Handbook on Smart Urban Innovations

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La Paz, Bolivia
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Foreword

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The COVID-19 pandemic has had a negative impact on all human development dimensions, but much of this impact has been felt in cities - which have seen 90% of reported cases, and major socio-economic impacts. However, the innovation and ingenuity of society has been a powerful asset in responding to these challenging times. Innovative approaches have been fundamental to fights against the pandemic in cities all across the globe – including tactical urbanism to improve safe mobility, community networks to support vulnerable groups, or digital solutions to provide financial support.

Looking beyond COVID-19 recovery and towards 2030, decision-makers must be able to manage complexity and uncertainty - while strategically using their available resources. This also applies to city officials, who are managing the public administrations that serve more than half of humanity. Cities are the closest administrative actor to citizens and businesses, and they are leading and informing global policy efforts. It is estimated that, to be achieved, 110 of the 169 Sustainable Development Goal targets will require some direct engagement from cities or local government authorities.

Cities that use innovation and

technology in initiatives to improve their citizen's lives are successful in responding to global challenges. This is what it means to be a smart city. Any city can be a "smart city" if it adopts a citizen-centric approach and responds to both current and future needs and realities of its citizens and residents, while strategically mobilising available resources.

In this Handbook, we explore how different kinds of smart urban innovations are shaping urban spaces in cities across the globe and from different income settings. Each of these innovations is driven by a combination of multi-stakeholder partnerships, local resources, and strategic data usage. UNDP has grouped these unique combinations into four different frameworks, which aim to support city leaders, public officials, and citizens to find ways to catalyse innovation and identify solutions to problems faced by their cities. Users can delve into the different elements that enable innovations to emerge in cities. The Handbook also features an exciting set of case studies, setting out how to create the conditions needed for urban innovations to scale and generate long-lasting impacts. It also includes a wide-range of examples on how urban authorities have leveraged their current assets to deliver innovative solutions.

Urban authorities can leverage the benefits of global interconnectedness by exchanging impactful initiatives to combat present and future challenges. South-South, and triangular cooperation can enhance current efforts and replicate successful solutions in local contexts. This Handbook aims to facilitate this exchange of ideas and knowledge. UNDP has supported local authorities in the implementation of the development agenda since the organisation's founding - including working closely with the leaders of Singapore following the country's independence. Through initiatives such as the City2City peer learning network, the NextGenCities programme, our new collaboration framework with UN-Habitat, and the UNDP Global Centre in Singapore, UNDP is connecting cities and providing targeted support in developing impactful solutions for urban challenges.

We hope that this reflection, in which we broaden the definition of a smart city beyond technology, will support the central role that cities play in international development and enhance the international exchange of practices between them. By focusing on how to build and deliver innovative initiatives with real impact, we expect this Handbook to help local governments and other development partners to identify and ideate new ways of solving urban challenges – toward 2030, and beyond.

Cities are complex systems, where we can find a diversity of actors, activities, needs and challenges. It is necessary to understand the context of each city, neighbourhood, and of their residents, to find the right solutions to their challenges.

Train Night Market Ratchada, Bangkok (Thailand)

Delivering the 2030 Agenda – Cities in development.

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INTRODUCTION

- SETTING THE CONTEXT

Executive Summary

As evidenced by the COVID-19 pandemic, we are facing new social, economic and environmental challenges. We need to generate ways to advance towards a green recovery, achieve the objectives of the 2030 Agenda and ensure we can quickly respond to new challenges and crises. Cities play a central role in improving the lives of their residents, which account for more than half of humanity. As the closest administrative actor to individuals and businesses, cities need to quickly adapt to new situations. Technology and innovation can be powerful enablers of this adaptation.

However, the Smart Cities discourse has been too heavily focused on high tech - limiting its global application and relevance. The Smart City concept has gained significant traction globally, with many governments launching bold initiatives to make their cities 'smart'. Many of these initiatives are technocentric, and this narrow framing of the notion 'smart' solutions excludes other less technological - yet highly innovative - approaches from the Smart City toolkit. These include nature-based solutions, behaviour change-based interventions, new organisational approaches or experimental solutions. These are having significant and positive impacts on the cities where they have been implemented.

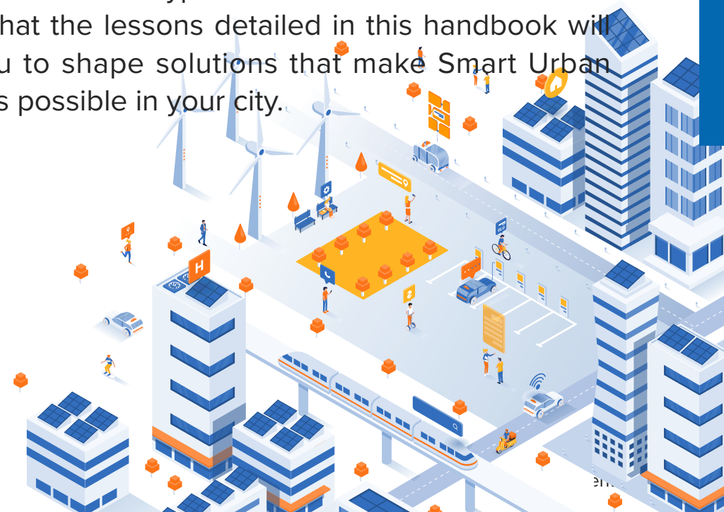
This handbook expands the definition of Smart Cities to embody a broader set of features that can be used to characterize 'smartness'. We believe Smart Cities are defined by their bold vision for the future, sustained trust between government and residents, an embedded culture of continuous learning, deep partnerships and collaboration among actors and an unwavering commitment to creating and maintaining inclusive urban spaces and services. While important, technology and data are simply two in an array of other attributes that enable urban centres to evolve intelligently.

Smart Urban Innovations are the foundation of modern 'Smart Cities'. They are initiatives that transform cities through innovation and technology. Smart Urban Innovations represent the range of potential solutions needed for the myriad of urban challenges faced by cities. They also demonstrate many of the characteristics that define Smart Cities. As Smart Urban Innovations are implemented, they coalesce and evolve to guide cities on their 'smart' journey.

Through a global analysis, we identified more than forty innovations and grouped them into one of four types of Smart Urban Innovations. Each innovation type distils the essence of the journey from its conception to implementation. The classification was created using a bottom-up approach and consists of four dimensions: actors, the roles they each play in the innovation; their use of data and information to diagnose, design and deliver solutions; and the tools that are leveraged throughout this process. The most important dimensions connecting and enabling this process are the actors and the roles that they play - and how these two components combine with the data, information, and tools available.

The four different Smart Urban Innovation types emerging from this analysis are summarized in the following pages and further detailed throughout this handbook.

The aim of this handbook is to kick-start an exchange of practices and strategies among city leaders about how to cultivate and implement Smart Urban Innovations in their diverse contexts. We encourage you to identify the best approaches for your urban solution from the four types of Smart Urban Innovations. We hope that the lessons detailed in this handbook will enable you to shape solutions that make Smart Urban innovations possible in your city.



55%
of the world's population lives in urban areas

70%
of global greenhouse gases are generated in cities

90%
of urban population increase will concentrate in Africa and Asia

2/3
of the world's energy is consumed by cities

80%
of global GDP is generated in cities

By **2030**, there will be **12** new megacities of more than **10 million** people (and 10 of these will be in Africa and Asia)

US$4 trillion worth of urban assets will be at risk from climate change by **2030**

Delivering the 2030 Agenda

Relevance of Cities in Development

Today, more than half of humanity lives in urban settlements. This proportion is expected to rise to 68% in 2050, when 2.5 billion people will inhabit the world's cities. Together, Africa and Asia are projected to account for almost 90% of this urban population increase and will host ten of the new megacities that will be home to more than 10 million people by 2030.

This increase in urban population is expected to parallel economic development in these emerging economies. Cities currently generate about 80% of global GDP. In some regions, major cities produce up to 12% of national GDP. Cities remain a platform of potential opportunity, prosperity, and wellbeing for residents – and continue to play a central role in improving lives and livelihoods. They are also often the closest administrative actor to individuals and businesses.

However, this concentration of people and economic activities comes at a cost. Cities generate more than 70% of greenhouse gases, while consuming two thirds of the world's energy. Consumption of large amounts of resources and high population concentration also makes cities particularly vulnerable to the effects of climate change. In addition, more than two thirds of the biggest cities around the world are in coastal areas. A total of US$4 trillion worth of urban assets will be at risk from climate change by 2030.

High population density in urban centres also makes cities more vulnerable to health threats, both external — as evidenced by the COVID-19 pandemic—and internal, such as those generated by air pollution. However, the density of cities also has positive effects. It can lead to increased walking, better health outcomes and the creation of communities.

Therefore, it is fundamental to direct efforts towards improving the ways in which cities operate and serve the needs of a growing number of people, while becoming more sustainable and resilient. This is especially critical in Low- and Middle-Income countries, where the concentration of opportunities and challenges will grow exponentially in the coming decades. Cities could also lead the 'Great Reset,' shaping the policies, frameworks, initiatives, and innovations for the world to build forward better following the pandemic. This includes shaping global movements, such as the Fourth Industrial Revolution.

The specific challenges and future objectives of urban areas are included in Sustainable Development Goal (SDG) 11 - Sustainable Cities and Communities. However, each of the 17 SDGs are relevant to cities – and to smart cities.

Human-centred and locally adapted urban innovations on the path to 2030

Green area for pedestrians in Metro Manila

The term 'smart city' has generally been used to reflect the intensive use of technology and data in cities located in high-income settings. However, a more holistic notion is evolving in which citizens and their needs are at the centre of the solution design.

In these smart cities, urban challenges are addressed using a diversity of solutions. Some of these solutions are based on new technologies, while others build on innovative approaches that are not necessarily tech-centric. These include innovative regulatory measures, experimental methodologies and approaches like tactical urbanism, and nature-based solutions.

As evidenced by the COVID-19 pandemic, the world is facing new social, economic and environmental challenges. We need to generate ways to advance towards a green recovery, achieve the objectives of the 2030 Agenda and ensure we can quickly respond to new challenges and crises. To do this, cities must have the ability to adopt new technologies; they must also develop their capacity to innovate and find solutions adapted to local needs, as well as approaches that can be efficiently deployed and sustainably managed in their specific context.

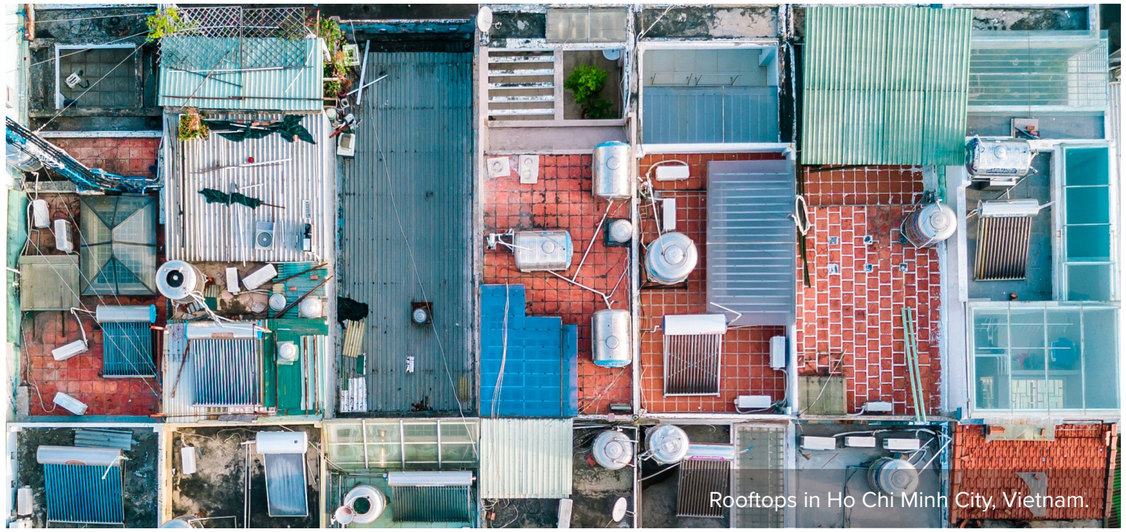
Cities across the world have extremely diverse national, political, socio-economic and historic contexts. There is no single smart city model that can be applied to all cities, just as there is no one-size-fits-all solution to the challenges that we all encounter. Instead, we can identify initiatives to help make cities “smarter” by providing concrete solutions to the challenges their citizens are facing. We call these initiatives 'Smart Urban Innovations.' They are characterized by the ways in which they leverage local resources and gain support through diverse partnerships between local actors.

Cities as singular urban systems

Cities are made up of a complex network of actors, local resources and relationships that can mutually influence each other and generate change in many directions. All local actors are embedded in this system and have the potential to meaningfully change and improve it.

These innovation ecosystems are made up of groups of local stakeholders and relationships that can generate, shape, and incorporate innovations and technology in the local context. Public authorities, private companies, knowledge providers and citizens are fundamental actors that can collaborate to generate meaningful change in urban centres.

Cities are complex systems. In a single city, we can find a diversity of uses of public space, activities, and actors. They are all connected at different levels.



Each city is as diverse as its citizens. There is an infinite range of different social needs and preferences in every corner.

Local governance, policy and multi-stakeholder partnerships for urban innovations

Smart Urban Innovations are the result of interactions between various stakeholders from the local innovation ecosystem and their use of resources. Local authorities or city councils are the perfect orchestrators to mediate, orientate or support the different solutions that can arise from the local innovation ecosystem. This handbook aims to guide local public authorities on ways to develop better policy and other approaches that will allow them to identify, enhance, improve and generate smart urban innovations to address local challenges - using the resources they have available in their concrete contexts as well as through new and impactful collaborations with city actors.

SECTION 01.

HOW TO USE THIS HANDBOOK

This handbook presents an array of Smart Urban Innovations that can make cities around the world 'smarter'. Each Smart Urban Innovation is shaped by the differing roles of local actors—including the public and private sectors, and civil society—and the ways data, information, and other tools are used.

The handbook also offers concrete policy recommendations to help policymakers to identify, enable and develop Smart Urban Innovations in their own context.

What is this handbook about?

This guide presents pathways city leaders can follow and adapt to create and implement Smart Urban Innovations in their cities, regardless of their starting point.

Smart Urban Innovations are urban solutions that solve concrete city challenges by using technology and innovative approaches. These solutions contribute to making cities smarter. Through our research of more than forty Smart Urban Innovations globally, we have discovered ways in which actors have used data, information and an array of tools to diagnose challenges, and design and deliver solutions to address a range of urban issues.

We have identified four distinct types of Smart Urban Innovations, each with unique characteristics and success factors. Each type also has a specific pathway for leaders to follow so that they can begin shaping and implementing Smart Urban Innovations in their cities.

Who is this handbook for?

Decision makers in government

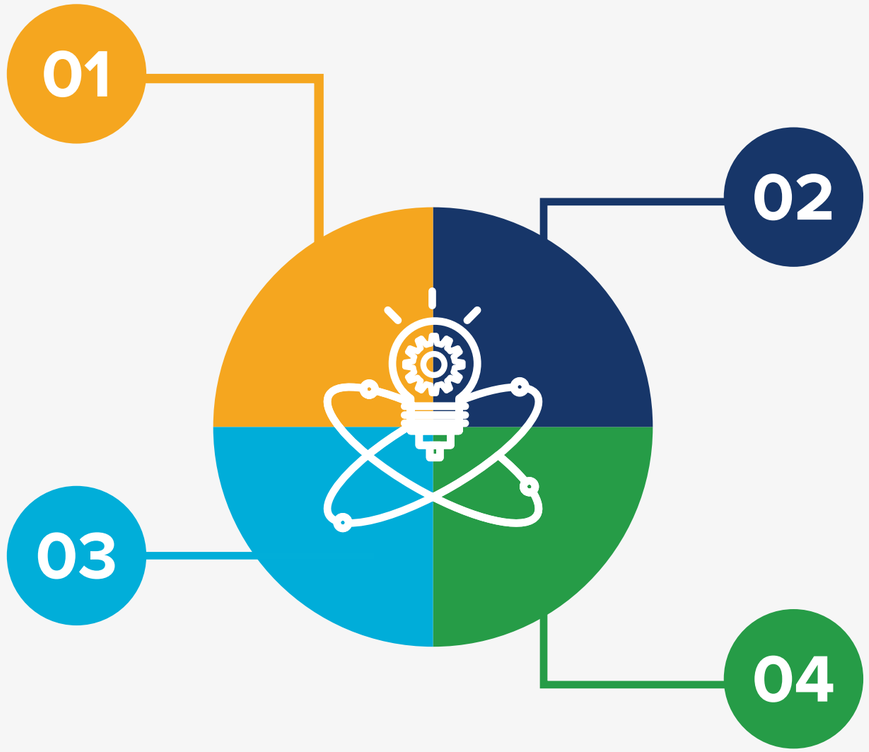
This guide is most relevant for local government decision-makers who are addressing a multitude of challenges faced by their cities. Often, these leaders are constrained by contextual conditions and may not immediately identify solutions that are relevant to them. This guide is not meant to be an exhaustive framework, but rather a resource to support city officials and their partners in building and shaping cities to support and empower their populations.

The different types of Smart Urban Innovations in this handbook can help leaders acknowledge and leverage the strengths offered by their own contexts, with actionable steps on how they can begin the process of designing and delivering Smart Urban Innovations in their own cities.

How do I use this handbook?

I am new, where do I start?

Go to page 15 to learn more about the concept of 'smart'.



What are Smart Urban Innovations? How do they fit into the bigger picture of a smart city?

Go to page 20 to learn about smart urban innovations and why they are the foundation of a truly smart city.

How can I use Smart Urban Innovations for policy-making?

Go to page 24 to understand how to analyse Smart Urban Innovations and how you can use the Smart Innovations Wheel to identify solutions in your context.

What are the types of Smart Urban Innovations? How can I promote them in my city?

Go to page 34 to explore the different types of Smart Urban Innovations and the pathways to promote them in your city.

SECTION 02.

UNDERSTAND THE CONCEPT OF SMART

Smart (adjective) /smar:t/

intelligent; able to learn and think quickly
showing good judgment

Oxford Advanced American Dictionary.

What does a “Smart City” mean to you?

We asked this question to a group of international urban and smart city experts and several city leaders, as we developed this handbook. Here is a glimpse of our conversations with them:

The needs and wellbeing of all citizens need to be at the core of any smart city intervention.

© UNDP Turkey

“A city is not smart if it forgets that cities, first and foremost, should serve their citizens.”

“Smart Cities are about better decision-making and not just better data. They promote access, equity and fairness for participation in urban processes and reduce vulnerability and redundancies during moments of crisis.”

“Smart Cities rely on people for insights and direction, with technology amplifying this—not the other way around.”

"There is greater recognition now that Smart Cities are about shifting quality of life, and how we must use smart approaches to improve living conditions and prospects of urban dwellers."

What is a Smart City?

According to the UN Department of Economic and Social Affairs (UN DESA), nearly 70% of the global population will live in cities by 2050. We need to ensure that urban environments are liveable, inclusive and sustainable—particularly in the context of shaping a ‘green recovery’ from COVID-19. This should be the driving force of any Smart City.

However, for too long, the Smart Cities discourse has focused far too heavily on technology, excluding less tech-intensive but equally innovative solutions. True Smart Cities offer governments and citizens the potential to solve their most pressing challenges and work towards achieving the bold targets set out in the SDGs.

The importance of this is reflected in the sheer diversity of cities around the world. From major metropolises in the biggest countries, to the urban centres of Small Island Developing States (SIDS). We need to ensure that all cities are focused on meeting the needs of their populations.

The provision of quality mobility systems enables access to services to all citizens and reduces the environmental footprint of cities.

Green infrastructures, including green roofs and gardens, help cities become more resilient to climate change.

Pedestrian areas and adequate urban planning increase the wellbeing and quality of life of citizens.

Common Characteristics of a Smart City

A bold, strategic vision for development

A Smart City offers a clear vision for its economic, social and environmental development. This can be in the form of public communications, including policies.

Trust and confidence in the city government gained through engagement, transparency and stability

A Smart City fosters trust and confidence among residents through regular engagement, transparency and accountability in its systems and processes, with the aim of nurturing stability in governance over time regardless of political changes.

Continual learning and building on existing capabilities

A Smart City invests in learning to improvise and adapt to its shifting needs, and builds on available resources and strengths to design solutions.

Collaboration and coordination across actors, systems and resources

A Smart City creates collaboration and buy-in among different actors in the ecosystem, and allocates resources in an efficient and impactful way that takes account of competing priorities.

Inclusive and accessible urban spaces and services

A Smart City creates inclusive physical spaces, provides economic opportunities and delivers services that can be accessed by all citizens, with special attention to serving the most vulnerable groups of society.

Smart Urban Innovations, the foundation of a Smart City

In the same way we need to recognize that no one-size-fits-all definition of a city exists, we must also broaden our perspective of what a Smart City is. Every city has the potential to be a Smart City.

This is the inspiration for our concept of Smart Urban Innovations: projects, programmes, initiatives and ideas that leverage technology and innovation to improve the urban environment.

Smart Urban Innovations are ways of solving a myriad of urban challenges while demonstrating many of the characteristics that define Smart Cities. Smart Cities are the sum of initiatives, solutions and collaborations that address urban needs and follow the basic Smart City principles presented on the previous page. When we look at these initiatives, we can find a diversity of bold approaches that have been applied in different contexts to solve all types of urban challenges. From flooding and urban mobility, to social cohesion and service accessibility.

Smart Innovations offer a path to becoming a Smart City

Smart Innovations can help cities to achieve the Sustainable Development Goals and solve their challenges in a sustainable, inclusive, citizen-centric, efficient and collaborative way. As Smart Urban Innovations scale and increase in number in urban centres, they can pave the way for cities to become smart cities.

To achieve Sustainable Development Goal 13, which addresses the need to take urgent action to combat climate change and its impacts, cities can look at different Smart Urban Innovations.

One Smart Urban Innovation is at work in cities across Vietnam, where decision makers are tackling flooding through the use of apps, data and Internet-of-Things sensors.

In Singapore, the city-state's Bishan-Ang Mo Kio Park was designed as an urban floodplain, routing floodwater into the drainage network. This provides both aesthetic and practical benefits for the city.

In Senegal, women in one suburb have diverted floodwater to irrigate herbs, which are then sold in local markets and provide an important source of income.

Each of these solutions presents a different way of combatting climate change and its impacts. They highlight the importance of broadening our definition of ‘smart’ city beyond just high-tech. You can find out more about different examples in the Appendix.

Cities should continue to learn from their Smart Urban Innovations

Embedding a culture and commitment to learn from Smart Urban Innovations is instrumental in meeting the characteristics of ‘smartness’. As the nature of urban challenges rapidly evolves, so too should the solutions we seek to address them and adapt to new contexts and citizen needs.

Developing the characteristics of a Smart City by adopting Smart Urban Innovations is a journey, not a destination. During this journey, cities need to incorporate monitoring, learning, and evaluation approaches to rapidly adapt to changing contexts. City initiatives that do not take into account updated information from their users and ecosystems risk reducing their impact or even becoming detrimental to the lives of those they seek to serve.

Learn from Smart Urban Innovations

In order to adapt and enhance the effects of Smart Urban Innovations, cities need to continuously learn from their experiences and use these insights to improve their actions. The key steps to do so are:

01

Monitor progress

Establish mechanisms in Smart Urban Innovations for regular monitoring by collecting data and information on the core activities and outcomes of a solution.

02

Evaluate impact

Over time, assess and analyse data and information collected through one or more different methods, depending on the complexity of the Smart Urban Innovation. Evaluation methods may include Randomized Controlled Trials or more micro-level approaches such as community focus groups.,

03

Distil and embed key lessons

Synthesize core lessons from the evaluation of your solution, disseminate and discuss implications with key stakeholders and arrive at key decisions necessary for implementing any course-corrections related to your Smart Urban Innovation.

Applying a gender lens to Smart Urban Innovations

Women experience cities differently than men. Often, they may have unequal access to public spaces or be excluded from key services, such as education, health, and internet access Despite evidence that female participation in decision-making improves collective outcomes, the representation of women in city design, decision-making and activities remains dismally low. A city cannot be ‘smart’ if it excludes - or limits the potential of - half its population.

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Especially for those solutions that use digital tools, it is important to verify that women and girls have access to devices and the capacity to use them equally with men.

How to incorporate a gender lens in Smart Urban Innovations

Leadership representation

Leadership and decision-making positions should be gender-balanced. Government actors can take steps to amend existing policies and promote more inclusive ones, in addition to advocating for a gender lens in the design and oversight of urban solutions led by other stakeholders.

Interpretation of data and other information

In diagnosing challenges and designing solutions, ensure that diverse voices are considered. Focus on understanding gendered nuances in data and information that may not be immediately apparent. This includes ensuring that data and analyses are gender-disaggregated.

Access to physical infrastructure and services

Consider the gendered challenges in relation to access to physical infrastructure or adoption of technology. Monitor the implementation of the solution with a gender lens, and seek to address additional challenges that may emerge during the design and implementation of the urban solution.

One Final Takeaway

Becoming a Smart City is a marathon, not a sprint.

Cities are not monoliths or static; they evolve and change. Policymakers have the opportunity to drive specific changes, such as promoting an environment that is conducive to the emergence of other solutions.

In the section **“Types of Smart Urban Innovations and pathways to impact”** (page 34), you can discover ways governments can encourage innovations to emerge.

Becoming a Smart City is a journey, not a destination. As the context of the city changes, additional Smart Urban Innovations may become possible and can be designed to solve new or existing urban challenges.

Public authorities need to be agile and respond rapidly to new needs or adapt their innovations. Monitoring and evaluating each project and learning from the data collected is key to evolving and improving solutions so that they are adapted and shaped to fit the context over time, thus becoming smarter.

We need more cities that are smart, and fewer “Smart Cities”

Smart Cities have become synonymous with high tech—from 5G, to blockchain to Big Data. These are valuable tools in the urban environment, but a Smart City needs to have more than technology. It needs to be a place where all citizens are included and where sustainability is at the forefront. ‘Smart cities’ need to be liveable and human-centred. We can only achieve these goals if we look beyond high-tech attributes and focus on shaping truly ‘smart’ cities.

SECTION 03.

SMART URBAN INNOVATIONS

—and how to analyse them

In this section, we describe different types of Smart Urban Innovations. We unpack their unique attributes and discuss ways policymakers can use them to improve their cities.

What does the idea of Smart Urban Innovation mean for my city?

Smart Urban Innovations are concrete initiatives or projects that provide solutions to challenges faced by the needs of a city's residents. These solutions mobilize the actors of the local innovation ecosystem and different sets of resources to solve concrete challenges.

Following an analysis of more than forty Smart Urban Innovations all across the world, we developed a framework that highlights the most common combination of elements, allowing us to generate a typology of Smart Urban Innovations: the Smart Innovations Wheel. Starting at the centre of the circle and moving towards its outer edge, the framework encompasses four dimensions that we find in all Smart Urban Innovations and presents a set of possibilities for each.

In the following pages, we provide detail about each of the dimensions of the Smart Innovations Wheel and the different possibilities that can be found in each context.

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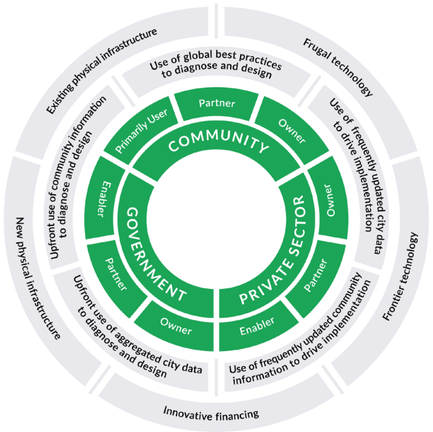
Each city is different from another. In a city, each neighborhood also has different needs. Smart Urban Innovations take many different forms because they are adapted to the local context, its challenges, and its potential solutions.

Unpacking the Smart Innovations Wheel (1/2)

Each of the four Smart Urban Innovation types is based on the different roles of the public and private sectors, and civil society - and how tools, such as technology and data, are used.



Actors

A dominant actor often initiates and leads the delivery of the solution while collaborating with the other two actors.

Key roles of actors

The roles played by actors are contingent on a range of factors including whether or not they are leading the innovation, their contextual conditions and the nature of the issue being resolved.

Data and Information

The smartness of an innovation relies on the ability of actors to use data and information of the right nature, level and frequency to arrive at decisions throughout the solution's life cycle.

Tools

Actors use a range of tools that are well-suited to their context and to overcoming the challenge they seek to resolve.

Unpacking the Smart Innovations Wheel (2/2)

Each type of Smart Urban Innovation results from the interplay of four different components: actors, their roles, data and information, and broader tools. In each type of Smart Urban Innovation, we see the mobilization of one or more aspects of each component.

Actors

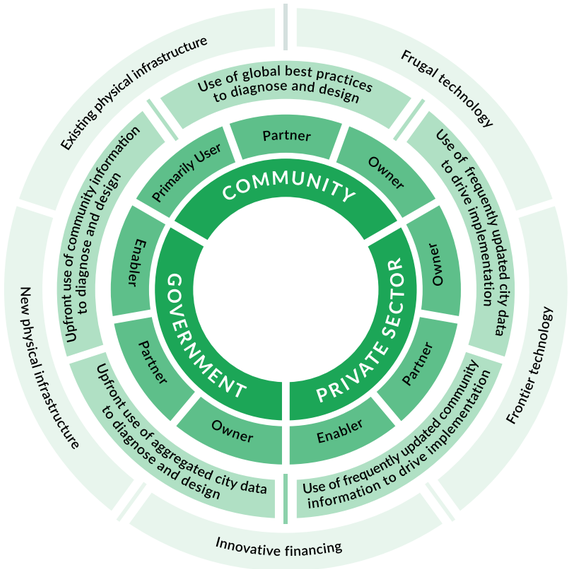
A dominant actor often initiates and leads the delivery of the solution while collaborating with the other two actors.

Three categories of actors lead or support the design and implementation of Smart Innovations.
- Community includes residents and citizens of the city, civil society actors - such as non-profits and advocacy groups—academia and entrepreneurs, including smaller social enterprises.
- Government represents administrators and elected officials across all levels.
- Private sector represents organized businesses, including established companies and large entities that operate with a for-profit purpose.

Data and information

The smartness of an innovation relies on the ability of actors to use data and information of the right nature, level and frequency to arrive at decisions throughout the solution's life cycle.

Actors use data and information to diagnose problems and to inform solution design and delivery. Variations depend on :
- Where data and information are sourced—from the city, the community or a set of global best practices.
- How frequently data and information are used—either upfront to conceptualize and design or across the life cycle of an innovation, from conceptualization to implementation.



Key roles of actors

The roles played by actors are contingent on a range of factors, including whether or not they are leading the innovation, their contextual conditions and the nature of the issue being resolved.

Actors play four main roles, some of which are unique:
- Owners initiate and lead the design and implementation of innovations with some support from other actors.
- Partners co-design or co-implement solutions with other actors.
- Enablers support solutions through various mechanisms, such as funding, strategic guidance and creation of an enabling environment.
- Primarily users are beneficiaries of the solution. This group of actors are present when the community plays a passive role in an innovation.

Tools

Actors use a range of tools that are well-suited to their context and to overcoming the challenge they seek to resolve.

Actors use tools based on their contexts and the needs of the solution. Types of tools include:
- Technology, which can be either frugal, simple and accessible, or frontier (more resource intensive)
- Physical infrastructure, which can consist of infrastructure that is leveraged or repurposed in its existing form or newly created infrastructure that requires heavy capital investment
- Innovative financing that helps broaden traditional financing opportunities and can potentially be mobilized

More details on each component of the Smart Innovations Wheel are available on Annex I - Smart Urban Innovations Wheel rubric

How does the Smart Innovations Wheel inform the typology of innovation?

The interplay of possibilities associated with each dimension of the wheel creates distinct patterns and leads to the identification of four discrete types of Smart Urban Innovations.

Beginning at the centre of the circle, the lead actor is the first dimension to anchor the typology. Its interplay with the other dimensions in relation to data, information and tools results in four Types of Smart Urban Innovations:

Community-organized

Community-led, locally-inspired and resourceful solutions driven by civil society, with direct support from the government or private sector

Frugal Innovations

Market-driven, frugal solutions stemming from the community, with government or private sector acting as enablers

Enterprise Ventures

Private-sector led, technology-centric and dynamic solutions, with governments creating the right conditions for success

Institutional Pioneers

Government-led, city-wide solutions that are catalytic and anchored on the use of significant state resources, often in partnership with the private sector

On the next page, you will find additional guidance on how the Smart Innovations Wheel can help you to identify and utilize your levers and resources to enable innovative solutions in your city. In the next section, you will find the description of each typology, including examples and policy recommendations to enable them in your local context.

How can I use the typologies of Smart Urban Innovations?

Cities can approach urban challenges in different ways. To see how this works, pick an urban challenge in your city that needs to be addressed. The process below can help you identify a path or type of Smart Urban Innovation that will help you see how to start tackling your challenge.

Revisit this process for each urban challenge you are looking to address!

Choices made in relation to the dominant actors, data and information, and available tools depend on your city's specific context and the urban challenge you are attempting to address. Also, remember that each typology is simply an ideal type (or archetype) and that it may need to be adapted to your particular context.

1

Identify the dominant actor/s active in the focus sector of your city.

- Which actors are focused on the urban challenge you are trying to solve?
- Which actor is best positioned to lead the design and delivery of the solution to your challenge?
- Which actors can play a supporting role?

2

Determine the type of data and the available information required to support decision-making by actors

- What kind of data is necessary to diagnose and implement an effective solution?
- Where does this data originate and how can it be accessed?
- At what stage and how often can this data and information be used to inform solution delivery?

3

Identify the tools you can leverage to support design and delivery of the solution.

- What types of tools are available in the ecosystem? How can those tools be leveraged?
- What kinds of tools are required during diagnosis, design and implementation? For example, is a new physical or digital infrastructure needed?
- What is the overall technology intensity?

4

Select the type of Smart Urban Innovation that fits your context.

- Explore the type of Smart Urban Innovation that could best work in your context. Consider the policy recommendations provided to drive these innovations in your city.

Using a problem-definition lens (1/2)

Smart Urban Innovations are the result of the interactions of different actors and the use of concrete resources to generate solutions for concrete challenges. The type of solution you can promote in your city will depend on the contextual elements you can mobilize to generate a solution, not on the challenge itself. Therefore, all typologies of Smart Urban Innovations can be applied in any sector - or to any challenge.

Consider this example to gain an understanding of how different typologies of Smart Urban Innovations can help you address one concrete challenge, depending on the available information in the context you provide:

How could I improve mobility in my city and reduce traffic congestion?

Community-organized
Digital Mataturs, Nairobi (Kenya)

In Nairobi, a Kenyan research institute worked collaboratively with drivers and volunteers, using technology to collect and analyse data from the network of matatus (public transport vans) to map and visualize the informal paratransit system. This innovation helps citizens and drivers plan their journeys, thereby enhancing mobility in the city; city authorities also use this information for urban planning.

Frugal Innovations
GoOv, several municipalities (The Netherlands)

GoOv, a social enterprise, aims to increase the mobility of people with disabilities. It guides users from door-to-door through their journey, indicating the time the bus or train will arrive, when and where to transfer, and the station at which to get off. Guardians follow the user's journey using the app's features. The government enables use of the app by covering the subscription fees for users.

Enterprise Ventures
Waze Connected Citizens, Boston (USA)

In Boston, the Google-owned-and-operated Waze app improved decision-making in traffic management and de-congested roads by establishing localized, mobile-based data-sharing platforms to aggregate and democratize real-time information on road incidents. This service was offered to the government as part of a broader public-private sector commercial partnership to aid decision-making.

Institutional Pioneers
Bus Rapid Transit, Curitiba (Brazil)

Combining the ease and efficiency of metro systems and the low cost of the humble bus, Bus Rapid Transit (BRT) offered the Brazilian city of Curitiba a cost-effective solution to their transport problem. Led by the mayor, Curitiba dedicated road lanes purely to bus traffic and added platforms to serve as safe waiting areas, greatly reducing congestion on the road.

Using a problem-definition lens (2/2)

Smart Urban Innovations can emerge to provide responses to a wide variety of urban challenges, such as reducing air pollution caused by urban mobility, or improving waste management practices to improve the environmental footprint of cities.

Smart Urban Innovations are solutions which are also adapted to the unique characteristics of each context, and leverage the resources available, mobilizing the resources that are available in it.

How can I improve waste management in my city?

Community-organized
Packa-Ching, Cape Town (South Africa)

Packa-Ching is a not-for-profit initiative dedicated to improving recycling in informal settlements and low-income areas. Residents earn income by selling recyclable packaging at different collection points within the community. Packa-Ching is supported by Sasol, a private company that has funded mobile units across South Africa and provided sponsorship for Packa-Ching business owners.

Frugal Innovations
Green Collect, Melbourne (Australia)

Green Collect, a social enterprise, focuses on resource recovery of discarded office resources and workplace waste. They not only recycle materials, but also re-use or transform them into other products. Their business is creating a circular economy where goods are donated or collected, repurposed, recycled, upcycled and sold back to the community. Green Collect has received funding from government to aid with its expansion efforts.

Enterprise Ventures
BigBelly, Dún Laoghaire (India)

BigBelly focuses on modernizing public space waste management through a variety of smart-waste and recycling systems. In the town of Dún Laoghaire, they have implemented their smart bins in public spaces, which collect and relay information on waste gathered to allow for need-based collection by authorities. The community is the primary user of the services provided by BigBelly and the government partners with the company to implement the solution in municipalities.

Institutional Pioneers
Faecal Management Call Centre, Dakar

Inspired by a citywide need to improve household sanitation, the government leveraged existing resources and frugal mobile technology to establish a call centre that connects private sludge management services with the community. The government runs the call centre, coordinating and overseeing the performance of private operators. It uses municipal information to process and quickly respond to community feedback.

One final takeaway

All Smart Urban Innovation types build on the capacity of city actors to lead and partner with other stakeholders to implement solutions. Cooperation is a fundamental element in generating any kind of Smart Urban Innovation.

Depending on the innovation type, actors can have different roles: **innovators** (leading the design), **design and implementation partners** (co-designing and co-implementing solutions), **enablers** (creating enabling environments), and **primarily users**.

Cities have different levers available to implement Smart Urban Innovations. **These levers determine the innovation types that can be developed or the resources you need to locate.** Be sure to consider the options that are available in terms of financing, infrastructure and technological solutions when selecting or planning for your innovation type.

Data is a fundamental tool for diagnosing a problem and for monitoring and evaluating the effectiveness of a solution. Don't forget to identify which data is most useful for your smart innovation and how you're going to collect and manage it while you're designing your innovation type.

SECTION 04.

TYPES OF SMART URBAN INNOVATIONS AND PATHWAYS TO IMPACT

There are four types of Smart Urban Innovations. In this section you'll find a detailed description of each, in addition to examples, key success factors and specific policy recommendations that will help you to explore the potential for innovation in your city.

Four types of Smart Urban Innovations

As described in the previous section, four types of Smart Urban Innovations result from the different interactions depicted in the Smart Urban Innovation Wheel. In the following pages, you will find a more detailed description of each, as well as examples and policy recommendations.

Further information about each of the examples can be found on Annex II - Smart Urban Innovations examples.

Community-Organized

Community led, locally inspired and resourceful solutions driven by civil society, with direct support from the government or private sector.

Frugal Innovations

Market-driven frugal solutions stemming from the community, with government or private sector as enablers.

Enterprise Ventures

Private-sector-led, technocentric and dynamic solutions, with governments creating the right conditions for success.

Institutional Pioneers

Government-led, citywide solutions that are catalytic and anchored in the use of significant state resources, often in partnership with the private sector.

Community-Organized

Community-led, locally inspired, resourceful solutions driven by civil society, with direct support from the government or private sector.

Community-Organized solutions address urban challenges unique to their local contexts in resourceful ways. Often originating from civil society (e.g., non-profits, resident associations, etc.), they partner with the government or private sector to co-design and co-deliver innovative solutions without the explicit intention of profitability. Despite resource shortages that may persist, they succeed as a result of actively listening and responding to the needs of the community and efficiently and imaginatively utilizing the resources accessible to them.

Key characteristics of Community-organized

• Urban challenges solved by **community actors** without profit-driven motives. The innovators often **partner with the government, private sector or development actors**, who lend support by kick-starting, co-delivering and scaling the solution.

• Diagnosis of the issue and solution design rely on the **use of community information**, with supporting actors using their knowledge to bring in **global best practices** to augment the solution. User perspectives are gauged at defined **intervals to course correct** as and when required. Solutions often **complement and integrate with existing physical infrastructure and public services**. Based on the scale and complexity of a solution, tools such as innovative financing and technology may be deployed.

Community-organized
Case study

Packa-Ching, Cape Town

Context

As a national economic hub and an international tourism hub, Cape Town is the second most populous city in the country serving as a home to more than 3 million people. Accompanied by this growth, the city has witnessed a rapid increase in consumption and related waste, with more than 90% of the waste being dumped in landfills.

The solution

Used packaged waste holds monetary value and accounts for a considerable portion of overall waste. to repurpose used packaging waste and spark behaviour change in waste management, Packa-Ching, a non-profit initiative, provides financial incentives to lower income communities to segregate and supply recyclable waste to mobile units owned by local businesses which are deployed across the city.

Scale

Around 1.8 million kgs of waste diverted from landfills; around US$92,000 earned by communities in exchange for recyclables

Click on the image to see a video on the solution

Core Actors

Polyco, a local non-profit organisation played a central role in designing, rallying important stakeholders and implementing the solution.

A core enabler of success for the solution is the space it creates for local businesses and community members to partner in its success. Local businesses driven by community members are engaged to partially own and fully manage the mobile units which drive around the city to collect waste.

Residents are continuously encouraged to provide the recyclable waste essential to the impact generated by the solution.

Supporting Actors

The government, through integrated policy measures and action, has created a favourable environment towards waste management which helped jumpstart adoption of the solution.
In addition, Sasol, a large energy and chemicals company, along with other large corporates has provided a significant share of overall funding.

Use of Information

The solution has used local information to identify the exact challenges as well as to identify lower-income communities that could get involved and help solve the problems. The core of the solution requires recycling the collected packaging materials, hinged on established practices which have been tried and tested across the globe.

Use of Tools

The solution has created digital platforms through which residents can book pick-up services and leveraged existing e-Wallet services to send digital cash as compensation for the waste. This is anchored on simple and widely.used mobile internet services.

Community-Organized

Examples

© UNDP Argentina

“Comercios con Vos” Network, Concepción (Argentina)

In partnership with small store owners, UNDP Argentina and Concepción City Council set up a network of local businesses to support neighbours with low literacy skills by supporting them in carrying out basic online tasks.

Inspired by a young store owner who voluntarily helped some members of the community to perform online tasks, UNDP and the City Council saw in this approach a method to provide quick, friendly local support to individuals with limited digital skills in the midst of the COVID-19 pandemic.

Capital Growth, London (United Kingdom)

Capital Growth aims to scale local food-growing practices by incentivizing community networks by unlocking financial and knowledge resources.

Arising organically from community knowledge and innovation, this solution allows members to direct and course-correct implementation based on local information. It is driven by the creative use of existing land while relying on frugal digital platforms that allow community members to track their activities.

©UNDP Vietnam - Phan Huong Giang

Independent Waste Collectors (IWCs), Ho Chi Minh City (Vietnam)

To improve waste management, local organizations came together to formalize and upskill informal networks of IWCs, supported by philanthropic funding and government policies.

In addition to being driven by the needs and actions of the community, the solution is based on establishing principles of cooperative organizational structures. It reorganizes the existing resources of the IWCs rather than investing in new technologies or physical infrastructure.

Community-organized

Why have these innovations succeeded?

Active community base

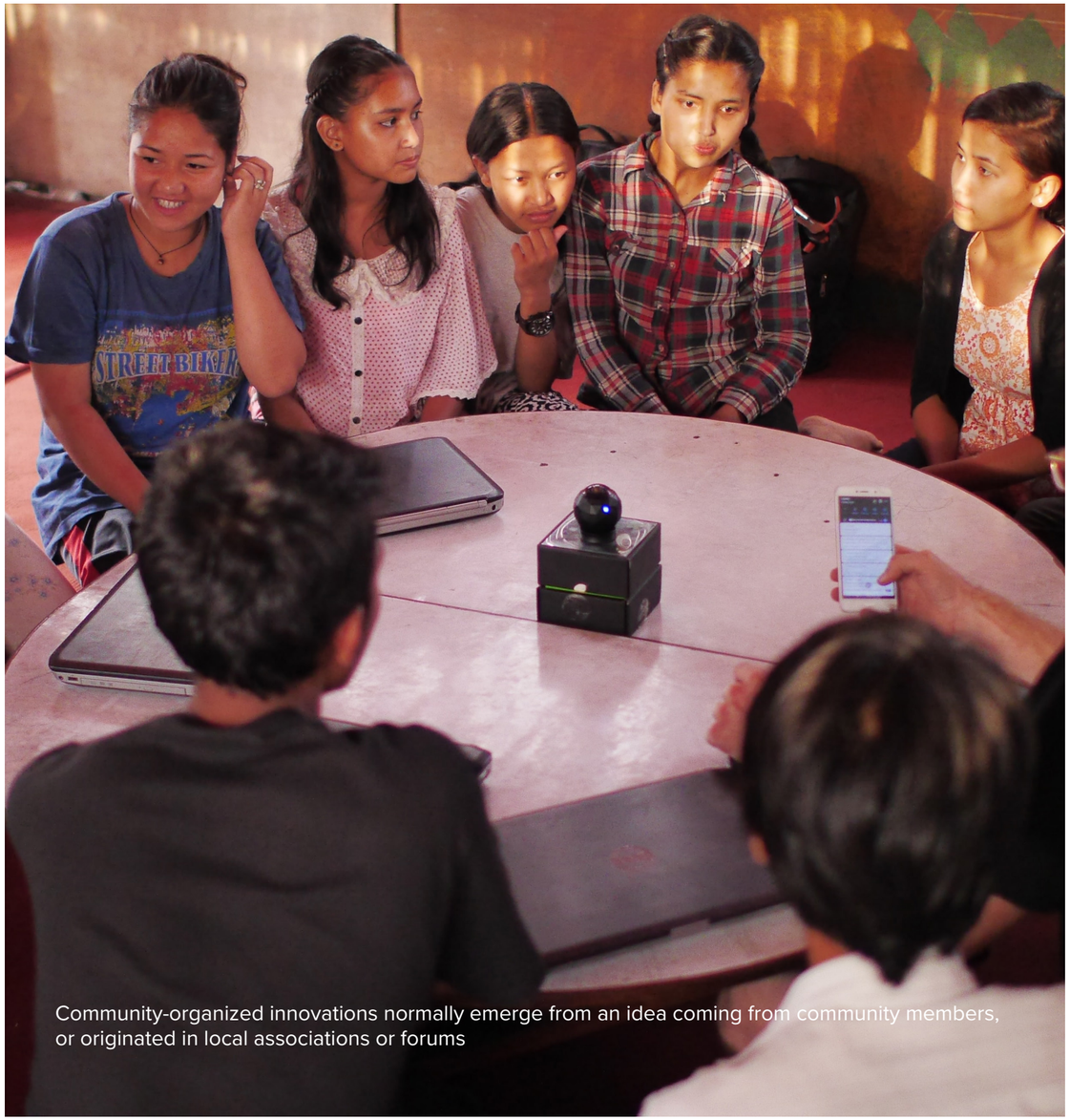
These cities have active civil societies that can organize into networks; they strive to impact deeply-rooted community issues. Their lived experiences lend a layer of depth that informs the solutions. In addition, investments dedicated to building the capacity of these networks enable them to organize and deliver solutions efficiently.

Government's ear to the ground

These cities have larger stakeholders that work closely with the community to unlock opportunities, ranging from policy shifts to financing. Moreover, community members are actively consulted and directly engaged in the design and development of solutions.

Government willingness to share power

Community-driven solutions thrive where the government recognizes the role and importance of solutions designed by the community. The government is willing to create space for community-based organizations to thrive and supports them with a conducive policy environment, financing and funding, strategic guidance, and implementation support.



Community-organized innovations normally emerge from an idea coming from community members, or originated in local associations or forums

Community-organized

How can I start creating this Smart Urban Innovation in my context?

Spark conversations with community organizations

Invest in setting up mechanisms or platforms to cultivate dialogues with community-based organizations. Embrace their voices to build trust and create alignment with a common vision for the city.

Address barriers to sustaining the solution

Identify regulatory, operational and financial barriers in sustaining the solution over the long term. Consider policy changes and diverse financial solutions that can help innovations weather major changes in the external environment (e.g., funding cuts).

Drive synergies with government initiatives

Identify common areas of work currently conducted by the government and community-based organizations. Use this knowledge to drive synergies and create complementarities to maximize collaboration and impact.

Learn and replicate at a hyperlocal level

Once a Smart Urban Innovation has established a proof of concept, disseminate lessons and facilitate replication by fostering collaborations and networks of community organizations or as a government implemented service.

What should I keep in mind?

All voices are important

Community Organizers thrive on their understanding of the people. You should listen to the voices of all organizations working with the target community and problem statement to encourage the design of inclusive and community-focused solutions.

Relationships come first

Before you jump in, actively engage with civil society in your city and ensure that your support is a positive addition to their efforts. Invest in power sharing to create space and platforms that allow civil society to perform.

Policy support is critical

Successful and sustainable community-driven initiatives require strong policy frameworks, which provide support. Ensure that you create a conducive policy environment for community organizers to thrive.

Frugal Innovations

Market-driven, frugal solutions stemming from the community, with government or private sector acting as enablers

Frugal Innovations are market-driven solutions that address the deeply-rooted urban challenges surrounding them. Often championed by individual local entrepreneurs in the beginning, they may emerge as social enterprises over time. While the innovators drive the design and delivery of these solutions, their efforts are further empowered by governments or corporations who help accelerate the growth and impact of these solutions through enablers, including policy shifts such as licensing and regulatory amendments, and financial support.

Key characteristics of Frugal Innovations

• Entrepreneurs from the community **design and deliver the solution integrating a business perspective**, aiming to generate profit while delivering social impact. The government or private sector often enables the solution through strategic guidance, policy changes and funding.

• Innovators leverage **community-level information** to diagnose challenges and solve them. This is supplemented by **continuously monitoring community perspectives**, which ensures that the solution can respond to evolving needs.

• **Frugal technology** and existing physical resources are used in the early stages due to resource constraints, though innovators may invest in frontier technology as the solution scales.

Frugal Innovations
Case study

NINA, Fortaleza

Context

Fortaleza, home to 2.6 million people, is the third richest metropolitan area in its region and an important commercial centre for Brazil. However, women and girls face major safety challenges while traveling on public transport.

The solution

NINA is a platform designed to maximise safety on public transport in the city. Witnesses and victims of harassment on public transport can easily report incidents on a mobile application. When complaints are issued, the police are notified and surveillance videos are sent directly to NINA. The company centralises this information and earns revenues by providing consultancy on improving women's safety and integrating their technology with other services for private sector transport companies and governments.

Scale

1 million+ users in Fortaleza. 1,300+ reports in the last 6 months, with 10% cases converted into a formal investigation

Click on the image to see a video on the solution

Core Actors

NINA was ideated by the daughter of a bus ticket collector, who presented the Project in an open innovation challenge. Her own experience and those from other women around her inspired her to create an accessible solution for the problem.

Supporting Actors

NINA was supported by public and private stakeholders. The project won the InnoveMob Challenge, an initiative promoted by big corporates such as Toyota Mobility Foundation and WRI Brazil, and public representatives such as the National Front of Mayors - an entity representing mayors from cities across Brazil.

The collaboration with both types of actors was fundamental to ensure an adapted business model, get initial funding, and have the possibility to pilot and integrate the solution with public transport operators and security bodies in a real environment.

Use of Information

In order to deliver its services, NINA collects and analyses data on a real-time basis from submissions through the various applications that have integrated its API. While it shares individual incidents with authorities, its bigger-scale value-addition comes from the aggregated data it shares with decision makers to help them improve their policies.

Use of Tools

NINA depends on carefully built digital platforms relying on simpler technology such as mobile applications. Rather than upgrading physical infrastructure, the solution relies on aggregating information on safety in existing physical spaces.

Frugal Innovations

Examples

SafeBoda, Kampala (Uganda)

SafeBoda is a locally led, market-based social enterprise funded by the private sector that aims to improve the safety of motorcycle taxi drivers encouraging the use of helmets and the adoption of safe driving measures.

This start-up uses aggregated data to continuously deliver and inform improvements to its services. Leveraging a rapidly-growing motorcycle taxi industry in Kampala, it relies on simple mobile applications to drive its solutions rather than significant capital investments in new physical infrastructure or

Agicool, Paris (France)

Founded by Parisian social entrepreneurs and financed by private sector investments, Agricool sells pesticide-free food at low prices by simulating farm conditions inside shipping containers.

The founders leverage community information based on their own experience as farmers to diagnose systemic gaps and prototyped solutions while incorporating user feedback to course correct. The solution recycles abandoned containers and uses simple technology to simulate farm environment through lighting and irrigation

NINA, Fortaleza (Brazil)

NINA aims to resolve sexual harassment in public spaces by using frugal technology to collect and channel real-time information on incidents to enforcement authorities.

Developed by the daughter of a bus ticket collector, she submitted the solution to an open innovation challenge. NINA provides services for free to users and enters into commercial partnerships with governments and private transport operators to provide advisory, research and technical support on safety issues.

Frugal Innovations

Why have these innovations succeeded?

Strong leadership from within community

Ingenuity is the driving force behind these innovations: Social entrepreneurs from communities who are seeking to frame solutions, often experimenting and iterating solutions in the earliest stages.

Ecosystem supportive of market solutions

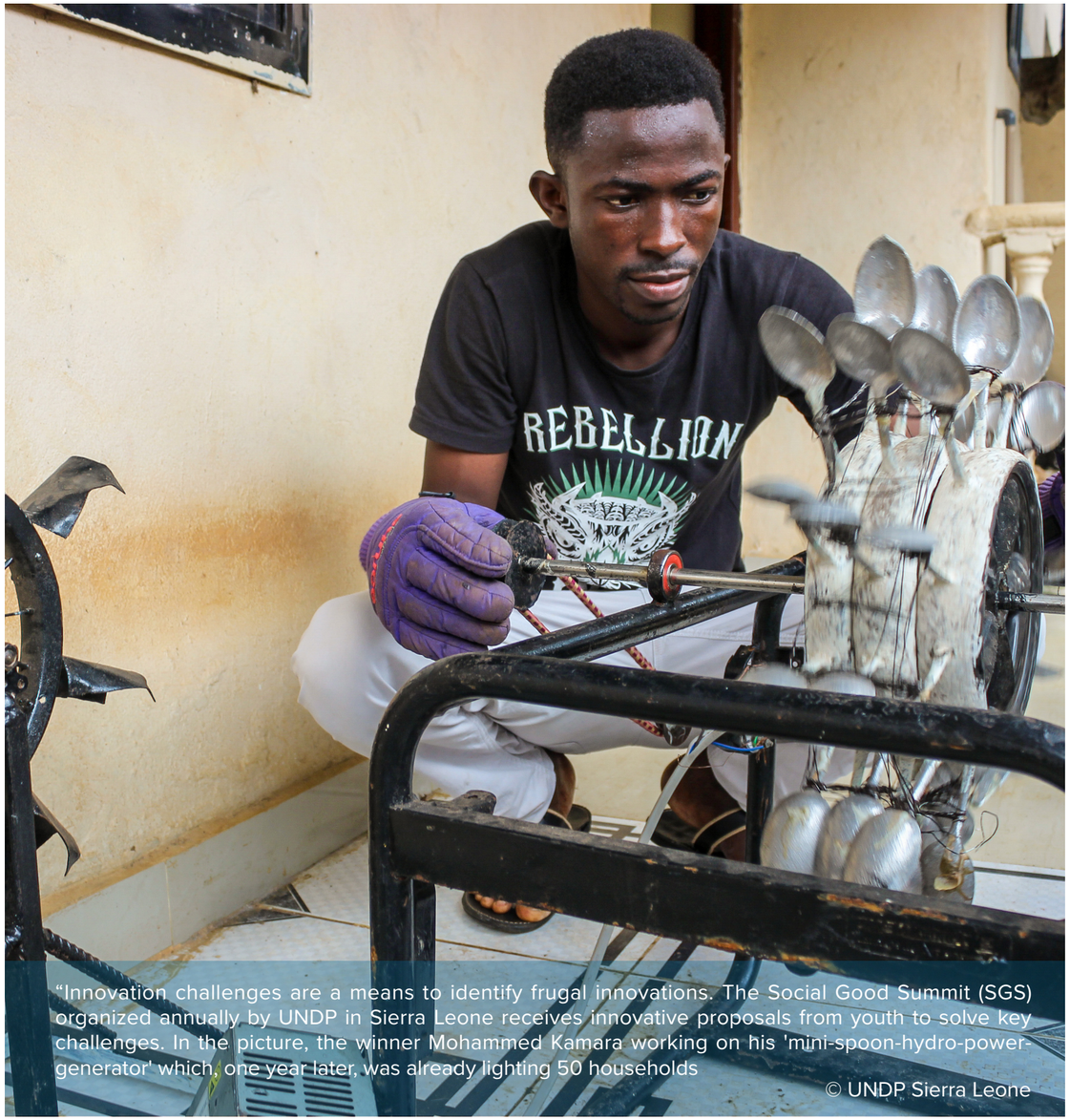
These type of urban innovations consist of solutions designed through a market lens; often, a viable market existed for the services they offered, and a suitable socio-political environment was present for them to operate in.

Bespoke community knowledge

These solutions stem from communities that have experienced the challenge first-hand. Such direct experience imparts invaluable knowledge and enables the creation of unique solutions.

Partners for scale

While they have emerged from frugal, agile origins, these innovations require strong partners that can provide financial and technical support so that they can scale citywide and beyond.



“Innovation challenges are a means to identify frugal innovations. The Social Good Summit (SGS) organized annually by UNDP in Sierra Leone receives innovative proposals from youth to solve key challenges. In the picture, the winner Mohammed Kamara working on his 'mini-spoon-hydro-power-generator' which, one year later, was already lighting 50 households

© UNDP Sierra Leone

Frugal Innovations

How can I start creating this in my context?

Identify the most active social enterprise

Look for active social enterprises or community leaders that are already solving your city's most pressing problems by applying a market lens.

Identify key barriers which hinder scaling

Engage and seek to understand the largest barriers that prevent them from developing their products and scaling their impact; reflect on root causes.

Assess barriers that can be addressed through government intervention

Determine which of these barriers can be solved by your department through legislation, enforcement, etc. or through actively engaging private actors in your network.

Deliver changes, seek feedback, iterate

Institute changes necessary to support the success of these solutions and seek feedback from social enterprises; go back to the drawing board to understand what else may be needed or which other social enterprises you can support.

What should I keep in mind?

Keep your options open

Community-friendly innovations can exist in sectors you might not expect. Moreover, for-profit social enterprises will likely have sustainable and self-financing solutions that can provide services in the long term. Keep an open mind when considering which initiatives to support, ensuring that they are also delivering relevant social impact.

Barriers can arise from many sources, including the government

Pioneers and trendsetters often come across legal issues when trying to challenge the status quo, especially those in informal sector. Be ready and willing to rethink conventions, including how to reallocate existing resources or creatively use data that may already exist.

Consider overall impact

Take into account the impact of the solutions on populations, and on other aspects that aren't directly targeted by them. By accounting for externalities, you can limit the unintended consequences of these interventions and take action to align market incentives accordingly.

Enterprise Ventures

Private-sector-led, technocentric and dynamic solutions, with governments creating the right conditions for success

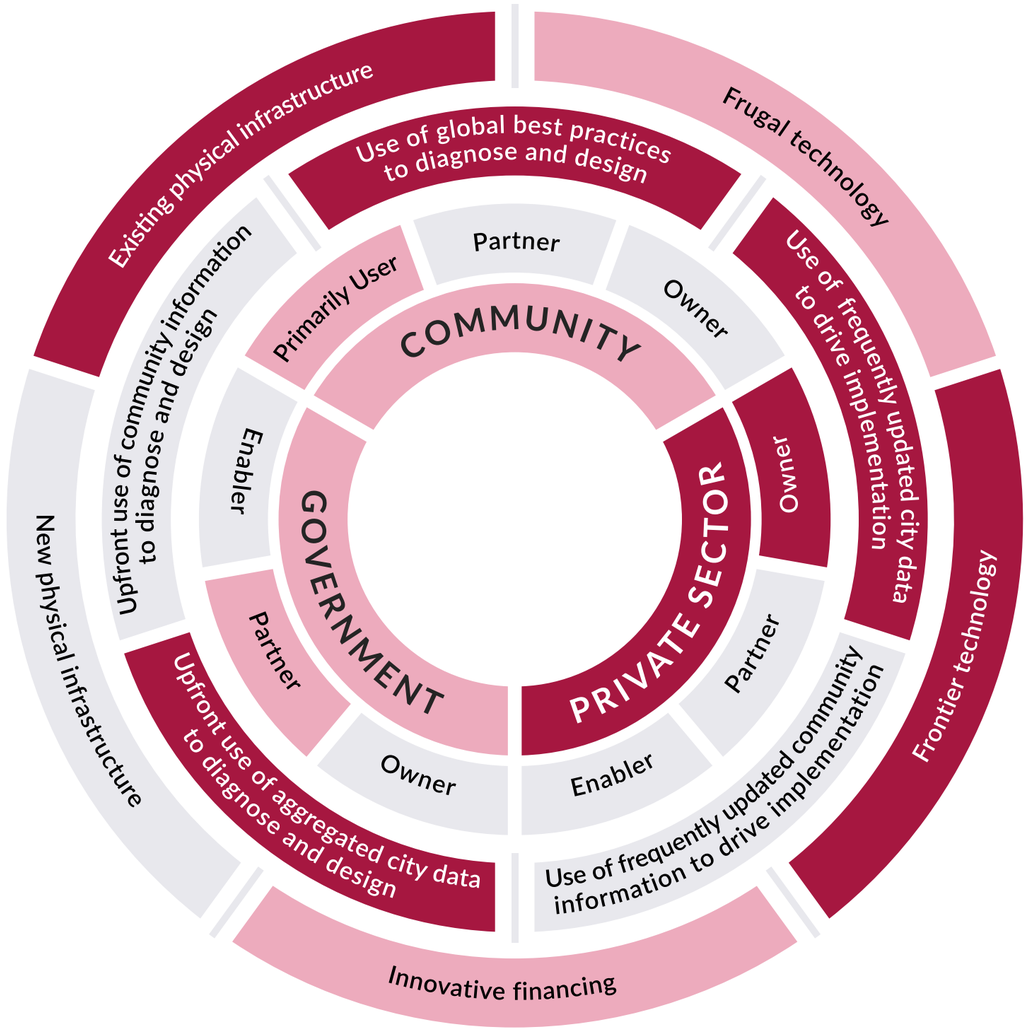
Enterprise Ventures represent larger-scale Smart Urban Innovations led by the private sector in cities where the government has provided the necessary groundwork for their success and, at times, acts as a key partner in delivery. Large national or international private sector players usually lead the design and implementation of these innovations, often collaborating with a range of professional partners that are incentivized equally by both profitability and public impact.

Key characteristics of Enterprise Ventures

• Innovations are **designed and delivered primarily by well-established, for-profit private actors** such as corporates and at-scale enterprises. The government enables these innovations by creating the right regulatory and resource conditions and often partners with private players in the funding and implementation of these solutions.

• Solutions are typically **tried and tested in other markets**. However, private actors seek **aggregated city-level data to calibrate solutions** according to local contexts. Insights from frequently updated, often real-time city data are used to course correct and deliver solutions.

• **Frontier technology** is used, often manifesting in the form of hardware solutions, retrofitted to leverage existing physical infrastructure. Based on the complexity of the problem, innovative financing mechanisms may be deployed.



Enterprise Ventures
Case study

Odyssey City Card, Bhubaneswar

Context

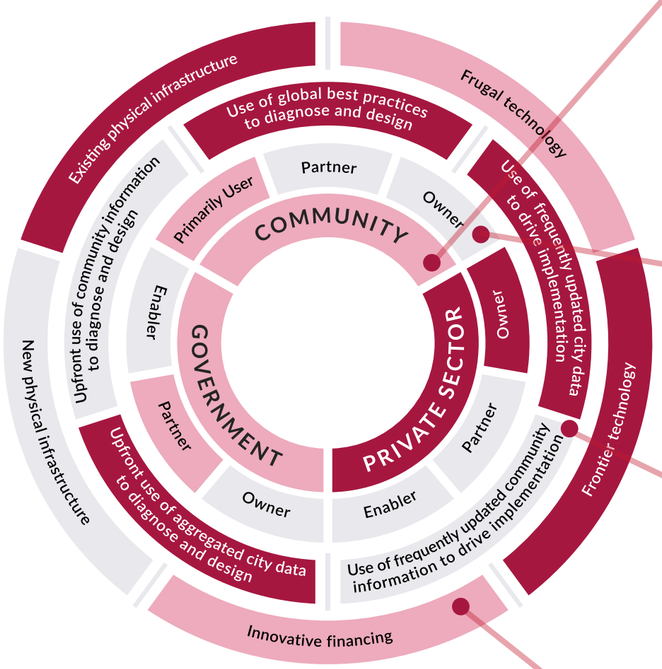
Bhubaneswar is a sprawling city of 1.16 million people, relatively small by most standards of urban cities. In past years, the city faced difficulty in managing payments for utilities, transportation and other services due to a heavy reliance on cash and fragmentation of payment systems across various departments.

The solution

The Odyssey City Card provides a one-stop-shop for safe digital economic transactions for public services to residents of Bhubaneswar. Residents can use the card for digital payment of government fees and taxes, utility bills, transit charges, parking and other city services. The Odyssey City Card involved background integration of systems across various municipal departments, improving efficiency through providing a common mechanism for commercial and civic payments across the city.

Scale

325 Point of Sale (POS) machines installed throughout the city, with a target for a POS machine to be available every 250-300m walkable distance



Click on the image to see a video on the solution

Core Actors

The initial idea for the card came from Bhubaneswar Smart City Limited (BSCL), the Special Purpose Vehicle (SPV) responsible for Bhubaneswar's Smart initiatives. ICICI Bank, a private Indian multinational bank co-designed and is still leading the technological development of the solution and providing the basic infrastructure for its execution.

Supporting Actors

ICICI Bank builds and operates this card initiative in partnership with the government office BSCL. The government has created the requisite legal and regulatory framework to house this initiative under a multi-year PPP mechanism.

Use of Information

City-level and government data were used to diagnose the problem and ICICI monitors the use of the card to identify possible expansion areas or problems. As a cashless solution, real-time management of data and information about payments through strong back-end systems and capabilities is necessary.

Use of Tools

The innovation leverages mainly existing physical infrastructure, but has required an important investment in technological development, in addition to retrofitting 325 PoS machines across the city for payment for purchase of goods, movie tickets or dining.

Enterprise Ventures

Examples

E-bike deployment, Ecopark (Vietnam)

UNDP Vietnam partnered with the firm MBI to provide a sustainable mobility solution in Ecopark (Hanoi). MBI had developed a model of electric shareable bikes using a mobile application, and was willing to test and replicate the solution. UNDP Vietnam had been supporting the government to promote sustainable mobility, and promoted a public private partnership to launch the initiative. The experience also helped to collect data about mobility patterns from residents, which was used to inform policy-making on sustainable urban mobility and soon other areas requested the service.

Odyssey City Card, Bhubaneshwar (India)

To improve access to cashless systems for all residents and ease the administrative workload from fragmented civic payments, ICICI Bank partnered with the government to develop an integrated e-platform and common cash card that residents can easily use for all payments, from utilities to bus rides. The solution leverages modern technology while largely utilizing existing physical infrastructure for real-time management of payment data

Connected market Vendors, Kampala (Uganda)

In the midst of Uganda's COVID-19 national lockdown, informal market vendors in Kampala were cut off from their usual customers and struggled to sell their products. In order to address this challenge with the limited resources available, UNDP Uganda partnered with the e-commerce company Jumia to leverage its digital and logistical infrastructure—including its network of motorcycle riders. This allowed market vendors to be integrated in the e-commerce system. The project supported vendors from five different local markets and received the approval of the Ugandan national government and Kampala City authorities.

Enterprise Ventures

Why have these innovations succeeded?

Solutions tailored to local contexts

These cities have leveraged the private sector to solve their specific and most pressing challenges and to realize their aspirations, rather than blindly attempting to emulate pre-existing solutions that have worked for other cities.

Ecosystem supports market solutions

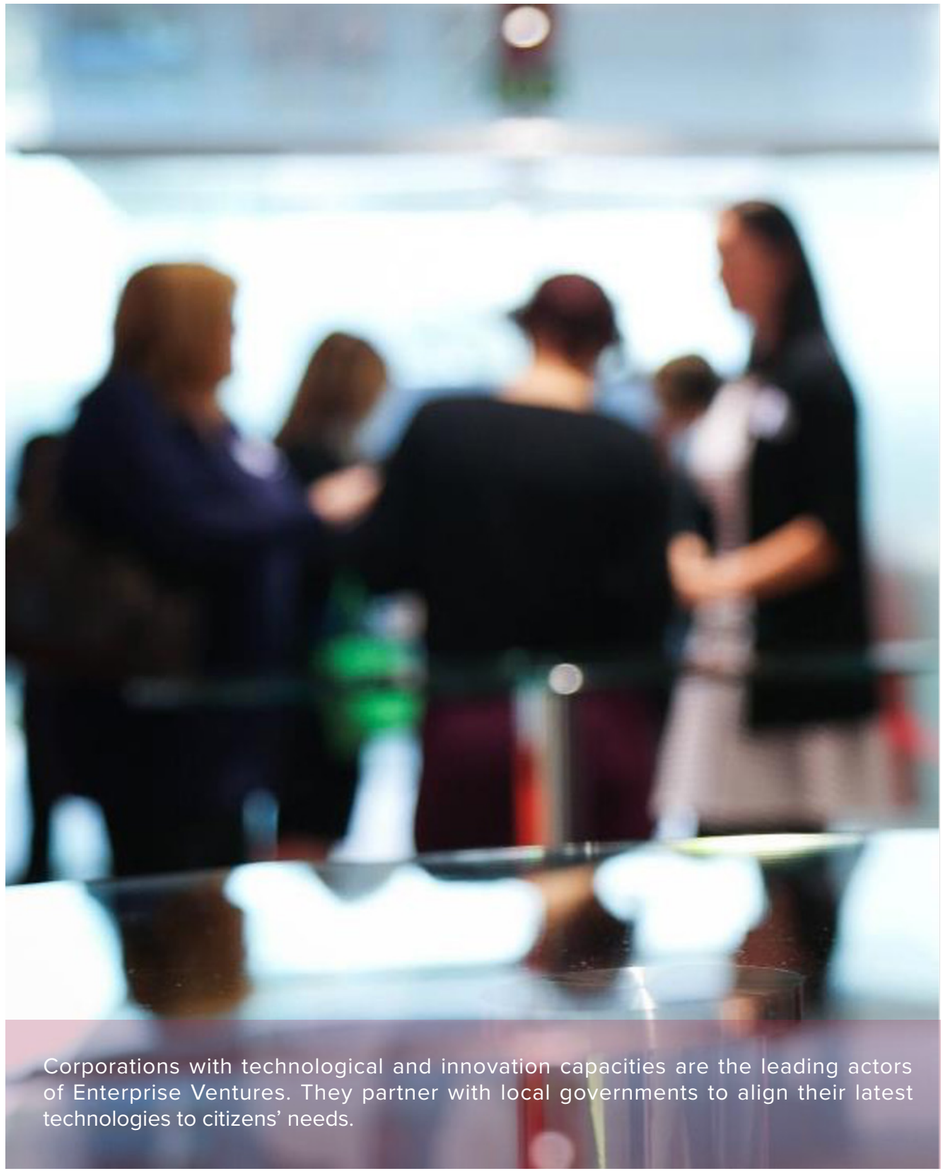
Public actors have facilitated the piloting and testing of these innovations by supporting them or offsetting innovators' risks via different mechanisms, such as conducive regulatory conditions, assistance with community engagement, and partnerships that enable sustainability in the long term.

Government representing the public interest

Governments in these cities play a strong role in guiding private actors towards serving the underserved by setting clear expectations and targeted results of the solution, which are also clearly stated in partnership agreements.

Rethinking traditional financing

These cities have developed unique mechanisms to distribute risks and incentives across the private and public sector through a series of innovative contracts or partnership agreements, which include innovative financial agreements. The complementarity of different funding sources and long-term sustainability provides a much better opportunity to design, implement and scale up solutions.



Corporations with technological and innovation capacities are the leading actors of Enterprise Ventures. They partner with local governments to align their latest technologies to citizens' needs.

Enterprise Ventures

How can I start creating this in my context?

Lead with the problem statement, not the technology

Ensure that private sector interventions are led entirely by the challenge at hand and responding to the public objectives, while recognizing that technology is only a tool and not an end in itself.

Determine incentives for private sector participation

When focusing on a specific challenge, identify which are the elements that disincentivise private investment in that area, and ideate mechanisms to make it more attractive for private sector to develop solutions. These mechanisms can include facilitating quick wins, piloting solutions, regulatory sandboxes or long-term partnership options.

Help test and kick-start the solution

Provide initial support to quick-start and test the solution. Public authorities can provide context, access to end-users (public officials or citizens), initial financing and/or institutional cooperation. Support localised pilots first before scaling them at citywide level when the results are validated.

Provide oversight to ensure citizen centricity

Ensure that citizen centricity is not being compromised at the expense of profits and that quality services are affordable and accessible for all residents without discrimination by tying incentives to performance and including impact measurements on most vulnerable groups.

What should I keep in mind?

Regulate with caution

Ensure that the regulatory framework provides enough room for private sector actors to create innovations that can scale without encroaching on the interests of the community at large. Embed a mechanism to monitor and regulate actions appropriately within this framework.

Uphold public interest

Beyond crime, violence and existing public safety issues, the high data use and the ubiquity of technologies controlled by the private sector present newer issues related to user privacy. Cities need to face tougher decisions to resolve these new issues that are driven by the need to make profits, lack of regulations related to data protection and lack of available channels to redress consumer concerns.

Ensure that all voices are heard

Reliance on technology can create digital bias in which the most marginalized are not considered or do not benefit from the solution. In these cases, ensure that the private sector's profit motive does not eclipse the need to understand the voices of the most marginalized residents by setting clear targets and impact objectives.

Institutional Pioneers

Institutional Pioneers are characterized as city-government-led solutions that leverage significant public resources and financing, for example, deploying technology and infrastructure. However, although the public sector is the actor leading the urban innovation, scope and approach, the success of these projects often strongly relies on the private sector's technical know-how and innovative capacity to build and implement—and, at times, manage—the solution.

Depending on the government-mobilized resources, we can identify two types of Smart Innovation for Institutional Pioneers: Pragmatic and Tech-Driven.

Pragmatic Subtype

Efficient use of resources by the reimagining and repurposing existing infrastructure

Tech-driven Subtype

Greater use of technology to stay ahead of the curve and actively plan for future challenges

Institutional Pioneers
Case study

Sponge Infrastructure, Shenzhen

Context
Shenzhen is home to 13 million people and is one of the fastest urbanising cities in the world. In 2014, Shenzhen experienced a period of heavy rain, later called a 50-year flood event, which pulled the city to a complete stop with more than 200 waterlogged areas despite having 13,700 km of built sewers. Computer models predict that with climate change, the total annual rainfall will remain relatively the same or increase.

The solution
Sponge cities are nature-based solution to urban flooding. By shifting away from traditional "grey infrastructure" of concrete, a sponge city builds porous, permeable infrastructure in the form of green roofs, permeable roads and gardens that mimic nature. These solutions help to absorb and retain rainwater.

Scale
Sponge city improvements cover 24% of city's total surface area with target of reaching 80% by 2030

Click on the image to see a video on the solution

Core Actors
The initiative is led by public authorities at national and municipal levels. Chinese president Xi Jingping endorsed the sponge city concept in 2013, and a 30-city pilot program followed with incentives for municipal investments. Shenzhen, as one of these pilot cities has embraced the concept, quickly starting the process to incorporate it into its master plan.

Supporting Actors
To implement the solution, public authorities have partnered with a wide range of stakeholders form the private sector, including architecture firms and academics with key technical knowledge. Community groups and environmental non-profits such as The Nature Conservancy have also played an important role as pilot runners of early ideas for the proof of concept at a smaller scale.

Use of Information
The sponge city concept has existed for centuries, but the modern version of the concept has been developed and tested in different regions (Europe, Australia, United States) during the last years. International best practices are informing the base of its design. Local aggregated data on the risk and impact of recent floodings is also mobilised for the design of the solution and monitoring its impact.

Use of Tools
Shenzhen has invested large amounts in the construction and adaptation of physical infrastructure from the 105-acre Honey Lake Park. This includes deploying green areas with porous grounds and permeable pavements. These bigger works are also combined with frugal solutions such as green roofs. Partnerships with key stakeholders provide innovative financing solutions to deploy them.

Pragmatic Institutional Pioneers

Efficient use of resources through reimagining and repurposing existing physical infrastructure

Pragmatic Institutional Pioneers lead innovative solutions that respond to persistent, citywide challenges by reimagining and repurposing the way public assets are used. Led by public entities and often supported by the private sector, they radically shift ways of living for their city residents by thoroughly reimagining the status quo.

Through sheer persistence and a deep commitment to change, these bold solutions apply global best practices and solve unique, citywide challenges by restructuring constrained physical resources in a more socially beneficial way.

Key characteristics of Pragmatic Institutional Pioneers

• Urban challenge diagnosed and innovation **designed and delivered primarily by the government**, with the private sector supporting the solution through technical know-how and implementation partnerships.

• Challenges are diagnosed using **city data**; solution design is based on **global best practices and urban design principles** and tailored to address the city's specific challenge.

• **Existing financial resources are used to restructure physical assets** in innovative and efficient ways with the help of frugal technologies.

Tech-Driven Institutional Pioneers

Greater use of technology to stay ahead of the curve and actively plan for future challenges

Tech-driven Institutional Pioneers lead innovative solutions through greater and more deliberate use of technology, intending to stay ahead of the curve and increase the city's capacity to respond to urban problems that can be complex. The defining feature of these solutions is strong interdepartmental collaboration, which helps to promote bold, scalable changes. These shifts are often supported by investment in the right tools to elevate their capacity and efficiency.

Key characteristics of Tech-driven Institutional Pioneers

• Urban challenge diagnosed and innovation **designed and delivered primarily by government** with strong partnership and implementation support from the private sector.

• Upfront use of **city-aggregated data** for problem diagnosis; continuously updated and iterated after initial identification using digital platforms and devices.
Real-time city data is collected, aggregated and analysed using digital tools and platforms to inform adaptation of the solution.

• **Significant investments in digital infrastructure** with potential to create new infrastructure should it be required to meet the evolving needs of the community.

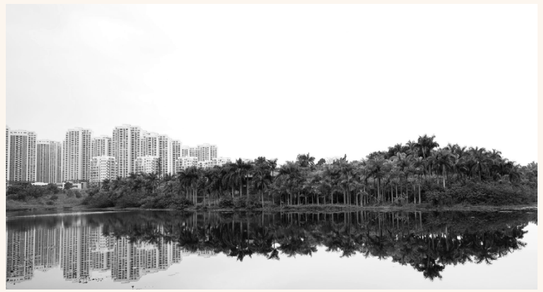
Institutional Pioneers

Examples

Pragmatic Institutional Pioneers:

Bus Rapid Transit (BRT), Curitiba (Brazil)

Led by the visionary government, the Bus Rapid Transit system in Curitiba offered a quick and cost effective solution to a systemic congestion problem.
The city was the first in the world to deploy a BRT system. Face to limited resources to invest in new physical infrastructure, the city created a network of dedicated lanes to bus transit, improving the public mobility services which attracted new users.



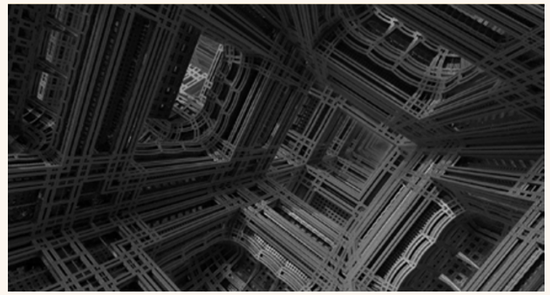
Sponge Infrastructure, Shenzhen (China)

Enabled by technical expertise from civil society, the city government has created a green, porous infrastructure to retain excess water and reduce floods. Encouraged by ancient practices, the solution incorporates city data to make decisions on the most vulnerable areas demanding intervention. The solution requires some investments in new infrastructure without reliance on technology.

Tech-driven Institutional Pioneers:

Energy Efficiency Transportation, Montevideo (Uruguay)

Several Ministries and the municipality of Montevideo are working together to promote a more energy-efficient transportation system in Uruguay. Following this vision, the Project Movés has been key to promote the deployment of electric buses in the city, the adoption of greener regulations, and enabling more sustainable mobility options for citizens. Led by public authorities, the project has been supported by UNDP Uruguay and the Global Environment Facility (GEF).



Virtual Singapore, Singapore

Using cutting edge 3D semantic modelling powered by real-time city data, Virtual Singapore shows a digital twin of the city that governments can use to simulate innovations.

The solution acts as a virtual pilot through which the city can assess the impact of future initiatives and helps the city consider upcoming investments in physical infrastructure, if needed.

Institutional Pioneers

Why have these innovations succeeded?

Bold, inclusive vision and government leadership

Governments and departments in these cities have bold visions and leaders that reflect their commitment, focus and drive. They share the power they have with various actors, effectively collaborating with and supporting other players.

Creative use of existing resources

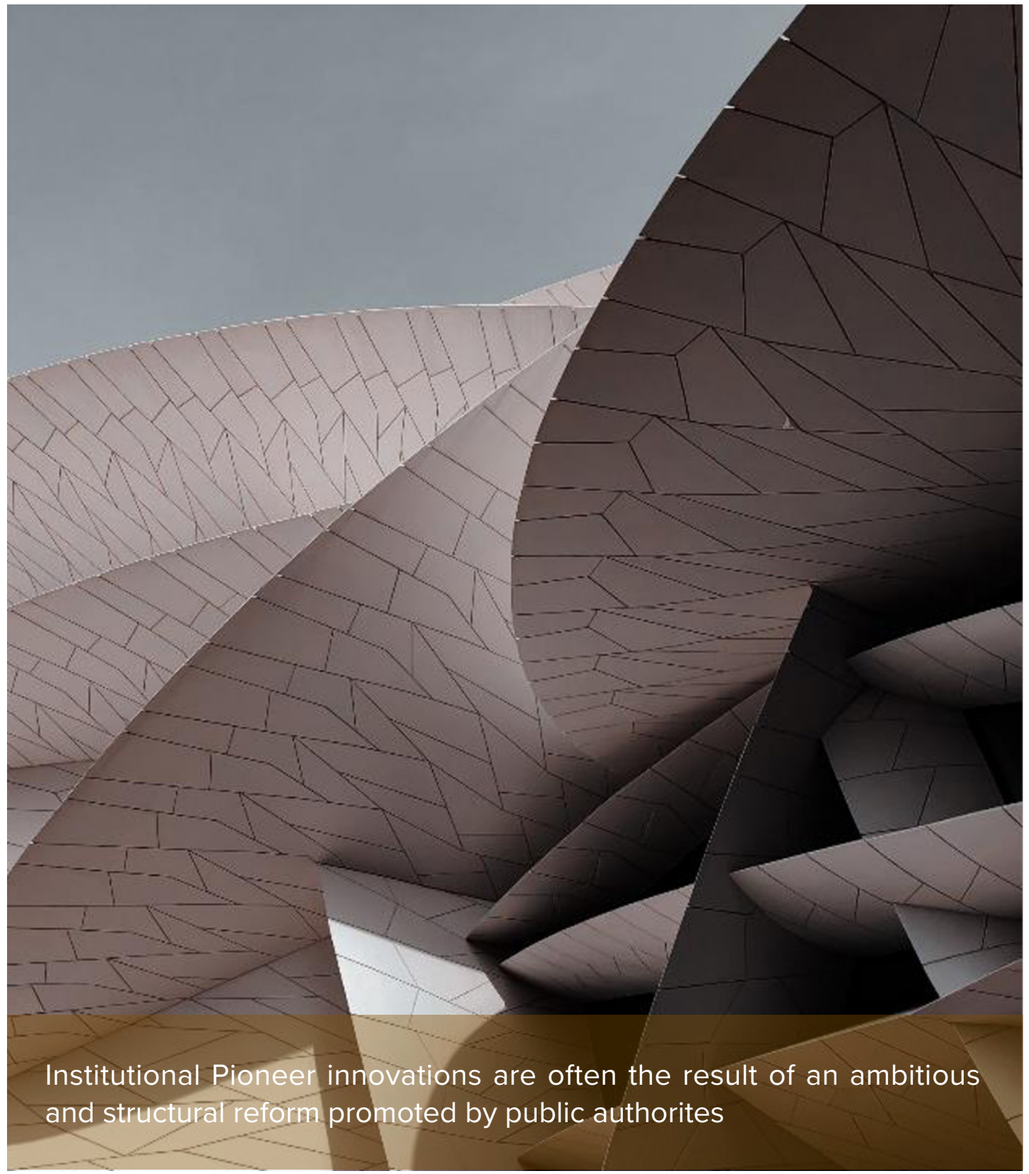
These cities have used well-developed parts of their physical infrastructure (such as roads), digital infrastructure and equipment (such as sensors) as building blocks for the solution.

Willingness to deviate from status quo

These cities have embraced the entrepreneurial spirit for experimentation and have taken on risky endeavours in the name of building better cities for their communities.

Continuity beyond political administrations

These cities have ensured the right policy and legal frameworks have been put in place to ensure sustainability of the solution and its results.



Institutional Pioneer innovations are often the result of an ambitious and structural reform promoted by public authorites

Institutional Pioneers

How can I start creating this in my context?

Articulate a bold, inclusive vision for citywide change

You will need others to join you in realizing your vision, so invest in creating a bold one. Share it with others to gather feedback and use the refined version to design your intervention.

Seek and rally commitment through partnerships

Rally support for your initiative within government and the private sector through close consultations, gathering resources and coordinating what you need to successfully carry out the intervention.

Test and iterate the solution

You are introducing a big change; continue testing your solution until you are sure you have the right answer, carefully measuring your impact during each round and adjusting as needed.

Plan for early wins

This is a long-term commitment; it is important to celebrate wins along the way to keep partners engaged and committed.

What should I keep in mind?

Rethink solutions, don't just upgrade them

Adopt unique approaches to considering or solving the problem rather than simply retrofitting it with improved infrastructure or technology.

Design for everyone

Ensure inclusivity in relation to factors that may affect access (e.g., race, gender, caste, disability and informal settlement) in the design of your initiative.

Breakdown silos

Ensure cross-governmental collaboration and integrate services to identify planning, operational and monitoring synergies.

Pilot first

Test your ideas in a smaller, more easily controlled environment before you scale citywide.

Tools are not ends in themselves

Remember that technology and analytics are tools, and you will need properly planned use cases that have been tested before you implement them.

Conclusion

Conclusion

Smart Cities work hard to improve the lives of their residents.
Smart cities put residents at the centre of their efforts, cultivating the conditions for a range of actors to collaborate, lead and deliver solutions to address a range of urban problems, regardless of their starting point.

The path towards becoming a 'Smart City' is an iterative journey, and Smart Urban Innovations play a key role in the process.
Smart Urban Innovations need not be anchored on technology; they comprise creative solutions that use a diverse set of resources to meet the needs of residents.

City leaders play an instrumental role in fostering the conditions for Smart Urban Innovations to thrive.
Governments foster enabling environments for Smart Urban Innovations through policies, funding, partnerships, and strategic and implementation guidance. In addition, they can continue to cultivate a deep culture of collaboration among actors, enhance a culture of learning and strengthen institutional capabilities, including data and information management.

Governments should continue investing in tools that fuel a diverse set of Smart Urban Innovations
Some types of Smart Urban Innovations may not require large investments in new infrastructure; they can offer creative solutions using existing resources. However, this should not be used as a substitute for necessary investments in infrastructure for the future, including investments in technology, that can help make other Smart Urban Innovations possible.

Because the majority of the global population is expected to be living in cities by the middle of this century, we need to ensure that these spaces are lievable, inclusive and sustainable.
We need to be shaping truly 'smart' cities. UNDP is leading efforts to redefine the smart city discourse and to support local and municipal governments in improving the lives and livelihoods of their citizens. This includes providing technical expertise, brokering collaborations and partnerships, sharing insights and knowledge, and shaping and supporting policy development. UNDP works in more than 170 countries and territories and at a global level through initiatives such as the City2City Network.

Get in touch to learn more: registry.sg@undp.org

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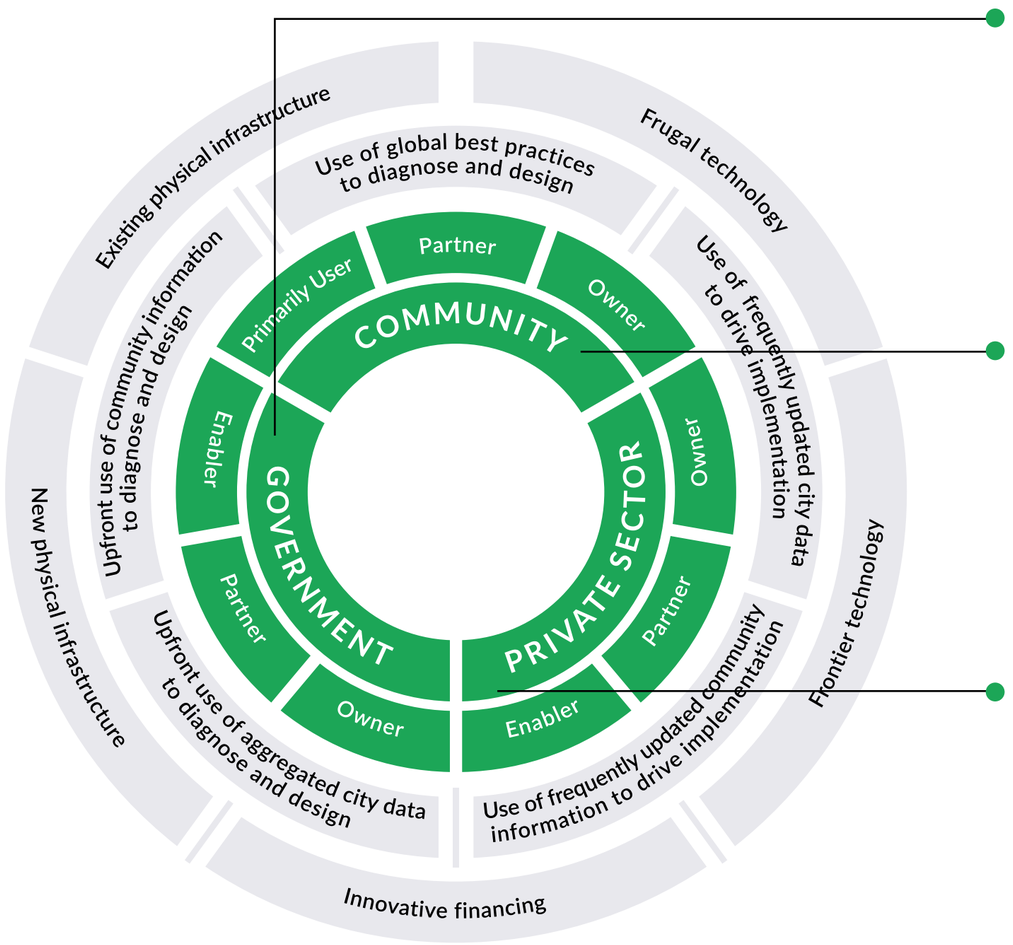
ANNEX 2

Smart Urban Innovation Examples 64

ANNEX 1

Smart Urban Innovations Wheel rubric

Actors and their roles



Government

Governance structures for public administration, such as city councils or municipalities, including elected and administrative officials

•**Enabler**: The government plays a passive role and supports solutions through activities such as policy changes, strategic guidance and grant funding

•**Partner:** The government plays an active role in co-designing and co-delivering the solution with another partner through activities such as technical advisory and implementation support

•**Owner:** The government owns the overall process from conception to implementation, diagnosing challenges, initiating solutions and driving the design and implementation of the solution

Community

Not-for-profit and cooperative players, such as residents, resident groups, universities or members of academia and organisations originating from the broader community, such as non-profits and small social enterprises

•**Primarily users:** Community members serve as end-users, with no meaningful role in the design and delivery of the solution

•**Partner:** Community members play an active role in co-designing and co-delivering the solution with another partner through activities such as implementation delivery

•**Owner:** Community members own the overall process from conception to implementation, diagnosing challenges, initiating solutions and driving the design and implementation of the solution

Private Sector

Mid-to-large enterprises operating at city, national or international scale, developing and delivering market-based solutions for profit

•**Enabler:** The private sector plays a passive role and supports solutions through activities such as strategic guidance and funding

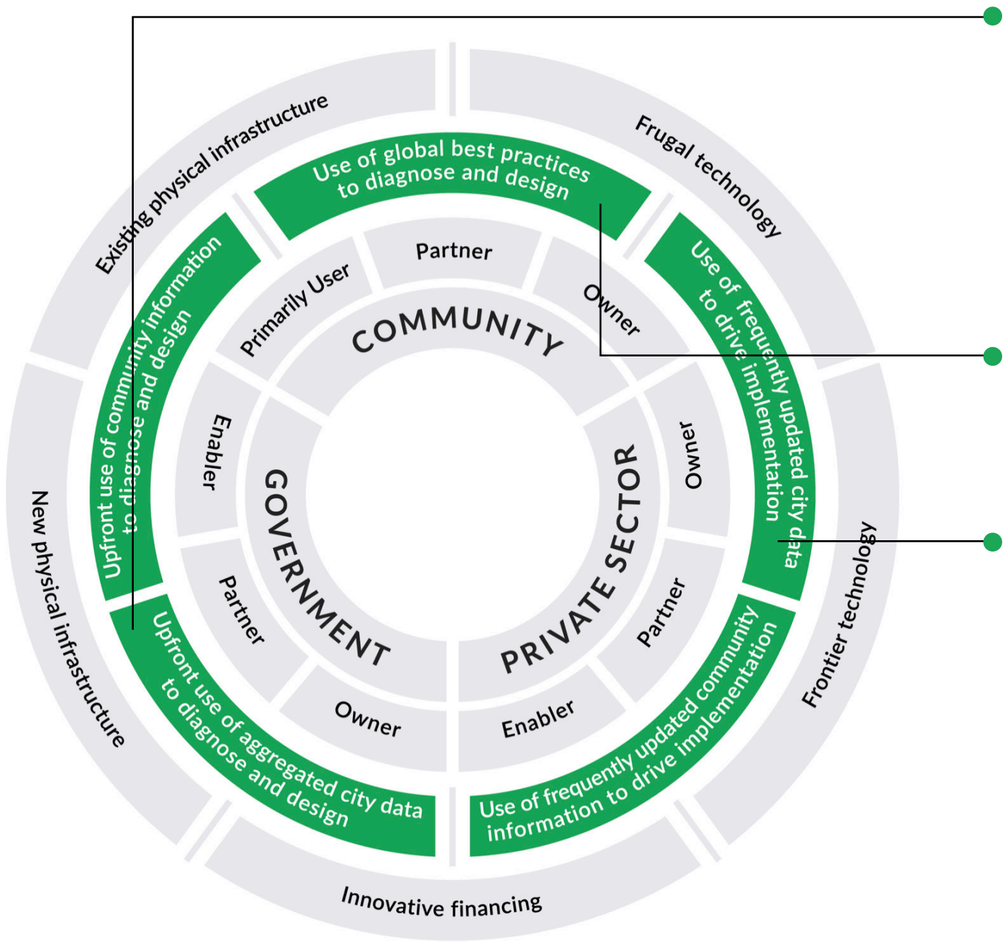
•**Partner:** The private sector plays an active role in co-designing and co-delivering the solution with another partner through activities such as technical advisory and implementation support

•**Owner:** Private sector owns the overall process from conception to implementation, diagnosing challenges, initiating solutions and driving the design and implementation of the solution

ANNEX 1

Smart Urban Innovations Wheel rubric

Data and Information



Upfront use of aggregated information or data to diagnose and design

In the initial stages, data and information play an important role in identifying the pressing challenges and designing solutions. There are two primary sources to diagnose and design solutions:

- **City data:** Aggregating non-resident data on the city's weather, traffic situation, crime rates, public waste collection and others from existing sources to diagnose the most pressing challenges and design their solutions. For example, city data on flooding can be used to map out at-risk areas and communities
- **Community information:** Aggregating localised information from community members to inform solutions. For example, gathering perspectives and feedback from the youth to design educational curricula

Use of global best practices to diagnose and design

Global practices, often rooted in creative urban design principles or modern advancements, serve as the inspiration for the solution. Adoption of these practices is facilitated by technical partners or secondary sources of information. For example, established principles of cooperative structures can be used to formalise informal workers.

Frequently updated information or data to drive implementation

When implementing a solution, continuous access to reliable data and information is required to review performance and shift priorities in order to increase impact:

- **City data:** Aggregating real-time, numeric data on the city's utilities, weather, natural and physical resources and others to enable agile decision making. For example, dynamic data on traffic hotspots can be used to manage traffic lights.
- **Community information:** Embracing continuous community perspectives through feedback loops to understand gaps and changing priorities of the community understanding and information base about their core capabilities and challenges. For example, real-time information on incidents of sexual harassment can be provided to authorities to prompt action.

ANNEX 1

Smart Urban Innovations Wheel rubric

Tools

Physical Infrastructure

Tangible structures and facilities that are built to support systems and processes in communities, such as roads, public transport, buildings etc. Innovations can incorporate them in two ways:

•**Existing physical infrastructure:** Rather than investing heavily in new creations or upgrades, existing physical resources can be leveraged in inventive ways to solve problems. For example, rerouting traffic in congested regions can improve walkability

•**New physical infrastructure:** Some innovations are anchored on heavy investments in new physical infrastructure. For example, setting up waste management plants may require significant financial capital.

Technology

Hardware and software products, owned by any actor, directly used to enable information and communication technology. Innovations can incorporate them in two ways:

•**Frugal technology:** Innovations can use easily accessible analogue or frugal digital platforms. For example, mobile-based applications can be used to receive resident grievances.

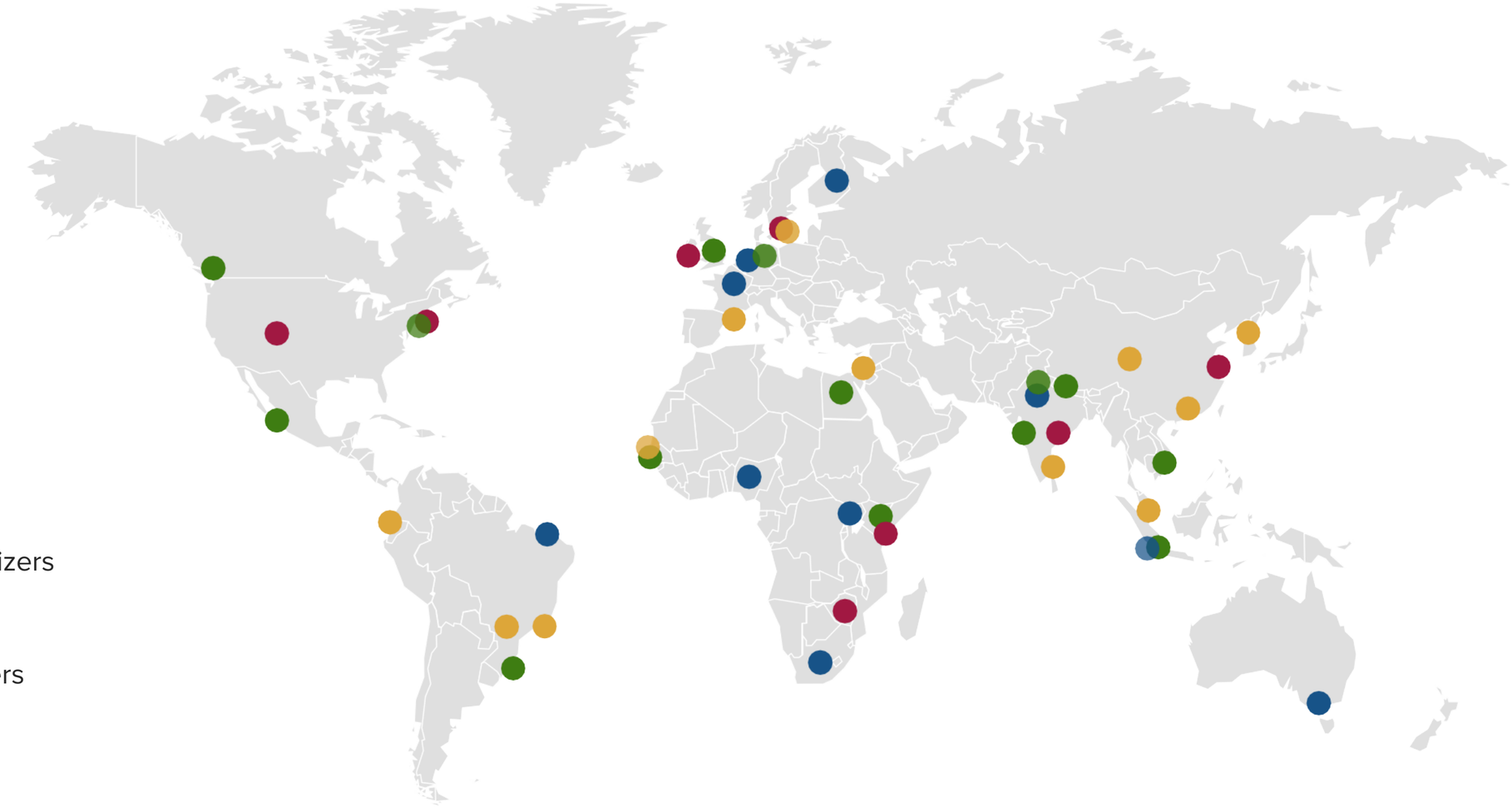
•**Frontier technology:** Innovations can use cutting edge solutions from modern technology, such as sensors, GPS trackers and CCTVs backed by Big Data capabilities. For example, real-time monitoring of water levels through sensors in coastal areas can mitigate the risk of flooding

Innovative Financing

Innovations can adopt non-traditional instruments for raising and managing financial capital, such as PPPs, social impact bonds, municipal bonds and others.

ANNEX 2

Smart Urban Innovations reviewed for this handbook



- Community Organizers
- Frugal Innovators
- Enterprise Venturers
- State Pioneers

ANNEX 2

Smart Urban Innovations reviewed for this handbook

- **Agricool**
  Paris
- **Amager Bakke**
  Copenhagen, Denmark
- **BigBelly Bins**
  Dún Laoghaire, Ireland
- **Bus Rapid Transit**
  Curitiba, Brazil
- **Capital Growth**
  London, United Kingdom
- **Call Centre for Faecal Management**
  Dakar, Senegal
- **Centre of Operations**
  Rio De Janeiro, Brazil
- **Cheong Gye Cheon**
  Seoul, South Korea
- **Cisco Kinetic**
  USA/Europe (multiple)
- **City Brain**
  Nairobi, Kenya
- **Citizen Funds for Affordable Housing**
  Dakar, Senegal
- **Cycling Infrastructure**
  Copenhagen, Denmark
- **Digital Matatus**
  Nairobi, Kenya
- **Virtual Singapore**
  Singapore
- **DigiTel Residents Club**
  Tel Aviv, Israel
- **Eastgate Centre**
  Harare, Zimbabwe
- **GoOV**
  Netherlands
- **Green Collect**
  Melbornurne
- **Harassmap**
  Egypt (multiple)
- **Health Stations**
  Buenos Aires, Argentina
- **Independent Waste Collectors**
  Ho Chi Minh, Vietnam
- **Kathmandu Vehicle Alliance**
  Kathmandu, Nepal
- **Lighthouse Communities**
  Pune, India
- **Mayor's Office of New Urban Mechanics**
  Boston, USA
- **M-PESA**
  Kenya
- **NINA**
  Fortaleza, Brazil
- **Odyssey City Card**
  Bhubaneshwar, India
- **PackaChing**
  South Africa
- **Participatory Budgeting**
  South America (multiple)
- **PetaJakarta**
  Jakarta, Indonesia
- **Public Space Network**
  Vancouver, Canada
- **RedBus**
  India (multiple)
- **SafeBoda**
  Uganda (multiple)
- **Safetipin**
  Global
- **Smart Citizen Kit**
  Amsterdam, Netherlands
- **Smart Grids**
  China (multiple)
- **SMS Women Safety**
  Quito, Ecuador
- **Sponge Infrastructure**
  China
- **Superblocks**
  Barcelona, Spain
- **Vertical Farming**
  Singapore
- **Water and Sanitation Pooled Fund**
  Tamil Nadu, India
- **Waze Connected Citizens**
  Global
- **WeCyclers**
  Nigeria (multiple)
- **Whim**
  Finland

Detailed Examples: Community Organisers

Lighthouse Communities, Pune

Location: Pune, India

Challenge: Low skills and bleak career opportunities for youth from slum communities

Solution: Localised sustainable livelihoods program for the urban disadvantaged youth

Scale: 11,000 youth from 350 slum communities engaged since 2016

Context

Pune, home to more than 7 million people, is considered an industrial hub, leading India's IT and automobile sectors. Further, the city is commonly referred to as the 'Oxford of the East' due to its numerous respected educational institutions. However, there is a high educational disparity among the city's youth, with those from slum communities having little access to quality education, resulting in low skills and bleak career prospects.

While skill development programs are common in India, they are plagued with issues ranging from engagement (low enrolment, high drop-out), content (lack of holistic curriculum or personal connection) and structure (limited funding, lack of scalability). To fill these gaps and ensure sustainable livelihoods for the disadvantaged urban youth in the city, 'Lighthouses' have been set up across administrative zones, serving as spaces of holistic career support. Led by the government and community-based organisations, the program aims to provide localised and contextual answers to the skills problem for youth in the city.

Core Actors

The innovation was born out of a burning need to bridge the skills gap for the sizeable community of underprivileged youth in the city. In line with other examples in this type of Smart Urban Innovation, engagement and active participation from the community define the design and success of the innovation.

Supporting Actors

The city government, through the Pune Municipal Corporation, supported the 'Lighthouse' movement by defining a strategic vision, providing initial resources and engaging communities and community-based organisations. While the government continues to coordinate activities across lighthouses and provide oversight, it plays a minimal role in delivering modules to communities. This localised and contextual co-creation of the program has been essential to its overall success.

Use of Information

While the broader vision and strategy of the innovation is uniformly decided through a centralised process, youth engaged at each of the seven 'lighthouses' established across the city have a high degree of agency in defining what support is provided to them and how it is delivered. Further, community-based organisations such as Pune City Connect, a joint CSR initiative by industry leaders, have been engaged to ensure that the voices of the communities are actively considered in higher-level decision making.

Use of Tools

The innovation relies on the use of physical spaces in the form of buildings to work with the enrolled students.

Detailed Examples: Community Organisers

Capital Growth, London

Location: London, United Kingdom

Challenge: Declining self-sufficiency of the city in food due to rapid urbanisation

Solution: Formalising and scaling practices for community networks engaged in farming to improve sufficiency in nutritious food

Scale: 150,000+ people involved in community food growing since 2008

Context

London, the capital and largest city of the United Kingdom, is home to ~9 million people. Over the last few years of its growth, the city has grappled with problems related to food sustainability. Specifically, while the availability of food is limited across the city, this is especially true for nutritious food grown through organic and environmentally-friendly processes.

To tackle the problem of declining food security in the face of rapid urbanisation, informal community networks sprouted up in various parts of the city to grow organic food on unused or abandoned land. These community-based practices serve a triple-layered objective of improving self-sufficiency in nutritious food, creating interactive green spaces from unproductive areas, and improving social interactions among residents.

To formalise these organic community networks and ensure their growth across the city, Capital Growth was co-developed by community-based organisations and city authorities.

Core Actors

This innovation relies entirely on the community's active ownership in its implementation for its success. To create initial buy-in and credibility, the organisation brought together practitioner networks through the engagement of local, community-based organisations such as London Food Link, CityBridge Trust and BigLottery.

Supporting Actors

The London Mayor's Office kickstarted the innovation and continues to provide strategic leadership and coordinate activities between major stakeholders to ensure growth and the achievement of objectives. The government rallies support and action from communities across the city to ensure scale through the right incentives without actively participating in the food growing practice.

Use of Information

To sustain the innovation, the organisation's activities and related support from the government are entirely centred around incentivising ownership and decision-making among community members. They create a one-stop shop for growers, pointing them to unused land and providing basic resources to get them started, training on food-growing skills and an online tool to track how much they grow and save. The decision-making freedom provided to communities has led to some novel approaches, such as engaging students to adopt the practice in schools and creating floating vegetable gardens along the city's canals.

Use of Tools

This innovation utilises large quantities of abandoned and otherwise unused land claimed with the support of the city government.

Detailed Examples: Community Organisers

Independent Waste Collectors, Ho Chi Minh

Location: Ho Chi Minh City, Vietnam

Challenge: Undermanagement of plastic waste, especially for peri-urban areas in the city

Solution: Reorganisation, formalisation and upskilling of independent waste collectors (IWCs)

Scale: 1,561 IWCs engaged for 350,000 residents across 13 districts

Context

Vietnam's most populous city, Ho Chi Minh, is home to more than nine million people, with its population having tripled in the last three decades. As one of the country's major centres of growth, the city has made remarkable progress in eradicating poverty, significantly advancing the quality of life for its residents. This rapid economic growth has not come without costs; the city generates more than three million tons of solid waste every year, with volumes increasing in line with population growth.

With city authorities facing capacity constraints, Independent Waste Collectors (IWCs) have emerged informally and have been recognised as a crucial component of the local waste management ecosystem – often, they complement waste collection and recycling services of the government, providing an essential service to residents.

Core Actors

As a response to pressing challenges and vulnerabilities concerning poor working conditions and limited skills in waste collection and segregation, the community of IWCs has rallied around cooperative-like structures and become a more formal platform for advocacy, empowerment and capability-building.

Supporting Actors

The solution is being enabled by the local government through policy changes such as increasing the upper limit of waste collection fees for IWCs.

These measures are helping to realign the incentives for waste collectors to provide better services at scale. Further, the solution has been catalysed by USAID, which provided grant and technical assistance for initial implementation.

Use of Information

The solution was initiated by the active voice of the IWC community members, who demanded that their position as a parallel solution to the city's growing waste problem be recognised and formalised. In creating a solution to meet these demands, community leaders and supporting actors relied on well-established principles from cooperative structures that have been practised across the globe.

Information on pain points, struggles and needs of the community is likely to have fed into the design of the solution. Since the solution is owned by champions from the community, they may use continuous information on the evolving needs of community members to course-correct and stay relevant.

Use of Tools

Rather than investing heavily in new physical assets, the existing capabilities and resources of the informal workers were reorganised and formalised to make them more productive and direct their services towards underserved populations.

Detailed Examples: Community Organisers

Packa-Ching, Cape Town

Location: Cape Town, South Africa

Challenge: Limited culture of recycling among urban residents

Solution: Creating financial incentives for residents to collect and recycle packaging waste

Scale: ~1.8 million kgs of waste diverted from landfills; ~US$92,000 earned by communities in exchange for recyclables

Context

As a national economic hub and an international tourism hub, Cape Town has seen a boom in migration and population over the last three decades and has now become the second-most populous city in the country, serving as a home to more than 3 million people. Accompanied by this growth has been a rapid increase in consumption and related waste, with more than 90% of the waste being dumped in landfills.

Used packaging waste holds monetary value and accounts for a considerable portion of overall waste. To repurpose used packaging waste and spark behavioural change in waste management, Packa-Ching, a non-profit initiative, provides financial incentives to lower-income communities to categorise and supply recyclable waste to mobile units owned by local businesses across the city.

Core Actors

Polyco, a local non-profit organisation, played a central role in designing and implementing the solution and rallying important stakeholders.

A core enabler of success for the solution is the space for local businesses and community members to partner in its success. Local businesses, driven by community members, partially own and fully manage the mobile units that drive around the city to collect waste. It is essential to this solution that residents are continuously encouraged to provide the recyclable waste.

Supporting Actors

The government, through integrated policy measures and action, has created a favourable environment towards waste management, which helped jump-start the adoption of this initiative. In addition, Sasol, a large energy and chemicals company, and other large corporations have provided a large portion of the overall funding.

Use of Information

Local information is used to identify the exact challenges being faced and lower-income communities that could get involved to help solve them. The core of the solution lies in recycling the collected packaging using established practices that have been tried and tested across the globe.

Use of Tools

A digital platform has been developed to help residents book pick-up services, leveraging existing e-Wallet services to send compensation for their waste contribution. This service is anchored on simple, widely-used mobile internet services.

Detailed Examples: Frugal Innovators

SafeBoda, Kampala

Location: Kampala, Uganda

Challenge: Lack of safety protocols in the operations of motorcycle taxis

Solution: Aggregation, training and provision of safety equipment for motorcycle taxi drivers

Scale: 8,000+ daily riders served by 1,500+ drivers (2019)

Context

Kampala, with a population of ~1.6 million people, is the capital city and economic engine of Uganda, generating more than 60% of the country's GDP. However, a steep rise in population has resulted in a serious congestion problem for Kampala's streets, with an estimated 24,000 hours lost every day due to traffic jams.

With mass transit options in the city unable to fill the growing transportation needs, 80,000+ motorcycle taxis, commonly known as boda-bodas, plug the gap and serve as the backbone of public transport in the city. A lack of incentive for drivers to invest in safety protocols due to the disconnect from formalised networks has resulted in a serious threat to the personal safety of boda-boda drivers and their passengers. A 2010 study conducted at Mulago National Referral Hospital in Kampala revealed that ~40% of trauma cases at the hospital were due to boda-boda accidents. By addressing the safety concerns of users through upskilling and the provision of better equipment, local entrepreneur-led program, SafeBoda, improved perceptions and increased the use of boda-boda services, resulting in a 50% increase in income for drivers.

Core Actors

SafeBoda was founded to address the urgent needs of boda-boda drivers, themselves residents of the city, to improve their working conditions and incomes. With a focus on economically empowering drivers, SafeBoda's market-based solution of aggregating and upskilling drivers under an umbrella brand was adopted.

Supporting Actors

The government has enabled SafeBoda through complementary policy changes such as formalising safety protocols for boda-boda operations and reducing the cost of operating and accessing digital platforms. These measures are helping improve incentives for the organisation and its users, thereby contributing to the growth and sustainability of the platform.

Use of Information

The solution was initiated by the active voice of the boda-boda community members whose income had been dropping due to the dangers associated with travelling on motorbikes. In creating a solution to meet these demands, SafeBoda relied on well-established principles from cooperative structures that have been practised across the globe.

Use of Tools

SafeBoda created an application that can be easily accessed through a smartphone and used this as the platform for both users and drivers. The start-up doesn't own any boda-bodas and instead has invited existing boda-boda drivers to join their platform.

Detailed Examples: Frugal Innovators

Agricool, Paris

Location: Paris, France

Challenge: Reduced and distant farmlands from cities, leading to wastage and higher prices

Solution: Recycling old shipping containers to create a simulated vertical farm

Scale: 15 stores established, with more than 7000 units of product sold every week

Context

Paris, with a population of more than 2 million, is the capital and most populous city of France. With rapidly increasing urbanisation leading to reduced and distant farmlands, the city faces a looming threat of a food security crisis. Agricool was conceptualised with a mission to build a sustainable food system by growing local, tasty and pesticide-free fruits and vegetables at lower costs.

The initiative simulates a protected, optimally-controlled agricultural ecosystem within recycled abandoned shipping containers through vertical farming, maximising the cultivated area. To reduce losses from logistical procedures and keep prices low, these containers are placed less than 20 km from the city. Additionally, the innovation utilises sustainable practices for resource management by recycling water across the vertical layers and using renewable, LED-based sources of energy. With an underlying objective of having a social impact, the start-up generates revenues and profits from the sale of the produce through a network of 24 self-managed stores across Paris.

Core Actors

This innovation was championed by two individuals who, being sons of farmers, witnessed first-hand the inefficiencies of urban food farming and logistical processes. Their experience consuming pesticide-ridden food as opposed to farm-fresh food that they were used to motivated them to recreate farming ecosystems as close to cities as possible.

Supporting Actors

The solution is financially backed by multiple rounds of private sector, returns-oriented funding from angel and venture capital investors.

Use of Information

The founders, in their unique positions as members of the farming community, used the information gathered through their own experiences in designing the solution. In the process of scaling to newer geographies, the solution has used community-based information in assessing areas with low availability of nutritious or affordable food to identify locations for their farms and stores.

Use of Tools

At the core of the solution is the repurposing of existing and abandoned physical resources to simulate a farming ecosystem. Simpler technology, such as LED lighting and metering for water use, is leveraged to create the optimal conditions for the growth of agricultural products.

Detailed Examples: Frugal Innovators

NINA, Fortaleza

Location: Fortaleza, Brazil

Challenge: Sexual harassment cases on public transport that go unresolved

Solution: Digital platform integrated with public officials to report harassment cases

Scale: 1 million+ users in Fortaleza. 1,300+ reports in the last 6 months, with 10% of cases resulting in a formal investigation

Context

Fortaleza, home to 2.6 million people, is the third richest metropolitan area in its region and an important commercial centre for Brazil. It is known for its large oceanariums and beach theme parks that have made it the second most popular tourist city in the country. However, women and young girls in Fortaleza face major safety and security challenges while travelling on public transport.

NINA is a platform designed to maximise safety on public transport in the city. Witnesses and victims of harassment cases on public transport can easily report incidents on NINA, located on the Meu Ônibus application, the city's bus route planner. When complaints are issued, the police are notified, and surveillance videos are sent directly to NINA. The company centralises this information and earns revenue by providing consultancy on improving women's safety and integrating the technology with other services for private sector transport companies and governments.

Core Actors

NINA was created by a private individual, a member of the community and the daughter of a bus ticket collector. Her experiences related to personal safety inspired her to create an accessible solution for the problem.

Supporting Actors

NINA was supported by the InoveMob Challenge, an effort to bridge the private sector and government, led by the Toyota Mobility Foundation and WRI Brazil, in partnership with the National Front of Mayors, a nonpartisan organisation made up of mayors and cities across Brazil. Although NINA can integrate with a variety of geolocation apps, its main operations are embedded within public service apps, such as Meu Ônibus. The cooperation of executive and legislative local authorities is crucial as the platform's value lies in ensuring that victims' voices are heard and answered.

Use of Information

In her own position as a member of a community facing serious safety issues in public spaces, the founder leveraged information from personal experiences to design the solution.

NINA collects and analyses data on a real-time basis from submissions through the various applications that have integrated its API. While it shares individual incidents with authorities, its large-scale value comes from the aggregated data it shares with decision-makers to help improve their policies.

Use of Tools

NINA depends on carefully-built digital platforms, relying on simpler technology such as mobile applications. Rather than upgrading physical infrastructure, the solution relies on aggregating information on safety in existing physical spaces.

Detailed Examples: Frugal Innovators

GoOV, The Netherlands

Location: The Netherlands

Challenge: Limited mobility for people with disabilities, especially on public transport

Solution: Personalised, real-time travel assistance for users, delivered a mobile application

Scale: Over 300 users daily

Context

The Netherlands, located in Western Europe, is home to more than 17 million people. As well as an economic powerhouse, The Netherlands is one of the most inclusive countries in the world, with its accessible education, healthcare and housing facilities driving it to seventh place in the World Economic Forum's Inclusive Development Index. Despite this, more than 100,000 Dutch people with mental or cognitive disabilities have trouble travelling independently on public transport.

GoOV is designed to empower people with disabilities to travel independently. It plays the role of a smart travel assistant that provides users with step-by-step, audio-visual guidance for travel, with detailed route navigation and dynamic public transport information.

Core Actors

Local entrepreneurs who are well-grounded in the contextual realities of the city and community are at the helm of the solution. They have been responsible for initial problem scoping and solution design, as well as gathering the required buy-in and resources to hit the ground running.

Supporting Actors

The government has played an instrumental role in catalysing the solution to provide updated information on public transport and route navigation through back-end support and access to information from the relevant public transport departments.

Use of Information

IThe use of contextualised and local information on the key challenges faced by people with disabilities is at the centre of the design and offering of the solution. Further, the solution relies on the dynamic provision of updated data and information on the availability of public transport and transport routes to continuously service the users and stay relevant.

Use of Tools

GoOV relies on responsible and seamless digital platforms built on frugal and easily accessible mobile-based technology to deliver its solution. It leverages and democratises information on existing mobility-related infrastructure rather than upgrading it.

Detailed Examples: Frugal Innovators

Green Collect, Melbourne

Location: Melbourne, Australia

Challenge: High unemployment in disenfranchised groups with the backdrop of global environmental challenges

Solution: Promoting a circular economy through the reuse, remake or recycling of office waste

Scale: 200+ businesses currently serviced; 125 tonnes of waste diverted from landfills in 2018

Context

With a population of 5 million people, Melbourne is a fast-growing city deeply conscious of its waste. The city is expected to grow to 8 million by 2041, leading to a projected increase in waste generation by 63%. In response, the city administration has instituted several initiatives.

Like many cities, however, Melbourne also suffers from the dilemma that employment is needed to gain housing, but housing is required to gain employment. Trapped in a vicious cycle of bureaucratic requirements, refugees, the disabled, and other disenfranchised groups fall into homelessness and poverty.

Tackling two major urban problems at once, Green Collect offers a way to reuse, repurpose, and recycle office waste while offering much-needed employment opportunities to community members. By reserving half its employment slots for those who face significant barriers and offering about 30 people each year six-month training and work experience, Green Collect demonstrates its commitment to give back.

Core Actors

This solution was pioneered by two entrepreneurs who used their experiences as working professionals to identify the scope for repurposing office waste. They applied their formal educational backgrounds in social work and environmental management to their findings to create a solution that generates profits and benefits communities.

Supporting Actors

Green Collect has received financial assistance from philanthropic organisations and public funding to sustain its operations. Over the years, it has also partnered with other social enterprises to meet its goals. Now an independent entity, Green Collect has paying clients across the city, including government offices.

Use of Information

The solution was designed using the experiences and formal knowledge possessed by the founders. Further, the journey of all waste collected by Green Collect is documented and reviewed from collection to final output for course correction. With the use of industry knowledge and a bit of creativity, Green Collect either reuses, recycles or upcycles all the waste it collects from its clients.

Use of Tools

The solution uses extremely limited frugal technology to track the progress of waste collection. It requires some investments in physical infrastructure to enable core services such as pick-ups and deliveries.

Detailed Examples: Enterprise Venturers

Waze Connected Citizens, Boston

Location: Boston, United States

Challenge: Increasing road congestion resulting in high transit time and related economic and social stresses

Solution: Data platform developed through two-way sharing of data between authorities and users

Scale: Users actively report more than 1 million alerts for potholes, traffic and crashes each month

Context

Boston, Massachusetts, is home to 700,000 residents. A growing commuting population, due to high housing prices and a notoriously underfunded public transport system, has led to a particularly difficult congestion problem for the city. According to one study, Bostonians lost a whopping 149 hours stuck in traffic in 2019. This put Boston as having the worst congestion in the United States and second-worst in North America, second only to Mexico City.

With public transportation systems being unable to meet the rapidly increasing mobility needs of the city, Waze, a Google-owned tech company, aims to arm residents and governments with knowledge about road and traffic incidents to improve decision making and de-congest the roads. The solution is centred around two-way data sharing from government departments around incidents such as road closures, construction and major events, as well as users on the road providing real-time data on incidents around them.

While Waze does not directly earn revenue through the data-sharing arrangements, its profitability objectives are likely met through the increased access to large urban markets, which may boost revenue from advertisements.

Core Actors

The core design and implementation of the solution have been led by private sector financial and human capital. Waze provides a platform for information sharing between its users and city officials.

Supporting Actors

The Massachusetts Department of Transportation (MassDOT) has partnered with Waze to make this innovation possible. The Bostonian city government set up the regulatory framework and necessary buy-in for Waze to establish data-sharing partnerships with various city departments such as transportation, police, and emergency response services.

Use of Information

At the centre of the solution is the aggregation and democratisation of data for governments and residents. Increased access to data for governments allows them to improve city planning, inform infrastructure decisions, and respond more proactively to accidents and other incidents leading to road congestions. Waze provides MassDOT with real-time, anonymous, Waze-generated incident and slow-down information. In exchange, MassDOT provides real-time, government-reported construction, crash and road closure data to Waze. Further, the solution democratises data on traffic to improve route planning and ultimately redirect automobile flows more equitably throughout the city.

Use of Tools

This innovation uses smartphone technology in the hands of users and makes few investments in physical infrastructure.

Detailed Examples: Enterprise Venturers

Odyssey City Card, Bhubaneswar

Location: Bhubaneswar, India

Challenge: Inefficient, non-user-friendly, separate payment systems for city services

Solution: A single ATM-like smart card to pay for a number of services across the city

Scale: 325 POS machines installed throughout the city, with a target for a POS machine to be available every 250-300m walkable distance

Context

Bhubaneswar is a sprawling city of 1.16 million people. Relatively small by most standards of urban cities, Bhubaneswar still suffers from administrative issues. In past years, the city faced difficulty in managing payments for utilities, transportation and other services due to a heavy reliance on cash and fragmentation of payment systems across various departments.

The Odyssey City Card provides a safe digital mode of economic transactions to residents of Bhubaneswar and reduces dependence on cash. Residents can use the card for digital payment of government fees and taxes, utility bills, transit charges, parking and other city services. The Odyssey City Card involves background integration of systems across various municipal departments, improving efficiency by providing a common mechanism for commercial and civic payments across the city. The success of the solution lies in providing access to cashless means of payment through simpler application processes and a one-stop shop for all of the residents' payment needs.

Core Actors

Although the initial idea for the card came from Bhubaneswar Smart City Limited (BSCL), the public office responsible for Bhubaneswar's Smart initiatives, ICICI Bank, a private Indian multinational bank, co-designed and still leads its development. The infrastructure and technology needed for the initiative came from ICICI.

Supporting Actors

ICICI Bank builds and operates this card initiative in partnership with the government office BSCL. The government has created the requisite legal and regulatory framework to house this initiative under a multi-year PPP mechanism.

Use of Information

City-level and government data were used to diagnose the problem, and ICICI monitors the card's use over time.

As a cashless solution, real-time management of data and information about payments through strong back-end systems is necessary to establish the credibility of the solution. Data about the quantity and frequency of payments is likely used by decision-makers to improve their services.

Use of Tools

The innovation leverages mainly existing physical infrastructure, in addition to retrofitting 325 PoS machines across the city for the purchase of goods, movie tickets or dining.

Detailed Examples: Enterprise Venturers

BigBelly Bins, Dún Laoghaire

Location: Dublin, Ireland

Challenge: Limited capacity to manage increasing waste burden in public spaces

Solution: Bins equipped with sensors to provide real-time notifications on waste collected

Scale: 85% reduction in collection leading to a cost reduction of more than US$200,000

Context

Boasting a rich cultural heritage and proximity to Ireland's economic centre of Dublin, the suburban coastal town of Dún Laoghaire has become a favourite for tourists in recent years. The sudden uptick in tourism led to an increase in the waste generated in public spaces. With limited internal capacity, the town was well-positioned to adopt smart solutions that could help them manage these new challenges in a resource-light manner.

The town adopted the smart dustbin solution developed by BigBelly to guide the day-to-day operations of the waste management department. As a result, 420 smart dustbins were installed to replace 520 traditional litter bins, with sensors in the new dustbins providing notifications on the quantity of waste collected, thereby guiding activities of waste collection only when a bin was ready to be collected.

Core Actors

The solution has been pioneered by BigBelly, a large US-based private sector leader in smart waste management and recycling.

Supporting Actors

The County Council played a pivotal role in kickstarting and encouraging community members to embrace the solution. The Council worked closely with BigBelly to guide implementation, starting from small-scale pilots to full-scale implementation in 2014.

Use of Information

The solution was based on principles of dynamic data collection and analysis that have been tried and tested by BigBelly in over 50 countries. The continuous use of the data on waste levels collected from sensors installed in the dustbins is at the core of the solution. The data has helped the County Council make improved decisions, from removing redundant bins that were placed too close to each other to streamlining resource use by scheduling the emptying of bins on a need-basis.

Use of Tools

This innovation requires the installation of new dustbins, which are not capital intensive. The core anchor of the solution is the use of frontier forms of technology such as sensors to monitor the amount of waste and transmit it to local authorities.

Detailed Examples: State Pioneers

Bus Rapid Transit, Curitiba

Location: Curitiba, Brazil

Challenge: High transit time and overall inconvenience of public transportation

Solution: Integration of bus lines and provision of dedicated corridors for speedy public transit

Scale: Network of 21 stations split into six lines with a ridership of 2 million+ per day

Context

Curitiba, the capital and largest city of the Brazilian state of Parana, is home to 1.8 million people. The city has a rich history in innovative public transportation. From adopting mule-pulled trams in 1887 to now having one of the most successful examples of transit-oriented development, Curitiba has come a long way in its journey to increase public mobility.

The city's current transit solutions found their origins in the 1970s when citizens' concerns around high transit time due to rising population and automobile ownership led city officials to crowdsource ideas on urban design. This led to the development of dedicated busways and feeder corridor services, now known as Bus Rapid Transit (BRT) systems, which have further developed and remain at the centre of the city's more contemporary innovations in public transportation. BRT involves the integration of all bus lines into a single Rede Integrada de Transporte. The integrated bus line has access to dedicated lanes to navigate quickly through traffic. The solution helps integrate underlying features of a light-rail or metro system in a cost-efficient manner to speed up public transport, thereby increasing its adoption.

Core Actors

Starting with the development of simple bus corridors in the 1970s, the young architect mayor of the city led the vision for their design and construction. City authorities, such as the Urban Development Agency of Curitiba (URBS), have driven the project's planning, operation and oversight.

Supporting Actors

The government-led implementation has been supported by a strong internal capacity to fund the solution for the costs beyond those covered by service revenues. These funds include grants from the city municipality as well as other levels of government. Further, to support URBS, the governmental Institute for Research and Urban Planning of Curitiba was responsible for assisting with technical aspects of the project and ensuring the overall progress towards physical and financial goals.

Use of Information

The innovation is ultimately used by communities, and their active and willing participation is necessary for its success. To ensure this, the government has created a strong feedback loop through surveys and spot checks to ensure the solution's community-centricity.

Use of Tools

Rather than investing heavily in new physical assets, Curitiba restructured its existing roads to accommodate this innovation.

Detailed Examples: State Pioneers

Sponge Infrastructure, Shenzhen

Location: Shenzhen, China

Challenge: Inconsistent water supply that swings from drought to uncontrollable flooding

Solution: Cultivation of green infrastructure in the city to act as sponges

Scale: Sponge city improvements cover 24% of the city's total surface area with a target of reaching 80% by 2030

Context

The bustling city of Shenzhen is home to 13 million people and one of the fastest urbanising cities in the world. However, rapid urbanisation across China and the world at large comes with major changes in urban hydrological and ecological processes, resulting in an increased risk of urban flooding. In 2014, Shenzhen experienced a period of heavy rain, later called a 50- year flood event, which pulled the city to a complete stop, with more than 200 waterlogged areas despite having 13,700 km of built sewers. The situation is likely to worsen as computer models predict that with climate change, although total annual rainfall will remain relatively unchanged, precipitation will be characterised by short duration and high intensity.

Sponge cities offer a simple natural solution to this urban problem. By shifting away from traditional "grey infrastructure" of concrete and, instead, building porous, permeable infrastructure such as green roofs, roads and gardens that mimic nature and absorb and retain rainwater for future use, Shenzhen hopes to reduce flooding while moving towards a more circular economy.

Core Actors

President Xi Jinping endorsed the sponge city concept in 2013, and a 30-city pilot program followed with commitments to incentivise municipal investments. As one of these pilot cities, Shenzhen embraced it more than most, quickly initiating the process to incorporate it into its master plan.

Supporting Actors

Academics and specialists have been lending their technical expertise, mixed with their experience of living within the city, to help design a number of innovations and initiatives across Shenzhen.

NGOs like The Nature Conservancy play an important role as pilot runners of early ideas that the government cannot take the risk to undertake without proof of concept.

Use of Information

The sponge city concept was born out of an understanding of natural ecological balance, which has existed for centuries. However, the modern version of the concept has gone through a few iterations in Europe, Australia, and the United States. As the solution continues to be developed, Shenzhen relies on the wisdom from other pilots and its own scientific experiments to thoughtfully construct resilient spaces.

Use of Tools

Shenzhen has invested large amounts in the construction of big and small physical infrastructure, from the 105-acre Honey Lake Park that includes porous ground dug up to replace the unyielding clay of Shenzhen to suburbs with permeable pavements that look like blacktop and concrete. The city is also experimenting with green roofs that slow the fall of rain.

Detailed Examples: State Pioneers

SMS Women Safety Program, Quito

Location: Quito, Ecuador

Challenge: Rampant harassment of women on public transportation

Solution: Text-based reporting outlet for female commuters on public buses

Scale: More than 2800 cases reported and registered in the first two years of the program

Context

Quito, Ecuador's most populous city, is a bustling metropolitan city with a rich history. However, women's safety on public transport has been a major issue, with a 2014 survey revealing that 81% of women using public transport claimed to have experienced harassment in some form. The issues range from lack of reporting due to fear of backlash to limited convictions for such crimes due to lack of a proper policy framework.

To counter these problems, a group of city officials first developed an application, and now an SMS-based platform, that enables riders to report harassment cases they witness or experience on a real-time basis. The SMS is received by the EPMTPQ – Quito's Transport Authority – control centre, who immediately calls the person reporting to learn more about the situation. Simultaneously, the bus driver is notified of the incident, and an alarm sounds in the bus unit, alerting all passengers that they should be especially vigilant. In addition, the police or security personnel of the EPMTPQ are made available to intercept the victim and/or aggressor at the next station.

Core Actors

This innovation was championed initially by the Vice Mayor's office, the only female at a transportation and mobility strategy meeting. After the conceiving administration left office, it has since been handed over to various leaders within the municipality that continue to refine and improve upon early prototypes.

Supporting Actors

The solution is enabled through the collaboration of multiple municipal offices, including those in transportation and social inclusion. In addition, UN Women provided invaluable support throughout the process with finances and guidance in the training of psychologists and legal practitioners.

Use of Information

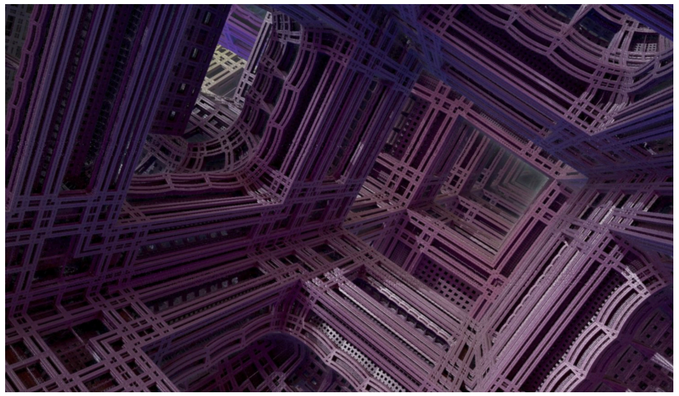
The personal experiences of those in office partially prompted the creation of this initiative, but it was built on work that was already underway thanks to Quito's commitment to addressing sexual harassment issues with UN Women. Baseline studies were conducted in 2011 and 2014 to assess the issue, and real-time, city-level data is collected to monitor the initiative's progress and impact.

Use of Tools

While this innovation required large amounts of financial and human resources, its ingenuity is in the use of simple gadgets already in the hands of end-users.

Detailed Examples: State Pioneers

Virtual Singapore, Singapore



Location: Singapore

Challenge: Costly implementation of pilot programs that have not been proven to work

Solution: A dynamic 3D digital twin of Singapore that enables users to derive insights, develop solutions, and run simulations

Scale: Information not available in public sources

Context

The entire country of Singapore is comprised of 5.6 million people, a fraction of most cities featured in this handbook. Yet, it has consistently been one of the most innovative countries since its independence in the 1960s, championing radical initiatives, such as reclaiming land from the sea.

Today, beyond being a financial hub, Singapore is a model for cities looking to be Smart—the traditional way. The city has invested vast amounts of resources into building technology that allows it to monitor, design and build sophisticated urban spaces. But Singapore has its own twist to the traditional Smart City, and at the heart of its strategy is design for people. Its citizen-centric approach has successfully delivered long-term policies and services, including racial integration in public housing and road pricing.

Singapore has always embraced technology as a tool for furthering its commitment to building solutions that work, and Virtual Singapore is living proof. Using a dynamic 3D digital platform, Virtual Singapore enables users to test solutions in a controlled simulated environment and see the real impacts before delivery.

Core Actors

This initiative was conceptualised by the National Research Foundation (NRF) and the Prime Minister's Office. The Singapore Land Authority (SLA) is expected to become owner and operator once it is completed.

Supporting Actors

The Government Technology Agency of Singapore (GovTech), among other public agencies, provides technical expertise in information and communications technology.

Use of Information

Virtual Singapore represents the terrain of Singapore in ways that 2D maps cannot. It offers an accurate, dynamic image of spaces gathered from sophisticated LiDAR 3D scanners at every level of the city.

Virtual Singapore has a large library of insights into the city, such as the heights of buildings and wind movement, which will be made publicly available. This information can be used to not only test but also devise future designs. This information is shared with departments across the government and might one day also be shared with the general public.

Use of Tools

This innovation aims to reduce the waste of resources when piloting initiatives. Thus, besides the LiDAR 3D scanners and the technological infrastructure required, very few physical resources are used.

Detailed Examples: State Pioneers

Call Centre for Faecal Management, Dakar

Location: Dakar, Senegal

Challenge: Lack of household access to economical faecal desludging services leading to unhealthy and unsafe desludging practices

Solution: Regulation of the private sector through a competitive bidding process, housed under an accessible call centre

Scale: Information not available in public sources

Context

Housing a metropolitan population of ~2.5 million people, Dakar is the capital and largest city of Senegal. The city's piped sanitation system has faced difficulty meeting the growing needs of an increasing population over the last few decades, with most households using on-site sanitation facilities.

Further, with access to mechanised desludging being sparse, primarily driven by information asymmetry and high prices, up to 52% of households in the city rely on manual emptying, which is inefficient and poses numerous health and safety hazards to those carrying out the practice for meagre sums.

To solve this growing challenge, the government has established and fully manages a call centre that connects households with regulated private sludge management services. Customers can call the centre to request services, which are fulfilled by private operators through a competitive bidding process.

Core Actors

The government has played the nodal role in this solution, with the National Sanitation Office of Senegal (ONAS) launching the call centre under the broader Program for the Structuring of the Faecal Sludge Market (PSFSM). Apart from set-up and funding, the government continues to play a central role in managing the call centre and coordinate activities with private sector actors.

Supporting Actors

The Bill and Melinda Gates Foundation is a core technical partner and provides grant funding for the solution. Further, private desludging companies play an important role as implementation partners, providing their services under the regulatory and operational framework established by the government.

Use of Information

The solution originated from a clear need for access to economical desludging services, reflecting in city-level data on resident behaviours. The delivery of the solution relies on the ability to process and quickly respond to city information, providing services to those in need in a timely manner.

Use of Tools

Using desludging infrastructure and human capital available to the government and private sector, the innovation has been successful by connecting essential resources to the public through the incorporation of frugal mobile technology.

About the UNDP Global Centre for Technology, Innovation and Sustainable Development

The UNDP Global Centre is a joint initiative by the Government of Singapore and the United Nations Development Programme (UNDP) which aims at identifying and co creating technological solutions for sustainable development. The UNDP Global Centre curates partnerships, identifies solutions and connects partners and innovations with UNDP's Global Policy Network and development partners.

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Singapore

Acknowledgements

The insights in this Handbook have immensely benefitted from conversations, interviews and workshops with more than 30 stakeholders ranging from academics, researchers, administrators, entrepreneurs to practitioners, who are leading thinkers on Smart Cities and urban development from MIT Urban Risk Lab, Mistletoe, African Centre for Cities, Mansueto Institute for Urban Innovation, Think City, Digital Ministry of Catalonia, DesignWorks, Gehl Architects, UCLG, Space Syntax, GRCN, UN Women, Centre for Liveable Cities Singapore, UNCDF, Busara Centre for Behavioural Economics, FabCity Foundation, TETO Brazil, as well as city officials from Addis Abbaba, Barcelona, Quito, Hue, Amman, Pune, and Chennai. Without their time, and their insightful perspectives, this Handbook would not have been possible.
The authors would also like to thank UNDP colleagues Renata Rubian, Minerva Novero, Kate Sutton, Kawtar Zerouali, Nithima Ducrocq, and Patricia Purcell, as well as colleagues from UNDP Country Offices in Uruguay, Ethiopia, Vietnam, Iran, India, and Regional Bureau in Asia Pacific and Arab States for their helpful comments on an earlier version of the framework and of this publication.

Designed by: Peter Kongmalavong, with the kind contributions of Neko Yanzhuang Chen and Yibei Chen.