Subsequently, for each of the 18 components, a set of practical recommendations will be outlined. These recommendations will be accompanied by pertinent quotes and examples of best practices, all of which have been sourced from the expert interviews and the extensive review of academic literature on smart city governance. Moreover, to enhance the comprehensiveness of this playbook, non-academic literature sources have been incorporated into this scholarly foundation.

Figure 1





## 01



## STRATEGY

This pillar refers to the administrative, legal, organizational, and strategic arrangements shaping the context in which smart city development takes place. Three themes are grouped under this pillar:

- The **public sector setting** describes the internal configuration of municipal governments or other public entities leading smart city initiatives, with regard to their administrative structure, the internal capabilities, and the organizational culture they have developed.
- **Policies and regulations** comprise all legal and policy frameworks influencing the governance of smart city initiatives: technical regulations and standards for digital technologies; technological innovation policies set at local, national, regional or global level to steer digital transformation processes; national or supranational rules for the public procurement of technological solutions.
- The **strategic agenda** refers to all documents and decisions that establish the strategic orientation of smart city initiatives and guide their implementation.

These dimensions directly influence the other governance pillars, as they contribute to orient the formation and development of the *collaborative ecosystem* in which *technology* is designed and implemented.

## 1.1. Public sector setting

### Administrative structure

- Establish a dedicated unit in charge of overseeing and creating synergies across the smart city initiatives of the city.
- Equip this unit with sufficient authority, autonomy, and resources to effectively coordinate municipal departments and other actors contributing to smart city developments.

### Culture

- Embrace a culture of open innovation and experimentation.
- Promote a positive attitude towards innovation among your employees at all levels of the organization.

### Internal capabilities

- Combine training and knowledge-exchange initiatives with recruitment strategies to bridge your skills gap.
- Adopt a wide-ranging set of measures to increase the attractiveness of public employment and promote the retention of skilled professionals.

### 1.1.1. Administrative structure

Too often, municipal departments, national agencies, and other public entities involved in smart city initiatives work in isolation. This lack of coordination within the public sector poses a major constraint to smart city development, as indicated by one-third of the respondents in the global survey.



**In order for a smart city initiative to be successful, we need to break existing silos and develop cross-disciplinary communities that work together.”**

Urban Catalyst, Germany

To overcome the existing administrative silos and foster collaboration among public sector organizations, a common approach adopted by municipalities across the world is to **establish a dedicated unit overseeing and creating synergies across all smart city initiatives** put in place by local actors (hereinafter, smart city unit). Fifty-seven percent of the municipalities who participated in the survey already have one. In 9 out of 10 cases, these units are located within the municipal administration rather than outside of it. This decision is supported by previous studies showing that municipal governments are best positioned to structure and manage these entities<sup>1</sup>.

The establishment and management of a smart city unit do not follow a single, universal approach, as indicated in Box 1.1, which offers an overview of diverse approaches adopted globally. When crafting these entities, it becomes crucial to carefully deliberate upon the local contextual factors, engage with relevant stakeholders, and assess the available resources. Furthermore, the configuration of these units may evolve over time to align more effectively with the varying phases of smart city development. For instance, in smaller municipalities, the initiation of smart city initiatives may initially hinge on skillful leaders possessing the ability to inspire and direct the endeavors of local participants. In contrast, in larger urban centers and during the more advanced stages of smart city development, it might become imperative to establish a dedicated unit specifically designed to address the intricacies of cross-sectoral collaborations.



## BOX 1.1

## Alternative settings of smart city units

- Following the establishment of a cross-departmental team spanning multiple policy areas, the City of Bratislava (Slovakia) has created an urban innovation unit<sup>2</sup> as an integral component of its information technology (IT) department. This specialized unit is equipped to harness expertise and information related to data, ensuring that the progress of the smart city initiatives in Bratislava aligns harmoniously with technological, societal, economic, and environmental objectives.
- The City of Amsterdam (Netherlands) has created a Digitization, Innovation, and Information Department<sup>3</sup> that is comprised of four directorates, each responsible for overseeing various facets of smart city development. These directorates encompass Digitization and Innovation, Digital Strategy and Information, Data, and Digital Facilities. Consequently, the Department boasts a diverse team of professionals, each bringing a unique disciplinary expertise and professional background to the table. Within this department, one can find a blend of IT specialists and project managers collaborating with privacy experts, as well as professionals well-versed in ethics, digital human rights, and digital inclusion.
- In Bogota (Colombia), smart city initiatives are coordinated by a dedicated team situated in the Mayor's Office. This team does not function as an independent entity; instead, it serves as a catalyst, fostering synergies and facilitating collaborations among various projects and ideas that are under development in different municipal departments.
- In Melbourne (Australia), the Strategic Planning Office assumes responsibility for overseeing the implementation of the Smart City Strategy of the city. This strategy has been formulated through a participatory bottom-up process that engages numerous local stakeholders<sup>4</sup>.
- In Jakarta (Indonesia), a public service agency was established in the year 2014 with the primary objective of optimizing the utilization of technology within the local government. As time has passed, this public agency has evolved into a vital intermediary entity, bridging the gap between the government and its residents in the co-creation of digital innovation.
- In Banjul (Gambia), smart city development has been led by the Gambia Accelerator Lab (AcclabGM), an incubator sustained by the United Nations Development Programme (UNDP). AcclabGM has been working with Banjul City Council and the University of Gambia to identify the key actions to prioritize as part of the local Smart Cities Pilot initiative<sup>5</sup>.

Based on the experience of municipal governments around the world, regardless of their configuration, **these dedicated entities need to be equipped with sufficient autonomy in decision making, adequate resources, and clear responsibilities to exert effective leadership** over the smart city initiatives put in place by different partners, within and outside the public sector. For this reason, smart city units should:

- *Be accountable to elected officials but autonomous from them*; this helps mitigate the risks deriving from political instability (as discussed in Section 2.2.2) while ensuring adherence between the objectives of smart city development and the overarching strategies and agendas orienting the activities of the municipal government.
- *Avoid rigid top-down structures* that could discourage innovation within public organizations (see Section 1.1.2 for more details) and constrain the bottom-up efforts of start-ups, civil society organizations, and other grassroots actors whose contribution is vital to inclusive smart city development (as discussed in Section 2.1.2).
- *Develop the capacity to support and harness participatory tools* (see Box 2.3) to sustain the active engagement of local stakeholders in the planning, design, and monitoring of smart city initiatives (see Section 1.3.1 and Section 3.2.2 for additional details).

## 1.1.2. Culture

To effectively coordinate smart city initiatives in collaboration with both internal and external stakeholders, municipal governments need to **embrace a culture of open innovation and experimentation**. Several considerations should be taken into account to tackle this complex task:

- *Building a shared vision on innovation* helps break administrative silos and ensure continuity in smart city development<sup>6</sup>.
- *Instilling an entrepreneurial mindset and culture of experimentation*, recognizing failure as a normal part of growth, contributes to creating a fruitful environment for the emergence of new ideas from within the public sector<sup>7</sup>.
- Developing a positive attitude towards innovation and experimentation is also crucial to *foster the adoption and acceptance of creative approaches* and solutions developed outside the public sector<sup>8</sup>.
- *Developing a public mandate that articulates the values informing smart city developments* further motivates elected officials to adopt a proactive approach when making decisions and adopting policies<sup>9</sup>.

As highlighted by the survey data, changing the culture of municipal administrations remains a major challenge. Although 70% of the respondents asserted that their municipal government nurtures a culture of innovation, resistance to change and fear of failure continues to constrain smart city development in one-third of the urban areas included in the sample.



**The concept of smart city goes beyond integrating technology in the projects and processes of the local administration. It requires a cultural change at the organizational level and a cultural change at the city level.”**

Municipalidad de Heredia, Costa Rica

To overcome these challenges, municipal governments need to **set incentives and arrange initiatives to promote a positive attitude towards digital innovation among their employees**.

Examples of measures include:

- *Appointing smart city champions* in charge of raising awareness about the opportunities that innovation could generate for the city and its government. These champions can belong to smart city units (see Section 1.1.1) or be selected from across different departments, especially among employees who show a strong interest and positive inclination towards digital technologies<sup>10</sup>. Learning about innovation from peers is expected to help municipal staff overcome their concerns about new technologies and build a climate of trust around digital solutions<sup>11</sup>.
- *Establishing a network of smart city officials, internal and external to the public sector*. This is the approach followed in Taipei<sup>12</sup> (Taiwan), where the municipality has formed working groups in which municipal staff and industry experts exchange ideas on how innovation can be applied in different sectoral areas (such as transportation and education). In addition to promoting the co-creation of new solutions, these working groups have facilitated cultural change in the municipal government by shedding light on the potential of innovation in different sectors and departments.
- *Creating a shared language to clearly articulate what innovation implies for the city and its government*. This entails developing a common understanding of what innovation means in the local context and how it should be integrated into urban operations and the municipal administration. As experienced in Louisville (USA), this shared language can help build consensus around smart city development within the municipal government while encouraging staff members to be creative and come up with innovative ideas.
- *Facilitating the access of public employees to data and other knowledge resources that can trigger innovative ideas*. For instance, the city of Addis Ababa (Ethiopia), in collaboration with its national government, has created a unified datacenter that collects information on different projects and creates a common pool of data, which all city officials can access. This solution has proved effective in supporting innovation processes and creating wide support among the municipality's staff towards smart city development.

### 1.1.3. Internal capabilities

A wide range of skills and competencies is required to successfully lead smart city initiatives (see Box 1.2). However, in the global survey, 35% of the respondents highlighted that the lack of skills within the public sector remains a barrier to smart city development. Moreover, 47% of the participants declared that their municipal governments do not have the competencies required to manage smart city initiatives effectively.

#### BOX 1.2

### Skills and competencies for smart city development

- The CAP4City project<sup>13</sup>, involving 12 universities in Europe and Latin America, has identified nine knowledge areas that are key for smart city professionals: business and economics, communication, governance, information systems, legal and ethical implications, public administration management, smart city foundations, socio-technical transformations in IT, and urban studies and sustainability.
- The OECD Framework for Digital Talent and Skills<sup>14</sup> in the public sector distinguishes among four key competences for public officials involved in digital transformation projects: digital government user skills, digital government socio-emotional skills, digital government professional skills, and digital government leadership skills.
- The Urban Learning Centre<sup>15</sup> is developing training modules that aim to equip public employees with a set of skills more conducive to urban innovation. This skillset includes diverse competences such as community engagement, sensemaking, foresight, and monitoring.
- The Teaching Public Service in the Digital Age<sup>16</sup> initiative (launched by a network of public administration academics and practitioners) has listed eight core competencies for public service leaders in the digital era: understanding service users; anticipating and mitigating risks; working with multidisciplinary teams; creating an environment for continuous improvement; overcoming barriers to change; making government more open, collaborative, and accountable; understanding the value of data; and understanding current and evolving affordances of digital technologies.

To bridge existing skills gaps within municipal governments, **a combination of the following measures should be put in place:**

- *Training of existing staff*, which can be developed internally or sourced from third parties. Many national governments and international organizations have launched programs and set up agencies in charge of building capacity for digital transformation in the public sector. Examples include the Scottish Digital Academy<sup>17</sup> and the Snap4City Platform managed by the University of Florence.<sup>18</sup>
- *Recruiting of new staff with expertise in emerging knowledge domains* related to smart city development, such as ethics of technology, artificial intelligence, big data analytics, and data governance. For instance, the city of San Antonio (USA) has hired staff with diverse backgrounds to meet their smart city development targets. As a result, data scientists work along psychologists and experts in citizen participation<sup>19</sup>.
- *Sourcing additional know-how and capabilities from external partners*, such as universities and other research institutions. By working with local and foreign universities, the municipality of Fortaleza (Brazil) has developed big data and machine learning capabilities that have been applied to enhance traffic management and improve decision-making regarding public transportation systems<sup>20</sup>. Similarly, in Freiburg (Germany), researchers from the local university have long acted as advisors to municipal staff working on smart city initiatives.
- *Leveraging formal and informal knowledge-sharing initiatives*, such as city-to-city networks at national and international levels. The African Smart Town Network (ASToN)<sup>21</sup>, for instance, has enabled peer-to-peer learning among various cities in Africa by creating a repository of good practices and providing training for capacity building.



Financial constraints, which are frequently exacerbated by austerity policies, have the potential to further erode the internal capabilities of municipal governments.<sup>22</sup> These constraints manifest in the form of challenges in providing competitive salaries that align with the economic remuneration offered by private companies. While certain constraints necessitate nationwide interventions for resolution, municipal governments retain the capacity to **implement a diverse array of measures aimed at attracting and retaining skilled professional**. Examples include:

- *Leveraging temporary recruitment to build long-term relationships* with skilled professionals. This approach has been successfully practiced in Lithuania, where many cities have managed to hire qualified staff after offering them challenge-specific, short-term contracts.
- *Identifying alternative funding sources to sustain the cost of recruitment*. These sources may encompass donations from philanthropic organizations or funds that are accessible within the framework of national recovery plans and regional development programs. A noteworthy example of this is the support provided by Bloomberg Philanthropies, which has contributed to the establishment and operations of digital innovation teams in six cities (Amsterdam, Bogotá, Mexico City, Reykjavík, San Francisco, and Washington, DC). These teams have been instrumental in harnessing digital technologies to enhance the delivery of public services<sup>23</sup>. Moreover, in the United States, the resources made available to municipal governments by the Coronavirus State and Local Fiscal Recovery Funds has opened opportunities for municipal governments to initiate capacity building activities, including the hiring of new staff<sup>24</sup>.
- *Establishing programs to attract graduates and young professionals* with advanced skills, particularly in the realm of digital technology. An illustrative example of this approach can be found in the trainee program initiated by the province of Gelderland (Netherlands) This program has allowed local municipalities to successfully recruit highly talented recent graduates, who have subsequently evolved into senior specialists in the field of smart city development.



**It is important to provide civil servants with mentoring and assistance to help them understand new technologies.”**

Fundação Getulio Vargas, Brazil

## 1.2. Policies and regulations

### Technological innovation policies

- Develop clear, citywide policy recommendations on the use of existing and emerging technologies.
- Align policy recommendations with supranational innovation policies.

### Public procurement

- Experiment with innovative approaches to public tendering within the frameworks set by public procurement regulations.
- Introduce evaluation criteria that encompass an examination of the social, ethical, and environmental effects of digital technologies.
- Align with national and supranational regulations promoting innovative approaches to the procurement of digital technologies.

### Technical standards and regulations

- Take the lead in exploring and defining new standards and regulations aimed at fostering smart city development.
- Collaborate with other cities to influence policymaking and the formulation of standards at the national and global level.

### 1.2.1. Technological innovation policies

To effectively guide and oversee smart city development, municipal governments should clearly outline their strategies for governing critical policy aspects that impact smart city initiatives. These aspects include the provisioning and regulation of digital infrastructure assets, cybersecurity, ethical considerations related to technology, data protection, and interoperability. However, a study conducted by the World Economic Forum has revealed that many cities have not implemented policies in these crucial areas yet, with the exception of open data<sup>25</sup>. These findings have been substantiated by the global survey; although 56% of respondents have stated that their municipality has an established open data policy, other vital policy domains have yet to be formalized within municipal laws or regulations.

**Developing clear, citywide policy recommendations on existing and emerging technological innovations** remains crucial to:

- *Provide the legal basis for the definition of technical regulations:* in the absence of national or international legislation, municipal laws can provide a legal framework and justification for implementing technical regulations and commencing standard-setting procedures. For instance, the Local Law 11 adopted in New York City (USA) in 2012 has imposed a range of obligations that compel the utilization of data standards within municipal administrations<sup>26</sup>.
- *Steer the procurement of technological solutions in the municipal government:* in 2021, the Barcelona City Council granted approval for a municipal strategy aimed at integrating artificial intelligence (AI) into municipal services<sup>27</sup>. This significant step was subsequently followed by the formulation of a comprehensive protocol in 2023. This protocol's primary objective is to delineate the mechanisms and establish guarantees that ensure the conformity of algorithmic systems with ethical principles and digital human rights during both the tendering and implementation phase<sup>28</sup>. Similarly, Mexico City (Mexico) has developed a strategic plan for the anticipatory governance of AI. This strategy is designed to guide and facilitate the seamless integration of AI technologies into municipal services and urban spaces.<sup>29</sup>
- *Direct local implementation of emerging technologies towards sustainable and ethically responsible outcomes:* it was the year 2021 when London (UK) adopted the Emerging Technology Charter established four fundamental principles that must be adhered to by individuals involved in the testing and implementation of innovative technologies within the metropolitan region. These principles encompass: openness, respect for diversity, responsible handling of personal data, and a commitment to sustainability<sup>30</sup>. Similarly, in Dubai, ethical principles and guidelines for the responsible use of AI have been integrated into the Smart Dubai Ethical Toolkit, which includes a self-assessment tool for developers of AI-enabled technologies<sup>31</sup>.

These policy recommendations should be **prioritized within the political agendas of local administrations**. Moreover, they should be **harmonized with the technological innovation policies established at the supralocal level**, particularly with regards to funding schemes. This alignment is essential for preventing multilevel governance issues. Ensuring consistency among technological innovation policies at different administrative levels is crucial to facilitate their enforcement and prevent legal conundrums that may result into political conflicts and a waste of resources<sup>32</sup>.



**Smart city initiatives cannot be completed if there is no alignment with national and regional policies.”**

ICLEI, Europe

## 1.2.2. Public procurement

The global survey shed light on a noteworthy trend: 57% of respondents from all five continents expressed agreement regarding the substantial challenges posed by public procurement regulations to smart city initiatives. Notably, existing regulations face criticism for imposing stringent bureaucratic control, which in turn hinders the engagement of external partners and restricts the choices available for the selection of technological solutions for implementation in smart city initiatives<sup>33</sup>.

For this reason, many municipal governments are increasingly **experimenting with innovative approaches to public tendering** and alternative public procurement processes, such as design contests, performance based-contracting, and pre-commercial procurement methods. Box 1.3 provides an overview of innovative procurements methods currently in use across the world.



## Examples of innovative approaches to public procurement

- The Climate Smart Cities Challenge<sup>34</sup>, launched by UN-Habitat and the Swedish government, is a multi-stage competition that aims to accelerate the transition to climate neutral cities. During the initial stage, teams of innovators have been invited to put forth proposals for climate smart solutions that hold potential for application within urban areas. In the subsequent stage, 45 teams have been selected and invited to co-design and test their innovative solutions with the municipal governments of Bogota (Colombia), Bristol (UK), Curitiba (Brazil) and Makindye Ssabagabo (Uganda).
- In Latvia, public authorities have experimented with pre-commercial procurement methods for algorithmic solutions to optimize transportation logistics<sup>35</sup>. Contracts have been awarded to both the best applicant and the second-best applicant. This approach ensures a reduction of risk for public authorities, thereby increasing the likelihood of obtaining an innovative prototype.
- Pitch Long Beach<sup>36</sup> is a program that allows technology vendors to pitch innovative ideas to the city government of Long Beach (USA). These proposals are judged by the Smart Cities Program Manager and other local experts. For the most promising innovations, the municipality issues an Expression of Interest to verify whether other organizations are willing to provide a similar solution. This process not only fosters innovation but also reduces the risk of public resources being allocated to less effective or redundant solutions.
- The city of Copenhagen<sup>37</sup> (Denmark) has used performance-based contracting for the procurement of a new street lighting system. The assessment criteria used in the public tender placed more emphasis on performance objectives rather than product characteristics. The new system procured through this approach has allowed the municipal government to halve the energy consumptions of streetlights.
- The Open Contracting Partnerships is an independent nonprofit public charity that operates in over 50 countries. This organization has successfully developed Open Contracting Data Standards, which have played a pivotal role in improving public procurement for smart city initiatives. These standards simplify the process of disseminating transparent information regarding the planning and execution of public contracts<sup>38</sup>.

Public procurement directly influences how technological solutions are designed and implemented in smart city initiatives. According to findings from the global survey, more than two-thirds of the urban areas within the sample have already integrated data protection and cybersecurity specifications into their procurement procedures. In contrast, ethical considerations regarding technology and requirements for open-source technology adoption are currently available only in approximately 40% of the municipalities.

Possible actions to address these shortcomings in existing public procurement processes are the following:

- *Introducing evaluation criteria that look at the ethical, social, and environmental impacts* of digital technologies to ensure that technology selection criteria are not only based on the most economically advantageous offers. In the procurement of digital technologies, the entire lifecycle of technological solutions and long-term maintenance should also be considered. This comprehensive approach serves to mitigate the risk of experiencing adverse financial consequences and the environmental footprint linked to electronic waste and non-reusable hardware. Moreover, The World Economic Forum advocates the inclusion of privacy impact assessments and accessibility requirements within public procurement procedures<sup>39</sup>.
- *Ensuring that both legal and technical teams are working together to design and conduct public tenders.* The collaboration between procurement teams and smart city units has been crucial in North American cities like Louisville and San Antonio. This partnership has been instrumental in gaining a more comprehensive understanding of how to enforce standards and establish necessary safeguards to effectively manage emerging technologies, such as AI.
- *Aligning with national and supranational regulation* promoting innovative approaches to procurement. For example, the European Commission has long endorsed pre-commercial procurement methods for Research and Development activities<sup>40</sup>. Moreover, it has recently revised its Open-Source Software Strategy<sup>41</sup> to ensure a level playing field to open-source software when procuring new software solutions.



We work very closely with our procurement team to develop technology pilot programs and make sure that we are abiding by their procurement policies and regulations, but we are still being innovative, and we are still giving technology companies a chance to work with us in more non-traditional ways.”

Long Beach City Council, USA.

- Portland (USA) has banned both private companies and public organizations from using facial recognition<sup>42</sup>.
- AI observatories have been established in various cities, including Barcelona<sup>43</sup> (Spain) and Vicente Lopez<sup>44</sup> (Argentina) with the overarching goal of monitoring the progression of AI-based applications and fostering their ethical utilization.
- In the Netherlands, five municipalities (Amsterdam, Utrecht, Eindhoven, Rotterdam, and The Hague) are working together to define a new standard for urban mobility. The objective is to facilitate data sharing between local governments and mobility operators, in compliance with the existing privacy regulation<sup>45</sup>.
- Through workshops and consultations with multiple local stakeholders, the municipal government of Bilbao has developed a Data Manifesto<sup>46</sup> that sets ten guiding principles for the responsible and ethical use of data in the city.

### 1.2.3. Technical standards and regulations

The implementation and application of legal frameworks and regulations specific to smart city initiatives remain a major challenge for many municipalities worldwide. One likely reason behind this challenge is the absence of comprehensive regulatory and legal frameworks for smart city technologies at the national level. While data protection has garnered substantial attention from lawmakers across the globe, less than half of the survey respondents confirmed the existence of regulations governing technology ethics, interoperability, and the utilization of open-source software.

When experiencing these regulatory voids, municipal governments across the world are **taking the lead in exploring and defining new regulatory measures to tackle emerging technical, ethical, and legal issues** in smart city development:

These experiences demonstrate that municipal governments can enact local laws and regulations that address issues related to smart city development in accordance with the regulatory requirements established at the international and national levels. Both national and international institutions are increasingly embracing new laws and standards for technological advancements. For example, the national governments of Chile<sup>47</sup> and South Korea<sup>48</sup> have each implemented national policy frameworks to govern the development and deployment of AI-enabled innovations. Furthermore, Open and Agile Smart Cities (OASC), an international network of cities, has actively advocated for the establishment of interoperability mechanisms to facilitate the replication and scalability of smart city solutions (see Section 3.2.1). Additional examples of standards for smart city development defined by national and supranational standardization organisms are listed in Box 1.4.



## Examples of standards for smart city development

- The International Telecommunication Union (ITU) houses the ITU-T Study Group 20<sup>49</sup>, which is dedicated to the development of international standards. These standards serve to define technical criteria, processes, and practices essential for facilitating the coordinated development of IoT technologies specifically tailored for smart city development<sup>50</sup>.
- The International Organization for Standardization (ISO) has produced the ISO 37122<sup>51</sup> document, which establishes definitions and methodologies for a set of indicators designed for the assessment of smart city initiatives.
- Data standards are being finalized and adopted by various organizations, which are focusing on different facets of smart city development. The Open Data Standards Directory serves as a repository for these standards<sup>52</sup>, while the Open Data Institute has outlined a checklist to aid decision-makers who have the intention of utilizing open data standards<sup>53</sup>.
- The Smart Cities and Communities Framework Series, developed by the US National Institute of Standards and Technology (NIST), provide municipal governments with technical guidelines for the design and implementation of smart city solutions, addressing both foundational and section-specific issues<sup>54</sup>.

Given the variety of actors involved and the complexity of the matters covered in policymaking and standardization processes, **collaboration is key to support the regulatory efforts of municipal governments and successfully influence policymaking at the national and global levels.** In this regard, the following items warrant your careful consideration.

- *Interacting with knowledge sharing initiatives, such as city-to-city networks, allow cities to build their capacity, especially technical and legal expertise. An example is the Intelligent Cities Challenge<sup>55</sup> initiated by the European Commission, which provides participating cities with expert advice on five thematic areas: citizen participation and digitization of public administration; green economy and local green deals; upskilling and reskilling; green and digital transition in tourism; and supply chains, logistics and the economics of mobility.*

- *Coalitions of cities are more effective at increasing awareness and shaping national and global debates on the legal, technical, and ethical issues that smart city development can generate. For instance, the Cities Coalitions for Digital Rights is leading the international debate on digital rights in urban contexts<sup>56</sup>. Similarly, the United for Smart Sustainable Cities (U4SSC)<sup>57</sup> is supporting the development of harmonized institutional policies for the use of digital solutions in urban environments.*

“  
If you want to deliver strong messages to national governments, go via your international partners. It does not always work, but it has some influence and effectiveness towards addressing our internal problems and situation inside the country.”

Congress of Local Authorities, Moldova



## 1.3. Planning

### Strategic orientation

- Establish a shared understanding of what smart city development means for a city and its urban development actors.
- Leverage participatory and inclusive approaches to planning processes.
- Formalize a clear strategic orientation aimed at coordinating the efforts of all stakeholder groups participating in the development of smart city initiatives.

### Implementation strategies

- Establish a comprehensive set of implementation strategies for the coordination of individual smart city initiatives.
- Put in place a monitoring system for evaluate the results of smart city initiatives.

### 1.3.1. Strategic orientation

The planning process for organizing smart city development involves the establishment of a clear strategic orientation, which is usually defined through the combination of a smart city definition, a vision statement, and a strategic plan. According to the global survey, 70% of the respondents indicated that their municipality had introduced at least one of these strategic tools, whereas only one-third of the municipalities had combined all three of them.

Moreover, 50% of the participants indicated that their respective cities have reached a consensus on an official smart city definition. This percentage remains consistent across continents, with one notable exception: Africa, where 75% of participants reported the absence of a clear smart city definition within their municipalities.

#### Establishing a shared understanding of how smart city development should be interpreted within the administrative boundaries of a city

is crucial. This shared understanding serves as a foundation for informing fruitful collaborations among stakeholders, avoiding misconceptions regarding the expectations that smart city development is meant to meet, and ensuring that all smart city efforts align with the overarching sustainable development goals of the city<sup>58</sup>. In light of this, the goals of smart city initiatives must extend beyond the mere deployment of smart technologies. Instead, they should encompass smart city development as a people-centered process that integrates digital technology with social factors to realize urban development that is both sustainable and inclusive.

To ensure that smart city development is truly centered around the needs and sustainably challenges of local communities, **the planning process should actively employ participatory and inclusive methods**. The survey has yielded a nuanced perspective on the extent of resident engagement during the planning stages of smart city initiatives. In North America, participation stands at 85%, followed closely by Europe at 73%. Latin America and Asian countries, excluding China, show lower levels of involvement at 51% and 50%, respectively. On the contrary, the involvement of residents in the planning of smart city initiatives is significantly constrained in both African and Chinese urban areas.

To foster the development and implementation of participatory planning processes, municipal governments can derive inspiration from these successful experiences:

- Glasgow (UK) has implemented a Participatory Budgeting Evaluation Toolkit<sup>59</sup> as a crucial component of its budget evaluation process. This toolkit serves the primary purpose of incorporating the viewpoints and input of local stakeholders into the assessment of budgets allocated to a wide array of municipal functions and activities. This inclusive approach extends to areas related to the advancement of smart city development within the city.
- The municipal government of Mesa (USA) employed a blend of interviews and public workshops as instruments to gather insights from various internal and external stakeholders concerning the city's future development and the primary challenges confronting local communities. These methods were instrumental in optimizing community outreach and involving residents hailing from diverse social and professional backgrounds.
- In the province of Pathumthani (Thailand), design thinking techniques has been leveraged to plan and develop smart city solutions with the direct involvement public and private actors at various levels. The design process unfolds through three distinct phases: first, the identification and prioritization of problems; second, the formulation of goals; and finally, the development of a comprehensive plan, encompassing activities for various timeframes.<sup>60</sup>
- The government of Canberra (Australia) has launched YourSay, an online consultation hub that allow residents to share ideas and feedback on a wide range of topics through a combination of online surveys, online discussions, and quick polls.<sup>61</sup>
- The municipality of Surabaya (Indonesia) has delineated its Smart City Strategy 2020 Program through a collaborative planning process that involved a combination of virtual workshops, social media communication, and on-field visits<sup>62</sup>.

- As part of the Smart Islands Vanuatu initiative<sup>63</sup>, the objectives and priorities of the program have been delineated through an inclusive process that engaged over 700 residents. The primary objective of this process was to foster a collective comprehension among local stakeholders while pinpointing sustainable measures for realizing their vision.

“**Every actor in the community should have a say on the road ahead and the smart city approach that you are choosing as a city.**”

Red de Innovación Local, Argentina

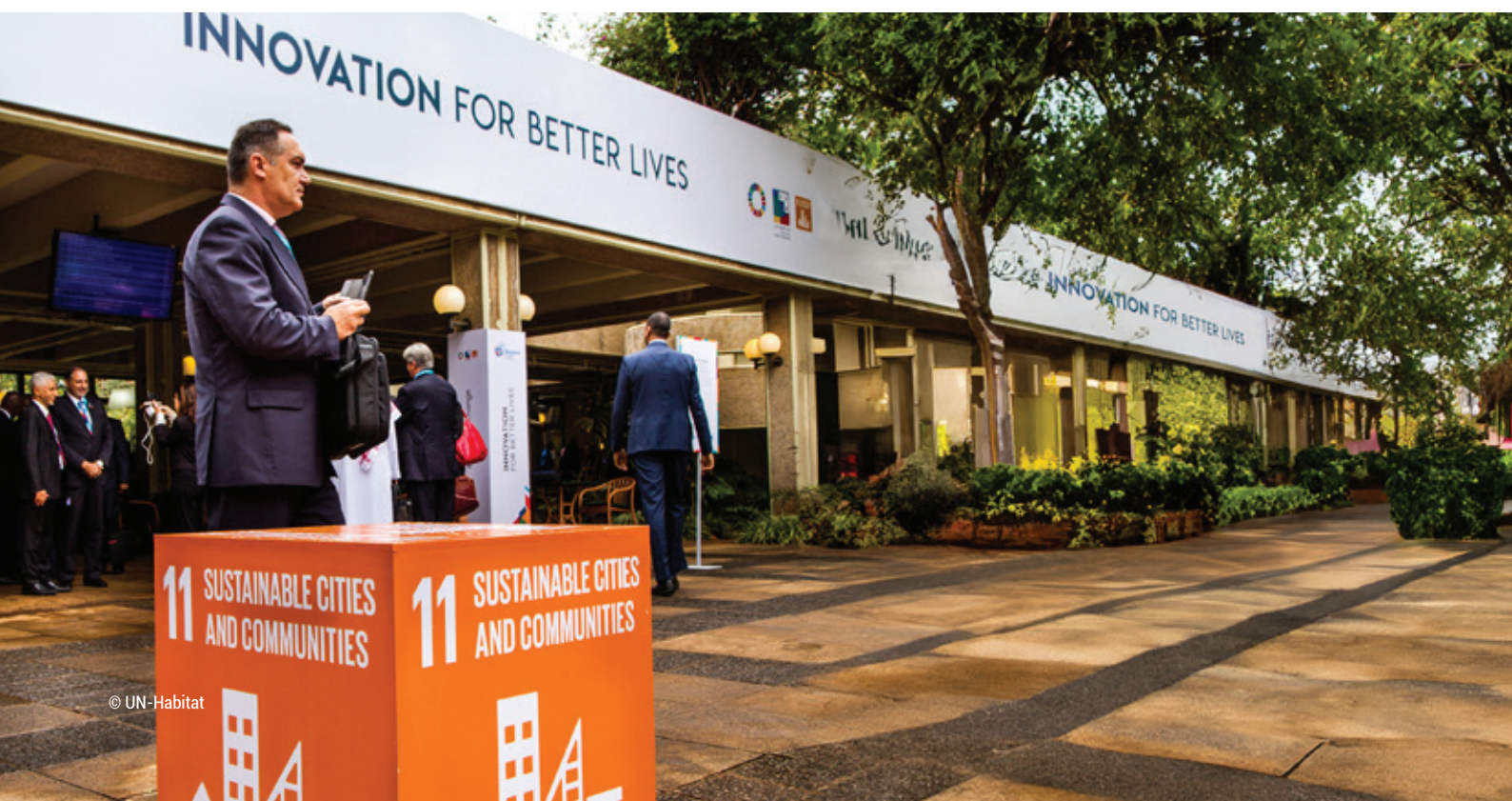
**Formalize a clear strategic orientation is indispensable to coordinate activities and stakeholder groups.** Strategic documents tailored to the context of smart city initiatives serve as crucial instruments to attain this objective. They enable the delineation of long-term goals, objectives, and strategies that it plans to use to realize them. These documents function as comprehensive roadmaps, charting the course of actions and decisions for governmental organizations over an extended timeframe, often spanning three to five years or more. Undoubtedly, they are essential tools for aligning collective efforts, resources, and

stakeholders toward a shared vision and common purpose for smart city development. Box 1.5 and Box 1.6 presents alternative types of strategic documents currently used by municipalities and national governments across the five continents.

When developing a strategic document for smart city development, it is important to:

- *Align it with concurrent strategies implemented at the municipal and other governance levels.* Examples include national agendas aimed at fostering digital transformations, citywide plans focused on sustainable development, and spatial and strategic blueprints. The establishment of such a linkage serves to foster synergies between the progression of smart city initiatives and the broader spectrum of sustainable development endeavors in the city.
- *Conceive it as a living document,* to facilitate the swift adaptation and updating of established courses of action in response to rapidly evolving technological landscapes and the insights gained from the implementation of digital technologies, including pilot initiatives.
- *Articulate objectives that are reflective of current and emerging city needs,* considering the socio-economic and environmental facets of sustainable urban development. These objectives should undergo periodic revisions to ensure their alignment with the overarching city strategy and the evolving needs of the local communities.





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## BOX 1.5

## Examples of strategic documents for smart city development implemented by municipal governments

- In Vienna (Austria), the municipal government has formulated an overarching framework strategy aimed at providing comprehensive guidance for the development of smart city initiatives within the city boundaries. This strategy has been complemented by numerous sectoral strategies to ensure that the most important public functions are addressed appropriately.
- In 2018, the city of Casablanca (Morocco) launched the *Master Plan for Digital Transformation*. This comprehensive plan adopts a portfolio-based strategy for fostering innovation. It encompasses a total of 70 distinct smart city initiatives, which are categorized under four primary axes of intervention: information systems, smart city services, infrastructures, and support projects.<sup>64</sup>
- In Prato (Italy), the municipal government has published a *Smart City Plan*. This plan encompasses seven distinct application areas for digital technology, offering an in-depth overview of the various smart city initiatives being actively executed by both public and private stakeholders.
- The city of Seoul (South Korea) has adopted a *Smart City & Digitization Master Plan*. This plan has been designed to tackle the growing demographic challenges, as well as the mounting social, environmental, and economic pressures confronting the metropolitan region. Guided by the overarching vision of “Seoul, leading the future of digital transformation as a global smart city”, the plan delineates three key strategic priorities and outlines nine major tasks to be pursued by 2025.<sup>65</sup>
- In Thimpu (Bhutan), smart city development has been defined within the broader vision of a healthy city. As a result, the municipal government has launched the *Health City Action Plan for 2022-2026*. The plan outlines how smart city solutions have the potential to enhance the quality of life within the city: an enhancement that can be achieved, as explained in the strategic document, by promoting inclusive and responsive urban planning, with an emphasis on addressing the needs of vulnerable residents<sup>66</sup>.



## Examples of strategic documents for smart city development implemented by national governments

- The *Smart City Rwanda Masterplan* details Rwanda's overarching goal of evolving into a knowledge-based society. This comprehensive blueprint is poised to steer the trajectory of smart city initiatives throughout the nation. It clarifies the roles and responsibilities of national and municipal authorities. Moreover, it articulates a concrete roadmap, outlining the steps and measures to be undertaken to realize the smart city vision for all urban areas within Rwanda.<sup>67</sup>
- The *Brazilian Charter for Smart Cities* is anticipated to exert a significant influence on the trajectory of smart city development in Brazil. It is set to make three primary contributions: defining the smart city concept for the Brazilian context; introducing five guiding principles and six guiding directives for local developments; formulating eight strategic goals and 163 action recommendations to guide the actions of municipal leaders in the smart city field<sup>68</sup>.
- In Turkey, the Ministry of Environment and Urbanization has adopted the *2020-2023 National Smart Cities Strategy and Action Plan*. It lays out a comprehensive nationwide framework for the implementation of smart city initiatives throughout the nation. By setting a vision for the advancement of smart city development, defined as "livable and sustainable cities that add value to life", this plan seeks to guarantee that municipal-level efforts are oriented towards fulfilling the requirements of citizens and bolstering the enhancement of living standards within urban regions.<sup>69</sup>
- Malaysia's *Smart City Framework* is built around seven smart city core components and characteristics: smart economy; smart living; smart environment; smart people; smart government; smart mobility; and smart digital infrastructure.
- The implementation of these components is guided by eleven criteria. These criteria serve as indicators of the primary requirements, values, and priorities that local initiatives are required to adhere to<sup>70</sup>.
- As part of the *SmartJAMP* program, the Ministry of Land, Infrastructure, Transport, and Tourism in Japan has released a guidebook aimed at providing local governments with instructions for the effective execution of their smart city initiatives. This guidebook showcases successful cases that have been drawn from national and international experiences<sup>71</sup>.

### 1.3.2. Implementation strategies

In the process of formalizing strategic objectives and priorities, municipal governments need to **establish a comprehensive set of implementation strategies for the coordination of individual smart city initiatives**, rather than addressing them as isolated and disjointed initiatives. An implementation strategy can be formalized in a plan or roadmap, as exemplified by municipal governments in Da Nang, Hanoi, and Ho Chi Minh City<sup>72</sup> (Vietnam).

Regardless of the format chosen, implementation strategies should:

- *Leverage the capabilities already available within the municipal administration* to optimize the allocation of financial and human resources. An exemplary model can be observed in Bratislava (Slovakia), where the smart city unit has established a close working relationship with the legal and financial departments. This collaboration allows them to tap into the expertise provided by these departments in critical domains of smart city development, such as regulatory compliance and financial budgeting.
- *Offer continuous guidance to all stakeholders participating in smart city initiatives, while maintaining the flexibility necessary to accommodate timely updates* in light of technological advancements and evolving needs that may arise during implementation phases. An illustrative example can be drawn from the municipal government of Toronto (Canada), which has developed a comprehensive set of strategic priorities<sup>73</sup>. These priorities not only serve as a guiding framework for the implementation of smart city initiatives but also explicitly take into consideration the necessity for adjustments and revisions in response to shifts in technology and politics.
- *Combine long-term thinking with short-term objectives*, identifying the technical and financial resources required to achieve both operational and strategic goals. As an example, the strategy employed by Busan (South Korea) for the *Eco Delta Smart City*<sup>74</sup> combines an overarching vision and long-term objectives, all complemented by a range of activities and solutions to be expeditiously executed in the short term. Notable instances encompass the establishment of cutting-edge technological platforms and the adoption of pragmatic methods for fostering citizen engagement.

- *Comply with the conditions set by funders, regulators, and other external stakeholders* that could influence the implementation of smart city initiatives. For example, the implementation of digital infrastructures must adhere to the requirements set by national agencies with respect to security, resilience, and minimum service standards. Similarly, municipal initiatives should be managed in accordance with the overarching national strategies for digital transformation. One illustrative case is offered by the city of Kigali (Rwanda), where all smart city initiatives stem from and are built upon the *Smart City Rwanda Masterplan*<sup>75</sup> (see Box 1.6 for more details).
- *Provide indications on how technological solutions should be selected and implemented.* In this regard, considerations on techno-economic characteristics and social implications are of the utmost importance. For example, when deploying a new digital service, it is important to rely on an implementation strategy that comprehensively delineates the potential effects on various segments of the resident population. Furthermore, it should proactively identify and propose solutions to optimize the accessibility and affordability of these services for all residents. (see Section 3.2.1 for more details).

To ensure the successful achievement of smart city development objectives and the effective implementation of smart initiatives, the **establishment of a comprehensive monitoring system** becomes necessary. This system

should encompass key performance indicators, balance scorecards, and regular progress reports for each smart city initiative. For example, the city of Prague (Czechia) has developed the Smart Prague Index.<sup>76</sup> This index serves as a tool for evaluating smart city advancements across a set of priority domains, including mobility, waste management, buildings, energy, tourism, urban environment, people, and data. These indicators undergo used for each priority domain undergo assessment in alignment with Prague's smart city development goals. Evaluation occurs at various levels, encompassing individual project assessments, city-wide evaluations, and comparative analyses with other cities.<sup>77</sup> As an additional illustrative example, in Brunei, the national government has established a dedicated committee tasked with overseeing and monitoring smart city development across all cities within the country.<sup>47</sup>

However, monitoring practices remain insufficiently utilized in the context of smart city governance. According to the global survey respondents, only 37% have confirmed the existence of a monitoring system within their respective municipalities. Previous research has highlighted the methodological hurdles that municipal administrations often face when attempting to gauge and evaluate the effectiveness of smart city initiatives.<sup>78</sup> In response to this challenge, international organizations are increasingly stepping in, by offering guidance through the formulation of standards tailored to smart city initiatives (see Section 1.2.3) and evaluating frameworks, such as the OECD Smart City Measuring Framework<sup>79</sup>. Fundamental principles to apply when setting a monitoring system for smart city development are also listed in Box 1.6.



## Fundamental principles to guide the establishment of monitoring systems for smart city development

- The monitoring system should not be seen solely as a tool for tracking ongoing activities. Instead, it should serve as a means to gather intelligence that extends beyond the single-project level. Its role is to comprehensively capture and evaluate the execution of smart city development in its entirety.
- The evaluation and reporting of both the outcomes of smart city development and the underlying processes are essential. Monitoring systems should be carefully designed to consistently provide information for ongoing decision-making processes throughout the implementation phases of all smart city initiatives. This approach will enable a more effective response to emerging challenges and new trends.
- The monitoring of smart city initiatives should be designed as a collective process where autonomous sources of data are combined with qualitative assessments.
- The monitoring process should engage diverse groups of stakeholders, including residents. These groups should include the organizations and individuals that are directly or indirectly affected by the smart city initiatives under evaluation, together with academics or other professionals with advanced expertise in the evaluation of public programs.
- The insights that result from the monitoring process should be disseminated to the public and communicated regularly. This sharing process of information serves the dual purpose of enhancing the knowledge of local communities and fostering greater acceptance of smart city initiatives.
- The information that results from the monitoring process should also be shared with other municipalities to facilitate the dissemination of best practices and promote mutual learning.
- Implementation strategies should explicitly indicate who is responsible for taking action upon the feedback coming through monitoring processes.



We can see what progress we are making and if there are barriers to achieve the goals in a timely fashion. This allows us to dive in deeper and provide a narrative about why we are running into these challenges.”

City of Louisville, United States of America



## 02



## COLLABORATIVE ECOSYSTEM

This pillar includes the governance mechanisms that are needed to coordinate the networks of stakeholders involved in smart city initiatives. These mechanisms can be categorized into two overarching themes:

- Innovation partnerships** refer to collaborations that foster the advancement of smart city development, and they can be classified into two primary types: cross-sector partnerships and intra-sector partnerships. Cross-sector partnerships involve entities from diverse sectors, like public-private collaborations that engage municipal governments and private companies. Intra-sector partnerships involve collaborations among organizations within the same sector, such as alliances between national and municipal authorities.
- Innovation partnership formation** entails a comprehensive array of instruments and activities designed to organize and oversee collaborations in the development of smart city initiatives. This includes cooperation agreements that delineate the roles and responsibilities of project partners, strategies and tools that facilitate the establishment of consensus in these collaborative ventures, and collaborative resources and spaces, such as hackathons and living labs, that facilitate the engagement of partners with residents and other local stakeholders.

Both themes are strictly interconnected with the other governance pillars. They are directly influenced by the *Strategy* pillar, while contributing to shaping the design and delivery of *Technology*.

## 2.1. Innovation partnerships

### Intra-sector partnerships

- Engage with networks and associations that promote smart city development and foster collaboration among public sector organizations at various administrative levels.
- Apply coordination mechanisms that enhance alignment and promote more effective collaboration with other public sector organizations.

### Cross-sector partnerships

- Foster the active participation of local businesses in smart city initiatives.
- Build upon the experience of civil society organizations to facilitate the direct engagement of residents in smart city initiatives.
- Collaborate with universities and other research organizations to strengthen capacity building efforts, develop new knowledge, and facilitate participatory processes.

### 2.1.1. Intra-sector collaborations

National and regional governments play a crucial role in providing municipal governments with strategic direction and policy guidance on smart city development. This support is also instrumental in capturing and disseminating best practices among municipal governments and helping them to set development goals and standards, outline local regulations, and obtain funding for smart city initiatives.

Effective collaboration between local and supra-local public sector organizations is indispensable to ensure coordination in smart city development activities and clearly define roles and responsibilities at different administrative levels. For instance, it is important to preserve local autonomy for decision-making and implementation, while ensuring that municipal governments have the capacity to adapt supra-local inputs to their local context conditions. However, establishing this multi-level governance has proven difficult.

The global survey shows that more than half of the urban areas included in the sample face challenges when attempting to coordinate with their national governments. To address this challenge, municipal governments can **engage with networks and associations that promote smart city development and foster collaboration among public sector organizations at various administrative levels**. These networks include:

- *Nationwide associations of municipal governments* that assist their members through the provision of consultancy services and the representation of their interests before national and supranational institutions. Two noteworthy examples of such associations are Fórum Inova Cidades<sup>80</sup> and RECI<sup>81</sup> (Red Española de Ciudades Inteligentes). Fórum Inova Cidades has been initiated by the Brazilian association of mayors (Frente Nacional dos Prefeitos) and plays a pivotal role in assisting municipal leaders in identifying collective solutions to the challenges they encounter when addressing issues related to innovation<sup>82</sup>. Similarly, RECI stands as a robust network encompassing over 140 Spanish local municipalities. Its primary mission is to serve as a comprehensive platform for the exchange of knowledge, experiences, and best practices in the field of smart city development.
- *Regional consortia that foster the coordination of local development projects* and facilitate the exchange of valuable resources and best practices. An interesting example comes from the town of Soissons (France), which has entered a Digital Roadmap agreement with other municipalities in the same agglomeration area. This collaborative effort aims to jointly design and implement local smart city initiatives. Similarly, Yverdon-les-Bains (Switzerland) has forged strategic alliances with other municipal governments within the same canton, enabling the fruitful exchange of resources and ideas. This synergy has been instrumental in shaping collective, location-specific solutions to common challenges.
- *International networks of local authorities* representing, safeguarding, and amplifying the interests of municipal governments in global fora. United Cities and Local Governments (UCLG) is one of them. In 2016, its members set up the *Community of Practice on Digital Cities*, whose main mission is to identify successful case studies that can serve as a reference to advance smart city practices<sup>83</sup>.



**We have communities with municipalities across the country, and when we have a problem, we ask to the community, and people reply from other cities, other provinces, and this is very useful, we help each other a lot.”**

Municipalidad de San Miguel, Argentina

The global survey data has also indicated that a significant impediment to collaboration between municipal and national governments in the context of smart city development is the absence of a clearly defined division of roles and responsibilities. But **multiple mechanisms exist that can favor a better alignment and more effective collaboration between different public organizations** involved in smart city initiatives.

- Many Italian municipalities, such as Turin<sup>84</sup> and Reggio Emilia<sup>85</sup>, have signed Memorandums of Understanding (MoUs) with regional and national authorities to clarify the terms of their collaborations in the field of smart city development. MoUs clearly present the responsibilities of each participating entity, their anticipated contributions, and the shared commitment to pursue mutually agreed-upon objectives.
- In Scotland, smart city initiatives are coordinated by the Scottish Government and the Scottish Cities Alliance. This alliance represents a collaborative effort among eight cities in Scotland, namely Aberdeen, Dundee, Dunfermline, Edinburgh, Glasgow, Inverness, Perth, and Stirling. To foster seamless synergy between regional and national endeavors in the realms of economic development and digital transformation, representatives from both local and national authorities actively participate in leadership group meetings hosted by the Alliance<sup>86</sup>.
- Strategic documents (see section 1.3.1 for further details) can also help forge and sustain partnerships between public authorities. For example, in Hamburg (Germany) the cooperation between the municipal government and other public sector organizations is embedded in the Digital Strategy<sup>87</sup> of the city. This document articulates a series of projects fostering intra- and cross-sector collaborations, such as the Urban Data Platform, which aims to break data silos and enhance data exchanges among public and non-public entities in the city and beyond. Similarly, in the province of Heredia (Costa Rica), a Digital Plan has been launched to foster the collaboration between rural and urban communities in the context of digitalization projects.

## 2.1.2. Cross-sector collaborations

To attain equitable and inclusive outcomes in smart city development, municipal governments are required to bring in a wide range of perspectives and experiences from all societal sectors in the city, whose viewpoints may exhibit differing expectations regarding the outcomes of smart city development. In this regard, the global survey provided a mixed picture. Among the respondents, two-thirds have described universities and research institutions as actively engaged or very actively engaged stakeholders. Private companies have garnered the label of active or very active from 42% of the participants, though this percentage has declined to 21% in low-income countries. Across all regions, the involvement of civil society organizations and residents was found to be notably limited.



**You need to work with all different entities, not only from a governmental perspective. You need to involve all people together.”**

**Ain Shams University, Egypt.**

Previous research has highlighted the existence of numerous obstacles to the involvement of local start-ups and small and medium enterprises (SMEs) in smart city development. Due to their limited size and restricted resources, local start-ups and SMEs are more likely to struggle to scale up smart city solutions, despite having the agility required to sustain radical innovation<sup>88</sup>. Therefore, seeking collaborations with these local actors is key for municipal governments. Working with local start-ups and SMEs can help obtain a deeper knowledge of the local context and local demand for technological innovation. These collaborations can also help ensure that smart city solutions are place-based.

To surmount the prevailing obstacles hindering public-private collaborations, municipalities should **foster the active participation of local businesses in smart city initiatives.**

This can be achieved by instituting specialized programs geared toward offering training and technical support, thus bolstering the skill sets of local businesses and augmenting their competitiveness in public procurement processes. This strategic approach has been successfully implemented in Almaty (Kazakhstan) and Córdoba (Argentina). In the case of Almaty, a dedicated incubation program has been instituted to provide comprehensive support to local startups in their endeavors to develop smart city services. Notably, this program is entirely cost-free and affords its participants the invaluable opportunity to pilot their innovative solutions in collaboration with the municipal government.<sup>89</sup> In Córdoba, the municipal government has launched the Córdoba Smart City Fund<sup>90</sup>, aimed at stimulating investment in government technology (govtech) and bolstering local startups by attracting capital from external institutions.

Municipal governments should also **build upon the experience of civil society organizations to forge effective collaborations with residents and foster their direct engagement in smart city initiatives.** Civil society organizations are deeply rooted in local communities and have extensive experience of engaging with citizens and advocating for their interests. By leveraging their know-how, municipal governments increase their capability to capture the needs of different groups of residents and select measures to effectively promote their direct involvement in smart city initiatives. The partnerships with community leaders and community spaces (such as public libraries, schools, and youth centers) are particularly relevant to tackle existing barriers to civic engagement and digital inclusion (see Section 3.2.2 for more details), thereby facilitating the participation in smart city initiatives of marginalized and digitally divided communities. Specific examples of how smart city development across the world is benefitting from the involvement of civil society organizations and the direct engagement of residents are provided in Box 2.1.



## BOX 2.1

## Examples of collaborations between civil society organizations, local communities, and municipal governments

- The City of San Antonio has partnered with dozens of civil society organizations to create SmartSA Sandbox, a program that provides digital literacy and Science, Technology, Engineering, and Mathematics (STEM) education opportunities designed to involve youth from different social backgrounds and vulnerable groups<sup>91</sup>.
- The municipal government of eThekweni (South Africa) collaborates with various civil society organizations, serving as an intermediary between the local government and the local communities. Certain organizations have been chosen through a competitive tendering process and have entered into official agreements with the local council. Conversely, in other instances, the cooperation is established not through formal contractual obligations but rather through informal arrangements.
- In Iceland, the non-profit organization Citizens Foundation<sup>92</sup> partners with the government to champion electronic collaborative democracy and enhance government decision-making by facilitating the direct and active participation of residents.
- In Cordoba (Argentina), community organizations have been involved throughout the different stages of smart city development. Third sector organizations have been consulted during the planning stage and asked to evaluate the citywide action plan. Subsequently, they have been entrusted with the responsibility of monitoring smart city initiatives to ensure their alignment with the initial plan.
- In Belgium, municipalities are collaborating with several civil society organizations as part of the Espaces Publics Numériques Mobiles<sup>93</sup> program. This program is designed as an itinerant initiative that promotes digital inclusion, by providing digital literacy training directly within the spaces frequented by communities that are digitally divided.
- In Kathmandu (Nepal), the Mayor and various representatives of civil society organizations sit in the jury panel of the Smart Urban Technology Challenge. During this competition, enterprising and inventive Nepalese youths work in teams to craft digital solutions aimed at addressing local urban development problems.<sup>94</sup>
- In Benguerir (Morocco), local authorities and civil society organizations have worked together to build a digital eHealth application addressing the needs of both medical staff and patients. Members of the local community have helped to boost the adoption of this application, acting as digital champions, and providing support to residents with limited digital literacy<sup>95</sup>.





Finally, **the collaboration with universities and other research entities is also crucial** for enhancing capacity building, advancing new knowledge, and facilitating participatory processes. The global survey has clearly demonstrated that academic institutions and research centers are already playing a significant role in both the planning (54% of the respondents) and implementation (39% of the respondents) of smart city initiatives. Moreover, these partnerships can furnish municipal governments with access to resources and capabilities that may be deficient in the public sector (as elaborated in Section 1.1.3) or assist in the design, prototyping, and testing of innovative solutions. Universities and research institutions can actively engage in monitoring smart city initiatives, serving as impartial and qualified evaluators. Box 2.2 provides illustrative examples of successful collaborations between city governments and research institutions.

#### BOX 2.2

### Examples of collaborations between universities and municipal governments

- The FinEst Centre for Smart Cities<sup>96</sup> is a joint initiative between Tallinn University of Technology, Aalto University, Forum Virium Helsinki (the innovation company of the city of Helsinki) and the Estonian Ministry of Economic Affairs and Communications. It actively collaborates with various municipalities in Estonia and Finland to co-create an innovative and sustainable urban environment through the utilization of digital technologies, data, and cross-border cooperation.
- To advance the collection of relevant data for the monitoring of Sustainable Development Goals (SDGs), the city of Cape Town (South Africa) has partnered with the African Centre for Cities of Cape Town University and Mistra Urban Futures (MUF), a Swedish-funded research center. The collaboration with these academic partners has also facilitated further partnerships for data sharing with private entities<sup>97</sup>.
- The University of Bahrain has played a pivotal role in raising awareness about smart city development in the Kingdom of Bahrain. One of its notable endeavors is the organization of the Smart Cities Symposium, an event that serves as a platform to exchange ideas and global practices on smart city development<sup>98</sup>.
- In Recife (Brazil), the local university has been a constant point of reference for the municipal governments and the innovation ecosystem of the city. In addition to training talented professionals and sustaining the launch of innovative start-ups, the university has contributed to smart city development by inspiring a pro-innovation culture within the municipal government.



## 2.2. Innovation partnership formation

### Collaborative tools and spaces

- Adopt a mix of online and offline participatory methods to support the engagement of multiple stakeholders.
- Establish measures to guarantee that local stakeholders are not only informed about engagement opportunities in smart city initiatives but also proficiently equipped to partake in them.
- Develop the internal capacity necessary to act upon the input provided by residents and other local stakeholders.

### Consensus building

- Ensure strong political support for smart city development.
- Place more emphasis on the long-term longevity of smart city partnerships.
- Use a mix of online and offline media to reach different audiences and convey messages tailored to them.

### Cooperation agreements

- Implement formal agreements that are flexible, context-specific, and project-specific.
- Create and nurture a climate of trust to reinforce informal cooperation.

### 2.2.1. Collaborative tools and spaces

**To attain a broad and inclusive engagement, it is essential to adopt a blend of online and offline participatory methods,** each carefully tailored to specific subjects and audiences. From the global survey, it has emerged that workshops are the most common instrument employed by municipal governments worldwide, followed by public consultations and public meetings. Conversely, the use of hackathons, app contents, and bootcamps remains relatively constrained. Box 2.3 provides additional details on how alternative participatory methods can be applied to support smart city development.

#### BOX 2.3

### Collaborative tools and spaces for smart city development

- *Public consultations* are commonly employed to gather feedback on strategic and policy documents. They can be delivered through various formats, such as online surveys, open-ended questionnaires, and public debates.
- *Public meetings, citizens' assemblies, and co-creation workshops* offer a platform for boosting open dialogue and facilitating knowledge sharing. These forums enable participants to articulate their concerns, offer suggestions, and provide feedback on a wide range of facets pertaining to smart city initiatives.
- *Participatory budgeting* entails the engagement of local communities in the decision-making process regarding the allocation of public funds for projects and services.
- *Hackathons and app contests* can be organized around specific urban challenges or themes, such as mobility, energy, or waste management. Participants develop prototypes or applications that address these challenges.
- *Bootcamps* are intensive training programs or workshops aimed at equipping participants with the necessary skills, knowledge, and tools to develop and implement smart city solutions.
- *Crowdsourcing* techniques can be used to collect data, solicit input on urban challenges, and engage citizens in the development of innovative solutions. Examples include online platforms for idea sharing, citizen science projects, and community-driven data collection initiatives.
- *Living labs* are experimental spaces where stakeholders iteratively develop, test, and refine smart city solutions, taking into account the feedback and experiences of end-users, including citizens, businesses, research institutions, and public entities.
- *Incubators and accelerators* provide a comprehensive array of resources to assist startups, entrepreneurs, and businesses in nurturing and advancing their innovative concepts, products, or services aimed at addressing urban challenges. These resources encompass knowledge-sharing, mentorship, financial backing, and networking prospect.

Before choosing a particular combination of participatory tools, it is essential to conduct a thorough analysis and evaluation of potential obstacles to citizen involvement. One such obstacle is the limited experience that residents may have in participatory processes, which can erode their confidence and enthusiasm for engaging in these initiatives.<sup>99</sup> Additionally, constraints such as limited digital literacy and time constraints further impede the participation of local residents.<sup>100</sup> Therefore, irrespective of the methods chosen to involve citizens, municipal governments should **establish tailored measures to guarantee that local stakeholders are not only informed about these engagement opportunities but also proficiently equipped to partake in them.**

- Offline and online communication channels should be combined to disseminate information about engagement opportunities in smart city initiatives and clearly explain how local stakeholders can participate. To illustrate, the City of Johannesburg<sup>101</sup> augmented the social media discourse within the Twitter community by orchestrating local events aimed at engaging residents in the exchange of ideas, the resolution of socially relevant challenges, and the cultivation of a sense of dedication to their communal bond. Likewise, residents of Mexico City can convey their ideas and promote their proposals by attending public gatherings and joining Plaza Publica<sup>102</sup>, an online platform purposely created for enhancing civic engagement.
- Offline initiatives should be organized across various locations within the city to foster the engagement of residents from diverse neighborhoods and communities. Moreover, emphasis should be placed on selecting public venues that have a widespread presence and are viewed as neutral spaces by the local community. Public libraries and schools are exemplary instances of such locations.
- Online events should be conducted using platforms and tools that are easily accessible, straightforward to utilize, and compatible with various devices. It is crucial to ensure that residents with restricted data plans or those without internet access have the option to connect from public locations.

- Both online and offline should be scheduled at different times to enable the involvement of people with different working patterns. For offline initiatives, childcare should be provided onsite to facilitate the participation of people with children. Interpretation and translation services should be offered to enhance inclusivity; professional facilitators and moderators should be engaged to stimulate both online and offline discussions.



**If you really want your residents to participate in smart city initiatives, you should make use of different media, go into the communities, have periodic engagement events and organise training programs.”**

**Kumasi Metropolitan Assembly, Ghana**

Moreover, to fully harness the potential of collaborative tools and spaces, municipal governments should **develop the internal capacity necessary to act upon the input provided by residents and other local stakeholders.** This requires the acquisition of data analytics skills and the implementation of various methods for collecting feedback, as elaborated in Section 3.1.2. In addition, a taskforce should be created within the municipal government to oversee all interactions with local communities. This taskforce should assume the responsibility of conveying the feedback to the relevant department and elucidating to local stakeholders how their input has been utilized to enhance the execution of smart city initiatives.



## 2.2.2 Consensus building

Collaborating with various stakeholders undoubtedly offers significant advantages for the advancement of smart city initiatives. Nevertheless, it is essential to acknowledge the challenges inherent in such partnerships. The global survey has revealed that nearly half of the municipal governments that participated in the survey have faced challenges when attempting to harmonize business interests with societal concerns and the overarching urban development needs of their cities. Consequently, an important task of municipal governments remains the establishment of a consensus among the diverse array of actors engaged in smart city development.

A **strong political support for smart city development** can help achieve an appropriate power balance within smart city partnerships and reinforce their commitment to meeting public needs:

- The endorsement of mayors and other elected officials holds significant importance in legitimizing the leadership of public managers operating within the smart city domain. It serves to enhance their recognition among internal and external partners.
- When smart city development is integrated in the political agenda and the mandate of local leaders, it becomes easier to formulate a shared vision regarding how smart city development should be interpreted in a city, and what its expected outcomes are.

In many cities, members of the cabinets or other elected officials have been designed as the political reference for smart city development. This approach reinforces the accountability of smart city initiatives. However, smart city development should not be limited to the agenda of single politicians. It should be embedded in the strategic vision and mission of local authorities to ensure that smart city initiatives benefit from cross-party support.



**Political support is determinant for the success of smart city initiatives and for implementing a smart city strategy in a city. Of course, you can have the initiative coming from the people or from the private side, but it is not the same thing unless there is political commitment.”**

**Câmara Municipal do Porto, Portugal**

Furthermore, to build trust among stakeholders and enable successful collaborations, municipal governments should **place more emphasis on the long-term longevity of smart city partnerships**. Sustained engagement serves as a preventive measure against tensions within these partnerships, fortifies their dedication to cooperation, and fosters a sense of ownership over the processes and outcomes of smart city initiatives<sup>103</sup>.

The degree of active involvement by partners in smart city initiatives varies both temporally and across different projects. Nevertheless, municipal governments should prioritize maintaining relationships with their partners, extending these connections beyond the completion of individual projects. This enduring commitment facilitates the continuous exchange of ideas, mutual support, and expertise. The objective should be to create an expanding community of practice. Communication tools assume a pivotal role in this context. Consistent updates delivered through newsletters, blogs, and printed material can help ensure that local communities and partners remain well-informed about the progress of ongoing initiatives and emerging opportunities for collaboration. Many cities worldwide, such as Modena<sup>104</sup> (Italy) and Tampere<sup>105</sup> (Finland), also organize annual events where they invite multiple stakeholders to share their experiences with smart city initiatives. These events foster the addition of new perspectives to local discussions on digital transformations in urban settings.

Overall, communication is vital to build and maintain consensus around smart city development (see Box 2.4 to learn how a city can benefit from regular, open communication with its stakeholders). The global survey revealed that municipal governments mostly communicate with external stakeholders through their websites and social media profiles. Press conferences, newspapers, and newsletters are additional tools, employed by more than half of the municipalities included in the sample. To reach a wide range of audiences and effectively communicate messages specifically crafted for various stakeholders, it is advisable to **employ a combination of both online and offline media platforms when disseminating information pertaining to smart city initiatives:**

- *Online channels facilitate the interaction with and among different stakeholders:* for example, online forums enable continuous exchanges of ideas among users and developers of digital services. Furthermore, social media can be used to monitor the sentiment of different stakeholders toward smart city initiatives. This information can be used to identify trends in public opinion and the acceptance of digital services in a city.
- *Conversely, physical meetings tend to provide more detailed insights into the needs, experience, and perceptions of specific groups and communities.* To further boost the participation of residents, these events should be hosted and moderated by third parties, such as neighborhood associations and local charities.

## Advantages of communication in smart city development

- Being open about their goals and priorities help project partners to *better manage their expectations* and achieve a fair distribution of powers and responsibilities.
- Sharing regular updates on the progress of smart city initiatives *help detect technical and organizational issues* that may emerge during the design and implementation phases.
- Being transparent on leadership structures and decision-making processes *reduce the scope for tensions* between the partners and enhance the legitimacy of smart city initiatives within local communities.
- Frequent communications with residents and other local stakeholders *enable their active participation in the development of smart city initiatives* and allow them to provide real-time feedback about smart city services (see Section 3.2.2 for more details).



## 2.2.3 Cooperation agreements

To maintain enduring smart city partnerships, municipal governments have adopted an array of cooperation agreements. According to the findings of the global survey, municipal governments have exposed a preference for formal procedures as opposed to informal ones. This result echoes the academic literature, which has underscored the significance of formalized collaborations and has spotlighted the diverse range of contractual and structural models implemented globally in the context of smart city partnerships.<sup>106</sup> (see Box 2.5).

### BOX 2.5

#### Examples of formal agreements

- In India, the local governments joining the nationwide Smart Cities Mission have set up Special Purpose Vehicles (SPVs)<sup>107</sup>. SPVs are organizations specifically established to oversee the implementation of smart city initiatives. They are cofounded by the Indian government, the State administrations, and the municipal authorities. All these partners also nominate their own representatives in the Board governing the SVPs.
- The city of Mannheim (Germany) has formed a joint venture with the local utility company to work on smart city initiatives that focus on both green transitions and digital transformations.<sup>108</sup>
- In Colombia, the data analytics agency for Bogota, known as Agata, has been established through a durable cross-sector partnership orchestrated by the Mayor's Office. This collaboration includes key stakeholders such as the Bogota Telecommunications Enterprise, Bogota Energy Group, Cadastre Administrative Unit, Bogota Water and Sewage Enterprise, and the Urban Planning Department.<sup>109</sup>

Most smart city initiatives rely on multiple partners with diverse expertise and resources. The expertise and resources required may vary across the different phases of a project. Accordingly, **cooperation agreements should be flexible, context-specific, and project-specific:**

- In some projects, *the design and implementation phases may need to be decoupled*: while the former may involve a wider range of actors from different sectors, the latter could be delegated to fewer partners because of technical and legal requirements. For example, civil society organizations, universities, and other local actors should be engaged when designing e-government services, as their input is key to identify the technological solutions that best address the needs of local communities. However, the implementation of these solutions should be in the hands of developers and technology vendors with the legal status and technological resources required to comply with the requirements set by cybersecurity agencies, other regulatory authorities, and standardization bodies (often belonging to national and regional levels of government).
- *Formal agreements should last enough to ensure the continuity and sustainability of digital services, but with safeguards to prevent vendor lock-ins and technological obsolescence*. The adoption of standards is key to ensure interoperability and avoid entry barriers and vendor lock-in that can be caused by the incompatibility among solutions sourced from different service providers (see Section 1.2.3). In addition, open-source technologies can help prevent vendor lock-ins by providing municipal governments with more flexibility and control over their digital services (see more in Sections 3.2.1).
- Formal agreements with technology vendors and service providers should clearly *articulate the responsibilities and duties of each party, taking into consideration the whole lifecycle of digital services and infrastructure components*. Given the fast pace at which digital technologies evolve, it is fundamental that cooperation agreements also specify who is responsible for maintaining digital infrastructures and upgrading smart city services.

- Additionally, specific provisions on data governance should be included, to clarify who owns the data collected through digital infrastructures and services and who is responsible for their protection.
- Formal agreements should also *clarify how the performance is going to be measured and evaluated*, indicating key performance indicators (KPIs) and mechanisms to enhance the transparency and accountability on the performance of smart city initiatives. These KPIs should be consistent with those articulated in the implementation strategies adopted at the project level (see Section 1.2.1 for additional insights).
- *Delineating shared values and mutual benefits* that can be achieved through smart city initiatives. These values and benefits should be identified through participatory processes for the finalization of smart city definitions and smart city visions (as discussed in Section 1.3.1).
- *Fostering open communication channels among all parties* to facilitate the exchange of ideas and feedback while ensuring that consensus among the partners is maintained throughout the different project phases (See Section 2.2.2).
- *Creating spaces and occasions for partners to express their dissent*, so that tensions and conflicts can be detected and addressed before they escalate.

Although less common, even informal cooperation agreements are occasionally embraced within the framework of smart city initiatives. The reduction of bureaucratic control over partnerships in the realm of smart cities is anticipated to streamline the exploration of innovative solutions.<sup>110</sup>

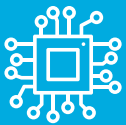
Nonetheless, to fully harness the potential of these informal agreements, municipalities must **create and nurture a climate of trust among their partners**. This objective can be achieved by:

“**Still structured, but more informal collaboration can work a bit better when you are trying to minimize the burden of bureaucracy.”**

GovTech Lab, Lithuania



## 03



## TECHNOLOGY

This pillar reflects the governance efforts required to steer the design and provision of the technological components that form the foundation of smart city initiatives. Two themes emerge:

- **Digital infrastructures** include the hardware and software components that enable the delivery of smart city services: broadband networks, sensor networks, and data platforms.
- **Digital services** encompass two critical aspects: the service development cycle, which informs the design of smart city services, and the business models necessary for sustaining their delivery.

The governance of both components is strictly interlinked with and influenced by the other pillars (*Strategy* and *Collaborative Ecosystem*).

### 3.1. Digital infrastructures

#### Broadband networks

- Serve as an intermediary between network providers and local stakeholders to ensure that solutions addressing the digital divide are duly taken into consideration.
- Facilitate the reuse of existing infrastructure components to reduce the cost of broadband rollout.
- Support the creation of cooperative broadband networks, owned and operated by local communities.

#### Sensor networks

- Consult local stakeholders to determine their data needs and determine what data sources should be used.
- Adopt and enforce regulatory measures to safeguard the digital rights of residents, protect their privacy, and ensure an ethical use of data.



## Data platforms

- Make data available in an open and interoperable format.
- Ensure that the data siloed in separate systems are integrated into unified data platforms.
- Articulate a transparent and comprehensive plan that details the actions that are taken to address the techno-economic, social, and ethical issues associated with data platforms.

### 3.1.1. Broadband networks

Mobile and fixed broadband networks provide the essential connectivity necessary to deliver and access digital services. Official statistics reveal significant disparities in the availability and speed of internet connections worldwide, both within and across regions. In the global survey, one-third of the respondents expressed negative evaluations regarding the coverage and quality of the broadband networks presently accessible in their respective urban areas. Notably, approximately 20% of participants cited the absence of widespread broadband infrastructures as a hindrance to smart city development, with a considerably higher incidence observed in low-income countries.

Around the globe, municipal governments have embarked on enduring initiatives to tackle connectivity gaps by implementing a range of measures aimed at expanding the availability of this service. In addition to providing subsidies and fiscal incentives to commercial providers, some municipalities ventured into the direct provision of broadband networks. For example, in Stockholm (Sweden) and Kamiyama (Japan) public fiber networks exist, which are owned and operated by municipal agencies<sup>111</sup>. More frequently, municipal administrations have opted to provide free Wi-Fi as a complement to the service offered by commercial providers,

catering to the connectivity needs of residents and visitors with limited data plans<sup>112</sup> (see Box 3.1 for further details).

In addition to supply-side interventions, municipal governments have taken action to tackle accessibility and affordability issues that hinder digital inclusion and the demand for connectivity. For instance, public libraries, schools<sup>113</sup>, telecentres<sup>114</sup>, and community hubs have been enlisted to provide access to connectivity and IT equipment for low-income households and residents in disadvantaged neighborhoods. Moreover, these public and community spaces have actively participated in the implementation of digital literacy programs aimed at boosting the adoption of digital services among residents who possess limited digital skills (as discussed in Sections 2.1.2 and 3.2.2).

To bolster the efficacy of the interventions aimed at addressing digital divides (encompassing efforts from the public, private, and third sectors) municipal governments should serve as an intermediary between network providers and local stakeholders **to facilitate the collection and exchange of up-to-date data on the local supply and demand of broadband**. This data assumes critical importance in the formulation of targeted, location-specific interventions that prioritize the alleviation of obstacles to digital inclusion faced by communities grappling with digital disparities. Some examples of effective practices include:

- The *establishment of taskforces or working groups* advising municipal governments on public interventions regarding broadband and digital divides. An illustrative example can be found in Bellingham (USA), where the Broadband Advisory Working Group has been created, comprising both residents and representatives of the business sector.<sup>115</sup> The primary mission of this group is to assess broadband equity and affordability conditions in the city. Moreover, they are tasked with conducting analyses of alternative strategies aimed at improving the quality and coverage of broadband accessibility.



- *Crowdsourced broadband mapping*, a collaborative effort that harnesses the input of local users to enhance the precision of broadband maps and furnish comprehensive insights into the present condition of broadband provision.<sup>116</sup> In Sumter County (USA), residents have been equipped with a speed checker<sup>117</sup> that collects real-time data regarding the broadband speed. As an alternative approach, municipal authorities can organize public gatherings, where local community convene to mark on maps the regions that suffer from inadequate coverage and identify optimal pathways and locations for the installation of new fixed and mobile networks.<sup>118</sup>
- *Demand aggregation*, which involves the collection of expressions of interest or pre-registrations from users who are interested in broadband services. This process is expected to alleviate the uncertainties and reduce the costs associated with the commercial rollout of broadband networks.<sup>119</sup> Additionally, it serves to raise awareness about available broadband services and stimulate their adoption. Municipalities can play a pivotal role in facilitating this process by collaborating with community organizations. For instance, in Canada<sup>120</sup> and the UK<sup>121</sup>, local councils have partnered with local associations to champion broadband initiatives and aggregate demand in suburban and rural communities.
- *Monitoring the current usage of broadband services*, which entails various strategic approaches, such as *conducting surveys, organizing focus groups, and convening citizens' assemblies* where residents are invited to divulge their prevailing consumption patterns and unmet connectivity needs<sup>122</sup>. This information serves as a foundational resource for pinpointing areas where there is a burgeoning demand for broadband enhancement. Additionally, it aids in selecting the most appropriate blend of fixed and mobile technologies to ensure equitable internet accessibility for all. In the context of broadband demand monitoring, it is critical to evaluate the enduring needs of local internet users. While a download speed of 10 megabits per second is typically deemed adequate for rudimentary internet activities such as basic web browsing, video conferencing, and audio streaming, it is worth noting that emerging and forthcoming smart city services may necessitate faster connections.<sup>123</sup>

## BOX 3.1

## Free public Wi-Fi networks

Many cities worldwide offer free Wi-Fi through hotspots that are strategically located in public areas, like in the cases of BA Wi-Fi in Buenos Aires<sup>124</sup> (Argentina) and Tshwane Free Wi-Fi in South Africa.<sup>125</sup> These freely-accessible public networks are frequently hailed as effective solutions for addressing the digital divide that exists in numerous urban areas.<sup>126</sup> Moreover, during emergencies, they serve as a crucial means of communication.<sup>127</sup> However, concerns regarding their security have been raised over the years, with many public Wi-Fi networks being discontinued due to unsustainable business models for their operations and maintenance.<sup>128</sup>

Therefore, when municipal governments contemplate the possibility of offering free public Wi-Fi services, they should carefully assess the opportunities and challenges inherent in these networks. These considerations encompass the following aspects:

- Free public Wi-Fi provide Internet access to individuals and households unable to afford broadband services or lacking access to fast and stable connections. However, it is essential to supplement such services with initiatives that promote digital literacy and implement measures to assist residents in acquiring the necessary IT devices.
- Free public Wi-Fi can serve as a valuable resource for drawing tourists and customers to public spaces, thereby generating benefits for local shops and businesses. Consequently, these entities could be approached to provide sponsorship for the installation of Wi-Fi antennas and contribute to their ongoing maintenance.<sup>129</sup>
- Operating free public Wi-Fi entails substantial cost implications, primarily due to the technical support necessary for infrastructure maintenance and safeguarding against cyberattacks and data breaches. To enhance the sustainability and security of these public networks, municipalities should work in cooperation with other local authorities, pooling resources and tapping into collective expertise in wireless network management.<sup>130</sup>



One of our initiatives was to provide free Wi-Fi throughout all the main streets in the city and inside all public buildings and municipal facilities. Now, almost the entire city is covered with the free Wi-Fi.”

Ramallah Municipality, Palestine

In addition to acting as intermediaries between suppliers and users of connectivity services, municipal governments can actively **contribute to cost reduction in broadband rollout**. They can achieve this objective by **facilitating the reuse of existing infrastructures**, such as poles, streetlights, and ducts, and by **incentivizing joint coordination of civil engineering works**.<sup>131</sup> These practices have been endorsed from both national and international regulators. For instance, the European Commission has implemented the Broadband Cost Reduction Directive, which introduces a set of measures aimed at easing the access of broadband providers to existing civil infrastructures.<sup>132</sup> Similarly, through its Dig Once Model Policy, the World Economic Forum has emphasized the importance of local policies in coordinating construction activities and promoting the delivery of multi-purpose connectivity.<sup>133</sup>

Municipalities can directly support collaboration among broadband suppliers, utilities, and other network providers through various means:

- *Facilitating streamlined communication among infrastructure operators by establishing public noticeboards where they can share civil engineering work schedules.*

- *Establishing a publicly accessible database of the reusable assets already in place, beginning with municipal facilities that could be made available for antenna installations or the rollout of optic fiber.*
- *Introducing specific regulations that mandate infrastructure providers to coordinate and share their civil engineering projects.*

Increasing the transparency and accessibility of existing local infrastructures also **supports the establishment of cooperative networks that are owned and operated by local communities**. Two notable examples are Guifi.net and Rhizomatica.<sup>134</sup> Guifi.net is a citizen-driven project that has been deploying community-owned wireless and fiber networks across Catalunya (Spain) since 2004.<sup>135</sup> Rhizomatica was established in 2009 in Mexico with the aim of facilitating the creation of micro-telecommunications enterprises owned and operated by rural and indigenous communities.<sup>136</sup> These grassroots initiatives contribute to minimizing the digital divide by offering affordable connectivity services in areas that lack coverage from commercial broadband providers. Additionally, they contribute to enhancing the resilience of local infrastructures and empowering local communities. This empowerment is achieved through training residents to install, operate, and maintain their own network systems.

### 3.1.2. Sensor networks

The global survey reveals that data collection is carried out through a combination of automated and non-automated sources in over 70% of the municipalities that participated in the study. Automated data sources are predominantly favored in high-income countries, with 82% of respondents opting for this method, compared to only 29% in low-income countries. Conversely, the use of crowd-sourced data remains limited across most regions, except for North America. These differences reflect an important consideration: there is no universal approach to data collection for urban areas. Therefore, municipalities are encouraged to explore diverse methods (see examples in Box 3.2) to address their specific data requirements.



## BOX 3.2

## Examples of data collection methods

- *Crowdmapping and crowdverification* have proven to be effective tools in expediting decision-making and facilitating timely interventions during emergency situations and in response to sudden urban condition changes. A prime illustration of this support is the Humanitarian OpenStreetMap Team<sup>137</sup> (HOTOSM), which has actively engaged volunteers from across the globe in the creation of maps essential for humanitarian and developmental initiatives. HOTOSM, in its pursuit of enhancing map accuracy, has devised a meticulous verification and validation process that combines automated tools with human oversight.
- Artificial intelligence finds practical application in the analysis of *satellite imagery*. For instance, Google Open Buildings<sup>138</sup> offers a comprehensive dataset of building footprints spanning Africa, South Asia, and Southeast Asia. This dataset serves humanitarian and development objectives such as population mapping and the establishment of addressing systems. Similarly, Facebook Data for Good<sup>139</sup> harnesses data from the Facebook platform to assist organizations in responding to natural disasters, enhancing public health, and addressing other social challenges.
- A novel framework for monitoring air quality in developing nations has emerged through *the fusion of ground observations from monitors and sensors with satellite data*. This integration has significantly expanded both the spatial and temporal scope of data collection while concurrently reducing the costs associated with sensor networks.<sup>140</sup>
- *Narrow-scale data collected through questionnaires and interviews*, with a focus on smaller sample sizes, can be used to contextualize and enrich the insights derived from big data analyses. This approach offers a more intricately nuanced understanding of local situations or cases.

The data requirements of municipal governments and their partners vary based on the challenges they aim to solve, and these challenges may change over time. Therefore, it is essential to understand which data is needed for realizing the vision and objectives associated with smart city development practices. To address this issue, **municipal authorities should engage in periodic consultations with local stakeholders.** This collaborative effort should aim to **reach a consensus on the data that needs to be collected.** Additionally, it should **involve an assessment of existing data sources that can potentially be reused.**

- Taking a participatory approach to data collection can yield dual benefits by capitalizing on pre-existing datasets while simultaneously identifying alternative data sources.
- Empowering residents to exert greater influence over the collection and utilization of data can play a pivotal role in mitigating concerns pertaining to privacy, security, and cybersurveillance.
- The insights and input provided by local stakeholders can be instrumental in guiding the formulation of local regulations governing data collection and usage, as elaborated upon in Section 1.2.2.

Open consultations, public meetings, and awareness campaigns represent some of the measures that can be employed to engage in discussions with local stakeholders regarding the objectives, functionalities, and expected outcomes of physical sensor networks and other data collection methods (see Sections 1.2.1 and 2.2.1 for more details on participatory tools). However, it is essential to emphasize that involving local communities should not be confined solely to the design and selection phases of data collection methods; rather, it should persist throughout the implementation stages. Local stakeholders should be approached whenever new technical, legal, or ethical issues arise in the context of data collection and processing. Ongoing communication efforts are also needed to regularly update local communities on the advantages derived from data utilization (see Section 2.2.2 to learn more about different communication tools).



**Think of creative ways to collect data. It does not always need to be a technology-oriented way. The engagement with the community is another critical data source.”**

National League of Cities, United States of America

Transparency on the deployment and operations of sensors networks should be further enhanced by **adopting and enforcing regulatory measures that safeguard the digital rights of residents and protect their privacy**. These measures should align with supralocal regulations on data protection, such as the EU General Data Protection Regulation<sup>141</sup> and the Digital Personal Data Protection Bill in India.<sup>142</sup> Additionally, they should be complemented with specific rules for the management of urban sensors. Some successful practices already in place include<sup>143</sup>:

- The implementation of a *notification obligation for new sensors installed in public spaces or publicly accessible areas*. This obligation allows for public scrutiny of potential concerns and reduces ambiguity surrounding the types of data being collected and the reasons for collection. Amsterdam has already adopted this measure, requiring private companies, research institutions, and government organizations to report sensors deployed in public spaces. Information about these sensors is made available through an online map, which includes details about the sensor type, owner, and whether personal data is processed. This provides residents with a clearer understanding of how, where, and what data is gathered from various sources, such as cameras, air quality and traffic sensors, Wi-Fi counters, and smart billboards.<sup>144</sup>
- The use of *Data Protection Impact Assessments (DPIAs)* as part of urban planning processes. DPIAs are essential for analysing and identifying potential data protection risks and proposing mitigation strategies. They serve as pre-emptive safeguards for the privacy of vulnerable individuals and marginalized social groups.<sup>145</sup> As an example, the UK's Office of the Information Commissioner has developed a DPIA template that includes a screening checklist to help determine when a DPIA is necessary.<sup>146</sup>
- The use of *permits and license processes* to mandate privacy-protective measures. For instance, privacy is one of the eight principles set forth in the Public London Charter, which offers guidance to users, owners, and managers of new public spaces. This planning regulation stipulates that public spaces should be managed in a way that respects the privacy of all users and requires landowners to adopt a privacy-by-design approach<sup>147</sup>.
- Enhancing transparency in the management of *informed consent* for the use of personal data. In Murcia (Spain), this has been achieved through the utilization of CaPe, an open-source platform modelled on the principles of MyData, a global non-profit organization that provides technical guidance for human-centric personal data management. Through the CaPe-powered platform, users of digital government services in Murcia can monitor how their personal data is being utilized and modify their consent if they choose to do so.<sup>148</sup>

### 3.1.3. Data platforms

In the global survey, 78% of the respondents indicated that their municipal governments use data to inform decision-making processes. This data stems from a diverse array of sources, both automated and non-automated sources (as discussed in Section 3.1.2), and multiple external organizations that offer third-party data. On a global scale, municipal governments widely embrace data from national public organizations, a trend observed in 59% of the urban areas in the sample. However, the practice of sharing data with other partners occurs less frequently. Moreover, only one third of the respondents identified residents and private companies as contributors of data to their city governments.

The promotion of data reuse and sharing is gaining traction among national and international institutions, manifesting through specialized initiatives. For instance, in 2019, the European Commission adopted the Open Data Directive, aimed at mitigating obstacles to the reutilization of publicly funded information.<sup>149</sup> Similarly, the Indian government initiated the Open Government Data Portal, which is designed to facilitate access to publicly owned data<sup>150</sup>.

**Making data available in an open and interoperable format is key to support smart city development.** This approach enables the processing of public information to prototype innovative services, monitor urban trends, and gather new insights into local development. The significance of open data becomes even more pronounced for municipal governments that lack the requisite skills and technical capabilities for data analytics, as detailed in Section 1.1.3. However, it is essential to strike a balance between the potential advantages for third-party users such as local startups, non-profit organizations, and grassroots movements, and the legal, privacy, and security concerns associated with releasing data in an open format.

As per the global survey, 57% of the participants pointed out that their municipality already has an open data platform. Nevertheless, it is infrequent for departments and agencies within their municipal governments to utilize a single data visualization tool. Multiple types of data platforms are currently in use within these cities (see examples in Box 3.3), often administered by different agencies or departments within the public sector. Consequently, a primary challenge for municipal governments lies in **integrating data siloed in separate systems into unified data platforms**, while ensuring the safe storage and encoding of sensitive information and personal data, compliant with existing cybersecurity and data protection regulations.

To facilitate this intricate process, each department should appoint a data champion or data steward. These individuals bear the responsibility of enforcing municipal open data policies and offering peer-to-peer support to colleagues dealing with regulatory and technical matters pertaining to data platforms<sup>151</sup>.

## BOX 3.3

## From Data Warehouses and Data Lakes to Urban Data Platforms and Open data Portals

- *Data warehouses* are large and centralized repositories for storing and managing structured data collected from diverse sources.
- However, the data derived from IoT and automation systems often are unstructured. Consequently, the necessity arises for the creation of *data lakes*, expansive storage systems capable of accommodating raw, unprocessed data in its native format. The Portland Urban Data Lake (PUDL)<sup>152</sup>, for example, gathers and retains data from a wide array of sources, encompassing sensor networks, connected vehicle infrastructures, and private-sector services.
- The mere presence of a data warehouse or a data lake does not inherently facilitate access and data sharing for public sector agencies and local innovators. For this reason, many cities, such as Tallinn and Helsinki, are in the process of developing *advanced urban platforms*. These platforms amalgamate existing data lakes and warehouses to enhance accessibility and usability.<sup>153</sup>
- Furthermore, many organizations are channeling investments into *open data portals*, which grant unrestricted access to structured datasets. One noteworthy example is the Humanitarian Data Exchange<sup>154</sup>, a portal launched by the UN Office for the Coordination of Humanitarian Affairs. Its primary aim is to simplify the process of discovering and analyzing humanitarian data.

To fully harness the potential of data analytics for sustainable urban development, municipal governments must also **articulate a transparent and comprehensive plan that details the actions taken to address the techno-economic, social, and ethical issues associated with data platforms**. Critical considerations include:

- *Data security*: the plan should explicitly identify the data standards and encryption protocols to be employed during data collection, transmission, and storage. An example is the General Transit Feed Specification (GTFS)<sup>155</sup>, a data standard for public transit information, covering routes, stops, and schedules. GTFS facilitates the integration of transit data into various applications, such as journey planners and mapping services. To ensure the security of sensitive data, which include real-time traffic information and personal travel patterns, data standards like GTFS should be complemented by cryptographic encryption techniques.
- *Data sharing*: municipalities should create templates for data sharing agreements, specifying the distribution of data ownership among partners, technical requirements for interoperability, openness of datasets, and responsibility for maintaining shared data platforms. Some national Data Protection Authorities, like the Office of the Government Chief Information Officer in Ireland, offer data sharing templates.<sup>156</sup> Additionally, several cities, including London, are developing their own templates for data sharing.<sup>157</sup>
- *Data protection*: the plan should provide a detailed explanation of the measures implemented to comply with privacy regulations. These measures encompass technical aspects, such as anonymization techniques that remove personally identifiable information from public datasets, as well as administrative decisions that designate responsibility for data protection within the municipal government and outline dispute resolution procedures.
- *Responsible and fair use of data*: guidelines should be established to ensure that data is used in accordance with ethical principles, which has become increasingly important with the proliferation of AI tools. Given that these applications involve extensive citizen data, transparency regarding data usage and decision-making processes is crucial. For instance, the Eurocities Digital Forum Lab has recently introduced the Algorithmic Transparency Standard, a standardized framework for algorithm registers to document decisions and assumptions made while utilizing AI<sup>158</sup>.
- *Data visualization*: the plan should also illustrate how data is presented and made available to local stakeholders through user-friendly visualization tools. Examples of such tools include the Boston CityScore Service<sup>159</sup> and the Greater Sydney Commission Dashboard.<sup>160</sup> When designing these tools, special consideration should be given to social and cultural factors that may influence their acceptance among local communities. To address diverse needs and capabilities among local users, the design should be inclusive, as exemplified by the Ila Dhageyso<sup>161</sup> project developed by the government of Somaliland and local NGOs. This project has introduced an interactive voice forum that provides illiterate citizens with access to government services and information through a simple voice-based interface.



A city needs very clear policies regarding the use of government data, what data can be shared and with whom, who owns the data, where data originates, and the procedures for ensuring that data is of good quality.”

United Nation University, South Africa

## 3.2. Digital services

### Business models

- Employ regulatory sandboxes as a mechanism to accelerate the testing and scale up of technological solutions while ensuring their long-term viability.
- Engage with knowledge-exchange initiatives to gain insights into business models that have already been implemented in other urban areas.
- Leverage open source and interoperable technologies to design sustainable business models.

### Service development cycle

- Co-design digital services with their potential users.
- Employ a diverse set of communication channels to gather user feedback on the functioning of digital services.
- Act against accessibility and usage issues while simultaneously enhancing digital inclusion.

### 3.2.1. Business models

Business models provide a comprehensive framework detailing how organizations generate, deliver, and capture value. Its integral components encompass the complex interplay of costs, revenues, activities, and resources that underpin the provision of specific services. In the context of smart city development, having an apt business model assumes paramount significance. It becomes the linchpin, ensuring the financial viability of digital services while concurrently fostering value creation for their users.<sup>162</sup>

Nevertheless, the formulation of viable business models has long presented a challenge within the smart city domain. Studies have shed light on the many difficulties faced by municipal governments and their collaborative partners as they grapple with the task of devising sustainable and scalable business models to propel smart city initiatives beyond the initial testing phase.<sup>163</sup> This trend is further substantiated by the findings of the global survey, wherein a half of the respondents acknowledged that the business models implemented in their municipalities' smart city initiatives failed to address the long-term sustainability of the technological solutions they sought to deploy. Moreover, 60% of the participants highlighted a predominant focus of municipal governments on pilot projects.

At the heart of smart city development lies technological experimentation, with pilot projects representing indispensable instruments for the real-world evaluation of digital services. The insights gleaned from these trial runs empower municipal governments to ascertain the responsiveness of newly introduced technological solutions to the specific needs of their local communities. Additionally, they facilitate a comprehensive evaluation of the socio-economic, environmental, and ethical implications inherent in these innovations. However, an overreliance on piloting, without subsequent scaling-up, inevitably curtails the sustainability potential of these technological solutions.



**Regulatory and proof-of-concept sandboxes can help overcome these challenges.** These mechanisms offer municipal governments a secure and controlled environment within which to conduct experimentation, unburdened by pre-existing regulations and compliance requirements that might otherwise impede innovative efforts. To illustrate, for example, the city of Cyberjaya (Malaysia) established a designated Drone Testing Zone to explore innovations tailored for urban logistics.<sup>164</sup> Similarly, Singapore instituted a regulatory sandbox in 2017 for the purpose of trialing autonomous vehicles.<sup>165</sup> In both instances, municipal governments and their partners were able to assess the feasibility of emerging technologies and construct specialized regulatory frameworks tailored to their unique application contexts. By expediting the assessment of project viability and minimizing delays, regulatory sandboxes concurrently yield cost savings in the development of digital solutions. Moreover, they empower local governments to effect swift and efficient course corrections prior to scaling up operations.



For some projects we are unable to scale up until we solve some of the policy and regulatory matters. This is where the sandbox program kicks in.”

Iskandar Regional Development Authority, Malaysia

Municipal governments should **not overlook the potential of city-to-city networks and other knowledge-exchange initiatives as valuable resources for sharing insights gained**

**from their pilot projects.** These connections also offer opportunities to  **glean insights from tested business models implemented in other urban contexts.** Engaging in knowledge exchange with other public authorities provides access to best practices and proven models that can be adapted and adopted. Consequently, coalitions of cities can collaborate to expedite the development of scalable business models for digital services and to identify more efficient strategies for procuring innovative smart city solutions.

For example, the Scottish Cities Alliance initiated a joint program whose objective is to nurture the co-development of smart city services and the creation of projects with scalability potential, which are inherently more appealing to business investors.<sup>166</sup> Similarly, as part of the Smart Cities Marketplace initiative of the European Commission, 120 Scalable Cities have been tasked with the mission of scouting and promoting business models that have the potential to expand and be replicated throughout Europe, with a particular emphasis on vital services such as sustainable mobility and clean energy.<sup>167</sup>

Finally, **the significance of open source and interoperable technologies cannot be overstated in the design of sustainable business models** that are adaptable across various contexts within smart city initiatives. Leveraging open-source technologies (see Box 3.4 for some examples) empowers city governments to create solutions characterized by flexibility and customization, readily tailored to meet the unique requirements of diverse communities. Interoperable technologies also play a pivotal role in facilitating the seamless integration of disparate systems and services, enabling cities to construct comprehensive and holistic solutions that effectively tackle a spectrum of interconnected challenges. Moreover, open source and interoperable technologies foster collaboration and knowledge-sharing among diverse organizations and stakeholders, thus fostering more inclusive and participatory innovation ecosystems.





## Examples of open-source and interoperable technologies for smart city services

- The FIWARE Foundation has taken the lead in the development of Smart Data Models, which build the foundational framework for a digital market of interoperable and replicable smart solutions. All smart data models are made publicly accessible without any associated costs.<sup>168</sup>
- The Open and Agile Smart Cities (OASC) network has advocated for the adoption of Minimal Interoperability Mechanisms (MIMs). These practical capabilities and technical specifications are instrumental in establishing the groundwork for the procurement and deployment of replicable end-to-end solutions within the context of smart city development.<sup>169</sup>
- The Open Geospatial Consortium (OGC) operates on an international scale, focusing on the development of geospatial standards and the promotion of best practices to enhance interoperability in location-based services and technologies. OGC standards, exemplified by CityGML and SensorThings API, facilitate the integration of geospatial data and IoT devices in smart city applications. This integration supports sustainable urban planning and effective environmental management.<sup>170</sup>
- oneM2M stands as a global standardization initiative dedicated to the development of technical specifications for a universal M2M (machine-to-machine) service layer. This initiative's primary objective is to foster interoperability among IoT devices and applications spanning various industries, including those within the smart city domain. By offering a standardized communication framework, oneM2M plays a crucial role in enabling the integration of diverse systems and data sources within sustainable urban services, such as energy management, waste collection, and air quality monitoring.<sup>171</sup>

### 3.2.2. Service development cycle

Smart city services often face challenges in gaining traction due to barriers that hinder their accessibility and acceptance among local users. These obstacles need to be considered during the formulation of business models and the development of smart city services. Surprisingly, approximately one third of the survey respondents reported that their municipal governments do not fully take into account the acceptance of new technologies or their alignment with local development needs.

To ensure a high level of adoption, it is crucial to **design digital services based on the effective needs and actual preferences of potential users**. Approaches to people-centered service design include the following:

- *Co-creation practices*: Municipal governments can engage in participatory design methods, directly involving residents and other societal actors in the ideation, prototyping, and testing of digital services. For example, the MySmartLife project<sup>172</sup> in Hamburg (Germany) successfully applied co-creation practices in the retrofitting of a neighborhood. However, it is important that municipal governments ensure the inclusivity and accessibility of these practices for residents across different social and age groups. In this regard, in Vietnam, the Children Innovate project<sup>173</sup> has shown how young citizens can be invited to propose urban design solutions through a playful process, including physical prototypes, 3D models, and virtual reality.
- *Grassroots digital initiatives*: rather than developing new services from scratch, municipal governments can also tap into already existing grassroots initiatives that aim to develop new digital platforms and applications addressing local needs. Examples include the Open Food Network, an open-source toolkit developed in Australia to sustain the creation of fair and transparent local food systems,<sup>174</sup> and The Mobility Factory, a European network of car-sharing cooperatives that has developed a common platform for smart mobility services.<sup>175</sup> Integrating grassroots initiatives into government-led smart city practices creates synergies that facilitate the delivery of place-based solutions and accelerate the scale-up of digital services.
- *Data-driven innovation*: the data collected and stored by municipal governments offer insights into urban development challenges that can be used to inform the design of innovative place-based digital solutions. Open data platforms are pivotal in this process, but municipalities can also support data-driven innovation by offering spaces and organizing events for local developers and programmers. An example is the Open Hack Night<sup>176</sup> held every Tuesday in Chicago (USA). These weekly civic hackathons have contributed to develop numerous applications in addition to providing learning sessions for residents seeking to enhance their technology skills.

Co-creation practices should be conceived as iterative processes that can help ensure the continuous improvement and updating of digital services to align with user feedback and their evolving needs. **Gathering this feedback requires employing a diverse set of communication channels, both online and offline.** These channels allow residents to actively share feedback on the quality of the digital services accessible in their urban areas. Additionally, they can put forth proposals for enhancements aimed at continually improving these services (see Section 2.2.2 for more details). Municipal governments can also harness the power of big data analytics and machine learning tools to identify emerging needs and monitor ongoing trends in digital service usage. For instance, during the COVID-19 pandemic, the Urban Observatory and IoT sensing infrastructure of Newcastle upon Tyne (UK) was expanded to encompass the tracking of the impact of lockdown measures and other policy responses to the crisis.<sup>177</sup>

Equally crucial to the development of people-centric smart city services are **measures aimed at addressing adoption challenges and fostering inclusivity.** The global survey revealed that most cities have already taken action to enhance the digital inclusion of their residents, with digital skills training and complimentary Wi-Fi access being the most commonly employed measures. To optimize the impact of their initiatives aimed at promoting technology adoption, municipal governments should consider implementing a combination of remedies, including:

- *Multiple access points:* Digital services should be offered through multiple access points, ensuring accessibility to all users via their preferred devices. For residents who lack the means to procure their own technological equipment, access to digital devices should be provided through subsidies and the resources accessible in public spaces such as libraries and schools.<sup>178</sup>
- *Accessibility audits:* To pinpoint the obstacles obstructing disadvantaged demographic segments from utilizing digital services, it is necessary to undertake accessibility audits. These audits should include the examination of interface usability for diverse user groups, the assessment of content readability, and an evaluation of compatibility with assistive technologies. The integration of established accessibility standards, exemplified by the Web Content Accessibility Guidelines, can significantly bolster the effectiveness of these efforts.<sup>179</sup>

- *Training for digital literacy and skills:* Municipal governments should support the implementation of training programs geared towards enhancing digital literacy and digital skills. For instance, the city of San Antonio (USA) has collaboratively developed a digital literacy curriculum in partnership with a local charity.<sup>180</sup> Meanwhile, in eThekweni (South Africa), training initiatives are offered through the Innovation Co-Lab, a joint effort involving the municipal government, local universities, civil society organizations, and local businesses. These initiatives not only focus on skill development but also aim to instill the competencies and confidence required for the effective utilization of digital tools. Additionally, these educational activities should prioritize raising awareness about essential subjects such as cybersecurity and data protection, which can significantly impact the utilization of smart city services. A noteworthy case can be found in the Learning Hub of the Canadian Centre for Cyber Security. This hub plays a vital role in supporting local communities, facilitating a deeper understanding of cybersecurity and promoting online safety.<sup>181</sup>
- *Awareness raising campaigns and trust building:* another critical task is to address apprehensions and concerns that might impact the acceptance of digital technologies within local communities. Municipal governments should actively collaborate with community groups, local leaders, and third-sector organizations to cultivate trust in digital solutions and foster a sense of ownership among residents. As an example, in Ghana, the utilization of the utilization of blockchain technology for improving transparency and accountability in land administration is undergoing a negotiation process involving government agencies, landowners, and citizens. This negotiation is facilitated by traditional community chiefs.<sup>182</sup>

“More rollout of free Wi-Fi and better data literacy in schools would help people a lot, along with making our websites easier to navigate and more user friendly.”

eThekweni City, South Africa



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