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# Exploring the Use of Open Data to Support Citizen-Led Initiatives for Sustainable Urban Development in East Africa

Submitted January 2022, in partial fulfilment of  
the conditions for the award of the degree **PhD Digital Economy**.

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I hereby declare that the dissertation is all my own work, except as indicated  
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## Abstract

In the last two decades, both the academic realm and urban governance practice have seen a rising interest in smart cities and open data to aid sustainable urban development and citizen engagement. However, little is currently known about data-driven citizen-centric practices ‘on the ground’. Research to date has been scarce and focused primarily on the experience in countries of the ‘Global North’. Therefore, the knowledge gap this work aimed to bridge was to develop an understanding of how open data are used to support citizen-led initiatives that address sustainable development in cities in the ‘Global South’.

The research employed an inductive exploratory approach using qualitative research methods to examine case studies in Dar es Salaam (Tanzania) and Nairobi (Kenya). The case studies were focused on how city governments and other stakeholders engage with communities dealing with sustainability challenges, and how data can support this. Expert interviews, 25 in Dar es Salaam and 25 in Nairobi, were conducted with representatives of national and local government, international and local experts in open data and urban data innovations, leaders in non-profit organisations, private sector companies and start-ups, international development organisations, local community initiatives and academia. These were followed by direct observations of four community projects (Ramani Huria and Nipe Fagio in Dar es Salaam, and Map Kibera and sensors.AFRICA in Nairobi), and focus groups with project participants. By taking a ground-level perspective on how data are generated, circulated, accessed and leveraged by stakeholders, the author has drawn conclusions on how cities adopted and supported ‘citizen-centric’ practices to address specific urban challenges, such as solid waste management, air pollution, flooding, and access to public services.

Overall, the nature of data-driven community initiatives in these cities was found to be different to the cities in the Global North. They were shaped by the way people traditionally participate in decision making and how they were initiated and resourced. Due to the prevalence of international donor funding in these countries, project agendas and their sustainability depended strongly on the continuation of donor programmes. Also, the history, local governance and motivation for community engagement played a considerable role in shaping these activities. Findings suggest that using data for citizen engagement in urban challenges in East Africa, and the design of urban sustainability interventions, should take into consideration these contextual differences. Addressing such specificities simply as ‘barriers’ or ‘gaps’ to achievement, rather than as practically and symbolically significant local practices integral to existing community

governance, risks failing to account for their importance, at the cost of the deliverability of data-driven project goals.

## Acknowledgements

This thesis is about how urban data and citizen participation could contribute to making cities better in some of the less advantaged parts of the world – African cities. It is a product of over four years of research enriched by my experience as a development practitioner since 2012. Although the thesis is the result of my own work, it would not have been possible without the support, guidance and collaboration of many people: supervisors, colleagues, friends, family and representatives of partners organisations to whom I am enormously grateful.

First and foremost, I am grateful for my supervision team – Prof Lucelia Rodrigues, Dr Murray Goulden and Prof Chris Greenhalgh. They have guided me through all these years at the University of Nottingham and provided insights and complementary knowledge from their fields. They have taught me to adhere to the highest academic standards and for years (!), patiently listened to my rambles even when they did not make sense even to me and always showed me that there is a light at the end of this tunnel. I can truly say that I was extremely lucky with my supervisors and I would like to thank them so much for sticking with me to the very end. I also would like to thank Prof Reiner Grundmann who was an annual reviewer for my work and provided critical review and helpful feedback on my research as it was progressing.

A lot of this research was possible thanks to my work at the World Bank Group. I'm grateful to my colleagues there who have shared their expertise, inspired me with their work on open data, digital development and innovations and provided mentorship over the years. Special thanks to Edward Anderson, Anat Lewin, Alla Morrison, and Oleg Petrov, who have played a big part in my becoming who I am today professionally. I also would like to thank Andrew Stott who has always been there for me to discuss my ideas, read my work, give feedback, and provide insights from his rich career as a British civil servant, senior World Bank consultant and world-renowned expert in digital government and open data. I also would like to thank the Tanzania Urban Resilience Program team for letting me be part of it and for sharing their experiences with me, forming long-lasting friendships with many of the team members (big shout out to Darragh Coward who has been a great friend and colleague, supporting me all throughout this PhD).

I would like to thank staff and volunteers of the community initiatives in Tanzania and Kenya, which I examined in this PhD, who contributed their own time to help organise many of the research activities and conduct focus groups. This research was possible thanks to the organisational support from Code for Africa, Map Kibera, Ramani Huria, and Nipe Fagio. I also would like to thank many people whom I interviewed and who participated in the research activities

and shared their practices and views on data and smart city developments in Dar es Salaam and Nairobi. Without their generous contributions and open sharing of their experiences this work would not have been done.

I would like to thank the Horizon Centre for Doctoral Training (CDT), my PhD cohort, and especially my colleagues Abi Fowler and Kate O’Leary who were my writing group pals and helped to get through the final stage of the PhD. I would like to thank my NLab family for making room for me in their research group, including me in their activities and for sharing many fun times together in Nottingham and in Africa where we overlapped on many field trips – big shout out to James Goulding, Gregor Engelmann, Maddy Ellis, Vanja Ljevar, Georgie Nica-Avram, Gavin Smith and Bertrand Perrat. I also would like thank Mark Iliffe for introducing me to the Horizon CDT Program and to NLab, even if the only motivation behind it was to rent out his flat to me (just teasing of course). I appreciated Mark’s warm welcome to Nottingham and continuous support throughout the PhD as a fellow student in Horizon CDT, friend, and colleague in international development.

I would like to thank my industry implementation partner, the Open Data Institute (ODI), and especially their Vice President and Chief Strategy Adviser Jeni Tennison for providing guidance, sharing useful materials, and giving feedback on my research as it was developing. I always appreciated a friendly welcome in the ODI office where I spent several months during the internship and presented my research at various stages.

In Nairobi, I would like to thank Maria Amelina and Philippe Dongier for hosting me during the research field visits, for discussions that provided insights and stimulated ideas on Kenya’s and Tanzania’s innovation ecosystem and for always making sure that my trips were not only productive but also fun.

Last but not least, I would like to thank warmly the people who have supported me with their love, and who have always believed in me and given me strength to keep going through these years. I would like to thank my partner Nik Nikam for support and motivation, and for keeping my sanity (and his) throughout the COVID pandemic when most of the writing up of this thesis took place. I also would like to thank my childhood friend Anna Petrenko who luckily for me moved to London in my first year of PhD and has been a destination for a much needed get away on many occasions. And of course, I would like to thank my loving family very much and most of all my mother Svetlana Lepeshkina — to whom I devote this thesis.

## Table of Contents

<b>Abstract .....</b>	<b>2</b>
<b>Acknowledgements .....</b>	<b>4</b>
<b>List of Figures .....</b>	<b>10</b>
<b>List of Tables .....</b>	<b>12</b>
<b>Acronyms .....</b>	<b>13</b>
<b>Introduction .....</b>	<b>15</b>
<b>Structure of PhD thesis .....</b>	<b>18</b>
<b>Contributions .....</b>	<b>19</b>
<b>Chapter 1. Smart cities and data .....</b>	<b>21</b>
<b>1.1. Smart city rhetoric.....</b>	<b>21</b>
<b>1.2. Data-driven cities .....</b>	<b>25</b>
<b>1.3. Open data in an urban context.....</b>	<b>28</b>
<b>1.4. Conclusions.....</b>	<b>33</b>
<b>Chapter 2. Cities and their citizens .....</b>	<b>35</b>
<b>2.1. Citizen engagement and participation .....</b>	<b>35</b>
<b>2.2. The role of citizens in smart cities.....</b>	<b>36</b>
2.2.1. Bottom-up and top-down approaches to the smart city .....	43
2.2.2. Volunteerism .....	45
<b>2.3. Participatory approaches in international development .....</b>	<b>46</b>
<b>2.4. Cities of the Global South: technology and data for development .....</b>	<b>47</b>
<b>2.5. Conclusions.....</b>	<b>51</b>
<b>Chapter 3. Methodology.....</b>	<b>53</b>
<b>3.1. Methodological approach.....</b>	<b>54</b>
3.1.1. Reflexive Statement.....	59
<b>3.2. Case study .....</b>	<b>61</b>
3.2.1. Case study selection .....	62

3.2.2.	Dar es Salaam, Tanzania .....	64
3.2.3.	Nairobi, Kenya.....	68
<b>3.3.</b>	<b>Methods of data collection .....</b>	<b>72</b>
3.3.1.	Expert interview.....	72
3.3.2.	Direct observation and contextual interview .....	76
3.3.3.	Focus group discussion .....	78
3.3.4.	Ethics considerations .....	80
3.3.5.	Limitations .....	80
<b>3.4.</b>	<b>Data analysis .....</b>	<b>81</b>
3.4.1.	Thematic analysis .....	81
3.4.2.	Triangulation .....	84
<b>3.5.</b>	<b>Conclusions.....</b>	<b>84</b>
<b>Chapter 4.</b>	<b><i>Dar es Salaam</i>.....</b>	<b>86</b>
<b>4.1.</b>	<b>Government data.....</b>	<b>86</b>
4.1.1.	National government data.....	86
4.1.2.	Local government data .....	88
4.1.3.	Data processing, management and access.....	90
4.1.4.	Data use.....	92
4.1.5.	Challenges in using government data.....	94
<b>4.2.</b>	<b>Non-government data .....</b>	<b>98</b>
4.2.1.	Permission for data collection .....	98
4.2.2.	Dar Ramani Huria – a community mapping initiative.....	100
4.2.3.	Nipe Fagio – a community clean-up initiative .....	108
<b>4.3.</b>	<b>Citizens in Dar es Salaam.....</b>	<b>112</b>
4.3.1.	Community meetings .....	113
4.3.2.	Community action .....	114
4.3.3.	Role of citizens in collecting and using city data.....	115
<b>4.4.</b>	<b>Stakeholder interactions .....</b>	<b>119</b>
4.4.1.	Government .....	119
4.4.2.	Engaging with the government on the lowest level.....	120
4.4.3.	International aid institutions and donor stakeholders.....	121
<b>4.5.</b>	<b>Conclusions.....</b>	<b>122</b>
<b>Chapter 5.</b>	<b><i>Nairobi</i>.....</b>	<b>124</b>

<b>5.1. Government data</b> .....	<b>124</b>
5.1.1. National government data.....	124
5.1.2. Local government data.....	128
5.1.3. Data collection, management, processing and sharing.....	129
5.1.4. Data access and use.....	130
5.1.5. Challenges in accessing and using government data.....	134
<b>5.2. Non-government data</b> .....	<b>138</b>
5.2.1. Map Kibera – a community mapping initiative.....	139
5.2.2. sensors.AFRICA – a community initiative against pollution.....	148
<b>5.3. Citizens in Nairobi</b> .....	<b>155</b>
5.3.1. Public meetings and newspaper notices.....	156
5.3.2. Role of citizens in collecting and using data.....	158
<b>5.4. Stakeholder interactions</b> .....	<b>159</b>
5.4.1. Civil society.....	160
5.4.2. International aid institutions and donor stakeholders.....	160
<b>5.5. Conclusions</b> .....	<b>162</b>
<b>Chapter 6. Analysis and application</b> .....	<b>163</b>
<b>6.1. City organisation</b> .....	<b>163</b>
<b>6.2. Access to information: permissions and rights</b> .....	<b>167</b>
<b>6.3. The role of donor institutions</b> .....	<b>168</b>
<b>6.4. Professional volunteerism</b> .....	<b>171</b>
<b>6.5. Sustainability of community-led data-driven initiatives</b> .....	<b>175</b>
<b>6.6. The issues of ‘culture’ and ‘mindset’</b> .....	<b>177</b>
<b>6.7. Barriers and ‘gaps’</b> .....	<b>180</b>
<b>6.8. Conclusions</b> .....	<b>181</b>
<b>Chapter 7. Conclusions, limitations, and future work</b> .....	<b>183</b>
<b>7.1. Research Question 1: How do cities in the East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?</b> .....	<b>185</b>
7.1.1. Government data.....	186
7.1.2. Non-government data.....	187



7.1.3.	Citizen participation.....	188
7.1.4.	Stakeholder interactions .....	190
<b>7.2.</b>	<b>Research Question 2: How should cities in the East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development? .....</b>	<b>191</b>
7.2.1.	City organisation .....	191
7.2.2.	Access to information: permissions and rights .....	191
7.2.3.	The role of donor institutions.....	192
7.2.4.	Professional volunteerism.....	193
7.2.5.	Sustainability of community-led data-driven initiatives .....	194
7.2.6.	The issues of 'culture' and 'mindset' .....	195
7.2.7.	Barriers and gaps.....	195
<b>7.3.</b>	<b>Implications .....</b>	<b>196</b>
<b>7.4.</b>	<b>Limitations and future work .....</b>	<b>200</b>
<b>7.5.</b>	<b>Personal reflection .....</b>	<b>202</b>
<b>References.....</b>		<b>204</b>
<b>Appendices.....</b>		<b>219</b>

## List of Figures

Figure 1-1: Six domains of smart cities assessment Framework (Giffinger et al., 2007, p. 12). .....	22
Figure 1-2: Typology of information sources in smart cities (Sta, 2017, p. 412). .....	26
Figure 1-3: Diagram showing relations between government data, open data and big data (Szegedi, no date, p. 14). .....	29
Figure 1-4: The data spectrum (The Open Data Institute, 2020, p. 6). .....	31
Figure 1-5: Civic data ecosystem where data production and information consumption are in a constant exchange between local institutions and the public (Le Dantec et al., 2015, p. 329). .....	32
Figure 2-1: Top 50 smart cities in the Smart City Index 2021 (Institute for Management Development, 2021, p. 9). .....	39
Figure 2-2: Scaffold of smart citizen participation (Cardullo and Kitchin, 2017, p. 6). .....	41
Figure 3-1: PhD research design. ....	54
Figure 3-2: Scientific paradigms (Santos and Travassos, 2011, p. 215). .....	55
Figure 3-3: The inductive logic of research in a qualitative study (Creswell, 2014, p. 100). .....	58
Figure 3-4: Kenya open data ecosystem (Rahemtulla et al., 2012, p. 20) .....	70
Figure 3-5: Number of interviewees per category of stakeholder group represented in Dar es Salaam, Tanzania and Nairobi, Kenya. ....	74
Figure 3-6: Questions for a semi-structured interview. ....	75
Figure 3-7: Questions for a focus group discussion. ....	79
Figure 3-8: Phases of thematic analysis (Braun and Clarke, 2006). .....	82
Figure 4-1: List of data student volunteers were requested to collect in a ward by a Ward Executive Officer. ....	89
Figure 4-2: Ward government office. ....	91
Figure 4-3: Ward Executive Officer searching for data. ....	91
Figure 4-4: Ramani Huria and OMDTZ office – staff working on data on administrative boundaries. ....	101
Figure 4-5: Sub-ward government office. ....	105
Figure 4-6: Office wall with a ward map and the list of all residents of the sub-ward with their IDs. ....	105
Figure 4-7: Nipe Fagio and Ramani Huria volunteers conducting waste mapping. ....	109
Figure 4-8: Nipe Fagio clean-up event in Dar es Salaam - municipal truck and workers are picking up collected rubbish. ....	110
Figure 4-9: Nipe Fagio clean-up event in Dar es Salaam - plastic bottles have been sorted out and are being counted for waste and brand audit. ....	110
Figure 4-10: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit in progress. ....	110
Figure 4-11: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit in progress. ....	110
Figure 4-12: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit report. ....	111
Figure 5-1: Map Kibera Office - preparation for a mapping project. ....	140
Figure 5-2: Maps produced by Map Kibera and posted in the office. ....	140

Figure 5-3: sensors.AFRICA air quality sensor (on the left) and solar battery (on the right) compared to a pen. .... 150

Figure 5-4: sensors.AFRICA's air quality sensor – internal components. .... 150

Figure 5-5: sensors.AFRICA web dashboard comparing Nairobi pollution level with World Health Organisation's recommended norms. .... 152

Figure 5-6: sensors.AFRICA map of all sensors with the indication of the average measurements collected. .... 153

Figure 5-7: sensors.AFRICA website landing page on air pollution. .... 153

Figure 6-1: Thematic areas of analysis. .... 163

Figure 6-2: A conceptual model of open data in developed (on the left) and developing (on the right) countries (Rahemtulla et al., 2012, p. 19) ..... 169

## List of Tables

<i>Table 2-1: Examples of smart city initiatives in the Global North.....</i>	<i>40</i>
<i>Table 2-2: Examples of community data initiatives in the Global South (Landry et al., 2016, pp. 41–47). .....</i>	<i>49</i>
<i>Table 3-1: Governance structure of Dar es Salaam city (adopted from World Bank unpublished research and complemented by desk research and interviews).....</i>	<i>66</i>
<i>Table 3-2: Governance structure in Kenya (compiled based on interviews and desk research). .....</i>	<i>71</i>
<i>Table 3-3: Observations and contextual interviews – log of activities. ....</i>	<i>76</i>
<i>Table 3-4: Focus group log sheet in Dar es Salaam in Nairobi .....</i>	<i>80</i>
<i>Table 5-1: Quotes on the lack of trust and corruption issues by different groups of stakeholders.....</i>	<i>137</i>

## Acronyms

AfDB	African Development Bank
AI	Artificial intelligence
AIDS	Acquired Immune Deficiency Syndrome
API	Application programming interface
ATI	Access to Information Act
CCM	Chama Cha Mapinduzi (English: 'Party of the Revolution')
CCTV	Closed-circuit television
CDT	Centre for Doctoral Training
COSTECH	Commission for Science and Technology
CRA	Commission on Revenue Allocation
CSO	Civil society organisation
CTG	Centre for Technology in Government
D-by-D	Decentralisation by devolution
DfID	UK's Department for International Development
DPF	Development Partnership Forum
EU	European Union
FCDO	Foreign, Commonwealth & Development Office
GDPR	General Data Protection Regulation
GIS	Geographic information system
GPS	Geo-positioning system
HIV	Human Immunodeficiency Virus
HOT	Humanitarian OpenStreetMap Team
ICT	Information and communications technology
ICT4D	Information and Communications Technology for Development
IoT	Internet of Things
ITU	International Telecommunication Unit
KNBS	Kenyan National Bureau of Statistics
KODI	Kenya Open Data Initiative
LMIC	Low- and middle-income countries
NACOSTI	National Commission for Science, Technology and Innovation
NBS	National Bureau of Statistics

NGO	Non-governmental organisation
ODA	Official development assistance
ODI	Open Data Institute
ODK	Open Data Kit
OGP	Open Government Partnership
OMDTZ	OpenMap Development Tanzania
OMK	Open Map Kit
OSM	OpenStreetMap
PAS	Public announcement system
TIDDP	The Integrated Devolution Data Portal
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Program
US	United States
WEO	Ward Executive Officer

## Introduction

As Simon Van Booy wrote in his novel *Everything Beautiful Began After*: “For those who are lost, there will always be cities that feel like home” (Van Booy, 2011, p. 11). Indeed, more and more people are making their home in cities, moving away from rural areas in search of better opportunities and higher standards of living (Martin, 2003). Data shows that the global city population has been growing dramatically in the last few decades: from 1960 to 2020 it increased from around one billion to 4.4 billion (The World Bank, 2020), so more than four times in just 60 years. Today, we are living in a world where more than half of the population live in urban areas. City dwellers are estimated to reach five billion by 2030 and pass six billion in two short decades after that (Song, 2014; United Nations, 2018), with the main increase happening in the ‘developing’ countries in the ‘Global South’ (Watson, 2009; Roy, 2011; Eskelinen *et al.*, 2015). And thus, as the urban landscape is changing, bringing millions of people to cities, urban development issues have received the increased attention of academics, policymakers and practitioners.

With the extreme growth in the number of inhabitants, cities are facing a wide range of challenges that local governments around the world strive to address. The overall challenge is to ensure that cities address urban issues, taking into account people’s needs and providing essential services as well as the best possible experiences of city living to every resident. These issues concern both optimizing tangible infrastructure such as transportation, energy distribution networks, waste management and supporting intangible assets such as human capital, the intellectual capital of companies, and organisational capital in public administration bodies (Neirotti *et al.*, 2014). As digital technology progresses, and cities accumulate digital data about their operations, city governments turn to technology and data-enabled solutions to solve urban challenges and make city management more ‘efficient’ (Song, 2014).

City governments produce, collect, and process large volumes of data internally and have begun to publish open data that anyone can access, use or share, which has the potential to empower local communities to become more sustainable, making cities more people-centred and resilient (Landry *et al.*, 2016). In the search for effective and efficient solutions for critical urban challenges, for example, concerning energy consumption, transportation and climate change to name a few, city governments and policymakers have turned to ‘smart’ tools supported by modern technologies and data. “*Making a city ‘smart’ is emerging as a strategy to mitigate the problems generated by the urban population growth and rapid urbanization*” (Chourabi *et al.*, 2012, p. 2289).

Cities have eagerly embarked on a 'smart city' journey, asserting that people's and communities' needs are at the heart of this vision and hence make urban communities more 'sustainable and resilient'.

In addition to opening up data, public participation and collaboration among all stakeholders are considered key in solving pressing issues of urbanization. However, persistent questions remain: who identifies these issues, and how? What role does a citizen play in a citizen-centric smart city and how are data utilised to ensure that the potential advantages of the smart city benefit all the people who live there? Smart cities are frequently blamed for providing 'solutions looking for problems'. The primary concern with developing any complex system (such as a smart city) is that it creates distinct benefits for some of its users and marginalises others in a manner that is can be either very obvious or very opaque to its developers (Hollands, 2008; Vanolo, 2014).

Smart city research so far has been primarily focused on the cities of the 'Global North' (Lupton, 2020). Similarly, urban and planning theories have been developed in the countries of the Global North and do not apply to or reflect the majority of the cities in the Global South, where urban development has been shaped by their specific contexts (Roy, 2011; Watson, 2016). Thus, given the push for smart city initiatives', there is a need to take a closer look at the impact of data-driven initiatives on sustainable urban development in less developed countries and how it reflects on citizen participation.

The use of communication technologies and data have the potential to provide new opportunities for developing citizen-centric practices in cities. These innovative approaches have been actively promoted in a number of African countries to address issues of urban sustainability in recent years, mainly with the help of international development donors and multilateral institutions.

Wider smart cities research has been done to look at more advanced countries in Europe, North and South America, and Asia (Giffinger *et al.*, 2007; Aldama-Nalda *et al.*, 2012; Neirotti *et al.*, 2014). While the fastest-growing urban centres are located in the lower-middle-income countries in Africa (Estevez, Lopes and Janowski, 2016), very little academic research is written about smart cities on the continent compared to the Global North (Lupton, 2020). Therefore, the aim of this PhD research is to lessen the knowledge gap in understanding of how open data are used to support citizen-led initiatives that address the sustainable development of cities in the 'Global South', with particular focus on countries in East Africa.



Like other large cities in East Africa, Dar es Salaam and Nairobi need to address pressing urban challenges of insufficient physical infrastructure, environmental sustainability and mobility, energy grids, healthcare, as well as public safety and security in order to effectively support its fast growing urban populations (Slavova and Okwechime, 2016). 'Smart city' projects have potential to address these needs through 'data-driven' decision-making. Therefore, research questions central to this PhD research are:

- I. *How do cities in East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?*
- II. *How should cities in East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?*

In order to unpack the first research question and to understand the practices of citizen-led data-driven initiatives 'on the ground' additional questions were developed:

- *How are data generated, circulated, and used (government and non-government)?*
- *How do citizens get involved and participate in this process?*
- *What are the stakeholders' roles in this process?*

Whether in line with the widespread notion of smart cities or not, many cities in Africa have started to transform city services through technology and data. Kenya and Tanzania were among the few countries on the continent at the forefront of introducing such innovations in the public sector. They launched national open data initiatives and a number of government- and citizen-led projects using data to address issues in urban communities. Therefore, this PhD thesis explores the research questions in two case study cities in Africa: Dar es Salaam, Tanzania and Nairobi, Kenya. It does not assume any specific working definition of 'smart city', but rather that, as part of the work, the researcher attempted to assess what this concept actually means to locally related stakeholders within these two cities.

The researcher has worked in international development as a digital innovations and engagement practitioner since 2012 and supported open data and digital transformation projects in over a dozen countries, including Tanzania. Through this experience, she witnessed that sizable funding was allocated by donor institutions towards open data programs in Africa, however there was a general lack of research and understanding around how effective these initiatives were to engage communities and improve their well-being. It motivated her to do this PhD.

## Structure of PhD thesis

This thesis is structured as follows.

After the Introduction, Chapter 1 presents a literature review covering the domains of smart cities and data. It starts by introducing smart city rhetoric, and briefly examines how the term 'smart city' came into use and some critical components of the definition. Particularly, the chapter outlines how the role the citizens were expected to play in the development of smart cities appeared to be overestimated. Then, the chapter describes what data approaches were used in modern cities and associated risks and benefits in the urban context. The final subsection presents 'open data' as a concept and an enabler of a more citizen-centric smart city development.

In Chapter 2, the literature review continues and more concretely turns to the citizens and the role they played in making their cities 'smarter'. It starts by introducing citizen engagement and participation in urban development, which has become a mandatory component of legitimizing government decisions about cities in many countries. The chapter also explains 'bottom-up' (citizen-led) and 'top-down' (government-led) approaches to smart cities and also looks at 'volunteerism' as a form of expected input from citizens in the Global North. Then, the chapter turns to discussing the issues of public participation and volunteerism in the cities of the 'Global South'. In particular, the chapter looks at how these concepts are employed in the foreign aid work, which funds a large portion of citizen-led data-driven innovation projects in Africa.

Chapter 3 presents the methodology, including the methodological approach and research design, methods of data collection and analysis. The chapter provides the rationale for selecting the two case study cities (Tanzania and Nairobi) and two community initiatives within each city for examination in this research. Each data collection method (expert interview, direct observations with contextual interview, and focus group discussion), which engaged participants from various stakeholder groups (representatives of national and local government, private sector companies and start-ups, international development organisations, local community initiatives and academia, international and local experts in open data and urban data innovations, and leaders in non-profit organisations), is described in detail including how fieldwork was carried out, what ethical considerations were taken into account and the limitations of the work. Finally, the data analysis section describes in detail how a thematic analysis was applied to the data collected for this thesis, and triangulation was employed throughout the iterative research activities to develop a thorough understanding of the phenomena.

Chapter 4 and Chapter 5 cover findings from Dar es Salaam and Nairobi respectively. They are organised in sections that unpack the data collected for this research as related to the first research question – *How do cities in East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?* In line with the supporting questions set out in the previous section, the sections describe: (i) how government and non-government data were collected, managed and used; (ii) how citizens were involved in these initiatives; and (iii) how interactions between different stakeholders influenced community data-driven projects.

Chapter 6 presents the results in line with a thematic analysis of the data collected for this thesis. It is organised into seven themes, which came out of the studies where both cities were compared and contrasted to each other as well as to the literature on the same issues in the Global North.

Chapter 7 presents the conclusions, addresses both research questions and offers final thoughts including the implications of the research and possible directions for further work.

### Contributions

This PhD thesis contributed to knowledge about data-driven citizen-centric practices ‘on the ground’ as well as provided recommendations for different groups of stakeholders based on in-depth analysis of community-based data initiatives in East Africa.

First, this PhD project collected substantive data from field research in practice within the varied contexts of East African urban communities. Field studies – interviews, focus groups and observations – provide case study examples of community initiatives, including how data were circulated and used. This knowledge contributed to more in-depth understanding on the function and form of these practices.

Second, these data and materials were analysed to provide the application of the data and to respond to the research questions of this PhD thesis.

Third, the researcher, being also an international development practitioner, considered the implications of the research findings for practical implementation of data-driven community-based initiatives in East Africa. This resulted in the recommendations provided at the end of this thesis, which give guidance for different stakeholder groups on what practically can be done to improve these practices in the context of East Africa.

Finally, the researcher, effectively working in the space of international development as the research project was progressing, was able to feed the findings from this PhD into the

conversations and settings where they could be directly applied. Through participation in practitioner-oriented events, such as Understanding Risk Tanzania 2019 Conference<sup>1</sup>, and through presentation of emerging findings at the Open Data Institute – internally and publicly – this PhD research was disseminated widely as it developed.

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<sup>1</sup> Understanding Risk Tanzania 2019 was a conference with the focus on urban resilience, organised by the World Bank's Tanzania Urban Resilience Program. Roza Vasileva provided inputs into the development of the conference agenda and moderated a session on Research, Innovation, and Partnerships for Resilience which centred on smart city innovations in Tanzania and other African countries: <https://www.worldbank.org/en/events/2019/10/02/urtz-2019#1>. Last accessed on January 10, 2022.

## Chapter 1. Smart cities and data

With the continuous trend of rapid urbanisation and a growing number of inhabitants in urban areas, modern cities have become centres for innovation and the employment of the newest technologies. This chapter looks at the phenomenon of the smart city and its rhetoric in current literature as well as how it relates to city data, and especially open data (data that are provided publicly for anyone to use for any purpose).

### 1.1. Smart city rhetoric

Despite the recent explosion of literature on smart cities, “*smart city ideas and technology are still very much in the development phase and investing in them poses a risk for city administrations charged with providing stability, certainty, and reliability in the delivery of city services*” (Kitchin *et al.*, 2017, p. 15). The smart city phenomenon is not new but has yet to be well-defined or grounded in empirical academic research. The term ‘smart city’ has been in use for over 20 years and is believed to have its origins in the ‘smart growth movement’ of the late 1990s, which advocated for new policies in urban planning. The idea behind smart growth was to “*facilitate a shift in values, priorities and perspectives from a narrow, short-term and often money-driven perspective, to a broader, more holistic and long-term view that embraces both the collaborative political processes and a spatial perspective*” (Herrschel, 2013, p. 2344). Some even believe that the ideas behind the smart city concept can be traced back to 1898 when the term ‘urbanism’ emerged (Veselitskaya, Karasev and Beloshitskiy, 2019, p. 86).

Since its inception, the ‘smart city’ concept has undergone extensive debate, specifically around the role and prioritisation of technology-driven solutions and the role of citizens in the smart city concept development and implementation. More recent interpretations of a ‘smart city’ place the needs of peoples and communities at the heart of sustainable development (Albino, Berardi and Dangelico, 2015). This new idea is often defined as a ‘sustainable and efficient’ city (Calvillo, Sánchez-Miralles and Villar, 2016). Vanolo (2014, p. 885) identifies this idea of a sustainable (or resilient) and intelligent city as the most recent phase of the ‘history of urban imaginaries’ (Vanolo, 2014, p. 885). The emphasis in this idea of a smart city is placed on connecting people, physical places and information to deliver a sustainable interconnected system where all the elements work together. Giffinger and Pichler-Milanović (Giffinger *et al.*, 2007) whose definition Vanolo (2014, p. 887) considers ‘the most reliable’ characterised a smart city through six major aspects: Smart Economy, Smart Mobility, Smart Governance, Smart

Environment, Smart Living, and Smart People. These smart city domains are presented in Figure 1-1.

<p><b>SMART ECONOMY</b> (Competitiveness)</p> <ul style="list-style-type: none"> <li>▪ Innovative spirit</li> <li>▪ Entrepreneurship</li> <li>▪ Economic image &amp; trademarks</li> <li>▪ Productivity</li> <li>▪ Flexibility of labour market</li> <li>▪ International embeddedness</li> <li>▪ <i>Ability to transform</i></li> </ul>	<p><b>SMART PEOPLE</b> (Social and Human Capital)</p> <ul style="list-style-type: none"> <li>▪ Level of qualification</li> <li>▪ Affinity to life long learning</li> <li>▪ Social and ethnic plurality</li> <li>▪ Flexibility</li> <li>▪ Creativity</li> <li>▪ Cosmopolitanism/Open-mindedness</li> <li>▪ Participation in public life</li> </ul>
<p><b>SMART GOVERNANCE</b> (Participation)</p> <ul style="list-style-type: none"> <li>▪ Participation in decision-making</li> <li>▪ Public and social services</li> <li>▪ Transparent governance</li> <li>▪ <i>Political strategies &amp; perspectives</i></li> </ul>	<p><b>SMART MOBILITY</b> (Transport and ICT)</p> <ul style="list-style-type: none"> <li>▪ Local accessibility</li> <li>▪ (Inter-)national accessibility</li> <li>▪ Availability of ICT-infrastructure</li> <li>▪ Sustainable, innovative and safe transport systems</li> </ul>
<p><b>SMART ENVIRONMENT</b> (Natural resources)</p> <ul style="list-style-type: none"> <li>▪ Attractivity of natural conditions</li> <li>▪ Pollution</li> <li>▪ Environmental protection</li> <li>▪ Sustainable resource management</li> </ul>	<p><b>SMART LIVING</b> (Quality of life)</p> <ul style="list-style-type: none"> <li>▪ Cultural facilities</li> <li>▪ Health conditions</li> <li>▪ Individual safety</li> <li>▪ Housing quality</li> <li>▪ Education facilities</li> <li>▪ Touristic attractivity</li> <li>▪ Social cohesion</li> </ul>

Figure 1-1: Six domains of smart cities assessment Framework (Giffinger et al., 2007, p. 12).

Each of these areas has a number of indicators, which Giffinger and Pichler-Milanović (Giffinger et al., 2007) offered as a methodology for ranking European medium-sized ‘smart’ cities based on indicators that fit this framework. This makes for quite a utopian list. The neoliberal language contained in aspects of ‘smart economy’ and ‘smart people’ in particular assume an appeal of permanent ‘disruption’ or revolution. The only outlier among these ideas that points towards a narrative of stability and investment is the last item in ‘smart living’ – ‘social cohesion’. ‘Social cohesion’ is defined by Larsen (2014, p. 2) as “*the belief held by citizens of a given nation-state that they share a moral community, which enables them to trust each other*”, which in Giffinger’s methodology is measured by two indicators: ‘perception of personal risk of poverty’ and ‘poverty rate’ (full methodology is available in Appendix 1). While neoliberalism is generally perceived as “*interested in increasing the overall level of wealth in an economy via market forces*” (Bates, 2014, p. 389), it has been criticised for driving inequalities globally. Equality however is not listed in the framework and is not measured as part of this ranking methodology. This brings us back to the questions of who holds power and who benefits from these ‘smart city’ schemes.

Since 2005, large technology companies such as Cisco and IBM have adopted the smart city concept and offered packaged solutions for governments to make cities smarter. In 2011, IBM

officially registered the trademark 'smarter cities' (Söderström, Paasche and Klauser, 2017). These companies championed the use of technology as the key component to provide "smart city" systems aimed at ensuring public safety and the technologically controlled operation of urban infrastructure and services, such as city planning, building maintenance, transportation, and the distribution of water and electricity (Harrison, C. and Donnelly, 2011). However, cities have been falling into the trap of buying costly technological solutions for smart cities offered by private companies, which despite being expensive have not delivered on their promises, and the return on investment has remained unclear (Kitchin *et al.*, 2017).

Many authors have attempted to define a smart city, but the field is complex and influenced by many disciplines. Based on an analysis of 116 existing definitions, the International Telecommunications Union (ITU) proposed the following definition of a 'sustainable' smart city: *"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects"* (UNECE-ITU, 2015, p. 3). It is worth noting that the ITU's definition adds 'sustainable', suggesting perhaps that a 'smart city' approach needs to have a focus – in this case on sustainability – which is the desired outcome of using 'smart' technologies. A closer look at this definition can pick up on some possibly contradictory goals to simultaneously improve 'quality of life', 'efficiency', and 'competitiveness'. O'Keeffe (2018) argues that efficiency, for example, is not inherently good in the public policy discourse, and in fact does not necessarily improve their people's quality of life or increase competitiveness.

Furthermore, to achieve efficiency gains in smart cities, Green (2019) claims that the public sector puts on 'tech goggles', where technology is perceived as intrinsically good and a value-neutral solution to complex social issues, which can be derived algorithmically, and serves as the main instrument for social change. Smart city hence has taken on a 'technologist' or 'solutionist' approach where deeper values and trade-offs tend to be ignored in favour of providing one clean solution – that is technology:

*"By conceptualizing urban issues as a technology problem, smart city ideologues lose sight of these issues' normative and political elements. In turn, they evaluate solutions along technical criteria (such as efficiency) and overlook the broader consequences"* (Green, 2019, p. 6).

While the most articulated benefits of smart cities are efficiency gains from the use of technology such as sensors and digital control systems, fixed and wireless networks, information management systems, real-time data analysis tool, etc. (Harrison, C. and Donnelly, 2011) it is unclear who benefits the most from smart city interventions, i.e., which socio-economic groups. Therefore, so often claimed as a key benefit of smart cities, 'efficiency' needs to be examined. It should be considered critically whose efficiency smart cities improve, and who benefits from this. Kitchin (2014) stresses that the neoliberal frameworks of 'smart city' put forward by large business corporations and governments, and conceptualised in current literature, lead to "*an inevitable tension within smart cities between: serving global, mobile capital and stationary ordinary citizens; attracting and retaining an elite creative class and serving other classes; and top-down, corporatized, centralized development and bottom-up, grassroots, decentralized and diffuse approaches*" (Kitchin, 2014, p. 2). While citizen participation is considered one of the key indicators of urban sustainability (Science for Environment Policy, 2018; Winter, 2018), how much citizens are able to take part in the development of smart cities and benefit from them continues to be questionable.

Gil-Garcia, Pardo, and Nam (2015) conducted an extensive review of available definitions of a smart city and identified the following common features between many of them, which are in line with the definition proposed by the ITU: (1) technology; (2) critical infrastructures; (3) better services for the population; (4) integration of systems and infrastructures; and (5) vision for a better future. This notion of 'forward-looking' underpins many of the definitions, as well as sustainability and liveability. Country-specific characteristics including economic development goals and the political agenda also influence the 'smartness' of its cities, including how smart policies are designed and implemented (Neirotti *et al.*, 2014).

Vanolo (2014, p. 4) concludes that the 'smart city' is "*a generic and optimistic concept for the city of the future*" with no "*suitably widespread definition*". In a sense, a smart city could be considered a 'boundary object' to establish a general understanding among different communities of practice and academic disciplines without a clear single definition. Boundary objects are "*those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them*" (Bowker and Star, 2000, p. 16). In the city, there are many stakeholders who use the smart city to address their needs. There are certain relations among these actors, and individuals sometimes simultaneously belong to several groups with conflicting interests (Cohen, Almirall and Chesbrough, 2016). For example, government officials are at the same time citizens and equal users of public spaces (Watson, 2009).



Although more recent interpretations of a ‘smart city’ highly emphasise people’s and communities’ needs as well as sustainable development (Albino, Berardi and Dangelico, 2015), digital technologies and tools continue to characterise smart cities (Pereira *et al.*, 2017). In this context, data as a ‘fuel’ for smart city technologies, applications, and solutions play an important role in smart city discourse and will be discussed in the next section.

Most digital technologies, including smart city models, tools and strategies, are produced by and for populations of Global North and reflect their digital practices and politics (Young, 2019), so they do not fit the reality and context of the Global South and particularly African cities (Watson, 2015). The development of new digital practices and models, which would work for the Global South, will require “*stronger inclusion of postcolonial thinking within ICT for development (ICT4D) interventions to facilitate the exploration of new, critical questions*” (Young, 2019, p. 1425). Further discussion of ICT4D is provided in Section 2.4.

## 1.2. Data-driven cities

City governments produce, collect, and use a great deal of data internally. Data-driven solutions are at the heart of most if not all present smart city development strategies and action plans: “*The data-driven city is one of the recent faces and future forms of smart cities*” (Bibri and Krogstie, 2020, p. 4). As city governments have discovered, the data they collect from various transactions offer important insights that can transform their operations and make them more efficient. For example, combining historic traffic data with the ‘real-time’ movement of vehicles gathered from road tolls can help to prevent congestion. It can also enable better coordination between agencies, for example in times of crisis. The book *The Responsive City* (Goldsmith and Crawford, 2014) provides several cases from the US where city managers were able to transform critical city services through the use of data.

The Merriam-Webster dictionary defines *data* in the following ways: (i) *factual information (such as measurements or statistics) used as a basis for reasoning, discussion or calculation*; (ii) *information in digital form that can be transmitted or processed*; and (iii) *information output by a sensing device or organ that includes both useful and irrelevant or redundant information and must be processed to be meaningful*. For a smart city, which uses digital tools to draw insights from city data, the following components are key to the definition: ‘*factual information*’, ‘*in digital form*’, and ‘*must be processed to be meaningful*’.

City data take on many forms, from audits and cartographic surveys to remote sensing and photographs, that could be quantitative and qualitative and through the use of the tools of

interpretation provide information and knowledge about the cities: “As such, urban data form a key input for understanding city life, solving urban problems, formulating policy and plans, guiding operational governance, modelling possible futures, and tackling a diverse set of other issues” (Kitchin, 2015, p. 2). Kitchin (2015) notes that since the 1980s official urban data were generated mostly digitally, more recently through e-government services portals, and processed using digital means. Although this could be the case for the cities in the Global North, urban data in the less developed regions likely continued to be collected manually in many instances (Martin, 2014). In addition to official government data, smart cities can collect data through various technologies, including the Internet of Things (IoT), internet-connected infrastructure, social media. Figure 1-2 presents different sources of smart city data.

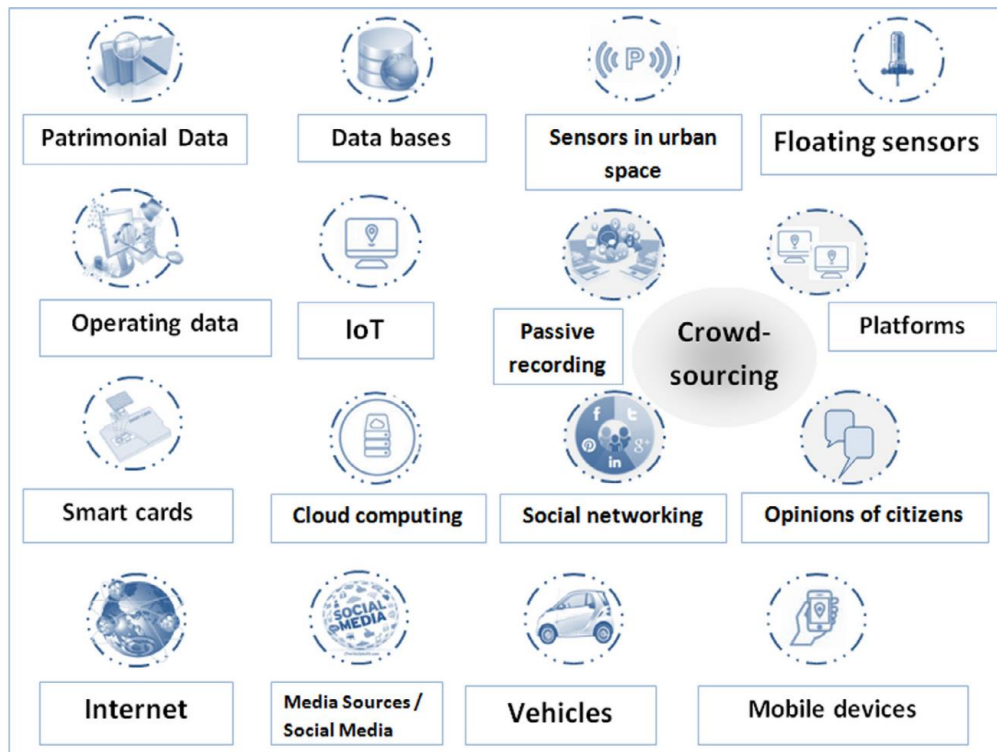


Figure 1-2: Typology of information sources in smart cities (Sta, 2017, p. 412).

Since the 2000s, the production of urban data shifted from small data to big data in a number of city domains, especially operational data where city infrastructure became ‘digitally networked’, e.g., transport and utilities (Kitchin, 2015). This shift led to increasing the wealth and accessibility of urban data. “Data-driven, networked urbanism [...] is the key mode of production for what have widely been termed smart cities” (Kitchin, 2015, p. 1). The use of big data analytics is often considered a critical component of smart city applications and solutions.

'Big data' are "*massive, dynamic, varied, detailed, inter-related, low-cost datasets that can be connected and utilised in diverse ways*" (Kitchin, 2014, p. 3) especially in the context of smart cities. Traffic camera feeds, city-wide sensor networks, and local government management systems, to name a few, are the sources of big data, which when used with algorithms, data integration and analytical tools enable real-time city monitoring and surveillance.

The ability to gain insights from the streams of big data has been named 'big data analytics', which use machine learning techniques and algorithms to make decisions and predictions about any city activity or event "*subjecting relations and flows within the urban environment to a dispassionate, calculative and expansive gaze*" (Smith, 2020, p. 7).

*"The technologies, platforms and processing codes are idealised in celebratory, abstract and reductionist terms, with the city presented as being more intelligent, responsive, efficient, innovative, democratic, safe and resilient as an outcome of its 'smartification'"* (Smith, 2020, p. 1). While having these data-enabled insights is considered useful for understanding cities, their use for urban management and governance has raised a number of concerns in recent literature and should be critically evaluated. For example, Smith (2020) discusses how these 'machinic' approaches create a 'black-box city' and asserts that "*... the highly abstract nature of algorithmic governance makes it hard for publics to comprehend, let alone verbalise, how they are being dominated through these techniques*" (Smith, 2020, p. 7).

Like with other previous technologies adopted by government, big data analytics provides massive power to those who are in charge of them, which limits the rights to privacy of regular citizens (Smith, 2020). While artificial intelligence (AI) tools are used for processing big data to make decisions about citizens' lives in smart cities daily, citizens are provided no information regarding how such algorithms are developed and deployed. There are growing concerns about the degree of accuracy, and hence potential bias and discrimination of the algorithmic approaches used in public service (Dencik *et al.*, 2019). Even if these AI solutions could be more accurate, the way they are developed and employed "*contribute to the creation of unaccountable black-box cities*" (Green, 2019, p. 9) where "*Big Data is seen as a troubling manifestation of Big Brother, enabling invasions of privacy, decreased civil freedoms*" (Boyd and Crawford, 2012, p. 664). This leads to an important question in smart cities: who gets to decide which data are collected and how they are used, and for whose benefit?

Data collected from individuals, accumulated automatically from numerous sources and streamed into a single 'panoptic vantage point' include private and potentially sensitive information. If hacked and leaked, such data used by an unauthorised party could lead to harmful

consequences, and this creates tensions between effective urban governance and citizens' right to privacy (Kitchin, 2014). In light of the global COVID-19 pandemic, the use of big data, enabling functions such as facial recognition by governments in some countries for checking the violations of quarantine restrictions and contact tracing for monitoring the spread of the infection, has deepened these fears (Bengio *et al.*, 2020; Ramos, 2020).

While people's privacy concerns regarding smart city technologies require a closer look and further empirical studies (van Zoonen, 2016), the promise of more effective and efficient management of the cities, which in turn provide better public services and more liveable cities, has been greasing the wheels of smart city marketing (Dirks and Keeling, 2009). Besides, the introduction of the General Data Protection Regulation (GDPR) in the European Union (EU) in 2018 aimed to address these concerns by "*elevating individuals' right to access and control use of their personal data*" (Goddard, 2017, p. 705). Privacy concerns related to the use of personal data for smart cities seemed a lot less common in the Global South than in the European countries (McKinsey, 2018).

These debates surround the use of data that are hidden from the eyes of a regular citizen and employ techniques that outsiders cannot comprehend. However, city governments and other city data producers also provide public data relevant to people's lives, e.g., on energy, transport, housing, pollution, including big and real-time data. In the literature, providing data publicly online and enabling open access, use or sharing (definition of open data by the Open Data Institute) is often connected with the potential to empower communities to drive sustainable development in cities and "*transform the public realm and the way we live and interact in urban areas*" (Hemment and Townsend, 2013, p. 1). The next section discusses the concept and benefits of open data for cities.

### 1.3. Open data in an urban context

As discussed in the previous section, city governments produce, collect, and process large volumes of data internally and have begun to publish 'open data', thus making data accessible online for anyone to use, re-use and share. The World Bank emphasises that data can only be considered 'open' when it is provided for free in machine-readable format (technically open) under

an open license, which permits the use and re-use for any purpose including commercial and informs the users under what condition they can use these data (legally open)<sup>2</sup>.

Modern connectivity and technology options made it easy and economical to collect, manage and share data with a wide range of external data users, which could be potentially useful (Harrison, Pardo and Cook, 2012). This assumption could be fair for the Global North, however, most countries in the Global South still did not enjoy the same level of connectivity and technological advances. Only 28 per cent of Africa’s urban households were connected to the Internet in 2019, and that figure drops to 6 per cent in rural areas (ITU, 2020).

Open data can include government and non-government data (from private sector companies, research institutions, and other stakeholders) and only a portion of open data are big data (see Figure 1-3).

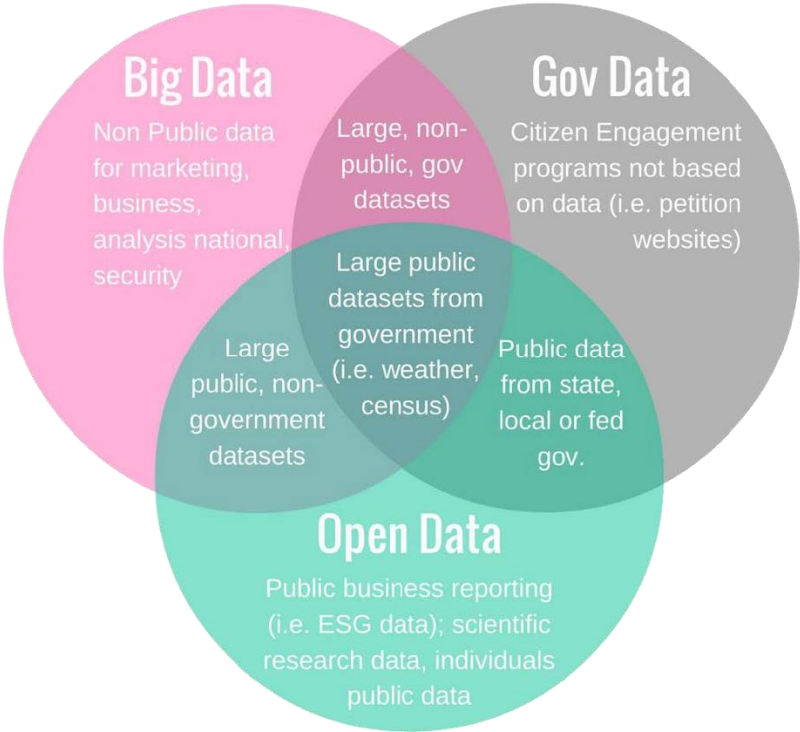


Figure 1-3: Diagram showing relations between government data, open data and big data (Szegedi, no date, p. 14).

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<sup>2</sup> Full definition of open government data is available at the World Bank’s Open Government Data Toolkit at: <http://opendatatoolkit.worldbank.org/en/open-data-in-60-seconds.html>. Last accessed on December 4, 2020.

Open government data have been claimed to have a direct link to open innovation, i.e., innovation based on “*an open boundary between an organisation and its surrounding environment such that innovative endeavours can interweave across the boundary*” (Chan, 2013, p. 1891). In other words, opening government data can help drive innovations outside the government involving various groups of stakeholders, especially in cities where the uses of city data can help create tangible outcomes for local communities (Walravens, Breuer and Ballon, 2014; McKinsey, 2018). Various stakeholders could use open data to address issues, for which they advocate and create solutions to city challenges. For example, the Housing Data Coalition<sup>3</sup> in New York uses public data for online tools available to New Yorkers to eliminate housing discrimination and to further housing justice.

The Deloitte study (2017) on the open data platform of Transport for London (TfL) conveyed impressive numbers for the uses of open data. TfL publishes over 80 data feeds, including real-time bus feeds, Oyster Card data, cycling routes. These open data are used in over 600 apps, with over 12,000 registered developers. The report stated that 43% of Londoners use these apps, 83% have used data on websites, which could indicate highly engaging and usable open data, which improve the commute experience of millions of Londoners every day (Deloitte, 2017).

Concerns regarding security and privacy of data as discussed in Section 1.2 arise about open data as they do about other data used in smart cities, albeit at a much more reduced scale. As the advocates of open data clarify, open data are already available to anyone, so it is hard to compromise these data by giving them to any ‘unwanted’ party – anyone can use it for any purpose. Only non-personal or properly anonymised data should be released as open data. Consider Figure 1-4, which demonstrates a range of different types of data access on a spectrum from closed to open, with examples of datasets – only data on the right end of the spectrum qualify to be published openly. The examples could be transportation schedules, weather forecasts, location of city facilities, etc.

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<sup>3</sup> Official website of the Housing Data Coalition, New York: <https://www.housingdatanyc.org>. Last accessed on February 6, 2021.

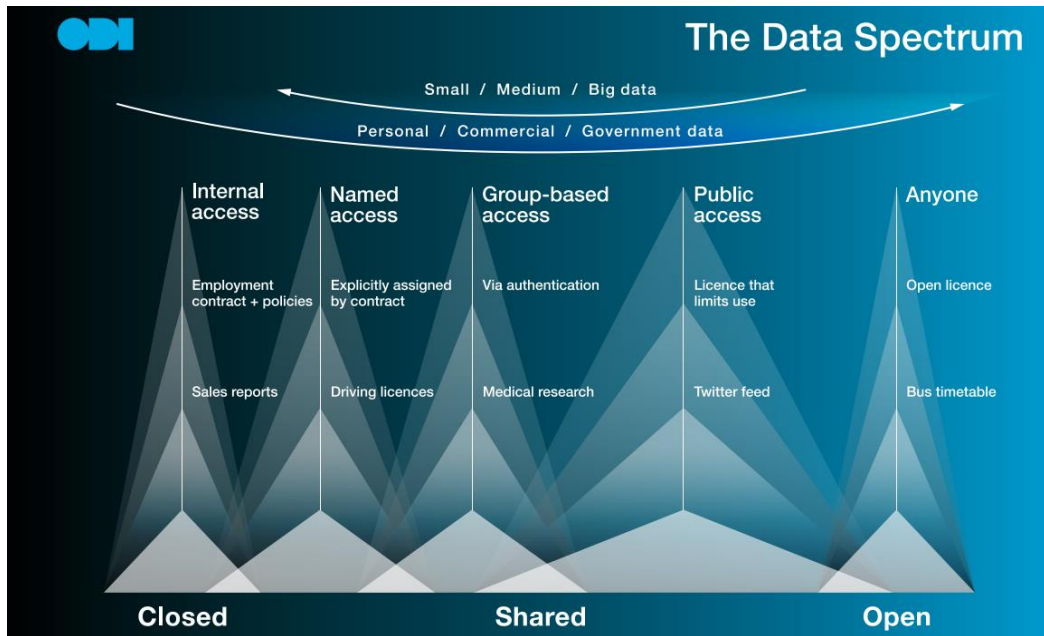


Figure 1-4: The data spectrum (The Open Data Institute, 2020, p. 6).

What data are being collected and how things and people are 'counted' depend strongly on who collects these data (Martin and Lynch, 2009). However, when we talk about open government data it is understood that data that are being published were collected for specific government functions. As long as the detailed metadata with clear specifications of what datasets include are enclosed with the data published and open data standards are used, it is considered useful for the community to have access to these data. Outside actors and community members can generate new insights by looking at the same data that the government uses. Generating new and useful ways to apply data that were collected as part of government activities are considered the essence of open and data-driven innovations (Hemerly, 2013; Smørdal *et al.*, 2016).

One of the issues is that city data related to its operations, which is often the bulk of open data, are generated and made available periodically, sometimes months and years after being collected (Kitchin, 2015). Providing highly relevant and timely data is a constraint that city governments face, and if coupled with a lack of enthusiasm to support an open data initiative, could hinder the efforts to derive a wide range of benefits open data could offer (UN-GGIM, 2020).

For an open data programme to become successful, the World Bank describes an 'ecosystem' approach, where the engagement with the 'demand' side of open data, or the potential users of data, is one of the critical success factors (World Bank, 2015). An open data

portal similar to other e-government services cannot presume that “if you build it, they will come” (Chan, 2013, p. 1896). Figure 1-5 presents an ecosystem for city data production and data exchange between government and civil society. This framework was developed based on a case study of a partnership with multiple city and regional agencies in Atlanta aimed at transforming Atlanta’s transportation system.

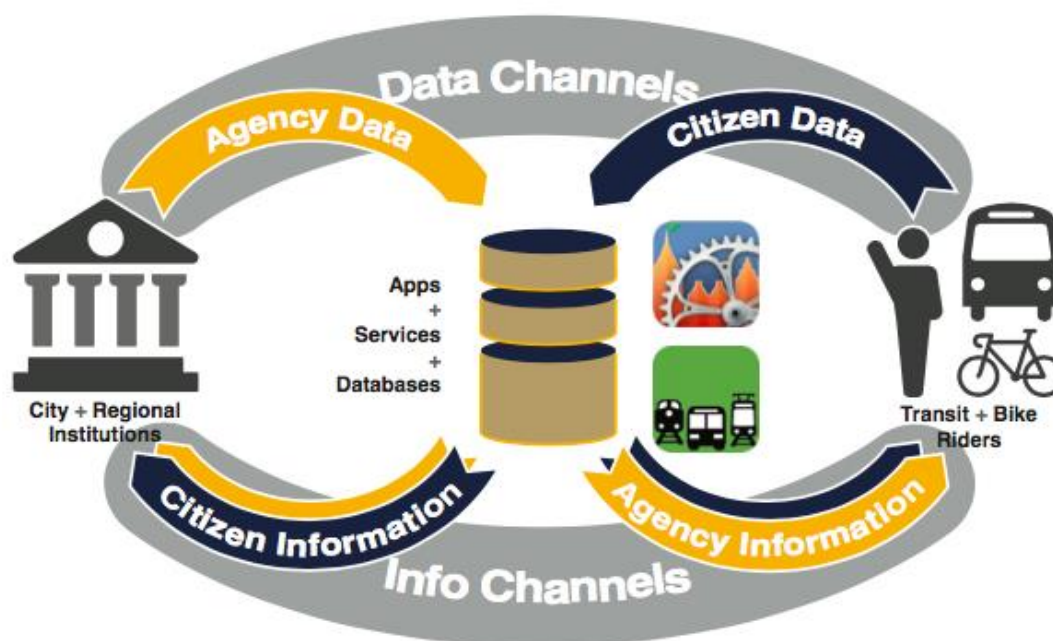


Figure 1-5: Civic data ecosystem where data production and information consumption are in a constant exchange between local institutions and the public (Le Dantec et al., 2015, p. 329).

This type of data exchange assumes that local governments are open to collaboration and co-creation with the public and private sector of services, which were traditionally provided by the public sector. This creates certain transitions between the ‘bottom-up’ demands and the existing governance structure (more about ‘bottom-up’ and ‘top-down’ approaches will be discussed in the next chapter in Section 2.2.1). City bureaucracies, which are used to provide public services, and the politicians seeking to regain political support, find it difficult to re-adjust towards such collaboration. Creating and maintaining an open city ecosystem supported by digital data also requires from the government new skills and processes, which are sometimes absent or are in conflict with the ‘old’ ways (Cohen, Almirall and Chesbrough, 2016).

For open data to create the benefits that are associated with data sharing, use and re-use, they cannot be separated from the governance model (Harrison, Pardo and Cook, 2012). ‘Open’ is key in the discussion on the Web 2.0-inspired transformations in society – as in ‘open



data' or 'open platform'. In the US, 'Government 2.0' was adopted to describe a new era of government beyond the information age. In Korea, the conversation shifted to 'Government 3.0' as the next stage of a governance model that cultivates 'open' culture "*where citizens not only have access to information, documents, and proceedings, but can also become participants in a meaningful way*" (Harrison, Pardo and Cook, 2012, p. 902).

Using smart cities as a platform for open innovation where open data provide new opportunities for civic engagement is considered a relatively recent concept, with only a few cities able to implement it (Mainka *et al.*, 2016). This is what Cohen, Almirall, and Chesbrough (2016, p. 7) call "*a new breed of smart cities*". Existing literature demonstrated that the availability of open government data is a key enabler of urban innovations (Stephenson, Di Lorenzo and Aonghusa, 2012; Bakici, Almirall and Wareham, 2013; Baccarne *et al.*, 2014), and is considered a "*defining element of smart cities*" (Ojo, Curry and Zeleti, 2015, p. 2327).

While open data are expected to help increase citizen participation and collaboration, and "*may be the best transition so far of the platform model to Smart Cities*" (Cohen, Almirall and Chesbrough, 2016, p. 10), there is not enough evidence that these initiatives actually result in increased public engagement. Despite the expectation that open data would help generate new apps and innovative solutions to urban challenges, there are "*surprisingly few tangible examples of companies who have successfully leveraged a city's open data platform to generate profitable applications or related services*" (Cohen, Almirall and Chesbrough, 2016, p. 10). Several possible reasons could explain the lack of expected outcomes from an open data programme, including low engagement of potential data users or lack of relevant data.

#### 1.4. Conclusions

Modern cities are inspired by the idea of 'smart' as a way to achieve their goals and find solutions to pressing urban challenges, primarily through the use of technology and data. This chapter outlined the concept of a smart city, looking at various definitions and challenges presented in the literature with regards to smart city rhetoric. The role of data and open data in the 'smartification' of cities was also described. As no consensual definition of smart cities exists, this PhD research attempted to determine meaning for the concept as it was conferred in data-driven projects in East Africa.

The abundance of digital data has created various ways that data are used to achieve 'smartness'. Big data analytics as a way to improve a city's efficiency and the effectiveness of city services have become critical in a conversation around smart cities. However, the literature

specifies a number of risks when using this approach, including the lack of accountability and insights into what these analytics do with the data and how this impacts citizens, as well as a significant shift of power towards those who design and implement these solutions – the government. Open data are positioned as a more citizen-oriented approach to a smart city as it relies on communities to co-create solutions to improve cities using data.

Smart cities as a concept “*may do good, but we have little detailed understanding of why. Smart Cities is a field in want of a good theoretical base*” (Harrison and Donnelly, 2011, p.6). Turning to algorithmic approaches to manage cities can overlook the complex social and political contexts and issues, which leads to questioning whom these smart city solutions serve. If in the case of the Global North some (though not always empirically supported) smart city case studies have been accumulated, and some theoretical frameworks have begun to emerge, there is little to no academic literature that takes a detailed look at specific cases of using data for urban development in the cities of the Global South. Some assumptions, as a prerequisite for smart approaches such as advanced connectivity and technology options and systematic digital data collection by the public sector, might not be justified for those countries. There is an acute need within an academic discourse to take a close look at data-driven urban initiatives in low-income countries. In doing so, it is necessary to conduct an empirical analysis of these initiatives by deconstructing the processes that take place including collaboration and power dynamics between the city stakeholders and understanding which data are being used and how.

One of the promises of a smart city is that citizens will be at the heart of urban agendas and provide inputs into their development. While citizens play an important role in achieving urban sustainability, the literature demonstrates otherwise for smart cities thus far. The next chapter will focus on citizen engagement and participation in cities, and how digital technologies and data are used to support urban communities in making their cities ‘smart,’ especially what it looks like in the Global South.

## Chapter 2. Cities and their citizens

This chapter looks at what role citizens play in their cities and brings in the perspective from the cities in the Global South, where international aid actors often promote and shape the participation and innovation agendas, including in urban development.

As defined by the ancient Greeks, the city (“polis”) was the place marked for conducting ‘communal affairs’ (Vernant, 1990, p. 52). Building an engaged community and maintaining a sense of community is a major challenge that modern cities face, and it needs to be addressed in public policies and government practices (Perkins and Long, 2002). This community engagement forms what Putnam (1995) refers to as ‘social capital’, i.e., “*features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit*” (Putnam, 1995, p. 2). Changing urban demographics and growing individualization (Putnam, 2016), which characterise modern big cities, may make this task more challenging. Putnam (1995, p. 2) in fact argues that the increased mobility of people and the technological advances that have set ‘privatizing’ trends are in part responsible for the decline in ‘civic engagement and social connectedness’ in America in the last several decades. In this light, community engagement has been claimed a key priority for the city governments as they design ‘smart city’ documents and programmes to address urban issues. Hence, user-centred approaches to smart cities have started to emerge, often proclaiming a shift from ‘for’ to ‘with’ the citizens. However, there is a diversity of views within the smart city’s ‘epistemic communities and advocacy coalitions’ on the role of citizens in shaping and driving smart city solutions (Kitchin *et al.*, 2017, p. 15), and hence what benefits smart city interventions bring to the people.

### 2.1. Citizen engagement and participation

Urban development specialists around the world have long been engaged in a debate on the role of citizens in addressing pressing urban issues. “*The freedom to make and remake our cities and ourselves is [...] one of the most precious yet most neglected of our human rights*” (Thomas *et al.*, 2016, p. 8). Thomas *et al.* (2016) argue that ‘people’s right to their city should be a strong motivation for citizen engagement. This right is not individual but common, and therefore should be “*based upon the collective exercising power in the processes of urbanization*” (Thomas *et al.*, 2016, p. 8). “*Citizens can, and should, play a leading role in conceiving, designing, building, maintaining our cities of the future*” (Hemment and Townsend, 2013, p. 2). Unfortunately, this has not yet been the case.

Citizen engagement has become a duty that is required to legitimise government projects,

and yet the processes of public consultations are not a standard element of new government measures. Government projects are often seen as illegitimate if they do not include forms of citizen engagement such as consultations, surveys, ‘town hall’ events, or citizen panels. For example, in the United Kingdom (UK), the ‘Duty to Consult’ local residents, businesses and third sector organisations on council services is a statutory requirement that all municipalities must fulfil (Davies and Simon, 2013).

The academic and business literature on citizen engagement or “*the processes by which public concerns, needs, and values are incorporated into decision-making*” (Nabatchi, 2012), together with the use of digital platforms for participatory decision-making, has produced a large number of models and typologies for citizen participation in governance. To some extent, each of them described a spectrum of engagement, from provision of information (or services) to the people (one-way communication), to full engagement with partnership-like exchange and collaboration between government and citizens and community groups (Aulich, 2009; Chun *et al.*, 2010). An example of such typology and how it applied to the concept of ‘smart city’ is discussed in the next section.

It should also be noted that the realisation of public participation is ‘context specific’ and the “*institutionalisation [of participatory processes] cannot be taken for granted, representing an issue that matters, especially in transitional national systems and in emerging countries*” (Maiello *et al.*, 2013, pp. 167–168). The use of participatory approaches in international development is discussed further in Section 2.3.

## 2.2. The role of citizens in smart cities

Digital technologies have become popular for city administrations also for the reason that they are easier to manage and maintain. Therefore, governments readily accepted the new paradigm of public administration ‘digital by default’ (Yates, Kirby and Lockley, 2015; Corydon, Ganesan and Lundqvist, 2016), which gives rise to some critical questions about the appropriation of some of these methods. While it makes it easier to manage and helps the city government to run a city from the administrative point of view, without robust civil society mechanisms and institutions, “*smart city systems may actually contribute to the securitization and fragmentation of urban space, exacerbating socioeconomic and political divides*” (Gaffney and Robertson, 2016, p. 2).

“*The adoption of technology plays the role of a catalyst for driving different government projects to success, but not as a goal itself*” (Aldama-Nalda *et al.*, 2012, p. 290). This links to the

ITU's definition of a sustainable smart city provided in Section 1.1, and the need to identify a goal which the city aims to achieve by being 'smart'. City officials interviewed for the study of four smart cities in the US, Canada and Mexico conducted by Aldama-Nalda et al. (2012) perceived the use of information as the key element of a smart city that enables a range of benefits, including citizen participation, that can ultimately make a city more liveable. Caragliu et al. (2011) stress that information and communications technologies (ICTs) should not encompass the entire definition of a smart or intelligent city but on the contrary, there must be room for the role "*of human capital and education in urban development*" (Caragliu, del Bo and Nijkamp, 2011, p. 3). Moreover, "*technological solutions on their own are not going to solve the deep-rooted structural problems in cities as they do not address their root causes*" (Kitchin, 2014, p. 9).

While the exact definition and meaning of a smart city has been debated in the literature, in a broad understanding, smart cities "*imply the utilization of ICT in urban management and serving citizens*" (Lee and Lee, 2014, p. 2). Serving the needs of people and communities is considered a critical factor of a smart city across various definitions, especially in the most recent ones. In many instances, however, the use of digital technology in a smart city project is limited to simply responding to the individual needs of a specific user and to be more user-friendly: "*the smart city is required to adapt itself to the user needs and to provide customized interfaces*" (Nam and Pardo, 2011, p. 283). As a response to this trend, Chourabi et al. (2012) urge city administrators to rethink these individualistic means in a smart city context and "*not to refer to members of the city only as individuals, but also as communities and groups and their respective wants and needs within cities. Citizens and communities are a component that requires smart city initiatives to be sensitive in balancing the needs of various communities*" (Chourabi et al., 2012, p. 2293).

'Bottom-up' innovations, i.e., initiatives run by citizens and community groups as opposed to government-led 'top-down' initiatives (this is discussed in more detail in Section 2.2.1) and collaboration coupled with leveraging data at all stages starting from problem identification could potentially drive the development of smart city interventions: "*focus on the central place of citizens in smart city design can open up new possibilities for alignment and progress heretofore unseen*" (Hemment and Townsend, 2013). While the terms 'citizen-centric' or 'people-centred' often accompany the discourse around smart cities, the literature tends to ignore the voices of those who live and experience cities when it comes to smart transformation of urban spaces (Thomas et al., 2016). "*Only inclusive and active participation from different user groups can creatively identify and co-create urban proposals to transform local neighborhoods*" (Khan et al., 2017, p.

3).

Whereas smart cities have claimed to provide a more 'citizen-centric' approach to urban development than other forms of cities, community needs have been "*traditionally neglected on the expense of understanding more technological and policy aspects of smart cities*" (Chourabi *et al.*, 2012, p. 2293). They continue that "*most smart cities have an impact on the quality of life of citizens and aim to foster more informed, educated, and participatory citizens*". Technologies employed in smart cities initiatives are claimed to allow citizens "*to participate in the governance and management of the city and become active users*" (Chourabi *et al.*, 2012, p. 2293). Such technologies may enable citizens to be more informed, participatory and to become more active users, but the citizen-centric approach typically only relates to the actual services and treats citizens as customers (Lee and Lee, 2014) rather than offering ways for communities to be engaged and understood.

London is considered one of the top smart cities in the world according to the Smart City Index 2021 (Institute for Management Development, 2021) – the list of the top 50 smart cities featured in the ranking is presented in Figure 2-1. Thomas *et al.* (2016), when interviewing London city dwellers to learn their perception of the term 'smart city', found that the majority of interviewees did not know what a smart city was and "*they found the phrase to be distant, obscure and abstract*" (Thomas *et al.*, 2016, p. 10), which further suggests that the smart city concepts do not trickle down to the citizens in a way that people can relate to, understand and ultimately participate in shaping the smart city vision. Also, people interviewed for the study expressed concerns "*with the role digital technologies might play in future smart cities, privacy, the interconnectedness of multimodal transportation services, and community*". These "*nuanced and at times conflicting perspectives and demands*" of citizens on a smart city, for example the demand to enhance personalised services while at the same time voicing concern for the privacy of their data, the authors of the London study believe "*can be used to inform responsible development, spatially and socially inclusive technologies, and ultimately more resilient cities*" (Thomas *et al.*, 2016, p. 8).

Smart City Rank 2021	City	Smart City Rating 2021	Structure 2021	Technology 2021	Smart City Rank 2020	Change
1	Singapore	AAA	AAA	AAA	1	—
2	Zurich	AA	AAA	A	3	▲ +1
3	Oslo	AA	AAA	A	5	▲ +2
4	Taipei City	A	A	A	8	▲ +4
5	Lausanne	A	AAA	A	NEW	—
6	Helsinki	A	AA	A	2	▼ -4
7	Copenhagen	A	AA	A	6	▼ -1
8	Geneva	A	AA	A	7	▼ -1
9	Auckland	A	A	A	4	▼ -5
10	Bilbao	BBB	A	BBB	24	▲ +14
11	Vienna	BBB	A	BB	25	▲ +14
12	New York	BBB	BB	BBB	10	▼ -2
13	Seoul	BBB	B	A	47	▲ +34
14	Munich	BBB	AA	BBB	11	▼ -3
15	Zaragoza	BBB	A	BB	48	▲ +33
16	Brisbane	BBB	A	BBB	14	▼ -2
17	Amsterdam	BBB	A	A	9	▼ -8
18	Sydney	BBB	BBB	A	18	—
19	Melbourne	BBB	BBB	A	20	▲ +1
20	Dusseldorf	BBB	A	BBB	13	▼ -7
21	Newcastle	BBB	A	BBB	23	▲ +2
22	London	BBB	BBB	A	15	▼ -7
23	The Hague	BBB	A	BBB	28	▲ +5
24	Leeds	BBB	BBB	A	NEW	—
25	Stockholm	BBB	A	BBB	16	▼ -9
26	Manchester	BBB	BBB	BBB	17	▼ -9
27	Rotterdam	BBB	BBB	BBB	29	▲ +2
28	Abu Dhabi	BB	BB	BB	42	▲ +14
29	Dubai	BB	BB	BB	43	▲ +14
30	Riyadh	BB	B	BB	53	▲ +23
31	Los Angeles	BB	BB	BBB	26	▼ -5
32	Bordeaux	BB	BBB	BB	NEW	—
33	Vancouver	BB	BBB	BB	19	▼ -14
34	Madrid	BB	B	BBB	45	▲ +11
35	Washington D.C.	BB	BBB	BB	12	▼ -23
36	Toronto	BB	BBB	BB	30	▼ -6
37	Busan	BB	B	BBB	46	▲ +9
38	Montreal	BB	BBB	BB	21	▼ -17
39	Lyon	BB	BB	BB	51	▲ +12
40	Hamburg	BB	A	BBB	22	▼ -18
41	Hong Kong	BB	BB	A	32	▼ -9
42	Tel Aviv	BB	B	BB	50	▲ +8
43	Seattle	BB	BB	BB	37	▼ -6
44	Lille	BB	B	BB	NEW	—
45	Denver	BB	BB	B	35	▼ -10
46	Gothenburg	BB	BBB	BBB	31	▼ -15
47	Hanover	BB	A	BB	33	▼ -14
48	Dublin	BB	BB	BBB	34	▼ -14
49	Glasgow	BB	BB	BBB	NEW	—
50	Berlin	BB	BBB	BB	38	▼ -12

Figure 2-1: Top 50 smart cities in the Smart City Index 2021 (Institute for Management Development, 2021, p. 9).

In many cases, many of the key architects of smart city development tend to view the very citizens of these cities as either another element of a smart city, or even worse, as a possible obstacle to the acceptance of smart city design plans. Moreover, *“the epistemic communities and advocacy coalitions coalescing around the field of smart cities seem to little appreciate the need for democracy, openness and public consultation in city management: mostly executive decisions are made outside of democratic process and city managers green-light smart city projects with little political, media or public oversight or feedback”* (Kitchin et al., 2017, p. 18). For example, Kitchin et al. (2017) argue that in the case of Smart Dublin neither politicians nor the public have been consulted in the development and launch of smart city initiatives. Examples of smart city initiatives in Dublin and other cities are presented in Table 2-1. More examples of smart projects in Dublin are presented in Figure 2-2.

Table 2-1: Examples of smart city initiatives in the Global North.

City, Country	Initiative	Description
Dublin, Ireland	<b>Smart Dublin</b> <a href="https://smartdublin.ie">https://smartdublin.ie</a>	Run by the four Dublin Local Authorities, Smart Dublin aims ‘to bring together technology providers, academia and citizens to transform public services and enhance quality of life’. Smart Dublin platform includes an open data portal – Dublinked.
London, UK	<b>The London Datastore</b> <a href="https://data.london.gov.uk">https://data.london.gov.uk</a>	The London Datastore is a free and open data-sharing portal where anyone can access data relating to London City. The site provided over 700 datasets to help understand the city and develop solutions to London’s problems.
New York, USA	<b>BigApps NYC</b> <a href="https://www.bigapps.nyc">https://www.bigapps.nyc</a>	BigApps is a regular civic innovation competition in New York City that provided an opportunity for designers, developers, academics, entrepreneurs to participate in creating solutions that use city agency data to improve the city. The competition relied on the NYC open data portal, which published over 1,600 datasets on a wide range of urban issues.
Seoul, South Korea	<b>Seoul Open Data Plaza</b> <a href="http://data.seoul.go.kr">http://data.seoul.go.kr</a>	Seoul adopted a “citizens are mayors” approach, in which citizens have access to the same data as the mayor in real time to make decisions about their daily activities. Since 2012, Seoul Open Data Plaza provided citizens public access to more than 5,000 datasets, including sensor data in real-time. It has registered billions of views and led to the creation of 200 apps.
Singapore	<b>Smart Nation Singapore</b>	Since 2014, Smart Nation Singapore initiative has introduced a wide range of smart technologies in public and private sectors. This includes for example a Smart Nation Sensor Platform, which uses sensors nationwide to collect essential data on water, air quality, rainfall, footfall and more to create smart solutions.



The literature on smart city technologies demonstrates that citizens have been left out of their design, and were treated as consumers at best (Lupton, 2020). Consider the strategy statement of Bari smart city, for example: "*The primary goal ... is to inform, involve and mobilise the community, residents, associations and public and private organisations, in order to develop an effective action plan in co-operation with the European Commission... To build a smart city, we need citizens capable of inventing a new world*" (Vanolo, 2014, p. 893).

Cardullo and Kitchin (2017) reworked Arnstein’s ladder of citizen participation to create a ‘scaffold of smart citizen participation’ to understand how citizens are framed within smart city initiatives and to provide a tool to evaluate the extent to which a smart city initiative is citizen-centric. The scaffold is presented in Figure 2-2 below.

Form and Level of Participation		Role	Citizen Involvement	Political discourse/ framing	Modality	Dublin Examples
Citizen Power	Citizen Control	Leader/ Member	Ideas, Vision, Leadership, Ownership, Create	Rights, Social/Political Citizenship, Deliberative Democracy, Commons	Inclusive, Bottom-up, Collective, Autonomy, Experimental	Code for Ireland, Tog
	Delegated Power	Decision-maker, Maker				Civic Hacking, Hackathons, Living Labs, Dublin Beta
	Partnership	Co-creator	Negotiate, Produce			
Tokenism	Placation	Proposer	Suggest	Participation, Co-creation	Top-down, Civic Paternalism, Stewardship, Bound-to-succeed	Fix-Your-Street, Smart Dublin Advisory Network
	Consultation	Participant, Tester	Feedback	Civic Engagement		CIVIQ, Smart Stadium
	Information	Recipient				Dublinked, Dublin Dashboard, RTPI
Consumerism	Choice	Resident	Browse, Consume, Act	Capitalism, Market, Neoliberalism		Smart building/ Smart district
		Consumer				Smart meters
		Product				Personal data generated by tech
Non-Participation	Therapy	Patient, Learner, User, Data-point	Steered, Nudged, Controlled	Stewardship, Technocracy, Paternalism	Smart Dublin, Dublin Bikes	
	Manipulation				Traffic control	

Figure 2-2: Scaffold of smart citizen participation (Cardullo and Kitchin, 2017, p. 6).

Citizens can perform and experience different forms of participation and functions identified in this table and are in fact expected to actively participate in the context of the neoliberal operationalisation of urban theory. However, while citizens are urged to take the initiative, looking for solutions to practical urban issues, they are not expected “to challenge or replace the fundamental political rationalities shaping an issue or plan” (Cardullo and Kitchin, 2017, p. 18).

This approach hardly makes citizens 'smart'. Cardullo and Kitchin (2017) suggest that 'smart citizens' and 'smart citizenship' are concepts that need re-thinking, especially in the context of the 'right to the city', which has accumulated an extensive body of literature. "*The normative challenge then to creating truly 'citizen-centric' smart cities will be to re-imagine the role citizens are to play in their conception, development and governance*" (Cardullo and Kitchin, 2017, p. 20). "*The role of the public sector becomes one of a facilitator that harnesses the strength of various parts of the society to meeting the needs of the individual citizens*" (Chan, 2013, p. 1893).

As was indicated earlier, smart city projects in practice often simply respond to the needs of a specific user, with the main objective to be more user-friendly (Nam and Pardo, 2011). The citizen is treated as a consumer, and as such "*the individual has broad choices, tailor-made products and services*" (*White Paper on Digital Platforms of the Economic Affairs Ministry, 2017*). In addition, "*understanding citizen perspectives, needs and desires, provides the potential to implement local interventions that may be advantageous for the wider scale of the city but not identifiable from a large-scale holistic strategy*" (Thomas et al., 2016).

Deloitte (2015) identified the main challenge in a smart city as finding ways to use "*the power of data to create smart solutions that address real needs of city users and are perceived as meaningful by them*". The main idea of a user-oriented smart city is to provide such an intuitive design that it would be naturally adopted by the citizens and lead to sustainable behaviour changes. Being able to impact human behaviour is considered the key to smart solutions (Deloitte, 2015). The main goal is to design services with user needs and wants in mind. The key here is to design 'for' citizens as opposed to 'with' them, which captures the essence of the difference between 'top-down' solutions (smart city technology designed by private vendors for the government) and 'bottom-up' initiatives (technology-enabled citizen participation in co-creating smart city solutions). These two approaches are discussed further in Section 2.2.1.

Gil-Garcia et al. (2015) argue that a smart city (as well as any smart government or organisation) should utilise emerging technology to develop communication with people to gain an understanding of their constituencies in order to make smart, effective, and timely choices and to improve the smart city experience. The development of a smart city is intrinsically linked to the creation of 'smart citizens' who have to be willing to adapt to their new environment and utilise all its benefits. Citizens who refuse to adapt would only see peripheral benefits from smart cities. Indeed, it is these 'smart citizens' on whom the ground-up model depends (Vanolo, 2014).

People for whom smart solutions are designed "*need to be able to use the technology in order to benefit from it*" (Caragliu, del Bo and Nijkamp, 2011). This is closely related to a need to

ensure that people have the skills to benefit from the 'smartness'; therefore, providing continuous life-long digital training becomes essential. "Digital education and training must be provided at all levels of the education system in the interest of innovative commerce, decent work and better participation in working life through better digital evaluation skills and in the interest of people's capacity to take responsibility for their own data" (*White Paper on Digital Platforms of the Economic Affairs Ministry*, 2017). An example of the citizen as a user can be found in the Smart Lighting in Dublin project, where the city attempted "to give a higher degree of control and flexibility over lighting by converting it into digitally networked infrastructure" (Kitchin *et al.*, 2017, p. 16).

A significant portion of the smart city discourses are concerned with the way citizens are assumed to behave, or in other words to respond and adapt to smart cities. At the same time citizens are "asked to participate in the construction of smart cities" and "they are implicitly considered responsible for this objective" (Vanolo, 2014, p. 893). An expectation of an active citizen position leads to another idea of viewing the citizen as a 'prosumer': they "can assume a role as consumer and producer of services and products at one and the same time" (*White Paper on Digital Platforms of the Economic Affairs Ministry*, 2017, p. 1).

#### 2.2.1. Bottom-up and top-down approaches to the smart city

Citizens are occasionally consulted to provide input for strategy development (Deloitte, 2015) but these inputs come as a 'top-down' participatory approach when the government proposes smart solutions and the citizens can react (vote, comment). Usually, this engagement approach does not allow citizens to provide and develop their ideas and inputs as the process of consultations happens after the proposals have already been formed. The smart city movement still has much room for improvement in the area of citizen ownership and participation. Soliciting for feedback and surveying popular approval too often becomes a poor excuse for true citizen engagement (Kitchin *et al.*, 2017).

While Aulich (Aulich, 2009) states that the evidence suggests a stronger willingness in state and local governments, as opposed to the federal government, to engage citizens rather than simply consult with them or treat them as customers for government services, there does not seem to be any evidence that this willingness will translate into actions that are effective and sustainable.

Kitchin *et al.* (2017) considered a citizen-centric model one that "*fosters social innovation, civic engagement and social justice*". Ultimately smart cities should aim to fully engage with their citizens in a dialogue where 'bottom-up' approaches become an integral part of the decision-

making process. Despite a large number of citizen-driven initiatives, unless the government connects and supports them at the design level these initiatives become unsustainable.

*“The concept of engagement appears to be valued, perhaps even seen as necessary, but in few instances has the practice yet been accepted as a fundamental right of communities to enable them to assume a formal place in governance. State governments are being challenged to surrender their legislative power over local government in order to facilitate ‘real’ partnerships with local communities and embrace notions of participatory governance” (Aulich, 2009).*

Gil-Garcia et al. (2014) proposed that the government role should be understood “as the deployment of a creative mix of emerging technologies and innovation in the public sector, which is based on specific contexts and problems”, while also “enhancing the contribution of civil society through an ongoing synergetic role” (Gil-Garcia, Helbig and Ojo, 2014, p. 12).

*“To create a successful smart city, only a bottom-up approach will succeed. That means a municipality must first pay attention to what is happening in the city and then look critically at the processes and workflow in its own organisation” (Loohuis, 2016).*

Yet, despite the ideas of more creative and citizen-centred smart cities advanced by academia and ‘expert amateurs,’ the mainstream construct of smart cities remains technocratic and enables limited and facilitated forms of citizen participation (Kitchin et al., 2017). Khan et al. (2017) reviewed a number of initiatives for ICT-enabled citizen participation in urban planning employed by cities around the world and concluded that although they all look at various aspects of participation, none of them supported two-way communication and participation.

Tools like OpenStreetMap (OSM), which allow citizens to collect their own data that does not have to follow the official government classification, allow them to bypass bureaucracy and rely on the data that is important to the community (Lee, Almirall and Wareham, 2015). The issue of power and control is central to the discussion on urban planning. OSM was initiated and has been supported by a community of volunteers who collect and upload data, so it is considered grassroots or ‘bottom-up’ innovation. Volunteering for the good of the community or ‘giving back’ is expected of citizens in the Global North when citizen participation is factored into the smart city plans.

As discussed in Section 2.3, international development actors generally promote participatory approaches and forms of ‘active citizenship’, which fall under grassroots or ‘bottom-

up' participation. The World Bank recommends a community development approach by 'voluntary effort' (Green, 2014). While advocating for participatory methods, organisations like the World Bank and OECD actually foster top-down models of participation in the aid recipient countries (Guarneros-Meza and Geddes, 2010, p. 120). The next subsection will discuss volunteerism, and in particular how it is perceived in international development, which has established its own characteristics of volunteering.

### 2.2.2. Volunteerism

In the United States (US) as well as in the other countries in the Global North, participation in local community groups is a customary way to solve local issues, "*which is increasingly considered by contemporary policy analysts to be vital for effective urban service delivery*" (Chavis and Wandersman, 2002, p. 55). However, it has been problematic to unpack precise processes that individuals and communities undergo with regard to this phenomenon (Chavis and Wandersman, 2002).

Chavis and Wandersman (2002) identified processes aimed at improving communities (community development, building or organisation), where the key component is "*individuals' participation in voluntary organizations which produce collective and individual goods*" (Chavis and Wandersman, 2002, p. 56). Participation of community members in the life of their communities has been considered a critical instrument for addressing local issues, from improving physical infrastructure to combating crime and enhancing social services (Chavis and Wandersman, 2002). Practically, "*being a "citizen" in this context thus implies voluntary involvement either as a member of the community or a resident or alternatively as a representative of a customer or user*" (Anttiroiko, 2016, p. 8).

Wilson (2012, p. 177) defines volunteerism as "*freely chosen and deliberate helping activities that extend over time, are engaged in without expectation of reward or other compensation and often through formal organizations, and that are performed on behalf of causes or individuals who desire assistance*". Although he notes that what actually qualifies as volunteering in the real world is 'a matter of degree,' there are two points that are worth highlighting in this definition: 'freely chosen' activities and "*without expectation of reward or other compensation*" (Wilson, 2012, p. 177).

The abovementioned definition and interpretation of volunteerism might be true for the Global North, but these could vary throughout different cultures, especially in the context of development. For example, 'lack of remuneration' does not characterise 'development

volunteering'. Although originating in the Western culture, international aid volunteers receive a stipend or allowance that usually equals a local wage (Engel and Georgeou, 2011). Volunteering in this sense has provided highly skilled labour for development assistance projects at a significantly cheaper rate than what international consultancies would cost. This schema has not just disrupted local markets and imposed significant economic, social and political consequences on host communities (Engel and Georgeou, 2011), but also distorted the understanding of 'volunteerism' in the assistance recipient countries:

*"Volunteers in East African development interventions are no longer engaged primarily on the basis of their membership in the community that is the object of development interventions, but on the basis of their ability to act as intermediary between development programs and the community in question. The "volunteer" is now a formal category within development projects, with responsibility for community engagement"* (Brown and Green, 2015, p. 64).

And despite the efforts to find a more suitable term, 'international development volunteering' continues to be widely used in the field (Engel and Georgeou, 2011, p. 301). Hence volunteering as a concept upon which community participation in smart cities is based does not translate into the context of LMICs. International volunteers who serve in these countries are outsiders who seemingly receive compensation for their contributions in communities where they work. Following the same logic, local project participants taking part in community projects who are referred to as 'volunteers' have different expectations (i.e., compensation and other rewards, timeframe of their participation) than those of community volunteers within the community formed in the West.

### 2.3. Participatory approaches in international development

In international development literature and practice, 'participation' has become an important concept since the mid-1990s (Bliss and Neumann, 2008) and "*participatory 'methods' and 'approaches' are now commonplace*" (Green, 2010, p. 1243). "*The adoption of participatory approaches to the planning and management of development interventions by government agencies and civil society organisations is well established as a preferred means through which communities can be brought practically and representationally into the development process*" (Green, 2010, p. 1241).

Participation as an institution in international development could be considered a boundary object (boundary object is defined in Section 1.1) as it is "*providing objects around which new*

*coalitions across differences can operate at the same time as delineating the divisions and differentiation between them*” (Green, 2010, p. 1257). Green (2010) considers ‘participation’ a boundary object in international development practice because it is abstract and stakeholders with different positions can connect around it, and it is systematised in such a way that various participants can provide concrete inputs to the process. *“Reports and plans as the impressions of participation are perfect boundary objects, materialising the abstract moral qualities of participation as a development good and demarcating, through distillation into budget lines representing future projects, the divisions through which development is organised – between international organisations and the national government, between central and local government and between donors and beneficiaries”* (Green, 2010, p. 1255). Participation gives credibility to reports and plans created using participation as a method, and those can be presented as created by people rather than authorities (donors, government, civil society organisations) (Green, 2010).

In reality, however, how participation materializes in development cooperation is often significantly different from what is planned and described (e.g., actual participation is much lower than what is claimed). The report by the Institute for Development and Peace (Bliss and Neumann, 2008) concluded that ‘real participation’ is undermined by the decision-making process on the most critical aspects of the projects (such as goals, objectives and key activities), which usually takes place prior to participation activities. Hence, participation tends to be limited to information and consultation only, with poor and disadvantaged populations often being left out despite the claims in donor documents that these are the priority group: *“Despite efforts to engage citizens in development through participatory institutions and the use of more specialised development technologies of community inclusion over a 30-year period, it is far from evident that this translates into increased commitment to the investment and maintenance of public infrastructure, let alone the reduction of poverty”* (Green, 2010, p. 1241).

Nevertheless, participatory exercises have continued to be widely employed and advocated for by donors and development actors, have become routine processes and a normative expectation for enabling development assistance. The flipside of the ‘routinisation of participatory methods’ in development is that it *“may inhibit innovative approaches to problem solving through dealing with the unanticipated, what Albert Hirschmann called the ‘hidden hand’ of development creativity”* (Green, 2010, p. 1243).

#### 2.4. Cities of the Global South: technology and data for development

Overseas Development Assistance programmes to the countries of the Global South have

been incorporating ICT into their operations. The relatively new trend to mainstream ICTs into development projects has formed a field ICT for Development (ICT4D) (van Reijswoud, 2009; Bothwell and Hellen, 2015). Any large development institution has ICT components in the majority of its programmes. As an example, the UK Department for International Development (DfID)<sup>4</sup> launched a digital strategy 2018-2020 that “sets out a vision and approach for doing development in a digital world. [...] in order to have a bigger, faster and more cost-effective impact on the lives of poor people” (UK Department for International Development, 2018). However, the impact of the ICT4D work has not been rigorously studied by academics or even critically evaluated by the implementing agencies (van Reijswoud, 2009). In fact, this work has been heavily criticised for not being appropriate in the context of the Global South and for relying too much on solutions imported from the North. This work could best be described as ‘techno-enthusiasm’ (van Reijswoud, 2009, p. 3), which often employs a ‘one-size-fits-all’ approach, failing to recognise local nuances and account for them in the project design. The development aid has been criticised for importing solutions and bringing blueprints to the Global South. A typical critique of development work could apply to data-driven projects.

Furthermore, the World Development Report 2016 found that digital technologies have not fulfilled promises in development, and in fact could bring a risk of increasing inequality and deepening poverty if not supported by the ‘analogue complements’ such as the development of policies, skills and capacity of government institutions (World Bank, 2016).

*“The promotion of civil society as the realm for social action and organisation serves the neoliberal agenda of minimising the role of the state in society”* (Engel and Georgeou, 2011, p. 303). The exemplar of a citizen in the neoliberal system is “responsible, productive, competent” (Komporozos-Athanasiou, Renedo and McKevitt, 2019, p. 372). Community innovation projects using ICTs in international development often follow the logic of neoliberal urbanism, assuming that citizen engagement and participation will be present. Examples of community data initiatives in the cities of Global South are presented in Table 2-2.

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<sup>4</sup> On 2 September 2020 the official website of the United Kingdom Agency for International Development announced that the Department for International Development (DfID) and the Foreign and Commonwealth Office became the Foreign, Commonwealth and Development Office (FCDO) of the UK Government: <https://www.ukaidirect.org/news/name-change-for-the-uk-governments-department-for-international-development-dfid/>. Last accessed on December 4, 2020.



Table 2-2: Examples of community data initiatives in the Global South (Landry et al., 2016, pp. 41–47).

<b>City, Country</b>	<b>Open Data Initiative</b>	<b>Description</b>
<b>Barranquilla, Colombia</b>	<b>Mapping informal cities</b>	Researchers from the University of Miami are mapping informal communities in Colombia to better understand risks posed to them by climate change.
<b>Colombia</b>	<b>Aplicación Elefantes Blancos</b>	This application allows citizens to report on construction, maintenance or installation work that has a negative impact on the community.
<b>Ecuador</b>	<b>DigitalGlobe post-disaster infrastructure mapping</b>	Mapping and releasing images of physical infrastructure after earthquake to support emergency relief efforts.
<b>India</b>	<b>Easy-access real estate information</b>	Using open data to optimise real estate market, help people choose a place to live, proximity, building part of governmental assets not known in various cities in India.
<b>Kenya</b>	<b>Adopt-a-river Initiative</b>	Schools and community groups undertake regular monitoring of rivers using benthic invertebrates and upload their findings into a map platform called MiniSASS, which provides immediate evaluation of the river's health.
<b>Mexico</b>	<b>Mejora Tu Escuela</b>	Combining 230+ independent datasets, Mejora Tu Escuela allows citizens to compare schools.
<b>Montevideo, Uruguay</b>	<b>PorMiBarrio</b>	Citizens can easily report problems and damages to city officials.
<b>Nairobi, Kenya</b>	<b>Digital Matatus</b>	This project captured transit data for Nairobi, designed mobile-routing applications, and designed a new transit map for the city.
<b>New Taipei City, Taiwan</b>	<b>Hot Spots Analysis System</b>	Drawing on posts to the city's Web portals, logs of the emergency response centre, and traffic on social networks, the Hot Spots Analysis system identifies issues raised by citizens that are not being properly addressed.
<b>Uruguay</b>	<b>Dereschos Del Estudiante</b>	This tool allows students, parents and educational actors to consult with current and complete records on student rights information.

Watson (2015) heavily criticises new urban 'smart' visions of Africa that are promoted by property development companies and tend to copy the glossy model of cities like Dubai and Singapore. Dubai and Abu Dhabi can hardly be role models for African cities, as mega-urbanization projects financed by oil wealth were put forward by the cities in "*socially unjust and environmentally wasteful ways*" (Cain, 2014). The 'glossy images' of future smart cities in Africa presented by the private consultants do not take into account the poverty and informal context of these cities (Watson, 2015; Datta, 2018). Hence, these smart city plans are on the one hand not realistic and, on the other, impose a threat for the majority of the population to be left in even deeper disparity. Watson calls for a better understanding of the context of the Global South and how it affects urban planning. She asserts that the planning practices borrowed from the North or inherited from the colonial past have not proven successful. The main reason for that is that these practices often remained unchanged once implemented and do not keep up with the rapidly changing environment. Recently researchers have attempted to assess the impact of the use of ICT by the communities to achieve development objectives, but the results are questionable and more research is needed to understand the implications of using the ICTs in poor communities (Dey and Ali, 2016).

Overall, Parnell and Robinson (2012) argue that the development of the urban and planning theories applicable in the Global South have not received the same consideration as those that are applicable in the Global North. Academics have tended to prioritise the urban realities of their 'back yard', which has led them to "*overlook the rapidly growing cities of the global South where traditional authority, religion, and informality are as central to legitimate urban narratives as the vacillations in modern urban capitalist public policy*" (Parnell and Robinson, 2012, p. 596).

Similarly to ICT4D, international aid organisations started to promote the use of data to 'developing countries' "*to provide better services to citizens*" and "*for inclusion, not exclusion, and for enhanced privacy, not greater threats to security*" (World Bank Group, 2018, p. vi). In the last decade, nearly every development and donor institution working in the Global South has incorporated (open) data components in their programs, set up 'data-driven' projects in the recipient countries and published reports about the impacts open data could have in those countries (and cities). However, the examples of impact and success largely remain in the more advanced countries such as the US, the UK, or European countries.

Citizens and communities are expected to benefit from modern technologies and data-driven approaches. The digital transformation and data-enabled Industry 4.0, which mainly

characterizes the IT-driven shift in the manufacturing systems (Lasi *et al.*, 2014), are changing societies and economies and have created a new kind of economy that is digitally-driven. It is believed to bring opportunities to the Global South for 'leapfrogging' infrastructure deficiencies, taking advantage of digital markets and platforms enabled by digital technologies and data (Ciuriak and Ptashkina, 2019).

Leapfrogging promises are accompanied by 'enabling' factors such as strong governance, so the more advanced countries mainly continue to take advantage of these opportunities: "*without an enabling environment, one that provides the prerequisite for rapid adoption of ICT, ICT is not likely to have the full economic, political, and social impact we desire*" (Bothwell and Hellen, 2015). An enabling environment could include regulatory, political, business, infrastructure climate, skills, leadership and commitment to collaboration.

Moreover, technologies present new challenges, such as managing possible threats to national security and governance integrity (Ciuriak and Ptashkina, 2019), which the less developed are less equipped to address.

## 2.5. Conclusions

The previous chapter has already highlighted the tensions and contradictions between the different goals and mechanisms of smart cities and how citizens participate in and benefit from those solutions. There is a reason why citizens have not been portrayed as active actors in the literature on smart cities, namely, they have not played a role in constructing smart cities to date. This chapter focused on the role of citizens in creating their cities and how these roles are assumed and realised in the Global North and Global South.

Public participation has been adopted as a legitimising factor in the government decision-making process in urban development in the Global North, and thanks to the neoliberal agenda citizens are expected to be active and contribute towards their communities' well-being. This is achieved through volunteerism, which means that citizens need to give back to the communities using their skills and/or resources in their spare time. This is also a basis for a bottom-up approach to smart cities, which is citizen-led, as opposed to top-down, which is government-led.

Like the assumption of active civic engagement in urban development in the Global North, international development work in the Global South adopted the neoliberal logic of active citizenry, where participatory approaches became the norm for carrying out development interventions. These approaches, however, have developed different connotation in such community-based projects, as volunteers often expected compensation for their participation and contributions, due

to the structure, nature and financial incentives employed in these projects, which undermined the idea of community participation for the public good (Green, 2014; Brown and Green, 2015).

The ICT4D and data-driven innovations have been proposed as a leapfrogging opportunity to address urban challenges through citizen engagement. These approaches have been criticised for the lack of customisation to the local contexts and the absence of a critical evaluation of their effectiveness. This reinforces the need to develop a deeper understanding of how data-driven citizen-centric approaches are used on the ground to address the urban sustainability challenges the cities face in the Global South. This presents a knowledge gap and an opportunity to explore it through the research questions tackled in this PhD thesis: *“How do cities in the Global South currently employ data-driven approaches to support citizen-centric sustainable urban development? How should cities in the Global South currently employ data-driven approaches to support citizen-centric sustainable urban development?”*

The next chapter will provide details of the research design and methodological approach employed in this research to start filling the knowledge gap identified through the literature review.

## Chapter 3. Methodology

This chapter sets out the research design for this PhD. It starts by providing an overview of the methodological approach adopted by the researcher, then details the particular methods used to collect and analyse data.

In order to address the key research questions of this PhD, namely “*How do cities in the Global South currently employ data-driven approaches to support citizen-centric sustainable urban development? How should cities in the Global South currently employ data-driven approaches to support citizen-centric sustainable urban development?*” and supporting sub-questions as outlined in the Introduction, the research design followed an inductive and exploratory methodological approach. The approach drew on research domains which included smart cities and sustainable urban development, public participation, data and city governance processes for addressing urban challenges in the context of sustainable urban development and international development.

The smart city concept penetrates multiple areas of the urban community ecosystem and aims to address local issues ranging from city planning, transportation, energy consumption and pollution to police, education, and health services. Smart cities rely on data-driven approaches: to identify which data can and should be used, analyse and apply data from a variety of sources, deal with the issues of privacy and personal data, decide which data should be made open, and others. These are multidisciplinary problems and issues that the cities aim to tackle, and thus require the involvement of a broad range of methods from social, urban, public policy, and data studies to be fully and properly addressed in a citizen-centric sustainable urban development. Therefore, this research adopted an approach appropriate to studying complex social phenomena with various stakeholders involved – qualitative research methods. The overall methodological approach to the research design of this thesis is explained further in Section 3.1.

The methodology included examining two cities as case studies, and two community-based initiatives within each city. The case study is considered the most suitable method, when the aim is to understand the underlying dynamics of processes studied and to answer the question ‘how’ (Drosou *et al.*, 2019). In doing so, triangulation of data, meaning that data were collected through multiple sources (Creswell, 2014), was employed to ensure the internal validity of the research design. Case study selection is covered in Section 3.2. Data collection methods included semi-structured expert interviews, focus group discussions, direct observations with contextual interviews and document analysis. These methods and the process of data collection are

described in detail in the subsequent Section 3.3. Analysis of data was guided by thematic analysis and is covered in the final Section 3.4 of this chapter. The research design is presented in Figure 3-1.

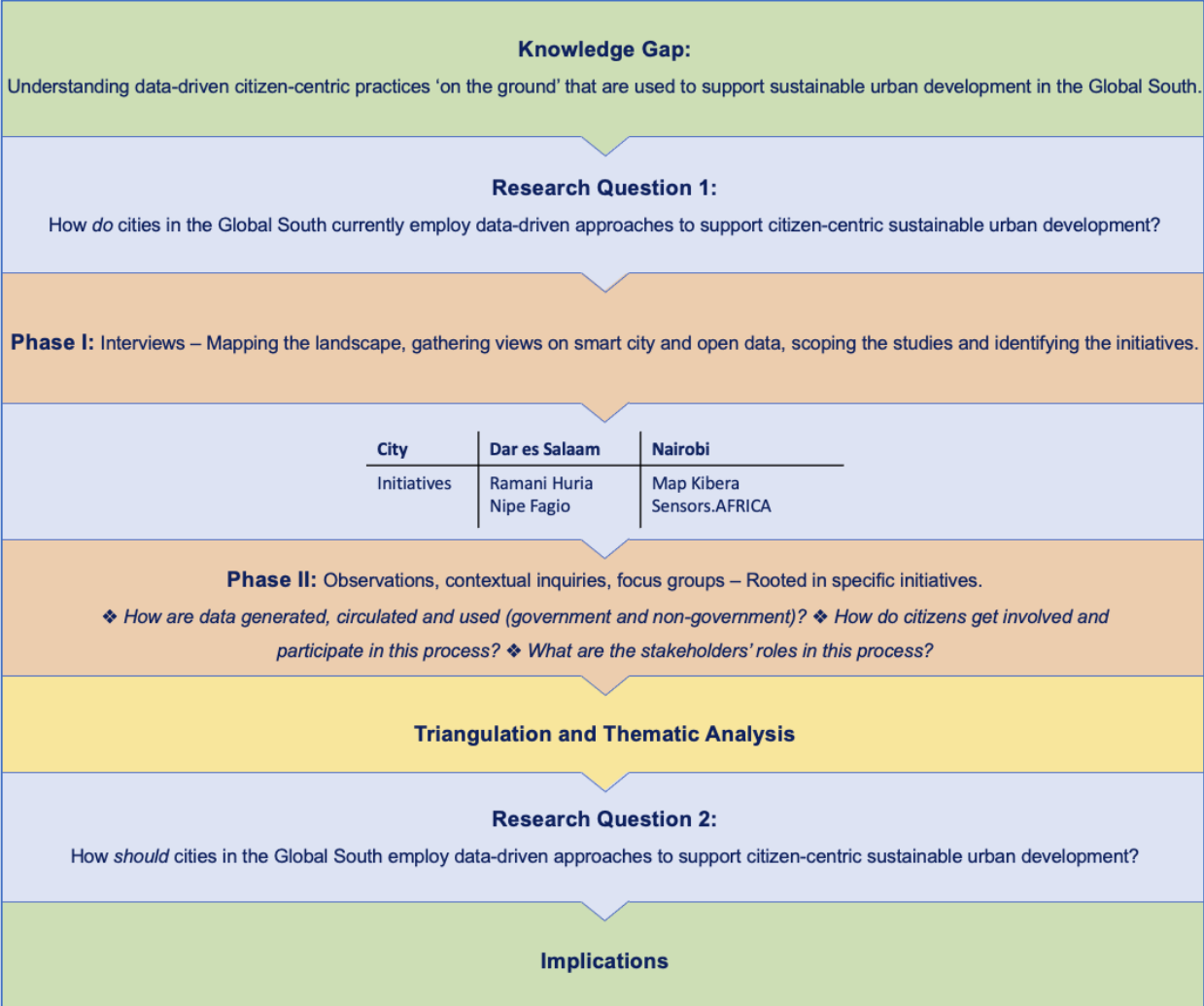


Figure 3-1: PhD research design.

### 3.1. Methodological approach

The methodological approach was formed by among others the philosophical assumptions of the researcher, the nature of the research issue and question, and the researcher’s personal experiences (Creswell, 2014) and in line with critical data studies that aim to advance qualitative methodologies to deepen the knowledge of the role of data in society (Kitchin and Lauriault, 2014; van Schalkwyk, 2020):

*“Whilst there is a rich and diverse tradition of critical social theory which can be directed towards data assemblages and the wider data landscape, such theory needs to be refined and fine-tuned to make sense of data and their work in the world, with new theory developed where needed. Yet we have barely begun to critically conceptualise data and their apparatus and elements. Such thinking needs to be complemented with more normatively orientated reflection on the ethics and politics of big data, open data, and data systems of different varieties”* (Kitchin and Lauriault, 2014).

Qualitative research presents the reality from the viewpoint of the people participating in the study, hence can *“contribute to a better understanding of social realities and to draw attention to processes, meaning patterns and structural features”* (Flick, Kardorff and Steinke, 2004, p. 3). Qualitative research provides a variety of methods and approaches which could be selected and mixed to address specific research questions, as *“it is unlikely that one will gather ‘depth’ and ‘insight’ via the statistics that are frequently used in quantitative methods”* (Otoo, p.67).

Qualitative research is usually associated with constructivism (or social constructivism), a research philosophy, where a researcher ‘interprets’ the view of the world transmitted by the study participants recognizing that the researcher’s own background and past experiences influence this interpretation (Creswell, 2014). Figure 3-2 presents scientific paradigms on the spectrum corresponding with the intensity of using qualitative and quantitative approaches in these paradigms (Santos and Travassos, 2011).

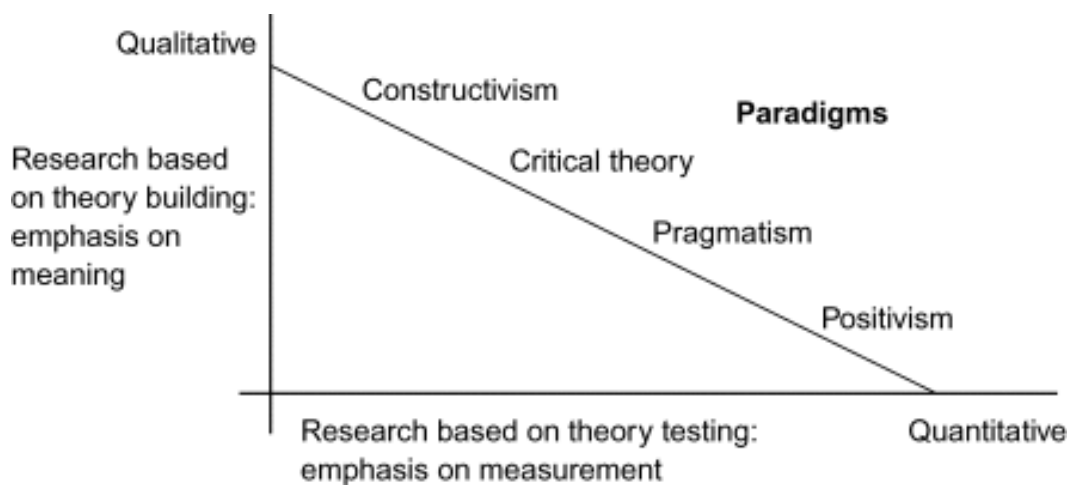


Figure 3-2: Scientific paradigms (Santos and Travassos, 2011, p. 215).

Several key assumptions distinguish constructivist ontology – ‘nature of reality’ (Creswell, 2014) – particularly from positivism, which mainly employs quantitative research methods. First, a researcher engages with participants through open-ended questions and constructs meaning based on this engagement. Second, as was mentioned previously, a qualitative researcher is bound to make sense of the phenomenon he or she studies through the prism of their own culture, historical and social context. Finally, the inquiry process is that social meaning data are collected through interaction with the other people and the meaning is generated inductively from the data collected during field research in the participant’s setting (Creswell, 2014).

In the area of information systems, as in other disciplines, researchers have also increasingly demonstrated interest in critical realism, which has similarities with critical theory (Ryan, 2018) and “*offers exciting prospects in shifting attention toward the real problems that we face and their underlying causes, and away from a focus on data and methods of analysis*” (Mingers, Mutch and Willcocks, 2013, p. 1). As an ‘alternative’ to positivism and constructivism, critical realism “accepts epistemic relativity (that knowledge is always local and historical), but not judgemental relativity (that all viewpoints must be equally valid)” (Mingers, Mutch and Willcocks, 2013, p. 1). However, critical realism has not developed set research methods (Fletcher, 2017) and often relies on a mixed method approach (Mingers, Mutch and Willcocks, 2013), employing ‘creative ways’ to collect the necessary data (Fletcher, 2017, p. 220). Critical realists have been criticised for ‘not being rigid in their research approach’, for ‘not being thorough’, and also for “*providing researchers with an approach whereby they ‘sit on the fence’ when interpreting research data to maintain the illusion of objective reality*” (Fletcher, 2017, p. 218). The research process also requires identifying ‘underlying causal mechanisms and structures’, which cannot always be recognised from the start (Fletcher, 2017, p. 220).

Constructivist researchers usually focus on the processes and interactions between people, specific contexts, historical and cultural settings and based on that inductively construct a theory (Creswell, 2014). Social constructivism considers the researcher’s role in interpretation (Santos and Travassos, 2011) and affirms that “*realities are multiple and socially constructed, the acceptance that there is inevitable interaction between the researcher and his or her research participants and the acceptance that context is vital for knowledge and knowing*” (Otoo, p.81). As the objective of this PhD research was to generate an understanding of how the data-driven citizen-centric approaches are used on the ground, which included looking at specific contexts, settings and interactions between different stakeholder groups, inductive exploratory research approach in line with the constructivist views was preferred.



Researchers with a pragmatic worldview “agree that research always occurs in social, historical, political, and other contexts” (Creswell, 2014, p. 40). and tend to focus on a ‘research problem’: “pragmatism as a worldview arises out of actions, situations, and consequences rather than antecedent conditions” (Creswell, 2014, p. 294).

Adhering to only one scientific paradigm, however, has consistently been challenged in academia, and “combining of different research paradigms into one research project could be synergistic and yield a deeper explanation regarding the observed phenomenology” (Bogna, p.464). Furthermore, sometimes a research project requires incorporating different paradigms within the research approach and research design: “A pragmatic approach can assist in drawing on strengths from different research paradigms, which as human constructs should be challenged and malleable to further interpretive practices that can find deeper explanations in qualitative inquiry” (Bogna, p.480).

Analysing qualitative data inductively means that the theory or the meaning of the research is built ‘from the bottom up’. Data are organised into units of information, and the process takes the form of an interplay between the data and analysis until a set of themes is developed. Then, a researcher needs to evaluate whether there is enough data to support these themes or if additional data are needed. This is a deductive process. So, while the overall approach is inductive, there are deductive steps in the process. The process of generating themes in qualitative research through inductive reasoning is presented in Figure 3-3.

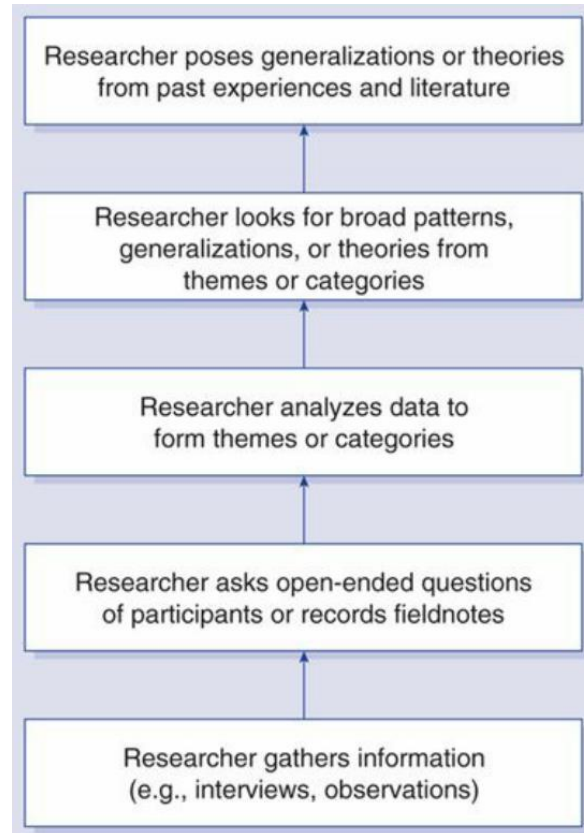


Figure 3-3: The inductive logic of research in a qualitative study (Creswell, 2014, p. 100).

Another important characteristic of the inductive exploratory approach is that the literature review at the beginning is significantly briefer than when using other approaches because it is normally incorporated at the end of the study.

While authors propose a number of different research designs that could be used in the qualitative approach, among the five key possible designs recommended by Creswell (2014) – narrative, phenomenology, ethnography, case study, and grounded theory – case study research best corresponds to the objectives of this research: “a *qualitative design in which the researcher explores in depth a program, event, activity, process, or one or more individuals*” (Creswell, 2014, p. 290). Such research is characterised by collecting detailed data using various qualitative methods within the boundaries of the case over a period of time.

As the researcher’s background influences the outcomes of the qualitative studies, the next section will address this issue in order to understand how her past and current experience at the time of the research may have affected the results of the study and what was done to ensure that these impacts are minimised. The section is in the first-person voice.

### 3.1.1. Reflexive Statement

The production of knowledge through qualitative research is 'situated' in social, cultural and historical contexts (Mauthner and Doucet, 2003). Therefore, in social sciences and in other disciplines where qualitative research methods are applied, the notion of 'reflexivity' has been adopted to help a researcher consider limitations related to their own 'position' (Salzman, 2002). Therefore, in this section, I will explain my own background insofar as relevant to understanding the data that I will be presenting. I will switch to the first person for this section.

I was born and raised in Soviet Russia, which turned to authoritarian rule in my early 20s — a political regime, which operates against my democratic values. My academic background was in public policy and international relations – master's degrees earned in the US upon values of citizenship, integrity and common well-being. Before starting the PhD programme, I had worked for four years as a practitioner in international development. Since 2012, I have been involved in projects developing policies and implementation plans for digital technologies, open data and citizen engagement as a consultant at the World Bank Group in over a dozen countries with emerging economies, including Tanzania. My professional network and connections in Tanzania, and later in Kenya, helped greatly to access study participants and receive insights that would not be easily accessible to researchers outside this community. Having access to these materials and contacts for my studies, in turn, contributed to the selection of case studies (the process is described in Section 3.2).

I continued to be engaged in such projects and to be part of the international development expert community throughout this research. As an Open Data and Innovations Consultant at the World Bank, I participated in the Tanzania Open Data Initiative (2015-2017) and Tanzania Urban Resilience Program (2016-2019), which provided access to partnerships with the local initiatives supporting the organisation of the study activities in Dar es Salaam (methods of data collection are described in Section 3.3). Through the World Bank and partner organisations in Kenya, studies were organised in Nairobi.

My professional experience shaped my views on the issues of using digital technologies and open data for citizen engagement in 'developing countries' or low- and middle-income countries (LMIC). I have been a passionate advocate of open data as a driver for bottom-up innovation, a catalyst for community engagement and improved service delivery. Through my work in the field of international development, however, I witnessed challenges when implementing data-driven projects on the ground in the countries receiving foreign assistance, as well as the lack of critical assessment of those initiatives and their impact. So, while I believed

that technology and data-driven development were inherently positive, on the other hand I saw that the interventions they facilitated needed critical examination. Therefore, I decided to investigate for myself what could be the reasons for these pitfalls. The research process did not start with a theory of reality, but rather employed a set of open questions, and a theory was inductively constructed through data collection and analysis (Creswell, 2014).

Aware of my own views and inclinations on how technology and data affect development and what role they play in citizen engagement, I was determined not to allow this to colour my findings and strove to keep the research process as objective as possible. This research was not driven by this agenda, but it was about finding out what was really going on, setting aside the presumption that open data will be the best answer. Therefore, when interpreting the results, I tried to keep an impartial position and looked at what the data showed regardless of my own beliefs.

Another impact that my background might have had was at the data collection stage. As I continued to be involved in the international development work through the World Bank, study participants could have seen me a certain way and this may have affected the answers. This is further addressed in Section 7.4 on limitations of this research. To avoid participants tailoring their responses to fit what they assumed my beliefs were due to my background, I had emphasised in all my studies that I was conducting my research independently of any organisation and that the information they were sharing with me was not going to affect their relations with any institutions affiliated with my work. During the studies, I also tried to give more room for participants to approach the same question from different angles and often prompted them with follow-up questions to understand better the grounds for their responses.

This PhD research was part of the Horizon Centre for Doctoral Training (CDT)<sup>5</sup> ‘My Life in Data’ programme (the name was changed to ‘Creating Our Lives in Data’ programme in 2019 – full description of the CDT programme can be found in Appendix 2) and was multidisciplinary in nature. As such, my research was overseen by three supervisors from different fields – sustainable cities, social sciences and computer science – and they contributed greatly from their expertise in each respective area. Discussions with my supervisors helped me to step back from

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<sup>5</sup> Horizon “My Life in Data” Centre for Doctoral Training (CDT) is the four-year research programme, which focuses on researching personal data and the traces we leave behind. The course consists of taught modules, annual summer schools, retreats and a three-month internship taken with one of the CDT’s partner organisations (<https://cdt.horizon.ac.uk>).

my role as an international development practitioner and try to look at the perspective I had adopted as one of the many in the mix of various stakeholders, agendas and priorities.

A distinct feature of the Horizon CDT program was that it assigned each student a partner from the appropriate industry to help navigate research and steer it towards actual industry needs. At the beginning of the first year of my research for this PhD, I took a four-month internship working as a PhD fellow at the Open Data Institute (ODI) <sup>6</sup>. In addition to supervisors, the implementation partner – the ODI – helped to shape the scope of this research. Having done extensive work in the open data space, including in Africa and specifically in Tanzania, the ODI provided me with additional information materials for this research, shared contacts of experts and stakeholders, offered opportunities to present the emerging findings to the ODI team and the public throughout the research and provided expert feedback to make sure this research was relevant and applicable for practitioners in the field. This also allowed me to view my research questions from the position of a different stakeholder group – an international NGO.

Throughout this research, my own assumptions and views on what the role of technology and data in community projects evolved, becoming more critical of how interventions are carried out on the ground. While international development projects are often guided by specific agendas and socio-political capital, it is never acknowledged in international development reports, which is also why this section is important. Section 7.5 provides further reflection on what impact my ontological position and background had on the outcomes of this PhD research.

The next section will set out the case studies selected for this research.

### 3.2. Case study

The research conducted “a collective case study” (Creswell, 1997, p. 62), which enables the examination of more than one case, with the focus on the issue of data-driven citizen-centric sustainable urban development. As such, to the fullest extent possible, comparisons will be drawn between the different initiatives in two different cities, to elicit how intra- and inter-city factors require discussion and distillation.

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<sup>6</sup> The Open Data Institute (ODI) is an independent, non-profit, non-partisan company that brings together commercial and non-commercial organisations and governments around specific sectors to address today’s global challenges. Driven by needs, and focused on timely challenges, the ODI helps people identify and address how the web of data will impact their businesses and their sectors (<https://theodi.org>).

### 3.2.1. Case study selection

This research examined two cities in countries in the Global South. The selection criteria were two-fold: academic to ensure the validity of research and pragmatic to ensure the research was feasible.

On the one hand, academic criteria were: cities (i) should be experiencing fast urbanization and challenges related to urban sustainability, (ii) had community initiatives that engage with data to address city challenges, (iii) had experience with open data initiatives, and (iv) were similar enough to be able to draw comparisons and contrasts based on findings. These criteria are in line with the research questions and ensure that the case studies will provide sufficient insight to achieve the objective of this PhD research. Pragmatic criteria included: (i) access to study participants, (ii) access to materials, premises and local events, and (iii) affordability of research activities abroad.

The pragmatic criteria were achieved by combining professional activities with the research activities wherever these were ethically feasible (ethical considerations are discussed in Section 3.3.4) and partnerships with local organisations formed through a professional network.

Tanzania and Kenya had comparable economies (both countries had just moved into the lower-middle-income level category according to the World Bank classification), their largest cities had a similar population size with high urbanization rates (Dar es Salaam and Nairobi respectively), which also served as economic centres in their countries. The geographic proximity of these cities and their history of competition for the leading economic position in the region made them suitable candidates for this PhD project.

Through the initial stage of this investigation (expert interviews) and based on an early scan of the literature on smart cities, suitable initiatives within each case city were identified. Two data-driven community initiatives per city were selected for examination to understand how the citizens got involved in data-driven community work and how they collected and used data to address specific urban sustainability challenges, critical for smart cities.

One initiative in each city aimed to collect accurate mapping data using community volunteers. Geographic data are considered foundational in smart city applications (Lv *et al.*, 2018; Naidu, 2018), and the lack of accurate location data can hinder innovation and the development of smart city services. Hence, community mapping projects were identified for further research:

- Ramani Huria<sup>7</sup> (“Open Map” in Swahili) in Dar es Salaam
- Map Kibera<sup>8</sup> in Nairobi

Both initiatives employed similar approaches of engaging the community in mapping activities through training to address challenges unique to the communities where data were collected: “*The participatory mapping confers power to people, demonstrating their perception of not only the locality and risks but also their relation with services, products, policies or even everyday tasks*” (Chmutina *et al.*, 2021, p. 4). Data were collected through the smartphone technology geographic information system (GIS) function and uploaded to the OpenStreetMap (OSM) where it became available in open source. OSM was the preferred platform for open geospatial data in LMICs, not least due to “*its de facto status as the main platform for crowdsourced topographic geospatial data*” (Iliffe, 2017, p. 7). In both cases, the initiatives worked with populations of informal settlements, which was one of the most critical challenges African smart cities were facing (Slavova and Okwechime, 2016).

Another set of two initiatives dealt with the most pressing sustainability issues in each city, which was also one of the top priorities in most smart global cities case studies – environmental sustainability:

- Community clean-up organisation Nipe Fagio<sup>9</sup> (“Pass me the Broom” in Swahili) in Dar es Salaam
- Community initiative sensors.AFRICA<sup>10</sup>, which monitored pollution levels in Nairobi

Nipe Fagio collected mapping data on rubbish hotspots to help plan future clean-up events as well as other data such as types of waste collected and the number of clean-up participants, which were shared with communities and presented in regular reports by the organisation to demonstrate impact. sensors.AFRICA collected air pollution data through sensors distributed to the community and presented these data through online map-based public dashboards.

These four initiatives engaged citizens and used different data to address city challenges they are facing and could be characterised as ‘smart city’ projects. These initiatives were

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<sup>7</sup> Ramani Huria official website: <http://ramanihuria.org>. Last accessed on June 22, 2020.

<sup>8</sup> Map Kibera official website: <https://mapkibera.org/>. Last accessed on June 22, 2020.

<sup>9</sup> Nipe Fagio official Facebook page: <https://www.facebook.com/NipeFagioTanzania/>. Last accessed on June 22, 2020.

<sup>10</sup> sensors.AFRICA official website: <https://sensors.africa>. Last accessed on June 22, 2020.

compared and contrasted against each other and then compared with literature from the ‘Global North’. Two cities were used as case studies, which provided context for the initiatives.

### 3.2.2. Dar es Salaam, Tanzania

The first case study city Dar es Salaam, Tanzania was selected in accordance with the criteria outlined in the previous section: (i) Dar es Salaam is one of the fastest-growing cities in the world with over four million people (National Bureau of Statistics and Ministry of Finance, 2013) and the majority of the city population are living in informal settlements (‘slums’) – between 65 and 80 per cent according to different sources; (ii) there was a number of data-driven and innovative approaches to development where community participation is often a key component (Green, 2014) and had received substantial donor funding towards these projects; (iii) Tanzania launched an open data initiative in 2015. These made Dar es Salaam an appealing case to explore. The last criterion (similarity of the locations) was addressed when another case study (Nairobi) was selected. Subsequent subsections unpack these criteria and provide a detailed profile of the city.

On the pragmatic side, Dar es Salaam was a strong candidate due to the researcher’s personal ties to, and network within, the city, which provided: (i) access to participants; (ii) access to materials; and (iii) minimised research cost through combined travel as outlined in the previous section.

#### *Innovation ecosystem and open data*

Tanzania’s innovation ecosystem historically has been slow-moving and stymied relative to neighbouring countries: in the Global Innovation Index (2019) report, Tanzania ranked lower than bordering Kenya, Burundi, Malawi, Mozambique and Rwanda. However, in the context of its rapid urban expansion coupled with pressing challenges such as flooding and solid waste management, several initiatives aimed to address these issues with the use of data and technology while engaging community members.

Tanzania was one of the first countries in Africa to launch a national open data initiative and portal<sup>11</sup> in 2015. In 2016, the Open Data Barometer Regional Report on Africa (2016), which ranked countries based on open data readiness, implementation and impact, placed Tanzania sixth in the region out of 21 countries. The city’s innovation centre and accelerator Buni Hub conducted a series of community-led discussions in 2016 with the citizens of Dar es Salaam

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<sup>11</sup> Tanzania national open data portal: <http://opendata.go.tz>. Last accessed on July 19, 2020.



around the concept of a smart city.

The National Five-Year Development Plan 2016/2017-2020/2021 of Tanzania declared that “*SMART interventions by the state has [sic] a potential pivotal role in catalysing industrialization*”, and continued that: “*It is noted that, successful industrialization requires smart developmental state [sic] role to spearhead strategic industrialization using various mechanisms including state procurement*”. The Plan also noted that the ‘smart intervention by the state’ would help create the enabling environment for economic growth along with ‘smart market interventions’.

Dar es Salaam hosted the first African Open Data Conference in 2015, opened by the President of Tanzania, and at the time of this research, for three years in a row hosted the unique annual event Data Tamasha<sup>12</sup> (‘Festival of Data’ in Swahili) that showcased and shared how data could make a difference in local communities. The event brought together data stakeholders from across Africa and offered a range of activities to contribute to the development of the global, regional, and national data ecosystem in a span of three days. During these days, various groups from Dar es Salaam and Tanzania more widely demonstrated the data innovations they implemented to improve their communities and address various challenges.

#### *Dar es Salaam governance system*

Dar es Salaam’s population in 1957 was 128,000 people (Sturgis, 2015). Being the first urban centre to be named ‘city’ in Tanzania in 1961 (Che-mponda, 1986), just a little over 50 years later Dar es Salaam accounted for 10 per cent of the total Tanzania Mainland population (National Bureau of Statistics and Ministry of Finance, 2013). It has doubled in the last decade and is expected to reach 21.4 million by 2052 (Sturgis, 2015). Dar es Salaam is the centre of Tanzania’s economic activity and accounts for almost 17.2 per cent of the country’s GDP (National Bureau of Statistics and Ministry of Finance and Planning, 2019). Che-mponda (1986) described the city’s government in the following way: “*three variables in running the City Government of Dar-es-Salaam [...] the national government, the Party and the City Council itself*” (Che-mponda, 1986, p. 73). This emphasises the role of the national government in the city’s governance, however, citizens and the community seemed not to play a role.

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<sup>12</sup> The Data Tamasha is an annual event that showcased and shared how data could make a difference in the African communities by bringing together data enthusiasts, leaders and practitioners across industries, the public sector and academia. The official event website: <https://datatamasha.dlab.or.tz>. Last accessed on July 19, 2020.

Although like many other former British colonies in East Africa Tanzania inherited an administrative process for urban management that gave a lot of freedom to municipalities (Calas, 2010), “the central government failed to provide its local counterpart with the actual means of carrying out the responsibilities delegated to them” (Calas, 2010, p. 163) and soon after the country’s independence, pushed for a more centralised governance system. The same happened in Kenya. Since the 1990’s Tanzania, like many other countries, introduced a range of reforms aimed to decentralise government functions including urban management, stressing the importance of direct citizen involvement in planning and decision-making processes. In 1996, the country introduced a Decentralisation by Devolution policy, which meant to shift power back to the local authorities and empower communities (Massoi and Norman, 2009): “*devolution is a comprehensive form of decentralization because it involves transfer of authority in fiscal, political, and administrative decision-making matters*” (Kanyinga, 2016, p. 157).

There are five elected district mayors, with one city mayor in Dar es Salaam. In addition, there is a regional commissioner who is appointed by the President of Tanzania and who is responsible for the region of Dar es Salaam, which includes the metropolitan area but also a larger area outside the city. Table 3-1 outlines the governance structure of Dar es Salaam.

*Table 3-1: Governance structure of Dar es Salaam city (adopted from World Bank unpublished research and complemented by desk research and interviews).*

<b>Elected</b>	<b>Appointed</b>	<b>Level</b>	<b>Population (census 2012 or estimates)</b>
<b>President</b>	The President’s Office – Regional Administration and Local Government (PO-RALG); Sector ministries	National	44.9 million <i>Estimated 56.3 million (World Bank, 2018)</i>
<b>City Mayor</b>	Regional Commissioner	City	4.4 million
<b>District Mayors</b>	District Commissioners (under regional commissioner) and Executive Director (appointed by PO-RALG)	Five districts/ municipalities	Ilala – 1.2 million Kinondoni – 1.8 million Ubungu ( <i>was part of Kinondoni prior to 2012</i> ) Temeke – 1.4 million Kigamboni ( <i>was part of Temeke prior to 2012</i> )
<b>Ward Councillors</b>	Ward Executive Officers (WEOs) appointed by the municipality	Ward (Keta)	Approx. 30,000 – 100,000 people
<b>Mtaa Chairman and Committee Heads</b>	Mtaa Executive Officers – <i>lowest official level of government</i>	Sub-ward (Mtaa)	Approx. 5,000 – 20,000 people

<p><b>Ten-Cell Leaders (wajumbe/mjumbe)</b> – <i>not part of the official government/appointed by the ruling party</i></p>	<p>Ten households (Sheena or Shina)</p>	<p>Approx. 150 – 2,000* <i>people</i></p> <p>*the number estimated based on the expansion of ten-cell to 50-70 houses as described by the interviewees and focus group participants.</p>
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The ten-cell leadership system is one of the most notable elements of governance in Dar es Salaam and came through as a strong theme in government data collection. This structure comes from Ujamaa ('familyhood' in Swahili), a 'self-reliance' approach to community development under Julius Nyerere, Tanzania's socialist leader from the country's independence in 1961 and elected president in 1961-1985. This socialist structure aimed to organise people in small groups.

Another critical characteristic for Tanzania as a whole, and particularly in Dar es Salaam, is the contributions of the international development donor and aid organisations. Tanzania is considered an 'aid dependent' country where the "*relation with international development is more intimate than in other development states*" (Green, 2014, p. 17). Tanzania ticked all the boxes to be a 'good recipient' and so became a welcome candidate to be a testing ground for many development projects with a 'community development' as a recommended approach for the project implementation (Green, 2014).

The pilot and follow-up studies for this project based in Dar es Salaam aimed to understand the context and processes that take place in the city when implementing data-driven approaches in dealing with the pressing urban challenges, and what makes them 'citizen-centric'. The following two initiatives were selected for examination to address the research questions.

#### *Dar Ramani Huria*

Dar Ramani Huria ("Open Map" in Swahili) is a community mapping project launched in 2015 with funding from the World Bank in collaboration with the international NGO Humanitarian OpenStreetMapping Team (HOT). The initiative emerged primarily to help community members and local government to collect high-resolution mapping data to prepare a response to flood events, the most common disaster risk faced in Dar es Salaam (Iliffe, 2017). Ramani Huria was working closely with the local government and the two main universities in Dar es Salaam, the University of Dar es Salaam and Ardhi University.

### *Nipe Fagio*

Nipe Fagio (“Pass Me the Broom” in Swahili), a community clean-up organisation, was started in Dar es Salaam in 2013. The founder of the organisation, Tania Hamilton, saw the poor condition of the rivers and started to get the community she was living in to come together to clean the rubbish out of the rivers. This initiative grew and as more people joined the clean-up events, eventually it became an organisation that is currently well-known for public clean-ups.

In the next subsection, we move on to consider community-based initiatives in the second-case city – Nairobi.

#### 3.2.3. Nairobi, Kenya

Once the first case was identified, the second case study city Nairobi, Kenya was selected based on the same selection criteria as the first case study (outlined in Section 3.2.1): (i) Nairobi is a fast-growing city with approximately 2.5 million people living in slums, representing around 60 percent of the population while inhabited only six percent of the land. Of these, around 250,000 people live in Kibera, Nairobi (Werlin, 2006); (ii) experts interviewed in Dar es Salaam provided several examples of data-driven initiatives in Nairobi as well as these were found through desk research; (iii) Kenya launched an open data initiative in 2011; (iv) the city had similar economic context and similar urban challenges to Dar es Salaam including high risks to safety, heavy traffic and pollution to name some of the top ones cited by interviewees. Similar to Dar es Salaam, Nairobi is not homogeneous. Tanzania and Kenya are neighbouring countries, which are often compared in the literature, which made Nairobi an appealing candidate for this project. Subsequent subsections provide full detail of Nairobi’s city profile.

Through the researcher’s professional network, the pragmatic criteria were addressed in the same way as in Dar es Salaam.

### *Innovation ecosystem and open data*

Kenya has been leading the way in innovations in Africa and was ranked the second country in Sub-Saharan Africa after South Africa in the Global Innovation Index (2019) report. The report also called Kenya’s levels of innovation outstanding for the level of economic development and GDP, a record that the country has kept for nine years in a row (Dutta, Lanvin and Wunsch-Vincent, 2019).

In this context, it is not surprising that the most celebrated African innovation in the area of financial services through mobile banking, M-Pesa (‘pesa’ means ‘money’ in Swahili),

originated in Kenya. Launched in 2007 by Safaricom, Kenya's biggest telco operator, this service became 'one of the world's first successful mobile phone-based platforms' (Kyule, Kangu and Emuron, 2018) and was serving over 40 million customers across Africa, carrying out over 12 billion transactions annually<sup>13</sup> by 2019.

A world-renowned citizen crowdsourcing platform, Ushahidi<sup>14</sup> ("Testimony" in Swahili) was developed in Kenya during the elections of 2008 to map reports of post-election violence, including Nairobi. The platform was initiated by a group of volunteers in response to the acute need to monitor violence and protect citizens and proved so successful that it has been utilised around the world and become a commercial product for crowdsourcing on various societal issues, allowing citizens to 'raise their voice'. The initiative was so successful that it led to the creation of iHub<sup>15</sup> in 2010, an innovation and technology incubation space known for driving further development of the innovation ecosystem in Kenya (Fingo, 2020). These developments led Nairobi to become "*the second-best innovation and start-up capital of Africa consisting of a decent number of innovation hubs and incubators, financiers including CSO's and the city seems to be packed with entrepreneurs*" (Fingo, 2020, p. 9).

In 2011, the national open data portal<sup>16</sup> was launched with financial support from the World Bank. Figure 3-4 demonstrates the ecosystem envisioned for the Kenya Open Data Initiative (KODI) where the World Bank played a central and connecting role between the government and data users. The government changed in 2013 and the momentum for KODI was lost, i.e., it no longer had a 'champion' in the government. Although the new president, Uhuru Kenyatta, made promises to open up government data, the initiative stalled when donor funding ended (Mutuku and Mahihu, 2014). The portal mostly contained data from the national agencies, and not from the county/city level.

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<sup>13</sup> Data provided on Vodafone official website: <https://www.vodafone.com/what-we-do/services/m-pesa>. Last accessed on February 7, 2021.

<sup>14</sup> Official website for Ushahidi: <https://www.usahidi.com>. Last accessed on February 7, 2021.

<sup>15</sup> Official website for iHub: <https://ihub.co.ke>. Last accessed on February 7, 2021.

<sup>16</sup> Kenya national open data portal: <http://www.opendata.go.ke>. Last accessed on June 22, 2020.

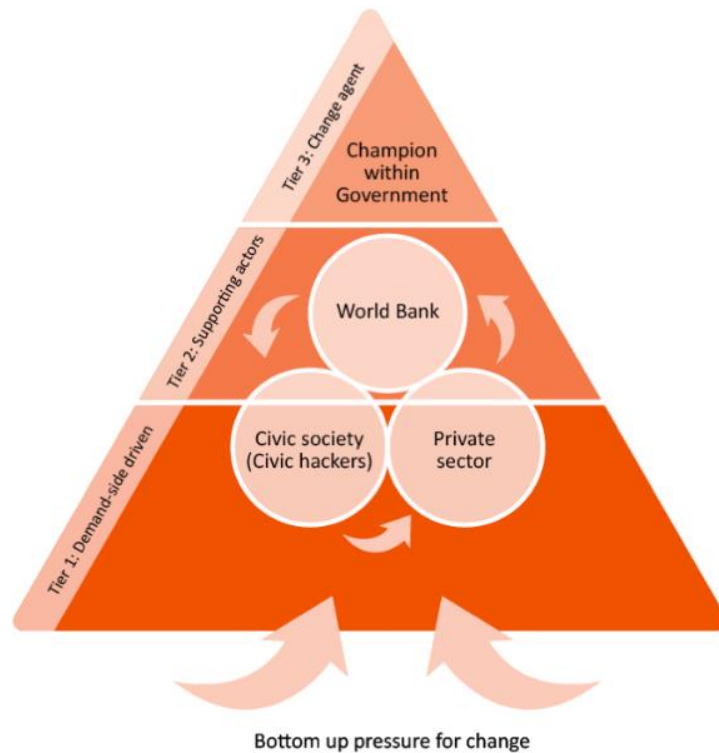


Figure 3-4: Kenya open data ecosystem (Rahemtulla *et al.*, 2012, p. 20)

Recognising the importance of digital spaces to Kenyan people, the government launched the eCitizen platform in 2014 to become a one-stop shop for all services. Since 2017, Kenyan citizens receive essential government services on this platform<sup>17</sup>, ranging from applying for a passport or driver’s licence to requesting health insurance or business registration. Other authorities such as tax and roads have developed similar portals that are not integrated with eCitizen (Nyabola, 2018).

#### *Nairobi governance system*

One of the key characteristics of Kenyan society in the last decade has been the decentralisation of decision power accompanied by a push for a more ‘engaged’ citizenry for enhanced accountability and service delivery through ‘bottom-up’ public participation approaches. Kenya adopted a new constitution less than a decade ago, which has an impact on how cities are functioning. Since the adoption of the new constitution in 2010, one central system of government in Kenya was replaced with the national and county governments. 47 counties at the same time

<sup>17</sup> eCitizen platform website: <https://www.ecitizen.go.ke>. Last accessed on February 7, 2021.

'are independent but interdependent with the national government'. Nairobi is one of the counties, so anything that pertains to a region within a county goes to the county governments. The lowest level of the official local government is a ward administrator, responsible for roughly 50,000 people. Table 3-2 outlines Kenya's government structure.

*Table 3-2: Governance structure in Kenya (compiled based on interviews and desk research).*

National Government	County Government	Level	Population (census 2019 or estimates)
President, Senator, Members of Parliament (elected)		National	47.6 million 53.8 million (UN, 2020)
Regional Commissioner		Region	
County Commissioner	Governor, Members of County Assembly (elected)	City of Nairobi (one of 47 counties)	4.4 million
Subcounty Commissioner	Subcounty Administrator	Subcounty	11 subcounties, circa 200,000 to 1 million in each
Assistant County Commissioner	Ward Administrator	Division	40,000-100,000 people
	Chief	Location	N/A
	Not present in Nairobi: Assistant Chief Village Administrators (volunteers)	Village/Sublocation	N/A

Since the first bombing in 1975, Nairobi has been under constant threat of terrorist attacks from neighbouring Somalia's terrorist group, the al-Shabaab (Rotich, 2020). In 2013, following terrorist attacks in one of the largest malls in Nairobi, Kenya adopted the Tanzanian 'Nyumba Kumi' ('ten households') system, adopted as a means to establish community policing at the household level (Ndono, Muthama and Muigua, 2019).

Key to the Kenyan governance system, especially on the local level, has been the process of devolution introduced by the 2010 Constitution of Kenya, which started implementation in the second half of 2013. The decentralisation process through devolution aims to empower the level of government and communities to take decisions on all matters. At the time of this PhD research, it was still a work in progress in Kenya, and the country's previous attempts to devolve decision-making powers to the lower levels of government had failed (Kanyinga, 2016).

The following two initiatives were selected to address the research questions.

### *Map Kibera*

Initially, Map Kibera started as an initiative 'to put people in Kibera on the map' using OpenStreetMapping tools and community volunteers. Soon, it moved beyond maps and started

using mapping data to do journalism and report on issues in the community. Recognizing the limitations of using technology in slum areas, Map Kibera has taken data offline, using paintings on the walls.

Map Kibera data has also been utilised by the government and community members to bring mobile clinics to Kibera, where the maps revealed a lack of health facilities, added toilets based on water and sanitation maps and organised additional security.

### *sensors.AFRICA*

sensors.AFRICA is a community-based project of Code for Africa<sup>18</sup>, a civic technology, open data and data journalism initiative. The sensors.AFRICA project provides citizens, community groups and local businesses with knowledge, sensors and data infrastructure to measure different types of pollution: air, water, noise and radiation. Then, these data are published openly online in a reusable format and through dashboards. Engagement has been found difficult. The project operates in different countries of Africa – Kenya, Tanzania, Nigeria, South Africa and Uganda. At the time of the study, out of 72 sensors deployed, 58 were in Nairobi. All sensors are location-tagged. While having the advantage of being the first pilot city in the project, it also has all the ‘pain points’ as the team is learning what works and what does not.

### 3.3. Methods of data collection

To investigate these city cases and initiatives, several data collection methods were used: (i) expert interview, (ii) direct observation and contextual interview, and (iii) focus group discussion – these are discussed in the subsequent subsections.

#### 3.3.1. Expert interview

Expert interviews were conducted to inform the case study research and to develop and refine the scope of a precise thesis. This method of data collection has been generously used in social sciences and is considered more ‘efficient and concentrated’ in exploratory phases of research compared to other alternative methods (Bogner, Littig and Menz, 2009). Semi-structured interviews are *“well suited for the exploration of the perceptions and opinions of respondents regarding complex and sometimes sensitive issues and enable probing for more information and clarification of answers”* (Barriball and While, 1994, p. 330), which was why this method was

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<sup>18</sup> Code for Africa official website: <https://codeforafrica.org>. Last accessed on June 22, 2020.

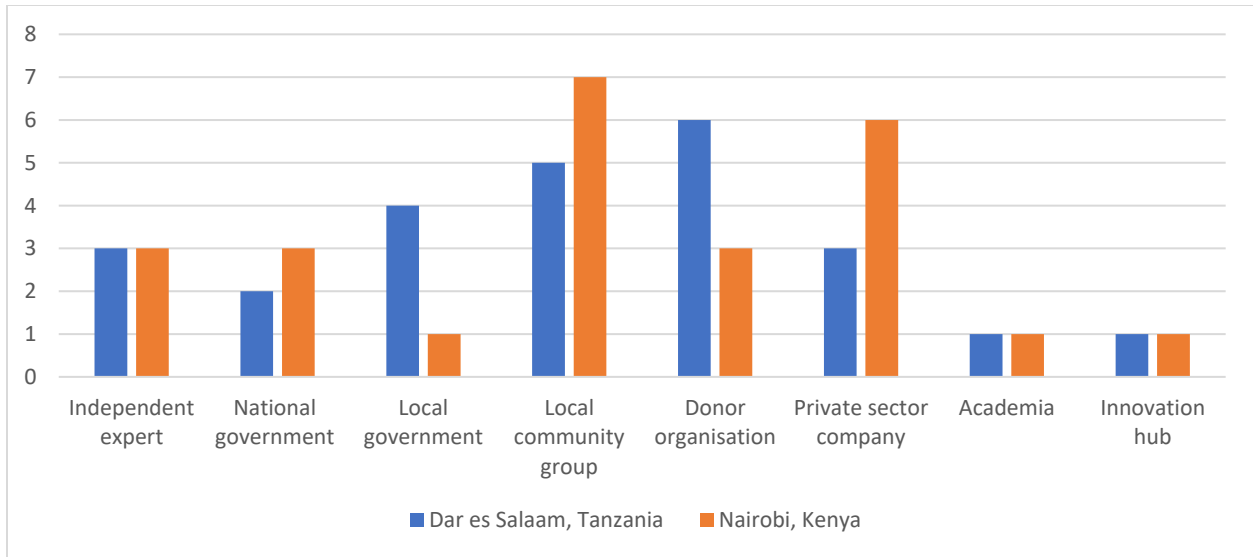


selected to gather information at the initial stage of research to form a base for further investigation.

What constitutes an expert is a relatively recent debate in the literature on qualitative research. This research adopted an approach to experts as 'stakeholders', i.e., the experts are also participants in the processes that are being studied. This approach is common for evaluation studies (Bogner, Littig and Menz, 2009).

A researcher uses their own judgement to recruit interviewees whom he or she considers experts for a particular study, taking into account the research objectives. "*An individual is addressed as an expert because the researcher assumes – for whatever reason – that she or he has knowledge, which she or he may not necessarily possess alone, but which is not accessible to anybody in the field of action under study*" (Bogner, Littig and Menz, 2009, p. 18). For this project, the researcher used her knowledge of the expert community and contacts with stakeholders in the field, supplemented by desk research and recommendations from colleagues and those experts who were interviewed, known as the 'snowball' technique (Flick, Kardorff and Steinke, 2004, p. 168).

An initial list of key stakeholders was developed of people who were involved in the implementation of community projects using technology and data in Dar es Salaam and Nairobi, and additional interviewees were identified following a 'snow-balling' approach, which means additional interviewees were added based on suggestions from the study participants. Stakeholders who participated in the interviews included representatives of national and local government, private sector companies and start-ups, international development organisations, local community initiatives and academia, international and local experts in open data and urban data innovations, and leaders in non-profit organisations. A total of 50 interviews were conducted in both cities: 25 in Dar es Salaam and 25 in Nairobi. Figure 3-5 presents the number of people interviewed from different categories of stakeholder groups.



*Figure 3-5: Number of interviewees per category of stakeholder group represented in Dar es Salaam, Tanzania and Nairobi, Kenya.*

Interview data were collected mostly in face-to-face interviews over several field trips to Dar es Salaam and Nairobi from November 2017 to October 2019. During these trips, semi-structured interviews were conducted to gather examples of how and in which areas people engaged with data, what processes took place and what the time scale was for these engagements. The initial list of questions for semi-structured interviews was derived from literature review to address the research questions of this PhD, by reviewing other examples and trying to identify useful departing points for a discussion with each interviewee, after which these were reviewed by supervisors. In the first field trip during the piloting phase, the initial questions were tested with several respondents. Based on the pilot interviews, questions were revised and refined, accounting for the feedback from the pilot interviewees. The final questions asked in the interviews are presented in Figure 3-6.

### Semi-structured interview

Global city population has been growing dramatically in the last few decades, with most the growth taking place in less developed countries. Cities generate vast amounts of data daily. City governments around the world have turned to data-enabled tools and 'smart' technologies known as a 'smart city' approach in search of effective and efficient solutions for pressing urban issues. Opening public data, citizen participation and collaboration among all stakeholders are considered crucial to solving pressing issues of urbanization.

The objective of this interview is to understand how the City [Name] currently employs citizen-centric approaches and data in smart city transformation. Your responses will be used to inform the case study research, and to develop a framework for inclusive data-driven decision-making in a citizen-centric smart city.

#### Questions:

##### 1. Introduction

- Please state your job title and explain briefly your role at your organization.
- What is the connection of your organization to City [Name] and Smart City?
- Do you use city data in your job? If yes: How? How does it benefit the citizens/city?
- What are the barriers to using data in city [Name]?
- Do use any open data and/or make any data open available? why/why not?

##### 2. Smart city concept and existing initiatives:

- What's the vision of City [Name] as a smart city? What are the barriers for City [Name] to meet smart city goals?
- What smart city initiatives in City [Name] are you aware of<sup>1</sup>?
- Which challenges they aim to address? What data is being used to address them and how? What is the 'traditional' way of solving them?
- How were they decided on/implemented? Are they 'citizen-centric'? Why/why not? What data was used to design them? How was public consulted to design them?
- Who is responsible for coordinating those projects? Who else are engaged?
- Do they use/produce open data?<sup>2</sup> Please explain how.

##### 3. Citizen participation:

- How do citizens participate in decision-making in City [Name]?
- How is data and technology used to engage with the citizens?
- What is the role of the citizens in generating city data? Does the city government use citizen-generated data to address city challenges? How? What are the barriers for using these data?
- How do citizens use government data to address city challenges? What are the barriers for using these data?

What does it mean to be a 'citizen-centric' smart city?

<sup>1</sup> If struggle to name "smart city" initiatives: any other initiatives in the city that transformed the way the city delivers service to its citizens/solves urban challenges using data and technology?

<sup>2</sup> provide definition of 'open data' if necessary

Figure 3-6: Questions for a semi-structured interview.

These interviews were subsequently transcribed and analysed thematically, which is described in the Data analysis subsection on page 81.

In addition to the literature review, expert interviews provided initial insights into processes within these urban environments, examples of how and in which areas people engage with data, what processes take place and what the time scale is for these engagements, and subsequently fostered the development of several hypotheses, which needed to be validated through follow-up studies with each of these communities. To deepen the applicability and insights of this work, direct observations with contextual interviews as well as focus group studies with community

representatives were conducted in each case study city for comparison with the interview findings – these are discussed in the next two sections.

### 3.3.2. Direct observation and contextual interview

Direct observation and contextual interview as ethnographic methods of data collection were employed to gain a deeper understanding of how community initiatives functioned on the ground. One of the key characteristics of ethnography as a research method is observing people in their natural setting (Sangasubana, 2011).

Observations have an advantage over interviews as the researcher acquires direct access to the phenomenon of interest instead of gathering other people’s perspectives on it (Merriam, 2009), and “enables us to document members accounting to each other in a natural setting” (Dingwall, 1997, p. 60). Key to this research method is to collect data by observing participants as they conduct their usual activities (Creswell, 2014).

The fieldwork following the expert interviews included direct observations on-site of people participating in data-driven activities related to dealing with the city issues. This included working from the offices of community initiatives, participating in mapping data collection exercises, and city clean-up campaigns among others (full list of study activities is presented in Table 3-3).

*Table 3-3: Observations and contextual interviews – log of activities.*

Date	Location	Name of the event	Initiative	Participants
July 3, 2019	Dar es Salaam	World Bank internal meetings	Ramani Huria	Staff
July 5, 2019	Dar es Salaam	Observations in the office; Interviews	Ramani Huria	Staff, volunteers
July 6, 2019	Dar es Salaam	Community clean-up	Nipe Fagio	Community members, local government, volunteers
July 6, 2019	Dar es Salaam	Observations in the office; Interviews	Nipe Fagio	Staff, volunteers
July 8, 2019	Dar es Salaam	World Bank internal meetings	Ramani Huria	Staff
July 9, 2019	Dar es Salaam	Observations in the office; Interviews	Ramani Huria	Staff, volunteers
July 10, 2019	Dar es Salaam	Observations in the office; Interviews	Ramani Huria	Staff, volunteers
July 10, 2019	Dar es Salaam	Community mapping field trip	Nipe Fagio Ramani Huria	Staff, volunteer mappers
October 2-3, 2019	Dar es Salaam	Understanding Risk Tanzania Conference	Nipe Fagio Ramani Huria	Staff, volunteers, community members, local government
October 10, 2019	Nairobi	Observations in the office; Interviews	Map Kibera	Staff, volunteers

October 11, 2019	Nairobi	Observations in the office; Interviews	Map Kibera	Staff, volunteers
October 14, 2019	Nairobi	Observations in the office; Interviews	sensors.AFRICA	Staff
October 15, 2019	Nairobi	Observations in the office; Interviews	sensors.AFRICA	Staff

The objective of direct observations was to investigate how people and communities involved in data-driven initiatives and community activities interact with and use data in their routine activities and community events, in dealing with the urban challenges they face. But also, observations provided an insight into how the initiatives are organised and managed on the daily basis. To conduct this, the researcher observed organisations implementing data-driven initiatives and attended community events organised by the identified community organisations in Dar es Salaam, Tanzania and Nairobi, Kenya, as well as attending meetings and participating in the discussions between different stakeholders. For example, while observing the everyday work of staff in the offices of community initiatives the researcher was able to gain an understanding of how the activities were being planned and organised and how data were stored, managed and used. This also provided additional opportunities to interact with the community members and leaders and ask clarifying questions in the settings that were comfortable for them. The researcher also attended local events and observed the participants as they were carrying out activities such as community mapping data collection and community clean up.

Observations of routine activities were captured in detail in the observation journal, which was used to support the research findings, and the contextual interviews with the participants following observations were transcribed, anonymised and complemented the data captured in the expert interviews and focus groups. Focus group studies are discussed in the next subsection of this chapter.

During the observations of activities performed by study participants, the researcher needs to understand what exactly is happening. For that, they may need to employ contextual interviews, which are used to ask clarification questions on what the researcher is observing. Integration of observation and interview is necessary to comprehend and develop a more detailed understanding of the processes that are being observed (Berndt, Furniss and Blandford, 2015): “a contextual interviewer observes users as they work and asks about the users’ actions step by step to understand their motivations” (Beyer and Holtzblatt, 1999, p. 34). Some organisation representatives and community members were approached for follow-up contextual interviews regarding some observations, with questions seeking clarifications on their tasks and additional general interview topics such as: (i) data collection; (ii) data access; (iii) data use; (iv) types of

data; and (v) collaboration with other stakeholders such as government, community organisations, international aid agencies, etc.

To ensure collaboration from the community members, the leaders of those initiatives facilitated access and introduced the researcher to the community. The study involved visiting workplaces of the selected initiatives for one or two days, and community events with up to approximately 25 participants in each setting. In Dar es Salaam, visits to Ramani Huria and Nipe Fagio offices were conducted combined with contextual interviews with team members, as well as participation in community clean-up and mapping activities, and attending World Bank meetings to discuss the progress of the Ramani Huria project in July 2019. In Nairobi, focus groups, office work observations and contextual interviews were conducted in October 2019.

### 3.3.3. Focus group discussion

Focus group discussions are employed in qualitative research and are effective where *“the provision of a rich understanding of people’s lived experiences and perspectives, situated within the context of their particular circumstances and settings”* (Freeman, 2006, p. 491) is required:

*“Focus groups are unstructured interviews with small groups of people who interact with each other and the group leader. They have the advantage of making use of group dynamics to stimulate discussion, gain insights and generate ideas in order to pursue a topic in greater depth”* (Bowling, 2002, p. 394).

There is no consensus around the design and the significance of the outcomes from focus group research; specifically, there are disagreements in the following areas: (i) sampling; (ii) group composition, i.e., homogeneity/heterogeneity; (iii) interaction between focus group participants; and (iv) ability to draw inference from the results. For this research, Kitzinger’s contextual constructionism approach was adopted, which considers discussion in pre-existing groups valuable as they have more ‘naturalistic’ interactions. The approach also considers less homogeneous and more interactive focus groups stronger. The generalisability of the results depends on the reader (Freeman, 2006).

The objective of the focus group discussion was to understand how the community initiatives in Dar es Salaam and Nairobi currently deploy data-driven approaches in dealing with the urban challenges they face, what are the benefits, disadvantages and obstacles to collecting and using the city data by the citizens. Hence the groups were formed with heterogenic participants, who either at the time of the study or before that participated in community-based

activities and collected or used city data in carrying out those activities. In some groups, some members had worked together and hence had a pre-existing relationship, which helped 'break the ice' between the participants and led to a more interactive discussion. Focus group discussion data were used to inform the case study research in addition to the expert interviews and observations. Questions for the discussions are presented in Figure 3-7.

Focus Group Discussion	
<b>Questions<sup>1</sup>:</b>	
<b>1. Introduction</b>	
	<input type="checkbox"/> Could you please introduce yourself and share with the group how you engage in the work of [Name] organization/initiative? <input type="checkbox"/> How did you get involved? Why?
<b>2. City challenges:</b>	
	<input type="checkbox"/> What challenges in your opinion are the most pressing in your city? How do they affect you as a citizen? <input type="checkbox"/> What is the role of the citizens/your role in addressing these challenging? <input type="checkbox"/> What initiatives are you aware of that use technology and data to address these challenges? Do you participate in them? How? <input type="checkbox"/> Does the work of [Name] organization/initiative help solve these issues? How? <input type="checkbox"/> How does the government support this work?
<b>3. City data access and use:</b>	
	<input type="checkbox"/> Do you collect your own data about the City [Name]? How? Why/why not? <input type="checkbox"/> Do you face challenges in collecting data? What about processing the data – is there work that has to be done with raw data before you can use it? <input type="checkbox"/> Do you search for city data? How? Why? Do you find it easy or difficult? <input type="checkbox"/> Are you familiar with the concept of 'open data' <sup>2</sup> ? Do you use government 'open data'? Why/why not? <input type="checkbox"/> Does your organization/initiative publish 'open data'? Why/why not? <input type="checkbox"/> In your opinion, what is the role of the citizens in generating city data? <input type="checkbox"/> What are the key benefits and disadvantages to using data as opposed to relying on traditional approaches?
<b>4. Smart city concept:</b>	
	<input type="checkbox"/> What does it mean to be a 'citizen-centric' smart city? <sup>2</sup> <input type="checkbox"/> Is your city a 'smart city'? Do you consider your project/initiative 'smart'? 'citizen-centric'? Why/why not? <input type="checkbox"/> Who should be involved in 'smart city' projects'? How? Why?
<b>5. Is there anything else you would like to add on the topic of our discussion?</b>	
<hr/> <small><sup>1</sup> Questions are semi-structured, not structured, so other related follow questions may be asked within the scope of interest</small> <small><sup>2</sup> provide definition of 'open data' if necessary</small> <small><sup>3</sup> if struggle to name "smart city" initiatives: any other initiatives in the city that transformed the way the city delivers service to its citizens/solves urban challenges using data and technology?</small>	

Figure 3-7: Questions for a focus group discussion.

The format of the focus group was a two-hour discussion with eight or nine people in each focus group (two per city). Discussions were audio and video recorded and then transcribed as necessary to ensure the accuracy of data. In both cities, participants for the focus group discussions were recruited via partner organisations. Specifically, the four initiatives that were being studied assisted in organising the studies. They included volunteers and members of the community who were active participants of similar initiatives, with a more or less equal gender

split between the participants. Partner initiatives also provided space for the focus groups. In Dar es Salaam, two focus groups with local community volunteers and activists were conducted in July 2019, and in Nairobi in October 2019. Table 3-4 presents a log sheet for all focus groups including when and where they took place, how many people participated, and which initiative helped organised which focus group discussion.

*Table 3-4: Focus group log sheet in Dar es Salaam in Nairobi*

<b>Date</b>	<b>Location</b>	<b>Number of participants</b>	<b>Organising partner</b>
July 4, 2019	Dar es Salaam	8	Nipe Fagio
July 8, 2019	Dar es Salaam	8	Ramani Huria
October 11, 2019	Nairobi	9	Map Kibera
October 15, 2019	Nairobi	9	sensors.AFRICA

Participants were not paid for participation but were provided with a meal at the end of their focus group session and reimbursement for their transportation cost to join the study.

#### 3.3.4. Ethics considerations

The appropriate ethical guidelines, considerations, and review were continuously followed throughout this PhD research project. The initial ethics application for Phase I of the research (semi-structured expert interviews) was submitted on 25 September 2017 and included: ethics application form, participant information sheet, participant consent form and interview questions. The approval was granted on 3 November 2017, following the resubmission of the application, which addressed reviewers' feedback to provide further information about the studies.

The ethics package was updated before the start of Phase II (direct observations and focus groups) to include information about new follow-up studies and updated consent forms. The updated ethics application was submitted on 23 May 2019 and the approval was granted on 13 June 2019. To avoid any possible conflict of interest due to a perceived affiliation of the researcher with the World Bank, the consent forms included a disclaimer that the studies were being organised independently from any organisation, including the World Bank.

#### 3.3.5. Limitations

One of the limitations was the lack of access to participants for focus group discussions. Collaboration with partner organisations on the group was the only way to recruit focus group participants, but in the process, there was little room to have oversight. After providing requirements, the process of recruitment was organised by a partner organisation, which meant



that in some cases the composition was more or less heterogenic, with groups that had some pre-existing relationship. This was not even across all four groups.

Specifically, for Tanzania, the researcher's lack of knowledge of the Swahili language or the ability to have a simultaneous Swahili interpreter imposed a limitation on who could participate in the focus group discussions. Since one of the requirements was to be able to speak in English, it attracted the participants who work more on the organisation level of community-based initiatives, rather than the community level. This is discussed further in the final chapter in Section 7.4 – Limitations and future work.

### 3.4. Data analysis

Recordings from expert interviews, focus group discussions and contextual interviews during fieldwork and observations were transcribed and analysed using thematic analysis.

#### 3.4.1. Thematic analysis

*“Thematic analysis is a search for themes that emerge as being important to the description of the phenomenon”* (Fereday and Muir-Cochrane, 2006, p. 82) and is the most common qualitative approach used for interview data analysis (Jugder, 2016). Unlike content analysis, which focuses on counting specific words and phrases and therefore is considered a quantitative analysis of qualitative data, thematic analysis is focused on *“identifying and describing both implicit and explicit ideas within the data, that is, themes”* (Guest, MacQueen and Namey, 2012, p. 9).

While thematic analysis is a qualitative method widely used across many disciplines, it has some potential pitfalls including failure to provide actual analysis, using data collection questions as ‘themes’ and lack of coherence within each theme (Braun and Clarke, 2006), and care was taken to avoid these potential issues. An inductive approach to thematic analysis is one possible option and it *“allows the data to determine the set of themes that are to be identified in line with the aim of this study”* (Bibri and Krogstie, 2020, p. 12). Framework for thematic analysis in this PhD was developed *“to identify themes (inductive) by discovering patterns, themes, and concepts in the data collected”* (Bibri and Krogstie, 2020, p. 12). The analysis followed the six stages outlined in Braun and Clarke (2006), presented in Figure 3-8.

Phase	Description of the process
1. Familiarising yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Figure 3-8: Phases of thematic analysis (Braun and Clarke, 2006).

Stage one included transcribing all audio and video recordings from the field studies: interviews, contextual interviews and focus group discussions. This was an ongoing process after each field trip, so a set of transcriptions was added to the database under each of the two case studies after each field trip. Transcriptions were combined with the observation journals and then reviewed initially to note initial ideas.

In stage two, initial codes were generated, and a database of codes was built. First transcriptions were used as sample texts to develop initial codes following inductive coding (also known as 'open' coding), generally employed in constructivist studies (Chandra and Shang, 2019). This means that codes are not prepared in advance, but are created and recorded from the data as the coding process occurs "*without being predicated on any theory, construct or concept*" (Chandra and Shang, 2019, p. 101). Text was analysed line by line which is an advisable technique in open coding (Flick, Kardorff and Steinke, 2004) starting from small portions of the transcripts progressing to larger units of text as codes were being developed. Initial open coding focused on recording all the phenomena mentioned by interviewees around any smart city vision for Dar es Salaam, examples, initiatives and processes; data collection, use, release and management practices; citizen engagement and government collaboration in the city. Once the initial list of codes was developed, other transcriptions were reviewed using the same codes. If

new codes emerged, they were applied to earlier transcripts to see if there were additional relevant data. All data were coded manually in the NVivo 12 software package, which helped the researcher to organise data for the analysis. Over a hundred code words and phrases were developed that had relevant evidence, and a long list of initial themes was developed.

In stage three, code words and phrases were combined into codes and were organised into a hierarchical coding frame. *“Hierarchical coding allows the researcher to analyse texts at varying levels of specificity with broad higher order codes providing an overview and detailed lower order codes allowing for distinctions to be made within and between cases”* (Nowell *et al.*, 2017, p. 6). As described earlier in this section, while the list of codes was developed inductively from the data, they were then organized deductively based on the factors that were relevant to the research questions of this thesis. Specifically, the researcher categorized quotes according to the following characteristics: (i) type/group of stakeholders; (ii) urban challenges; (iii) nature and process of community involvement; (iv) technical process and procedures of data lifecycle: collection, storage, management, sharing and circulation; (v) benefits and challenges of data use; (iv) smart city initiatives. Based on these characteristics, the code words were then grouped and organised.

In stage four, the initial list of themes was collated from the coded extracts (level 1) and the entire dataset (level 2) and study reports, which included summaries of the studies, were produced, including the ‘thematic map’ of the analysis. At this stage, codes were reviewed repeatedly and checked if they were being used consistently or if there were any overlaps. The working draft reports were produced for discussion with the supervisors.

In stage five, through ongoing review of the reports and engaging in regular discussions with the supervisors, specific themes were refined as was the story that the data was telling. At this stage, themes were revised and consolidated into seven key themes that accumulated a significant level of interest and evidence from the researcher’s point of view and were common in both Dar es Salaam and Nairobi, with some similarities and differences within each theme. For example, the key theme ‘City Organisation’ described in Section 6.1 included codes ‘Governance Structure’ as well as ‘Government Collaboration’ and ‘Accountable Government’ with four-five hierarchical sub-codes. The views expressed by participants in expert interviews and focus group discussions were analysed according to the stakeholder group they represented and compared with the observations made on the ground. The discussion of the results represents the researcher’s interpretation of these data.

In the final stage, vivid and compelling extracts and examples were selected to support the narrative of the identified themes. The final seven overarching themes are discussed in Chapter 6 – Analysis and application.

Overall, a ‘descriptive case study approach’ was used as a framework, which is deemed suitable “*to collect and analyze data from different documents related to the selected cases*” (Bibri and Krogstie, 2020, p. 13) employed for looking at data-driven innovations in smart cities.

#### 3.4.2. Triangulation

Triangulation is “*the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena*” (Carter *et al.*, 2014, p. 245). Throughout fieldwork and data collection from interactive research activities, a review of publicly available documents and video and audio materials was continuously conducted to help analyse the cases situated in the context, including understanding the social, historical and economic environment of both cities (Creswell, 1997). Triangulation was also achieved through the use of multiple qualitative research methods, including complementing direct observations with contextual interviews, which helped understand the processes the researcher observed with the explanations provided by the subjects being observed. Through regular supervision meetings while data collection was ongoing, and through the discussion of the interim findings with the supervision team, the perspectives from their respective disciplines were being incorporated into the data analysis.

### 3.5. Conclusions

This chapter focused on the research design and methodological approach of this thesis, which were developed to address the research questions and the knowledge gap identified in the first two chapters through a literature review.

To address research questions, a qualitative research approach was pursued to gain a ground-level perspective on how data are generated, circulated, accessed and leveraged by stakeholders through community-based initiatives in two case study cities – Dar es Salaam and Nairobi. Through Phase I – expert interviews – the initial scoping for this research was done and community-based initiatives were identified in each city for further examination of how they employed data-driven approaches to address particular sustainability challenges in their communities. The second phase – direct observations, contextual inquiries and focus groups – allowed us to take a closer look and gain deeper insights into how each initiative was operating to address sustainability challenges in their communities and cities. Such research design

contributed towards examining the data landscape from the point of view of critical social theory tradition, which to date appeared to be lacking in studies conceptualizing data (Kitchin and Lauriault, 2014).

The following two chapters will present empirical evidence and findings from two cities – Chapter 4 (Dar es Salaam) and Chapter 5 (Nairobi). Chapter 6 will provide a discussion of the themes that emerged from the data generated in both cities. The final Chapter 7 will draw conclusions by addressing the research questions and describe the implications of this research for different stakeholder groups.

## Chapter 4. Dar es Salaam

This chapter unpacks key discussion points, data, insights and issues raised by study participants, in four distinct areas, as a precursor to full thematic analysis. These areas correspond to and unpack the supporting questions:

- *How are data generated, circulated, and used (government and non-government)?*
- *How do citizens get involved and participate in this process?*
- *What are the stakeholders' roles in this process?*

Hence, the sections of this chapter cover the material as follows. Section 4.1 covers government data in the city of Dar es Salaam and how the study participants viewed using city data with regards to creating a 'smarter' city. Section 4.2 looks at the community efforts in creating and using data about Dar es Salaam. Section 4.3 looks at how citizens engaged in decision making in the city, including two community initiatives – Ramani Huria and Nipe Fagio. Finally, Section 4.4 provides findings related to stakeholder collaboration and how it impacted citizen participation for the improvement of Dar es Salaam. The concluding Section 4.5 summarises the data from the first case study.

This chapter reports data gathered from all studies, including interviews with various stakeholders: representatives of national and local government, private sector companies and start-ups, international development organisations, local community initiatives and academia, international and local experts in open data and urban data innovations, and leaders in non-profit organisations; and focus groups with the participations of community-based initiatives.

### 4.1. Government data

As discussed in Section 1.3, open government data is considered key to developing a smart city. The greater impact of open data at municipal and local levels was also highlighted by the stakeholders in expert interviews (this method of data collection is covered in Section 3.3.1), especially among the international open data experts.

#### 4.1.1. National government data

While there was a national open data portal in Tanzania, it did not appear to be updated regularly. Data presented on the portal, developed with the support of the World Bank, were limited to three sectors (education, health and water) and national statistics data, and often were 'not granular enough' as suggested by the users of the data in the interviews.

Census data collected every ten years were available and were the main source of national official statistics. The last census had been done in 2012 and interviewees from all stakeholder groups pointed out that the data were outdated and often inaccurate. For this reason, neither the government nor other organisations and communities could rely on the census data for proper planning and service provision. In this context, some community groups had started to collect their own data because there was a big portion of the information on which they were 'missing out'. These efforts are presented in detail in Section 4.2.

While some government data were available in open access, they appeared limited and outdated. Non-government study participants generally believed that the government seemed to collect a lot of data and used them for themselves, but they did not make them public or share disaggregated data that could be useful for analysis and decision making.

At the national level, by law, the National Bureau of Statistics (NBS) collected and was responsible for all nationwide data. Members of community groups reported in a focus group that they 'rely on NBS for the reliable data'. The Statistics Act, which regulated the public use and presentation of any official data, was passed in Tanzania in 2015 and revised in 2019. The Act stated the mission of the NBS was to "*produce quality official statistics and services that meet needs of national and international stakeholders for evidence-based planning and decision making*" and mandated NBS to release 'official statistics'. These data could be found on the NBS web portal<sup>19</sup> divided into categories: GIS data, census data, socio-economic data, and others.

Several organisations raised concerns that the Act might have harmful implications on anyone who worked with data in Tanzania, especially on media and civil society organisations by "*imposing fines, at least three years jail time, or both, on anyone who questioned the accuracy of official figures*" (Dausen, Fick and Heavens, 2018). For example, when it came to the population in Dar es Salaam or the population in the country, only official numbers from the government, which usually were outdated, were allowed to be used. The quote below from a focus group discussion demonstrates what community members thought of the government's role in collecting data, i.e., if the government collected data themselves, they would be able to act upon these data right away:

*"Our mindset here in Tanzania or in Dar es Salaam, everything data [-related are] supposed to be done by the government. [...] the last census here is 2012. [...] we*

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<sup>19</sup> National Bureau of Statistics of Tanzania official website: <http://ramanihuria.org>. Last accessed on July 19, 2020.

*are waiting for the government to do that, because it will go straight. You know the government has a long hand; it can get everywhere”* (community member).

#### 4.1.2. Local government data

At the local level, data were collected through ten-cell leaders (in Swahili: ‘wajumbe’ or ‘mjubme’ in plural), informal political community representatives traditionally covering an area of ten households.

The ten-cell leadership system was originally designed to address the need to collect data at the lowest level. The government added the ‘cell’ level to have more granular data to enable more revenue collection and better service provision. In addition to having access to granular data at the household level, whenever it was necessary, *“one of the drivers of [establishing the ten-cell leadership system] was that if [government] cluster people together, [they] can bring services”* (non-governmental organisation leader). These data could be a source of solutions to city challenges but there seemed to be no mechanism to collect, record and store these data systematically. Ad hoc data collection was used to satisfy specific and time-sensitive needs. Data that were collected often got lost and did not circle back to the people who contributed them.

Interviews with government officials on municipal and ward levels revealed that although the ten-cell leaders were not considered officially part of the formal government, they played a critical role for data collection efforts in cases of emergencies and when the government needed accurate data urgently: *“It depends on the urgency of the information. If it is urgent, we use ten-cell leaders”* (Ward Executive Officer). Apart from the national census that is collected every ten years (the next one is going to take place in 2022), at the local ‘cell’ level the government regularly collected data on businesses, buildings, different activities that were being undertaken within those areas, e.g., small farmers, animal husbandry, how many goats, cows, dogs, cats were in a ward.

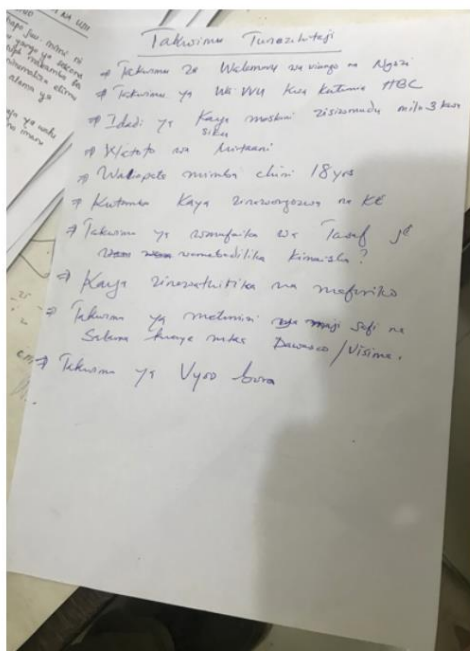
Reflecting on the time when the system of ten-cell representatives was established, a former municipal director said: *“Cell level is in ten households, it's very easy to manage, very easy to obtain all the data”*. He went on to explain that street level (in Swahili: ‘mtaa’) leadership was an official level elected in local elections. But the government wanted to go to another level in a municipality of ten houses (the ‘cell’ level):

*“...[‘cell’ level made it] very easy to know what's happening and even collect all the data precisely because this is a city. People move in and out. [...] So to capture all this data, especially on the resident, it's very easy if you scale it down to another*



level that we called cell level. So, most of the data we collected at the mtaa level and then posted ward level and then at ward level brought in the data to the municipality level. This is how we collect the data [...] Whatever data that you want should be collected at the lower level of government. How many people are there, which age category?" (former municipal government official).

Although it seemed that government data flow should have been constant from lower levels of government upwards, it appeared that often data were collected on ad hoc basis for a very specific purpose. For example, one WEO demonstrated a list of data he requested student volunteers to collect while they were available to provide short-term support to the ward office. Figure 4-1 demonstrates the data request.



List of data need to collect (translated from Swahili):

- Statistics for physical impairment and albinism
- Statistics for people with HIV (Human Immunodeficiency Virus) by using HBC (home based care)
- Number of poor households which cannot afford three meals per day
- Street children
- Impregnated below 18 years
- Identify female-headed households
- Statistics for Tanzania Social Action Fund (TASAF) beneficiaries. If their living condition has changed
- Households affected by floods
- Statistics for use of safe and clean water in Sub wards – Dawasco/Wells
- Statistics for improved sanitation facilities

Figure 4-1: List of data student volunteers were requested to collect in a ward by a Ward Executive Officer.

The WEO administering this data collection activity reported that the opportunities and resources to collect such data in the ward office were scarce. The data listed above had been necessary for his work for a while: “We have the community which needs to be helped so in different aspects”.

In situations of crisis or emergencies ward executives received requests for data from the higher level of government and passed them on to the lower level all the way to the ten-cell leaders to receive up-to-date data on residents. Different departments at ward level, such as health, community development, and social departments were responsible for collecting different types

of data. These data were collected by going to each person's home physically and were accumulated in paper form. Then, the data are passed on to the higher level of government where they get digitised in a form of key statistics (i.e., aggregated). The following section explains how these data are managed, processed and shared within the government.

#### 4.1.3. Data processing, management and access

Getting government data could be challenging even for government officials. WEOs interviewed for the study admitted that they could not access data to compare their wards to other wards because those data were not available to them easily. If they required digital data, they had to request them in person from the information technology (IT) section and needed to state a reason why these data were required, i.e., to have a rationale or 'task' to use the data:

*"It depends on the obligation which you're doing. Because you can't seek information if you don't need it. But if you have a specific obligation, then you seek information"* (WEO).

However, even if the data were available online, access to these data was still problematic for local government officials as one of the WEO interviewees stated, due to the lack of necessary 'equipment' in the ward government office. The WEO explained that when he needed the data from other government entities, it was easier for him to go in person. He said: *"Because we don't have access to the equipment [computers, internet, software packages etc.] which is supposed to be used online"*.

While a public official could gain access to necessary data within the government if a reason for data request was provided and considered valid, the process of requesting government data for anyone outside the government proved to be a more challenging one:

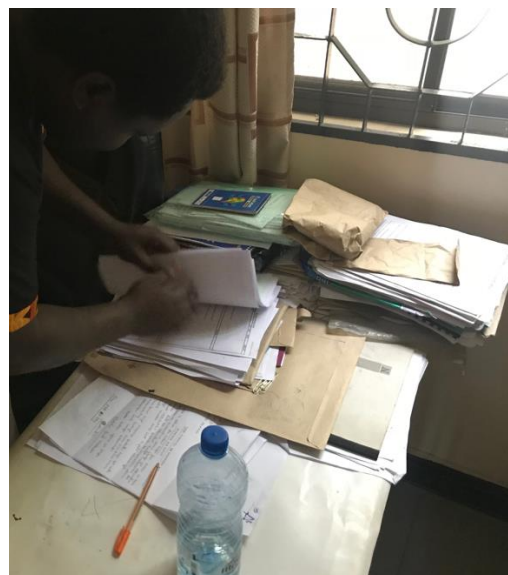
*"Every possible city or rural related data is there, but it's been almost a year since we sent in a formal request for us to be able to access the raw data and all we have been given is access to dashboards, which are like for public consumption, but we don't have access to raw data and we do really need to access raw data for coming up with say this dashboard, and we don't have it. So that's a big challenge"* (non-government organisation leader).

Both government representatives and members of community organisations suggested that the government had granular social data at their disposal in every local office, but these data were not available to the public to perform analysis and comparisons across time periods or across different locations. In one example, an interviewee used a gender-based violence case,

which was a big issue in some areas in Dar es Salaam, but such data were not available on a city level to see whether gender-based violence went up or down through the years. Part of the reason for that was cited as that the data were stored in paper form, and once they were digitised at a higher level of government they were aggregated and were not available outside the government. For data to be managed and processed properly, appropriate data infrastructure needed to be in place. Study participants shared that some basic infrastructure elements such as the internet and computers were not available in government offices at the local level. Figure 4-2 and Figure 4-3 demonstrate a government ward office and how data were being stored.



*Figure 4-2: Ward government office.*



*Figure 4-3: Ward Executive Officer searching for data.*

Data collected at the ward level were shared with the municipal government upon request. A WEO interviewee said that without a request for data from higher government, the data stayed in the ward office, in paper form. Often requests came during floods to assess the damage. When such requests came, then data were collected from the fields on the number of houses that were destroyed, the number of people killed, etc.

Since access to government data was difficult outside the government, often smaller organisations or activist groups opted to work with larger organisations that have already established their credible data exchange channels. One of the community project leaders interviewed for this research said that when they faced a need to access financial data from the

government, they engaged with ForumCC<sup>20</sup>, the organisation known for budget tracking and analysis, rather than going to the source of data at the Ministry of Finance or the NBS.

The next section presents use cases of government data provided by the interviewees from within and outside government.

#### 4.1.4. Data use

The benefits of using data and innovations in the city government cited by the interviewees, that were connected to some smart city examples, mainly focused on: (i) revenue collection (collecting payments through electronic means and phone payments), (ii) planning and decision making (allocating priorities), and (iii) simplifying the job for the government (electronic service delivery). The studies highlighted several needs, such as a lack of data, digitisation, and coherence, as well as a need to support decision-making. The examples below unpack these needs.

Collection of revenue and providing services more efficiently were the main drivers to adopt technology and data within the government. While this was improving the government's operations it was also believed to provide 'citizen-centric' services as it was offering a more convenient way for the citizens to receive those services.

*"In planning, what comes before anything is data"*, a government official said in the interview. He explained a matrix comparison that they used in the local government to identify which issues affected most of the people and which services cut across all of the sub-wards in the ward to make decisions. Examples also included using data for town planning and planning of social services. Key data, which the government used in their work, were provided by the NBS (this is covered in Section 4.1.1). The NBS undertook a population census every ten years, and based on that, the government extrapolated the needs for various utilities and services. However, many interviewees including government officials stated that the government had low capacity at the lowest level (Ward Executive Officers) to process data and use them for decision making:

*"Two things which I think can make that [smart city] come true. One is having the resources for the equipment [computers, Internet, software packages etc.]. But the second is the knowledge dissemination"* (Ward Executive Officer).

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<sup>20</sup> ForumCC is a national civil society organisation network of over 80 member organisations across Tanzania working on climate change issues and beyond. Official website: <http://www.forumcc.or.tz>. Last accessed on February 14, 2021.

A community organisation leader who worked closely with the government echoed this sentiment, stating that they had some challenges because this required capacity and resources that the government did not have. Sometimes they did not even have an office.

Geospatial or mapping data (also referred to as GIS data) were the data the interviewees said they used most often about the city. Accessible and accurate geospatial data are important for smart city applications (Al-Hader *et al.*, 2009; Naidu, 2018). Most interviewees in some ways referred to spatial data as a foundation for smart city services:

*“My belief is that because, for a smart city, data has to be spatial data”* (government official).

*“You can stop just dealing with the consequences and actually address the root of the problem. You can't do that unless you can understand where people are from”* (community mapping project leader).

In the government, efforts to link services to location-enabled databases were made primarily to increase revenue collection. Multiple examples of GIS-enabled government systems were provided, which enabled government officials to collect revenues more efficiently by using mapping tools (such as colour-coded map systems).

Many non-government interviewees assumed that data were available within the government and that the government were using them, however, they were sceptical about the willingness of the government to use the data for improving the city:

*“Improving flood resilience by providing better data to sub-national government officials presupposes that those government officials have the means and the motivation to do something about it, which is a stretch”* (non-government organisation leader).

Another use of the government data that was noted was to secure votes in the elections. A government interviewee reported that most of the data were available at the Chama Cha Mapinduzi (CCM; English: ‘Party of the Revolution’), the ruling political party in the country at the time of the study. Their offices had detailed demographic data in each area because they needed them for elections, which were reported as one of the main uses of government data. Since the majority of ten-cell leaders belonged to the ruling party, cooperation in getting those data seemed to be strong, but for local government officials who belonged to the opposition party in Dar es Salaam, and community members, getting the same data could be more difficult.

Most of the innovation in cities from open government data comes from data re-use (Walravens, Breuer and Ballon, 2014), i.e., from the unintended uses of data, not for the purposes for which they were originally collected. Examples of such uses of data were difficult to find in Dar es Salaam, presumably due to challenges in accessing government data. To improve data re-use in Dar es Salaam: *“there needs to be better recognition that data is data, and it has multiple purposes behind it”* (an international open data expert).

A direct benefit of using open data is considered increased accountability of government and therefore an ability to demand better service quality, albeit with little empirical evidence (Jelenic, 2019). The citizen as an end-user of the data could be more connected to policy discussions and discussions around the quality of public service delivery. For example, if you have access to budget data you could inquire from the government why there is not enough water when there is a budget allocated for water services. Or if you have access to accurate data on education, you could make an evidence-based argument to the government that there are not enough teachers in schools because the teacher-pupil ratio was worse than in any other place in Tanzania (Kambuga, 2013). Similarly, having access to data on the quality of water or air could enable citizens to leverage those data within the existing national government legislation about water and air quality to demand changes.

#### 4.1.5. Challenges in using government data

Apart from using data by private sector companies for planning business operations, examples of using government data in Dar es Salaam mostly remained hypothetical. Interviews with the data users such as open data experts, community members, private sector and even government representatives revealed numerous challenges in using government data for addressing urban sustainability issues.

##### *Access to data*

As mentioned earlier in this chapter, accessing data was a big challenge. Focus group discussants shared that access to reliable data was problematic. There was only one source of data that was considered ‘official’ and allowed to produce data, which was the government. In previous years, other sources such as non-government organisations and individuals were allowed to produce data, but then the government reportedly considered that when everybody produced data it could ‘create disruptions for the country’, as community members in the focus group discussion explained.

As a former municipal director shared, the municipality level data were being used for planning purposes. These data, as he explained, came from the lower level of government in paper form and got digitised at the municipal level. However, digital data were hard to find for the lower level of government. Data from the municipality did not go back to mtaa (sub-ward) level automatically. They needed to request them every time they wanted to use them, and state for which purpose (this is explained in Section 4.1.3). This made it difficult to gain access to granular data and compare indicators between the smaller localities such as wards and sub-wards.

#### *Accuracy of data*

The data that were available were often incomplete or inaccurate. This was reported as a big challenge for using city data for both government and non-government data users. For example, a WEO interviewed said that government data were ‘almost like estimations’.

*“Normally, we found that if we are looking for a map showing the existing situation we will only rely on these topographical maps, which are too old. Some of them are from the '80s and '90s. You cannot use them to design a city or any area at this moment”* (town planner).

#### *Informal settlements*

In the interviews and focus groups, various participants estimated as much as 85 per cent of Dar es Salaam as informal settlements, which means it was unplanned and had poor infrastructure. This made it difficult to collect data in those areas. Not having accurate data on such a large portion of the city will make it difficult to make decisions that appropriately address the challenges that the majority faces. Moreover, data collection efforts in informal settlements were considered ineffective for addressing the challenges citizens faced:

*“And within informal settlements, we understand their status, that the majority maybe they're not educated. So, they need something sustainable. Like we normally have researchers, we have organisations going there, but after that they are left behind. There is no one who will follow up”* (focus group participant).

#### *‘Culture’ and ‘mindset’*

People also often referred to ‘culture’ as a challenge in opening and using data. Local behaviours, customs and traditions provided a number of examples that could make it difficult to adopt data-driven solutions in Dar es Salaam. For example, during a focus group discussion,

participants found it difficult to translate 'smart' into Swahili, and participants who did not understand English could not relate to the term or provide examples.

The word 'mindset' was introduced by participants in a focus group discussion and used to explain a number of challenges connected to the collection and use of data. In certain areas of Tanzanian culture, information was restricted by age and topic. For example, sex education was a sensitive subject, and it was not culturally acceptable to talk about it in public:

*"Customs might have a barrier to the innovation, because, to me, innovation is all about openness. It's number one, a culture of being open to not having a monopoly on information consumption or production"* (former government official).

Many examples demonstrated that because traditionally communities were incentivised to display poor performance of local services so that they could get access to additional funding, data often were manipulated or not disclosed to demonstrate poorer performance than in reality. Anything that related to finances was considered really 'touch-and-go' because everyone 'wanted to look poor'.

*"For me, the most challenging cultural aspect that actually prevents development is that you are not well seen if you succeed. The success of your neighbour is not something for you to say: Cool, my neighbour succeeded!"* (community initiative leader).

Some superstitious beliefs often surrounded data collection efforts. For example, a water point mapping project conducted by a local university discovered that local communities considered that showing water points to foreign mappers was taboo as they believed that if you showed a water point to a foreigner it would dry up.

Another 'cultural' aspect potentially explaining low usage of government data reiterated mostly by international open data experts was a weak entrepreneurial appetite among Tanzanians to use data:

*"In a lot of African countries, people still dream of becoming [...] a big businessman, or they dream of becoming a football star. I mean, here they dream of getting NGO funding. I've met bright, young people, here, in Dar es Salaam, whom if I'd met them in most countries of the world, they would tell me: I have a start-up. And here, they say: I have an NGO"* (international open data expert).



The view expressed in the quote above was shared by international open data experts and project leaders. In interviews and focus group discussions, it was indicated that in Tanzanian culture and system of education, data were not necessarily instilled as an intuitively or automatically valuable asset. Therefore, data as a tool was not a ‘prevalent mindset’ among the Tanzanians, as was positioned during the interviews and focus group discussions:

*“First of all, you need to understand the importance of data, something which we don't, not necessarily do people appreciate data”* (local entrepreneur).

*“A fundamental barrier to using data at the city level is that most everyday people don't care about data, or statistics, or numbers”* (community data project leader).

This seems to be particularly true about geospatial data. People did not rely on maps in their daily lives. As a community data collection project leader shared, this did not depend on education level, or the subject area of an individual, and created a gap between collecting geospatial data and using it for decision making. Even using maps and GIS-enabled navigation smart phone services was reported as challenging for the Tanzanians.

Uber, which started operating in Dar es Salaam in 2016, was brought up by almost all interviewees as an example of smart technology in the city. At the time of the research, it was reported that Uber drivers often did not understand online navigation system and mostly relied on their traditional way of wayfinding places, which was calling customers and getting verbal directions:

*“You’ve had Uber drivers now. They can’t read a map. They’ve never used a map in their life”* (international open data expert).

Tanzanian culture was described as a culture of ‘story-telling’ where especially visual content was critical in communicating ideas. People tended to communicate via images on social media applications such as Facebook and Instagram, although this was not unique to Africa, and the trends for more visual social media interactions like those on Instagram were growing in the Global North as well. Taking this into account, the Data Zetu project<sup>21</sup> incorporated fashion design and mural competitions into their community data work and some smart city community discussions focused on using the arts to promote critical community issues derived from data.

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<sup>21</sup> Data Zetu (“My Data” in Swahili) was a donor-funded community data collection project that worked with community data at a hyper-local level in order to empower communities to make better evidence-based decisions. Official website: <https://datazetu.dlab.or.tz>. Last accessed on February 14, 2021.

However, if data were shared, some participants said they did not get used:

*“Sometimes they share [...] but it is a problem of Africans. They don't want to read. We don't really bother to go through the results, and information, so maybe they're there, open, but we don't really say, or we say that they were not being provided”* (focus group participant).

*“And maybe, most of Tanzanians, we are not data-driven. We are not good at using information for our own advantage, and we are not maybe curious enough to find data. So, we can blame the government, or we can blame the institutions which hold data, but also, we have problems. We don't find information. We are not the kind of people who find data for our own advantage”* (focus group participant).

The next section presents findings related to non-government data.

## 4.2. Non-government data

Due to limited availability and challenges in accessing government data, there were several efforts ongoing in Dar es Salaam to collect data to address city challenges. Various projects employed researchers to collect data using questionnaires. To initiate data collection, the projects were required to receive permission from the appropriate government office for data collection, which required a detailed explanation of why the data were required, how they would be collected, utilised and shared. This section describes further what conditions needed to be met to receive permission to collect data.

### 4.2.1. Permission for data collection

The process was explained by one of the community organisers: to request permission for data collection, the municipal council needed to receive an official letter, then a designated person within a department that managed particular issues within the municipality would need to be contacted. Different departments dealt with various issues: social issues were with the community development officers; solid waste management was with the environment officer and so on. Once the municipal government cleared the request and sent a letter to the ward, an appropriate officer in the ward would then write a letter introducing the data collection activity and the group collecting the data to the community.

Letters to the municipality had to be accompanied by a set of documents such as organisational constitution (for an organisation) or a personal identification document (for an

individual), description of the project, implementation plan, benefits of the project, followed by in-person meetings.

A critical element in the process was to explain 'why' data were necessary. Getting permission from the government to collect the data depended on the purpose of data collection. Community members who participated in focus group discussions explained that some research agendas were more difficult to get permission to collect data for than others. For example, the government-supported flood resilience and solid waste management projects because these topics were not 'controversial', but political agendas such as women's or voters' rights were more difficult. Having a 'non-controversial' purpose for data collection as a mandatory prerequisite to receiving government approval for data collection came through as a strong theme in interviews and focus group discussions with community members. Often interviewees stated that selecting a 'non-controversial' topic for data collection could be a strategy for getting the government to allow data collection.

In addition to the process at the municipality level, any data collection in the country needed to be registered with the Commission for Science and Technology (COSTECH<sup>22</sup>), a national body responsible for the coordination of all research and innovation activities in Tanzania. Any foreign researchers, Tanzanians who were studying abroad and needed to undertake research activities in the country, and Tanzanians other than staff and students from institutions of higher learning, affiliated research institutions or government ministries who are required to do research as part of their duties, needed to complete the registration process and receive clearance for their research from COSTECH, which could take up several months. Researchers or organisations from outside the country planning to conduct data collection in Tanzania were advised not to make any firm plans to visit the country and conduct research before the clearance was granted.

Several donors and foreign aid organisations collected data on specific issues in Dar es Salaam and nationally. The US President's Emergency Plan for Acquired Immune Deficiency Syndrome (AIDS) Relief (PEPFAR) programme, for example, had rich health data on many areas

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<sup>22</sup> Tanzania National Commission for Science and Technology (COSTECH) is a national agency responsible for all research coordination in Tanzania, including the definition of national research priorities and research guidelines, administration of research funds, monitoring implementation of research, and communication of research results. Official website: <https://www.costech.or.tz>. Last accessed on February 15, 2021.

in the country. The programme had detailed data on where human immunodeficiency viruses (HIV) spread and what the complications of the virus were in Dar es Salaam. Similarly, Twaweza (“We Can Make It Happen” in Swahili), an organisation promoting education in East Africa, collected detailed nationwide education data.

Private sector companies also initiated data collection where there were gaps in data. For example, a Cape Town-based company called ‘Where is My Transport’ was collecting data in Dar es Salaam on the dala-dala routes (local public transportation minibuses). They had done that in Cape Town and other cities in Africa. Once they had that data, they were planning to provide them to developers to use their application programme interfaces (APIs) to create local transport solutions based on that data.

A number of community-based initiatives collected data about Dar es Salaam. The next two subsections will describe two initiatives addressing flooding and solid waste management problems, the most critical issues the city was facing: Ramani Huria, community mapping project, and Nipe Fagio, community clean-up organisation. These two initiatives are described in Section 3.2.

#### 4.2.2. Dar Ramani Huria – a community mapping initiative

The implementation support for Ramani Huria came from HOT, an international NGO focused on open map data for community development and humanitarian action. The project employed local staff and worked with local community mappers as volunteers. In 2017, the local staff of Ramani Huria formed a new NGO called OpenMap Development Tanzania<sup>23</sup> (OMDTZ), which would continue working on community mapping and training projects beyond the Ramani Huria project funded by the World Bank and FCDO. Figure 4-4 shows the office of Ramani Huria and OMDTZ.

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<sup>23</sup> The official website of the OpenMap Development Tanzania: <https://www.omdtz.or.tz>. Last accessed on April 11, 2021.

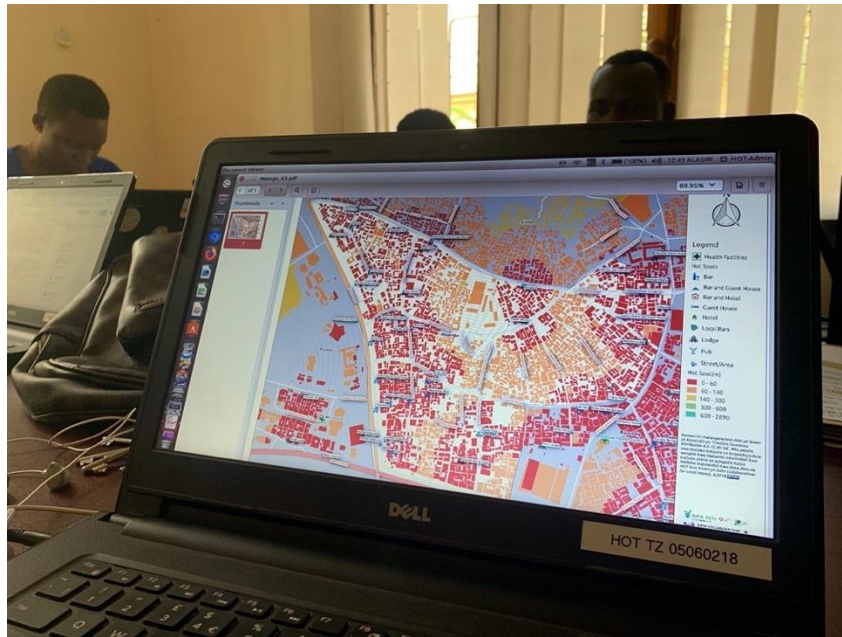


Figure 4-4: Ramani Huria and OMDTZ office – staff working on data on administrative boundaries.

Technologies and software the project used for mapping required training and oversight of the mapping process. The use of smartphones still was not widespread, and people used feature phones. Whereas in the Global North you could expect that the majority of people would have smart phones, especially in the cities, in Dar es Salaam this was still not the case.

Technologies used to engage community members in mapping processes were 'too complex' for citizens to continue using them on their own. Ramani Huria started working with university students, who were able to use more sophisticated technologies. While accurate and detailed mapping data were a significant output of the Ramani Huria project, one of the key objectives of Ramani Huria was to train the next generation of specialists well-equipped with GIS skills. Hence, Ramani Huria worked with young students to teach them the concept of mapping and data collection. Engaging the local university students in training and hands-on mapping activities and educating them as to how these data could be used for planning was considered one of the key successes of the initiative.

### *Community mappers*

Community mappers remained available after training and got called upon when there was a project and an opportunity to participate on a project-need-basis. It was reported that community mappers did not get paid but received a 'stipend' to cover transport costs, soda water,

food and a small amount of pocket money on the days they performed data collection and related tasks.

One such opportunity was at the time of floods. As the first step, volunteers called every ward. Through Ramani Huria's engagement with ward officers, they had collected a database with their names, phone numbers and email addresses. The first call was to try to validate whether the wards were affected or not. Mappers used a specific form when talking to WEOs, asking at what levels they were affected: ankle/knee/waist/chest or above that. This was used to prioritise which ward to go to first to do the mapping. Once in the field, they first used printed maps with tracing paper, pencils, and erasers. They were supposed to work with ward executive officers and other local leaders to trace the most affected areas, depth/volume of the water. Once this was done, they went out and verified the information using the Open Data Kit (ODK<sup>24</sup>) tool. The purpose of this exercise was to create community flood maps that showed assets and where they were affected, e.g., if there was a bridge and water did not pass. As an outcome of this, simple reports with the description of what was on the map were created and shared with Tanzania Red Cross, a key partner in the initiative, to respond to the flood emergency and help people.

#### *Data collection challenges*

Although community mappers were local residents in Dar es Salaam, often they did not come from the areas where they performed the mapping, as reported in a focus group discussion. In these cases, they needed to work with the community members who lived in the area and relied on them to provide the necessary information. In the focus group discussion, volunteers shared some techniques they had adopted for dealing with local communities when collecting data. First of all, they tried to work in one place for a long time to create an environment for local community members to know them and vice versa. Becoming part of that community, socialising and 'institutionalising' yourself towards the community was reported as good practice:

*"Maybe you visit a person; then, "Oh, my dear friend, how are you?" Or maybe without any greetings, you demand some information. Definitely you can't get that information" (focus group participant).*

Data collection on waste management in the community was considered a challenging task for community mappers because people perceived providing negative information (such as

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<sup>24</sup> Open Data Kit (ODK) is an open-source software tool for collecting mapping data using smart phone technology. Official website: <https://opendatakit.org>. Last accessed on February 14, 2021.

the location of rubbish hotspots) as potentially harmful for the community. Revealing information about poor waste disposal could lead to legal consequences from the government and a large fine. These fears could prevent accurate reporting about such problems within a sub-ward in order to ‘protect your pocket’.

Another challenge related to data collection through community initiatives introduced in multiple interviews and focus group discussions was the sustainability of these efforts:

*“If you find someone has rented for three months, and then that person is gone, and then comes another person. Who is there to educate another population at this time? So, if the awareness, the education is not sustainable, people will keep on having the same behaviours and the place will remain the same. So, we need something that is continuous”* (focus group participant).

A representative from a local government office said in the focus group discussion that since she started working at the office, she had not seen any NGO that collected data like Ramani Huria did, and even the government did not have the data that Ramani Huria collected in the same area. Ramani Huria data hence were better quality compared to government data.

#### *Data management and infrastructure*

Data collected through Ramani Huria were stored in a server. During the visit to the Ramani Huria office, a team member explained that in addition to a virtual server there was a physical server where all the data were stored. If somebody needed imagery or raw data, they needed to use the computer and download necessary data onto a flash drive directly from the server. During industrial training, when Ramani Huria worked with university students in the summer, they used Open Data Kit (ODK) and Open Map Kit (OMK<sup>25</sup>), and they stored those data in online OpenStreetMap (OSM) servers. Hence, some of the data were in the web-based virtual servers and some of them were on the computer in the office. The lack of appropriate infrastructure for storing citizen-generated and community project data was a strong theme, which the research participants described as a challenge to accessing and using citizen-generated data.

OSM online server hosted most of the data Ramani Huria collected that fit within an OSM data model. Depending on a specific project need, Ramani Huria collected other types of data such as drainage data, asset data, soil sampling data, and these did not fit into the OSM model.

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<sup>25</sup> Open Map Kit (OMK) is an open data collection platform – an extension of the Open Data Kit. The official website: <http://openmapkit.org>. Last accessed on February 14, 2021.

In the interview, the Ramani Huria project manager explained that a separate platform like geo-node would be a better way to share the data they generated. Otherwise, most of the data needed to fit OSM requirements, which limited the types of data the project could put online.

Ramani Huria collected different types of data that were not supported by the OSM portal. In addition, it was reported that the OSM platform had ‘a tagging issue’. Data tagged in accordance with ‘tagging principles’ might not have been visible to the users of the platform. To address these challenges, at the time of this study the project was working on getting a geo-node website where additional data could be released as open data, but it was not functioning. The project was looking for an optimal platform to release all data that had been collected.

Some data collected by Ramani Huria remained private and were provided directly to the government to address particular government needs. Some data such as household surveys for particular projects contained identifiable personal information and were therefore also kept private.

#### *Project impact*

Interviewees mostly considered Ramani Huria a successful data collection exercise. Ramani Huria had done detailed mapping of extensive areas of Dar es Salaam, which could be used by different stakeholders to come up with creative innovative solutions around Dar es Salaam. Using an open-source platform such as OSM for publishing data, while challenging for data management and sharing, provided an opportunity for local innovators to build solutions based on these data.

Some interviewees noted that the project had not yet demonstrated whether the data collected by the community were used to deliver the impactful outcomes of floods, the city’s main challenge that Ramani Huria aimed to address. Often interviewees said they had not seen a change or shift in flood prevention in the city in four years since the start of the Ramani Huria project operation. On the outskirts of Dar, floods destroyed people’s homes and disrupted the normal way of life.

Hard evidence that people used data to prepare for floods was hard to find. However, some anecdotal stories suggested that the local government and some town planners were using Ramani Huria data for local area plans – mainly because there were no other open datasets for these maps. Interviewees from Ramani Huria also reported that they had witnessed that people were using maps for purposes which the project did not intend to address initially.



Nevertheless, focus group participants working on Ramani Huria thought that the initiative had some impact and improved how the government dealt with flood prevention. They believed that the data they collected were useful for all levels of government because while the maps stayed at the local offices, when the government reported upwards, they ‘pushed the maps up’ to the higher levels of government.

Focus group participants also shared that the government had not previously conducted preparatory meetings concerning flood prevention, but since Ramani Huria began, they started to have them. Some study participants believed that the relocation of people away from the flood-prone areas came as a result of Ramani Huria findings, because the government took their reports, and made decisions on shifting people out of those zones. Reportedly the government saw that need and relocated people to safer areas. It was also believed to be a direct result of the data collected by the project. Figure 4-5 and Figure 4-6 demonstrate a local sub-ward office and how data were displayed.



Figure 4-5: Sub-ward government office.

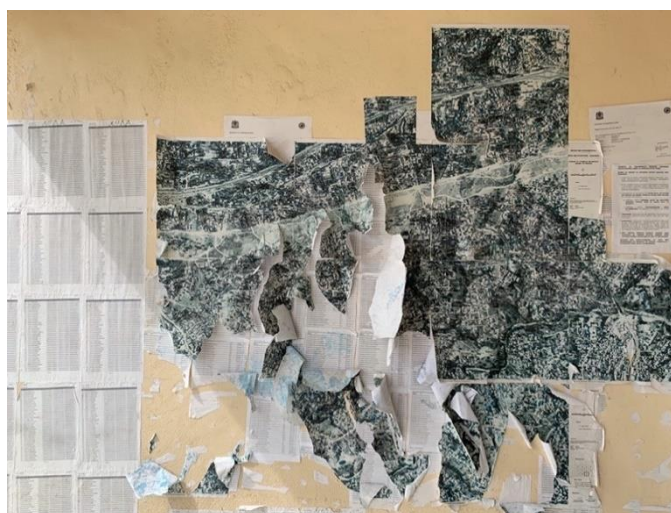


Figure 4-6: Office wall with a ward map and the list of all residents of the sub-ward with their IDs.

### *Government collaboration*

The opinions were divided, however, and some participants believed that on a large scale, most of the recommendations did not reach the appropriate government level:

*“We really fight to just help the government to use our data, because we’ve collected at many wards in Dar es Salaam, and we have a great deal of data from the community, because the government normally used to go when something is*

*happening, like when it's flooding. Then they just run to the places, and start to take photos, to ask people, and leave, while we have data from 2015, until today. Just trying to go to the offices, and trying to tell them that, "Hey, we have this data from 2015, up to today. We have data", so in that case we can compare, like Kigogo. In Kigogo, every year they have this, and we have all the information. We did flood extent mapping, we did sheena [ten households] mapping. Everything we did, we have a lot of data. They have to use it, but now the problem is we didn't get any information from them"* (community mapper).

A representative from a sub-ward office who collaborated with Ramani Huria on the government side also did not think that the government used Ramani Huria data. She reported that the government collaborated for data collection, but the data were being collected for the community and therefore would be returned to them to act on it.

A Ramani Huria staff member explained that they processed data according to what the government needed and then gave it to them. Ramani Huria, considered a non-government initiative, came to collect the data and then kept them. Ramani Huria community mappers believed that the community 'owned' the data since the local people participated in the data collection – they had 'ownership' of these data and believe they are 'theirs'.

Focus group participants considered their ability to work closely with the community was a major advantage that Ramani Huria had over government, as *"government is far level, top government, so they just put orders, so they are not very close with the community"* (focus group participant). The gap between government and community was referred to as a challenge that Ramani Huria was helping to address if the local government could use these maps.

To increase mapping data usage, Ramani Huria conducted training on geospatial data for government officials as part of their activities. Also, they offered training to the NBS out of their own good will, and to the President's Office Regional Administration and Local Government (PO-RALG) upon the government's request. Ramani Huria wanted to engage the NBS as they were 'responsible for all the data' and had to approve data and methodology for joint data collection exercises, but a representative from Ramani Huria admitted that it proved to be challenging:

*"That's a bit of a trick. That depends on the nature of the data and what the data are about. If the data give a conclusion of some sort – for example if we say that the population is this amount or if we say that the spread of cholera is this amount – these kinds of data are restricted, and you need to have permission to publish.*

*But we have this kind of data – we show where the school is and what the condition of the road is. These are kinds of public data that can be collected and shared” (Ramani Huria representative).*

Through another partner organisation, PO-RALG got in touch with Ramani Huria and requested their support to process data they had for administrative boundaries and prepare it for release on an online portal. The government decided to establish an online registry system where all the national boundaries from sub-ward or village to national level could be available. The portal aimed *“to host and have definitive administrative boundaries, all administrative divisions of Tanzania hosted in one place and anyone could go in”* (Ramani Huria team member). The portal would be used by government officials and members of the public with different privileges. For example, the Ministry of Lands was envisioned to access the system if they wanted to update the boundaries, but citizens were to access the portal if they wanted to see or download the data. In the process of developing that system, they came to realise that the data that they had from NBS administration boundaries was not updated.

The government first consolidated the list of all data for the region, district, village at all administration levels. After preparing the list, they took the existing national boundaries from the NBS. For this project, the government used their own data as *“that’s really the only administrative data that exist in Tanzania in any definitive form”* (Ramani Huria team member). When they started to match the updated list with the administrative boundaries, they realised that the data had a lot of errors and were not complete, so they needed to ‘clean’ the data to eliminate gaps and overlaps. They wanted to make sure that the data were clean enough to be uploaded in the system, and that was where Ramani Huria offered support with the skills that the government seemed to lack. At the time of this research, the work of the Ramani Huria project for the government was unpaid, using instead financing from the World Bank.

Ramani Huria collaborated and provided training not only to the government but to other initiatives as well (usually on a contract basis). As such, they worked with Data Zetu, a project which focused on collecting hyper-local data on ‘priority pain points’ or the most pressing challenges to be addressed in urban and rural communities. In Dar es Salaam, they worked in the Temeke district. These data collected in the communities were shared back to the local government bodies and made available online: *“Data Zetu being citizen-centric would mean that citizens do have some level of involvement, but even more some access to the data itself”* (Data Zetu team member).

Another local initiative that benefitted from Ramani Huria mapping training was Nipe Fagio, a community clean-up organisation, which is described in the following section.

#### 4.2.3. Nipe Fagio – a community clean-up initiative

Nipe Fagio became successful due to the lack of any other environmental organisations in Dar es Salaam, so it *“fill[ed] this gap [...] for people who want to take action and want to do something to improve the environment of this city”* (Nipe Fagio leader).

For the World Clean-up Day in 2018, Tanzania ranked third in Africa for the number of people mobilised for cleaning by Nipe Fagio as a local partner, and tenth globally. Nipe Fagio had community mobilization officers who worked with local community groups, mjumbe and local government representatives to organise clean-up activities in different parts of Dar es Salaam. The organisation was running on grants used to provide equipment and organisational support. Volunteers were not paid for participating in the clean-up activities. In addition to community volunteers who showed up for clean-ups, Nipe Fagio had a network of Youth Ambassadors who received modest coverage of their expenses such as communication and transportation to work with local youth groups and provide assistance to Nipe Fagio staff in mobilizing youth and compiling reports. One of the benefits of being a Youth Ambassador was seen as the opportunity to establish connections to other partners and to get involved in further work with them.

Like Ramani Huria, Nipe Fagio worked closely with local and city governments and had built a good rapport with them. Study participants reported that this relationship was possible for two reasons. First, the solid waste management problem was indeed a pressing one that the government could not address, and accepted Nipe Fagio's help in places where government services could not be provided. Second, the issue was not perceived as political or 'controversial'. This especially came out in a focus group discussion: participants stressed that 'explaining' to the government the activities and intentions of an initiative affected whether permission to conduct those activities and to access or collect data would be obtained.

Nipe Fagio communicated information primarily via a Facebook page and WhatsApp groups, and also provided regular updates through email. A Nipe Fagio leader explained that the organisation had become so well-recognised that it was extremely rare for community groups to organise a clean-up without asking Nipe Fagio to support them.

### *Use of technology for data collection*

While dealing with one of the most pressing challenges in Dar es Salaam, solid waste management, Nipe Fagio staff reported that they used a lot of data – most importantly GIS data for waste mapping. For this, Nipe Fagio volunteers used mobile phone applications and when they saw waste, they took pictures and input data about the size of the rubbish point, estimated effort to remove it, type of waste (domestic, plastic, hazardous, etc.). For waste mapping, the organisation had tried using a number of smart phone applications over time:

- Open Data Kit (ODK)
- World Clean-up
- TrashOut

The World Clean-up app was used to map areas for cleaning before the World Clean-up Day; about five months later the same areas were re-mapped, and the app was not used anymore.

For mapping, Nipe Fagio partnered with Ramani Huria. Through Ramani Huria they received training and assistance in collecting GIS data. Together, they did the drone mapping to identify rubbish points for Nipe Fagio. Then, they went to sites to verify some of those points – ‘ground truth’ for the data. Figure 4-7 demonstrates field work on validating those rubbish locations.



*Figure 4-7: Nipe Fagio and Ramani Huria volunteers conducting waste mapping.*

In addition to waste mapping, at every clean-up activity, community mobilization officers collected data on the type of litter community collected (‘waste audit’), e.g., recyclable/non-

recyclable, and the brands that were found in the litter ('brand audit'). Figure 4-8, Figure 4-9, Figure 4-10, Figure 4-11 and Figure 4-12 demonstrate a community clean-up event organised by Nipe Fagio, attended by the researcher as part of the observations in July 2019, and how waste and brand audits were conducted.



*Figure 4-8: Nipe Fagio clean-up event in Dar es Salaam - municipal truck and workers are picking up collected rubbish.*



*Figure 4-9: Nipe Fagio clean-up event in Dar es Salaam - plastic bottles have been sorted out and are being counted for waste and brand audit.*



*Figure 4-10: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit in progress.*



*Figure 4-11: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit in progress.*

06/10/2015

WASTE AUDITING of BRANDS (WAB)

Item	MBUNGO	KIPKANDU
Bottles	0	
Tires	01	
Water jugs	04	
Water Jugand	01	
Clothes	19	
Shoes	04	
Men. Water jugs	14	
Water Poles	04	
Diapers	03	
Sanitary Pads	00	
Sanitizers	01	
Needles/Syringes	00	
Ropes	01	
Plastic Bottles	83	
Glass Bottles	20	
Paper Bags	12	
Cigarette Packs	16	
Cans	02	
Paper cardboard	14	
Pressed wood	01	
Plastic Cups	13	
Food wrappers	14	
Foam	09	
Plastic Containers	12	
Colored Utens	13	
Stumps	22	
Plastic Jugand	32	
Glass Bottles	19	
Plastic Poles	400	
Shoes	01	
Water jugs	04	
Diapers	03	
Sanitary Pads	00	
Sanitizers	01	
Needles/Syringes	00	
Ropes	01	
Plastic Bottles	83	
Glass Bottles	20	
Paper Bags	12	
Cigarette Packs	16	
Cans	02	
Paper cardboard	14	
Pressed wood	01	
Plastic Cups	13	
Food wrappers	14	
Foam	09	
Plastic Containers	12	
Colored Utens	13	
Stumps	22	

Figure 4-12: Nipe Fagio clean-up event in Dar es Salaam - waste and brand audit report.

### Data management and sharing

Nipe Fagio community organiser explained that all the data collected from all apps went into a central database. During the visit to the office, Nipe Fagio staff explained that data were stored in the online ODK survey where weekly clean-up data reports were compiled. A ‘controller of the server’, staff member responsible for data management, checked these reports every Monday to make sure that all the data were entered, complete and correct. Server access was password-protected, so only Nipe Fagio staff could access it. These data were not made available online, although Nipe Fagio shared them regularly with the communities and stakeholders in the form of reports:

*“It’s difficult to understand or maybe to be curious to know raw data. But if you share compiled data or analysed data, [...] maybe if you have a pie chart, bars, sometimes people they love to see maybe bars, colour or something like that”*

(Nipe Fagio community organiser).

Data on waste ‘hotspots’ in the community helped in scheduling future clean-up activities and plan the resources (bags, gloves, trucks, etc.) that would be needed to clean those areas. In addition to collecting their own data, Nipe Fagio relied on other sources of data, especially demographic data from the National Bureau of Statistics. Nipe Fagio staff reported that if NBS did not have the data they needed, they went to Ramani Huria for the same data: *“it is not official but*

*sometimes we opt [for using it], because we can't do it if we don't have data anymore” (Nipe Fagio community organiser).*

Data collected from brand audits were shared with businesses to address the waste management problems:

*“We shared with most of them like Coca Cola. [...] So, this is local producers [pointing to the appropriate section of the annual report]. This MATL, Mohammed Douchey Enterprises, Azume, Afia, Access, these are the local companies. [...] So, we share with them, we sit with them, we discuss with them how they can improve their products” (Nipe Fagio community organiser).*

After each clean-up event, Nipe Fagio staff briefed the community on key data from the event: number of people that came, amount of rubbish that was collected, types of waste and brands that were found in the collected rubbish. After this debrief, they shared the data with sub-ward or ward officers, and some action community groups:

*“... because it's difficult to reach out to each individual. Some community action groups, we give them the reports that we have and the data that we found in the field” (Nipe Fagio community organiser).*

During a Nipe Fagio clean-up, a community member asked Nipe Fagio staff what they were going to do with all these data, specifically with the brand audit data. A Nipe Fagio staff member explained that these data would be used to approach companies and discuss with them what measures they could take together to decrease pollution. The community member expressed a strong opinion that the government needed to get involved: *“without government, nothing will get done”*.

The next section will focus on citizen participation in Dar es Salaam.

#### 4.3. Citizens in Dar es Salaam

Government devolution initiated in Tanzania in the 1980s was supposed to decentralise many government functions and transfer them to the lower levels of government with the engagement and empowerment of citizens and local communities. A study in Dodoma municipality, Kizota ward, demonstrated that decentralisation by devolution (D-by-D) was ineffective in engaging citizens in the planning and decision-making process (Massoi and Norman, 2009). In Tanzania, *“participatory systems are extremely bureaucratic and offer little scope for devolved direction” (Green, 2010, p. 1245).*



#### 4.3.1. Community meetings

The study participants shared that a traditional way for citizens to participate in decision making and for the government to engage and communicate with the community members was through community meetings (sub-ward meetings), which usually took place every two months on a Saturday and ran very long (approximately for five hours). The government used public announcement systems (PAS) such as megaphones to deliver key information to the public including invitations to community meetings. Ward Executive Officers who were interviewed said that the community meetings and PAS were the main means for government communication to the citizens even in Dar es Salaam.

These bi-monthly neighbourhood meetings aimed to bring everyone together to discuss and decide on the most important issues in the community, which then would be escalated to the appropriate levels of government to take action. The agenda of these meetings was set and run by the government, and reportedly there was little to no data involved in the way they were conducted and how decisions were made. Voting on decisions in the meeting took place by a show of hands, and these votes were recorded manually. The number of people who came to these meetings varied but generally was low.

Low participation in community meetings was discussed in the focus groups and in some interviews with community organisers. Lack of awareness about the meetings seemed to be one of the reasons for poor attendance. Another reason that was reported repeatedly is the 'political agenda' of those meetings. They were perceived to be driven by the ruling party CCM and did not cater to the needs other than political discussions. The approach was also described as 'vertical' – from the City Council and municipal director to the ward and sub-ward leaders: *“the government think that they are involving the community but, that's just vertical”* (community organisation leader).

*“[Because of] the level of education or the level of ignorance [it] is difficult to find a new way to let people participate in these issues [other] than calling these meetings”* (Ward Executive Officer).

Previously, there was an official decision-making system whereby the citizens selected an individual and that individual conducted the official meeting. At these official meetings, people attending represented the community and made decisions. The government-run open meetings in their present form replaced those self-organised meetings.

#### 4.3.2. Community action

Most communities around Tanzania including Dar es Salaam traditionally organise themselves in small groups to address different challenges. Depending on the kind of decision making required, it determined different kinds of groups. For example, for financial decisions, there were finance groups, for funerals or security issues there were other groups. It was within the Tanzanian tradition that the community really helped itself and one person helped another: *“There is a very strong sense of community, but that is very removed from taking action to improve the country as a whole”* (non-governmental organisation leader).

Community strength, connectedness and ability to come together in times of need came up in several interviews and during focus group discussions. Tanzania had a very good structure of ‘connecting’ the community, and this is what the Ujamaa government meant to achieve (Tanzanian Ujamaa ‘self-reliance’ approach is described in Section 3.2.2). Community self-organisation and support only worked when the action was perceived as the community working for the community, but *“it is really hard to do anything with the communities that somehow does not have some involvement from the government”* (community organisation leader).

Although Tanzania made a move towards the devolution of powers, the process was not effective (Massoi and Norman, 2009). The government continued to hold a strong position in society, which was perceived to be responsible for everything, and people expected the government to ‘take care of them’. To address issues through the government, community members had to go via the formal established channels of communications. When people failed to receive a response from the government, they had to rely on themselves.

Local entrepreneurs, innovation activists, government and community members who were interviewed for this study described an ideal approach to a smart city in Dar es Salaam as ‘bottom-up’, where the community would actively participate in the design of city services. Instead of making heavy investments in technology, they discussed having access to city data that could help promote innovations and local solutions based on data. At the same time, the government accepted ‘grassroots’ projects only in collaboration with them:

*“So, if the community raises that thing, goes to the upper authority, the upper authority will ... receive in a good way because it is they who want their city to be, but in collaboration with them, they [government] provide technical advice... They will bring the experts, the city planners so we can sit together, we can plan*

*together, and produce the very good city... I think if we need a good thing it should start from the grassroots and it goes up” (ward executive officer).*

#### 4.3.3. Role of citizens in collecting and using city data

Questions on the role of citizens in producing and using city data were key to understanding how stakeholders interpreted citizen-generated data given the local context and whether the government was receptive to using alternative sources of data for their own decision making, where government data either were missing or were of poor quality.

##### *Citizen-generated data*

‘Citizen-generated’ data were viewed by the government interviewees as data collected from citizens by the government through the established official procedures. Therefore, the citizen’s role was to be a source of data, whereas the role of the government was to collect data from the citizens. Consequently, using any citizen-generated data outside the official government data collection process needed validation from the government. An example of such a data collection exercise could be having the students at the ministry collecting data through a coordinated process. Data collected directly for the ministry could be used because the process was closely monitored by the government.

The government's view was that the government needed to collect data as it was their responsibility: *“Government is responsible for each and everything”* (former government official). Government authority over the data came out as a strong theme in interviews and focus group discussions.

*“The government is a custodian of everything. They're supposed to supervise and ensure that everything goes well within the framework. And that's knowing the data which are being collected are used not in a bad way. Just to monitor and make sure that data are collected very well. [...] Especially nowadays data collection has been controlled in a way because other people might use the data to say bad things about the government. So, the government has been quite sensitive. When you collect the data, you have to verify with a government official”* (community organisation leader).

##### *Government approval and participation*

The government representatives who participated in the research indicated that they would be hesitant to use data generated outside official government processes, as they considered data provided anonymously not to be trustworthy. Government interviewees did not

seem to have trust in data generated outside their official processes or be able to think of ways to use such data in their work. In the instances where members of communities wanted to initiate data collection or sought access to data, the government had to grant permission and was closely involved. In a focus group discussion, participants referred to this process as 'government support' and 'help offer'. In case the project needed to perform data collection, *"they are cooperating with us, so that the findings will be added to their own plans, to rehabilitate the societies"* (focus group participant).

As one of the interviewees described the process: for a community group to conduct data collection they needed to have 'political checks', which were based on who was collecting data, what data were being collected and how they would be used:

*"The problem is even if us, as maybe Ramani Huria, [...] will find ourselves stakeholders to do stuff that we needed for the project, the authorisation, and all the bureaucracy of the government, the only place that will hit the work button, because, without them, nothing can move on. [...] People are willing to help. They're there to create schools, and stuff, but the government are they only ones entitled to authorise, so even if we find the World Bank and stuff, their projects failed, because government said no. Even if the World Bank has the money, or has the projects, and stuff, no. It can't be happening"* (Ramani Huria volunteer).

Although Ramani Huria was positioned as a community-led project, since it started with support from the World Bank, it received all the necessary 'checks' to mobilise local government leaders and the communities to collect the data. In some cases, community members thought that Ramani Huria was from the government (similarly with Nipe Fagio). This in turn created challenges for accurate reporting, as the community members could be afraid of the government and sometimes were hesitant to disclose accurate data to community mappers in fear of facing consequences from the government.

From the government point of view, the data collected by Ramani Huria were not purely 'citizen-generated'. A public official from a national government agency explained that since the project was coordinated by the World Bank and people who were involved were facilitated, trained and guided by the project, these activities were allowed by the government and the data could be used. There were specific objectives in Ramani Huria, of which the government was aware and was involved in the implementation.

Community mappers who participated in a focus group discussion also saw as key the government's role in acting upon the data Ramani Huria collected:

*“They should enact other ways, consult the stakeholders. Hey, we need a water supply in this area. Do you think you can do that? It's up to them, because they have that mandate, and the ownership of the land. They know how to plan, where to put things. Us, as a community, we provide the information, but it's up to them to find the uses of that information. Like we need more and more schools, and churches, and stuff, so it's up to them, because we gave them everything”* (focus group participant).

Through its work, Ramani Huria realised that it was necessary to engage ten-cell leaders, who originally were overlooked, in their data collection efforts. The project found that only by working with the ten-cell leaders were they able to engage citizens successfully (the ten-cell leadership system is explained in Section 4.2.2).

#### *Engaging local communities*

In both focus group discussions in Dar es Salaam, the participants tended to separate themselves from the rest of the community members, often with association to one or the other initiatives – either Ramani Huria or Nipe Fagio: *“What I know is that they're supposed to know themselves what to do, to start to solve the problem”* (community volunteer).

*“I think it's the cooperation between us, mappers, and them. The process of being open, to give us information about their local surroundings. Their role. They need to be open about the real situation around the area, so your role as a citizen is, you tell me why you think this problem is occurring? What are the causes, and stuff? Without that, I'm new to that place. I can't know that for sure, but with your help, as a citizen providing me with the crucial and reality information, it'll be helpful to provide you with the actual report”* (community mapper).

Community mappers reiterated how difficult it was sometimes to collect data from community members, who perceived them as ‘outsiders’ since mappers often did not come from those communities where they collected the data. In this regard, they were treated the same as the international aid institutions who funded the data collection projects:

*“The community don't really have that will, [...] are not that open to the mappers. They don't really open up, because they believe they're entitled to that place, even though it's flooded and stuff, so they'll think if they give you information, they give*

*up their right to own the land, and stuff, so it's like you're trying to grab away their entitlement” (community mapper).*

On community engagement, Nipe Fagio’s approach and recommendation was to work with community leaders and organised groups rather than with individuals directly:

*“A community action group is like an entity, an organisation, like a living organism ... first [leaders] are here, then others will come. So, it will be to remain there. And the relationship will last longer, you see, rather than working with the individuals” (Nipe Fagio staff).*

Nipe Fagio made recommendations in local communities that the local community leaders should attend clean-ups as well as individual residents. Nipe Fagio staff who were approached for a follow-up interview reported that the number of leaders at the clean-up activities increased due to those recommendations.

Data collection was often associated with a cost, and lack of resources, especially in discussions with government representatives and local community volunteers. If people were to contribute or to collect the data, they wanted money because the assumption was that these data would benefit someone, but not the community.

Many projects either started off by compensating the community for data collection, or with the expectation that these efforts would be compensated in the future:

*“The problem which happened, the community were coming to us to say, “Now, how long will we continue to do this work without being paid?” Because there was no remuneration” (community organisation leader).*

The poverty context should also be taken into account when conceptualising the smart city of Dar es Salaam and data collection efforts:

*“The desire to transform Dar es Salaam into a smart city is there, but the truth is, the majority of the citizens, they don't even understand what a smart city is, and they are still worried about how to feed their families and way of life, if they get back home, their house will still be standing” (government official).*

This quote is grounding this in the lived realities of local people, rather than the realities of the World Bank, or some remote policymaker or industry figure. It is about understanding the ‘situated actions’ of those involved (Suchman, 1987), rather than just trying to impose an external one over them, via ‘data’:

*“It is impossible due to our lifestyle. Because we are trying to move, to adapt those technologies, but due to our lifestyle, we are still to be rid of poverty, right? [...] Our perception towards this technology is still down. [...] We are trying to use technology, the technology they don't want us to use”* (community activist).

#### 4.4. Stakeholder interactions

This section looks at different stakeholder groups that appeared to play important roles in community data projects.

##### 4.4.1. Government

It was nearly impossible and could be considered illegal to release or use any data other than officially provided by the government:

*“I'm not sure, but I don't think it's possible to do that. Because even if you have your own private data, you can't publish unless you get some sort of authorisation from [the government]. Especially, if you want this data to be quoted in news department for making decisions”* (local entrepreneur).

The international open data experts criticised the Statistics Act and claimed that it strongly affected the development of open data in Tanzania, and specifically in Dar es Salaam. The law paralysed data release by other non-governmental organisations and hence hindered open data in the country and in the city:

*“...the application or the dissemination of what the Statistics Act allows you to do and what it does not allow you to do is a major hindrance because we know that there are NGOs that want to publish their data on our infrastructure because we have sort of a small server infrastructure where we enable organisations to post data. We have not been able to do that because of the interpretation or the lack of interpretation of this law. So, on the legal side we have never really managed to start publishing data or share data”* (representative of the Data Lab).

In 2019, the Statistics Act was amended to remove prison punishment for civic groups publishing independent statistics, but nevertheless, the perception in the community that the government was the main custodian of the data remained.

As demonstrated in the previous section, to collect or publish any data, the government had to grant permission based on the purposes of the data collection project. In order to make the data official and accepted by the government, therefore make it public, there was a process

that applied to such data collection efforts. It was unclear what the process involved was, but a representative from Data Zetu indicated that there was a fee that covered the NBS staff time to come out and participate in data collection and to audit it to approve it afterwards. Data Zetu tried to engage the government in the data collection process, to make the data they collected at the community level 'official'. They began following the process outlined in the Statistics Act, but the project finished in January 2019 and did not prove to be successful in making any of the data accepted by the NBS.

Everything needed permission from the government. Even conducting a community clean-up required a permit from the local government. Unless the government was involved, community initiatives were not considered valid.

#### 4.4.2. Engaging with the government on the lowest level

From the beginning, Ramani Huria had established strong working ties and relations with sub-ward leaders as the lowest official level of government. This was done to ensure support for community engagement at the lowest level in data collection activities. However, in doing so the project relied on the formal government structures, whereas the ten-cell leaders (wajumbe) were the lowest leadership level that was the closest to the community but was not formally part of official government (the ten-cell leadership system is explained in Section 3.2.2): *“You know in a government issue, you need to go first to that wajumbe”* (focus group participant). Ramani Huria reported that they did not realise until later in the project the important role that the ten-cell leaders played in the community, and then started to engage with them more closely.

A community mobilization officer from Nipe Fagio also conveyed that the only possible way that they were able to identify rubbish hotspots in the community was through contacting ten-cell leaders.

While the title 'ten-cell leader' suggests responsibility for ten households, in the focus group discussion it was revealed that the government increased the number of households to 50 per wajumbe:

*“Mjumbe, those people with 50 households, are the ones who really know the problem of their people, compared to them who sit in the office waiting for them, so it means that we really need the community to give us the information, and not leaders who are in the office”* (focus group participant).

A focus group participant who worked with Ramani Huria on a sheena (ten households) mapping project with a purpose to identify the boundaries of each sheena, so that the new people



knew who their leaders were, and local leaders knew their boundaries, said they worked closely with the ten-cell leaders:

*“We work with [ten-cell leaders] in knowing the number of people they have, so as to know the available health centres that are within their areas, and the main objective of that project was to reach as many people as we can, so they can get a good health service, and that project. We did it with Amana Hospital. [...] so just creating those maps, so that we can know where the mtaa leader is, where their boundaries are, and just give them back the maps, so that they can know their own boundaries, where they're supposed to live”* (community mapper).

For a community project to be successful, it needed to engage on all levels of local government – from national for the clearance and registration of data collection activities, municipality for the approval of the activities to take place in the specific areas, to ten-cell leaders for the implementation support.

#### 4.4.3. International aid institutions and donor stakeholders

Donor support and involvement originally were not part of the questionnaire. In the first several interviews, it became apparent that donor organisations were key stakeholders in many data-driven initiatives in Dar es Salaam: *“Imagine the investment! Investment put in Tanzania on data is unparalleled”* (representative of a donor organisation).

A lot of ‘community’ data work was argued to be ‘donor-driven, and hence’ to lack local ownership as the local culture and traditional ways of doing things were not taken into consideration: International open data experts who were interviewed saw donor assistance on data-driven initiatives as a challenge, which diverted the interests of young and talented citizens away from business and innovation. Other countries that received donor support for technology and data-rich programmes were claimed to be more innovative: Kenya, Ghana, Senegal.

In addition, donor support seemed to create different incentives for people to participate other than improving urban living, hence could undermine the future sustainability of these efforts.

Coordination of efforts between community, non-governmental and civil society organisations, donors and the government were named one of the key challenges in a focus group discussion:

*“We should make a proper strategy that will focus on those strengths. We have made this kind of effort. We have made the deal with overseeing the problem and*

*we need a solution to solve this problem. This will need a proper coordination between the community and those are the people who are working in the organisation and the government. When you address this people will solve this problem of wasting materials”* (focus group participant).

Interviewees also reported that foreign assistance in providing support to data-rich projects was not systematic. In the interviews with international open data experts, emphasis was put on the need to take stock of what had been done, what data had been collected, where it was stored and published, and on bridging sustainability and infrastructure issues rather than putting more efforts into collecting more data, bringing more tools and providing more training. Various groups of stakeholders suggested that this would help to integrate into a more comprehensive data system to support a smart city. While a large number of data-driven projects were initiated by international donor institutions, the involvement of donors in the development of a smart city vision in Dar es Salaam was described as a challenge:

*“Another barrier... is competing donor priorities, and donor-driven agendas that are driven by conversations that people with a lot of money and the donors were having at smart city expos where the biggest pavilion, basically, wins and gets the influence of the donors.[...] donors pushing an agenda that's not very well informed or coordinated”* (international open data expert).

Opinions of interviewees were divided, however, where government participants claimed that donor support provided a necessary external push:

*“Now if we use such things because somebody comes from Dfid, from the World Bank and says, “We want to run a project. We're going to do this with the technology and create data and use data, most of the time, that's how data come to play a role in trying to create a citizen-centric, data-driven city. Otherwise, on their own, they don't have that thinking”* (national government representative).

#### 4.5. Conclusions

The objective of this chapter was to report empirical evidence and findings from the first case city, Dar es Salaam. Through the focus on data, citizens and stakeholder interactions it presented useful insights into how community-based initiatives operate on the ground.

The chapter first described how government and non-government data were collected, managed, shared and used and what challenges were associated with each of these processes. Then, it covered the nature of citizen participation in decision making and citizens interacted with

city data through the lens of the two initiatives, Ramani Huria and Nipe Fagio. Both initiatives employed data to address particular challenges – flooding events and solid waste management – so respective sections focused on unpacking the process of how citizens were engaged in these efforts. The final section described the stakeholder interactions and how they influenced this work.

The findings emphasised the importance of relations and the power dynamic between the government, international aid institutions and communities in the facilitation and organisation of community-based data-driven projects. The government appeared to have strong authority over what data were collected and shared in Dar es Salaam through implementing a permit request process for any data collection and regulating who can collect, use and publicise official data. Stakeholders described a number of challenges related to data-related work, which closely linked to specific stakeholder groups and their objectives. The structure of local governance – semi-formal ten household leadership – appeared to serve as a powerful tool for local data collection efforts and mobilising citizens for community action, although it also blurred the lines between the community and the government.

Both community-based initiatives had strong relations with the government, which ensured securing permits for data collection and support for their activities. However, the voice of the actual communities often seemed to be lost. Even community volunteers often described communities as ‘they’ as opposed to ‘us’ when speaking about local beneficiaries from their efforts.

In the same manner, the next chapter will report empirical evidence and findings from the second case city, Nairobi. Based on both empirical chapters, analysis and conclusions will be presented in the two following chapters.

## Chapter 5. Nairobi

In the same way as the previous chapter, this chapter presents the data and insights from the studies conducted in Nairobi in four main sections. Section 5.1 covers themes related to government data in the city of Nairobi and how the study participants viewed different aspects of using city data. Section 5.2 looks at the community efforts in creating and using data about Nairobi. Section 5.3 looks at how citizens engaged in decision making in the city, including two community initiatives, Map Kibera and sensors.AFRICA. Section 5.4 provides findings related to stakeholder collaboration and how it impacted citizen participation for the improvement of Nairobi. The concluding Section 5.5 provides a summary of the findings from the second case study.

### 5.1. Government data

The conversation about city data, especially government data and how different stakeholders could gain access to them, led to discussions of how the government was organised in both cities, Dar es Salaam and Nairobi. Governance structures developed as a theme for government data processes, including how the government collected, managed, used and shared data in the case cities.

In the interviews, the theme of devolution was closely linked to the questions of public participation and the role of citizens in generating and using government data. The Kenyan government established norms and processes for public participation, which were to ensure sufficient public engagement for any decision to take place. This is covered in Section 5.3.

#### 5.1.1. National government data

With the new levels (national and county governments) of government through the process of devolution came the new division of functions between the two arms of government as per the constitution of Kenya (Kenya Correspondents Association, 2018). Nairobi city was one of the 47 counties, hence had its own county government (the city's governance system is explained in Section 3.2.3). Some functions such as police and transportation remained at the national level, whereas functions such as health, agriculture, water and county transport were county-level functions.

It was suggested in the interviews with the local government and other stakeholders that the way functions were divided between the two levels caused some uncertainty regarding the city government's responsibilities. Study participants reported that government officials oftentimes used as an 'excuse' that some services were outside their control so they could not get the data

because the data were related to the functions which were not within their responsibility (e.g., police are at the national level, so county officials could not access those data). This was said to be true for smart city development and coordination in the government: *“In Nairobi’s case, the challenge that we’re having is that a lot of the smart city-related decisions, for example transport, etc. are national government decisions”* (non-governmental organisation leader).

Systematic collection of data in digitised format was described as one of the challenges, on both levels of government. Interviewees from within and outside the government explained that it was difficult to know who collected which data and where they were stored. For instance, focus group participants described that there was a ‘rumour’ that government collected air quality data in Nairobi using mobile sensors several years ago, but no one shared those data, and it was not clear where these data went despite the efforts from the focus group participant to find out.

Unlike Tanzania, Kenya is a member of the Open Government Partnership (OGP<sup>26</sup>) and at the time of conducting the studies was on its third OGP National Action Plan 2018-2020, which declared one of its intrinsic values was to *“Improve the quality of measurement of development and data for decision making for all”*. The Plan made commitments to opening contracting data and using geospatial data for development.

#### *Environmental data*

Air pollution was noted by study participants as a big challenge in Nairobi. The government recognised it and collaborated with Liquid Telecom, a leading communications services provider in southern Africa, to install air quality sensors. While the World Health Organisation (WHO) was alarmed by the amount of pollution in the city (The Guardian, 2016), the official data from the government related to air quality were difficult to obtain and often were not free:

*“I know there are places I can’t live in just because I have access to this data and it’s because I know what it’s going to do to myself and what it’s going to do to my children. Having said that they won’t give you that data. It’s not cheap to get access to that data and put it together”* (local community organiser).

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<sup>26</sup> Open Government Partnership (OGP) is a partnership of government leaders and advocates promoting transparent, participatory, inclusive and accountable governance. Official website: <https://www.opengovpartnership.org>. Last accessed on February 15, 2021.

Other telecom companies installed air quality sensors on their towers. It was unclear whether the sensor data were collected in collaboration with the private sector and would be provided to the public.

#### *Security issues and surveillance cameras*

Among other city challenges where the government's attention and data were required, security was named as one of the biggest, and the government already used 'smart' solutions to improve the situation. Road safety issues and crime incidents added to the security concern in the capital. In order to address this issue, the government installed a closed-circuit television (CCTV) network around the city that provided a constant feed to the police command and control centre.

The government engaged the private sector to look for technology-enabled solutions such as roads monitoring, and CCTV cameras were operated from the police command and control centre. The National Police Service is a central government agency and were planning to install about 1,800 cameras in Nairobi and Mombasa (Atta-Asamoah, 2015), the second-largest city in Kenya on the coast of the Indian Ocean. Cameras were installed on poles along the roads – several on each pole – and were considered by many interviewees a smart city project. These included traffic cameras (that take photos of license plates and drivers) and general surveillance cameras.

The surveillance project was a communication system for the police. Call centres and police could view the surveillance system on their mobile phones using 4G handsets, they could send camera footage from their phones back to the headquarters, and by using geo-positioning system (GPS) they could allocate staff and send them to crime locations.

Non-government interviewees suggested that the government did not seem to use 'smart' devices to full capacity to collect the data (some data or some functionalities were not explored). There did not appear to be much coordination between the agencies to collect appropriate data, manage, use, share them with the public. Part of the challenge was that agencies other than the National Police did not seem to have access to cameras and the data they collected:

*"It has a mandate, because the cameras are under the Ministry of Interior. So, I think it's simply how the government comes to think to have an ecosystem approach to things, because right now I understand, the primary role of those cameras is for security. [...] It's Huawei who put it up, so I know it. [...] it's how a lot of these things are planned. Unless we run our ecosystem, so we still do the silo*

*stuff which is always a challenge. But right now, they're pretty much on security, not unless somebody goes to Interior, but security seems to be really good at it. It's – how do you give us data that is beyond security?"* (national government representative).

At the time of conducting interviews, there was a scandal with the murder of a politician when the police refused to reveal CCTV camera footage. According to the interviewees, it created additional scepticism and accusations of corruption around the use of the cameras by the government. Courts claimed they could not gain access to those data from the cameras. Some interviewees suggested that the cameras do not work. A local government employee expressed doubt as to whether all the cameras were working properly, which also spoke to the challenge of trust even within the government itself:

*"Let me say sometimes African is African. Not all security cameras I'll say they're working or per se are used for security reasons"* (ward administrator).

#### *Transport data*

Transportation and traffic issues in the city presented yet another pressing challenge. Public transport was chaotic and was based on privately-owned minibuses called 'matatus'. To address traffic issues, Kenia Urban Road Authority installed a smart traffic lights system, which was equipped with vehicle detection cameras. It monitored the flow of vehicles and how many vehicles were going through each junction at any time. Signalling and the timing for the traffic lights could be changed based on the data from the cameras on where the vehicles were or where they were not.

The national government did some work around improving transport with data, and the potential use of data to plan roads to decongest the city traffic. They started conversations with Uber on using data in rainy seasons to investigate the cost of traffic when there was rain and what needed to be done about it, including the location of traffic lights. The complex system of road authorities and the division of functions between the national and county-level authorities made it difficult to collect, use and share different types of data. None of the data collected by the cameras was open. The media allegedly had to mount their own cameras to report on traffic conditions.

#### *Huduma – national ID system*

Huduma was a large national programme to provide Kenyan citizens with services and improve service delivery with the use of technology. The integrated service delivery system was designed to provide all necessary services through a 'one-stop shop' approach, i.e., all services

were available in one platform using an individual ID number. The programme included multiple modes of access, including physical centres, call centres, m-Huduma for mobile access and e-Huduma for web access (Gakii, Mukiri and Murimi, 2018).

Although it was considered a successful program for incorporating digital technologies into service delivery in a 'citizen-centred' way (Gakii, Mukiri and Murimi, 2018) and connecting all government services in one place, some focus group participants expressed concerns regarding the security of personal data provided to the government under the Huduma program:

*“There's a line on the Huduma Number form that does not exist on your ID card and your passport or any other government identification. That line says that you agree and understand that the government can share your information with a third party without letting you know... Remember that this is biometric data, so all scans, facial recognition”* (community organiser).

#### 5.1.2. Local government data

At the local level, the government often used social media and communication tools such as WhatsApp to collect data on local issues. WhatsApp groups were named in the interviews as the main tool for organising what used to be a physical meeting, for communication in neighbourhoods between the residents and with the local government, for discussion on community issues and beyond, and even for ad hoc data collection and some service provision.

A non-government interviewee explained that creating a WhatsApp group for people in the ward developed as common practice for a ward administrator as he assumed his duties. These chat groups became the main channel to file requests and receive services that rely more on 'local arrangements' and traditional ways: *“It works wonders. I mean, on this WhatsApp group, a broken water pipe can be reported by 8 AM, and by 10 AM, two hours later, it's fixed”* (non-governmental organisation leader). Ward administrators could use WhatsApp groups to collect information from the residents on issues such as which roads they thought needed streetlights or which roads needed re-carpeting.

A ward administrator interviewed for this study explained that when he needed 'background knowledge' on an issue he ran it on WhatsApp. WhatsApp was considered cheap, low on data usage and an effective tool for quick feedback generation.

The challenge with the data generated through WhatsApp was that they were not useful beyond the purpose for which they were collected:



*“One of the biggest frustrations for me [...] is that there is so much useful citizen-generated data that is locked within WhatsApp. Like I said, every estate, every building block has a WhatsApp group, and in our WhatsApp group we're talking about a break-in in one of the flats two nights ago. [...] So, there's a lot of data, but a lot of it is locked up in platforms like WhatsApp”* (non-governmental organisation leader).

#### 5.1.3. Data collection, management, processing and sharing

As a result of the new functional division within the government, multiple national and county agencies were responsible for the delivery of essential city services and infrastructure. One of the key issues that came up in the interviews was that those agencies appeared ‘not talk to each other’, but more importantly they seemed to collect data in silos and did not share those data between the agencies and different levels of the government:

*“All of that data is sitting on the controller budget website. Then, the Commission for Revenue Allocation, they just publish in Gazette notices. So, there's these two different government bodies that do basically the same function, but they're not communicating”* (community project manager).

At the time of the research, access to government data and sharing them between the different levels of government was a challenge. In an interview, a ward administrator reported that there were minimum data available and that access to government information was a challenge, even to ward administrators. He went on to explain that often data in relation to his job, for example on primary education, came from a higher level of government such as a subcounty administrator’s office but then he had to use it and distribute it back to the government, such as a member of the county assembly and the chief education officer:

*“I wish this information were shared back because it only goes to the National Police, they file it as national and it's a secret for them now, they don't want to share. The only time they come and share it is maybe, say they have a festive season of holidays, is when they say often such and such a place in Nairobi is way dangerous at night, it's not a good place to go to. So, they give out on the black spots, so they have black spots within the city, they always say, guys take care when you're walking in this area, don't go there at night, so that's the only time they say. [...] I wish that even within the county they shared with us so that we can also share with the residents as well”* (ward administrator).

There seemed to be a lack of consolidation of data between different government entities. Community members in focus groups discussed that the consolidation of data was a major problem. Some data could be available from the Nairobi county government, some from other ministries, but the data were not complete and could even be contradictory, although they were from the same government. Community members in the focus group discussions were under the impression that every ministry had their own way of collecting and processing data. Even if the data were collected on the same subject, it was done differently – they felt that this also caused the contradictions in the data.

A community member shared in the focus group that he was able to access building data for Mathare (a low-income informal settlement in Nairobi) from a student at Nairobi University. The student directed him to the office at the Nairobi County, but they told him they did not have the same data for Kibera (another low-income informal settlement in Nairobi):

*“The challenge is always, one, getting a central place where this information is being hosted. Then [...] knowing the right ministry where this information is being stored. Because they'll always take you around. They'll always tell you, "Go to this office, go to this one". So [...] it's not consolidated. The data is everywhere, and it's not standard. Also, I think the standard way of data collection, we don't have a standard way”* (focus group participant).

A national open data portal was an attempt to solve this, but it did not work as had been envisioned. Very little data got uploaded on the open data portal, and after a while the portal stalled. Some government agencies such as the Ministry of Health put data out on their own websites. The Ministry of Health had a master list of all the health facilities in Kenya, which sometimes would be copied onto the open data portal, but occasionally not.

In general, interviewees were in consensus that there was a lot of government data available online, which was scattered across different government websites including Kenya open data portal, Kenya National Bureau of Statistics, Communications Authority and some others.

#### 5.1.4. Data access and use

In the government, data were reportedly used where planning was concerned: *“we're now seeing it happening on a sub-national level which is where I've been working for the last couple of years where you're beginning to see, for issues of security, data is being used very extensively”* (national government representative).

Although traditionally like in Tanzania, comparisons between different locations could be perceived negatively, the government, especially at the national level, started to use data to compare counties based on their population, revenues and expenditures, and other performance indicators to encourage performance improvements.

Another use of government data within the government was for resource allocation. The Commission on Revenue Allocation (CRA) shared ambitious plans for The Integrated Devolution Data Portal (TIDDP), a project that had been started with the help of the EU and is carried on in partnership with the World Bank. The Portal was launched in July 2017 ([www.data.crakenya.org](http://www.data.crakenya.org)), however, the website did not load in February 2021. The CRA hoped that the portal would be used to inform government planning, budgeting, performance measurement and accountability. The portal aimed to provide a tool to the government as well as provide access to the public once it was fully operational so that citizens could also use the data and the portal's functionality to analyse the data, including national and county plans, county revenue legislation, budgets, revenues, expenditures, and service delivery indicators. The plan was to have all these data available in raw format as well as a customised view based on the user profile:

*"If you're logging from county X and you identify yourself as county X, the look and feel, everything changes that website to your colour scheme. The pictures that come are for your county. The news, county news comes in here. [...] the finance bill comes there. You'll not see other counties' bills"* (Commission on Revenue Allocation representative).

Other uses for technology and data that the government has implemented are 'smart city' solutions in the areas of revenue collection: a lot was done around parking fees in the town centre. The government had a launch event showcasing projects with various vendors using 'smart' technology around revenue generation. A lot of the 'smart city' functions were devolved to corporations, such as Kenya Power and Lighting for the power and lighting project, Nairobi Sewage and Water company for smart water meters. These were semi-government organisations and there had been corruption scandals associated with some of those projects. For example, a smart power meter project turned into a procurement scandal and none of the power meters worked (from the interview with a private sector representative).

Among non-government stakeholders, the views about how the government used the data were divided. Private sector representatives seemed to believe the government used the data but without informing which data they have used and how:

*“The question we should be asking is, are they using the right data? Which I don't think they are. So, we use data. When you look outside, and you say, it doesn't look like it's going to rain. And then you walk out and then it rains. Did you use data? You looked outside, your data points sky looks clear, your data points the sun is out. I'm going to walk out. But if you had looked it up, for instance, that can predict that it's only clear the next five minutes, you would have used the right data to make a decision”* (private sector representative/former national government consultant on open data).

Scepticism also surrounded the use of data from CCTV by the police themselves:

*“And the other question is whether they're using it themselves or not? Because they also might not even be using it themselves you know? Obviously, they use the system for catching criminals, but they may not use it for monitoring their performance, I don't know actually if they do or not. Because I think that almost is the first point, use the data yourself and then of course share it with others with the relevant safeguards and so on”* (private sector representative).

The use of government data by non-government stakeholders often focused on drawing the government's attention to various issues, to react and take decisions to address them. Data 'forced' the government to take decisions. The examples of these uses centred around transparency and accountability of the government on the services they provided and the decisions they took. However, as discussed by focus group participants, if those cases required court hearings, only government 'accredited' (official) data were taken as evidence: *“any data that can be used for court cases or anything legal in this country has to come from a government-accredited body”* (community organiser). In order to make a legal case, *“citizens have to navigate how to get access to data that might exist that is not publicly available”* (community organiser).

#### *Access to information regulations*

Unlike in Tanzania, interviewees in Nairobi did not see the existing regulations (or lack thereof) as a barrier to collecting or using data, and described the current Kenyan regime as democratic and open:

*“If you have a leadership that is very clear around using instruments of government, to protect and ensure the public is in effect, but also can hold the government accountable, then that for me becomes the basis of it. So, democracy will go hand in hand with open data”* (national government official).

Although there was no legislation specifically for open data in Nairobi, the usage of data was perceived as increasing. In 2016, Kenya passed the Access to Information (ATI) Act. The Act reflected the right to information outlined in the new constitution:

*“It’s in our laws, access. It’s our right. Any citizen, not just a journalist, any citizen is supposed [to be able to], according to our laws, walk into the ministry environment, and say I need data on Nairobi City, and you are given it free of charge, that is according to our laws”* (community member).

In line with the Act, anyone could request any public data from the government and had to receive them within 21 days (Access to Information Act 2016, Section 9). If the data were not provided in that timeframe, the focus group participants suggested that there was ‘personal liability’ on the government staff member responsible for the request in a form of a fine or imprisonment, or both. The Act however stated that *“where the applicant does not receive a response to an application within [21 days], the application shall be deemed to have been rejected”* (Access to Information Act, Section 9). So, it was unclear how the consequences for the government staff were enforced, and non-government interviewees and focus group participants were not sure that the Act had been enacted or if the procedures to request data via the Act had been put into place. They also were doubtful whether the data would be provided when requested from the government using the Act.

The premise of the devolution process in Kenya was to enhance transparency and accountability of government. Nearly all interviewees said that the key benefit of using government data by the citizens was to keep the government ‘accountable’: *“where Nairobi is concerned, and where Kenya is concerned in general, there’s a challenge of something called social accountability”* (non-governmental organisation leader). The government’s efforts to open data for the public were motivated by the same:

*“Every bit they want. We are not locking anything. This is part of fiscal prudence. If your governor is misusing the money, you’re able to see. If the governor is giving only one particular area, you’ll be able to see. If one country is not spending the money they’re supposed to, you’ll be able to see”* (Commission on Revenue Allocation representative).

The next section will discuss some challenges reported by the study participants that were in the way of using data by the communities.

#### 5.1.5. Challenges in accessing and using government data

There were a number of issues from the data user perspective with using these data. One of the biggest challenges named by data users for using open government data in Nairobi was the lack of granular and 'local' data (like Dar es Salaam):

*"When you look at how the government collects data and how they released the data, it's very aggregated. As a business, for instance, sometimes you don't just want to know how many agricultural farms there are. You want to know what size, you want to know what kinds of chemicals they use, who owns them. [...] There's a lot of open data out there, but it's so disaggregated, in the form of... it's not all in one place"* (private sector representative/former national government consultant on open data).

Government agencies often shared reports and the outcomes of data analysis but not the raw data:

*"You never get to see the primary information, you only see the secondary information, edited. And then they tell you these are the proposals"* (focus group participant).

The National Police occasionally shared news, stories, snippets of statistics on their website and a Facebook page, but not any data that could be downloaded. According to a private sector interviewee who worked on the project of installation of the cameras in the city, none of the data collected from these cameras were open, despite encouragement to do so from the company the interviewee represented:

*"The police are very sensitive about the data. They will share some occasional statistics, like the crime rate has gone down or something like that or they give some examples of using the system to capture criminals for example"* (private sector representative).

Kenya's open data portal seemed to be inactive. The consultant who was working on it left with the end of the funding from the World Bank, and in transition to the government 'everything went slow': *"I don't know of any data that would be useful that's out there. I looked at the open data website and the data sets aren't useful"* (private sector representative). In addition, the portal seemed to be hard to navigate:

*“The data sets, first are not easy to organise, to find the data that you want, that the categorization is too high level. Like education, you find hundreds of data sets on education, so you need to have more advanced filtering. Or more advanced searching capabilities”* (private sector representative).

Access to government data often came with established trust and a relationship with a data provider: *“because we had built a relationship over time, it wasn't issues of access [...] the government was interested in wider engagement by citizens, only that policy hadn't caught up, the policy of that particular engagement”* (national government representative/former non-governmental organisation leader).

Indeed, many study participants, especially data journalists, reported that personal relations and knowing someone in the government who could get the information to you was critical in getting the data they needed. Many community representatives described their experience looking for government data in the government offices as being ‘taken from one office to another’. Government officials sometimes said that they did not know *where* the information was even though they knew they *had* it, i.e., they knew it existed, but were not sure where it was: *“You just have to sit back and try asking around and look for people who have been in the city before et cetera and such”* (urban activist).

#### *Government ‘mindset’*

Even knowing the person with the data did not always mean that one would be able to access them. A data journalist shared in the focus group discussion that a junior staff member in the government office whom he knew was not able to share the data that he had on their computer, because he did not have authorisation. It was perceived by the focus group participants as a ‘mindset’ issue in the government. There could be various reasons for that – such as the idea that the government spent resources on data collection, so it should not be released free of charge, or due to security concerns, or to the lack of appropriate mechanisms for sharing:

*“There's no mechanism through which they can make this data available to you, and they risk either prosecution or termination of their employment if they were just to release the data. So, it always comes back, “What is our policy? What is our framework? Under what conditions is this data released?” To add to that, that policy question, I mean, a lot of us really try the ground-up approach and met various obstacles within our national settings”* (non-governmental organisation leader).

Another community member attempted to request transport and traffic data for his project on urban planning, but when he went to the city authorities and requested the transport plan, traffic survey and traffic information for a particular construction, he was told that this was protected information and could not be shared:

*“In fact, the word he used was ... It’s a word we use normally at times in academia. Basically, he was implying that giving it to me would be plagiarism, which doesn’t make sense”* (urban activist).

However, in interviews with government representatives, officials reiterated that the government was willing to provide the data to the public and was looking for ways to do that:

*“We are thinking of merging our health data, whatever exists, to our national data systems. We are working to create wells of data. But no one knows how to provide that data to the public”* (national government representative).

#### *Data format and accuracy*

Another issue for data users that was reported in interviews and focus groups was the format of the data. The government provides a lot of the data as reports in PDFs, where there are aggregated numbers, and the analysis has already been done.

How government data were being generated and then uploaded online impacted the format, and in turn the accuracy of the data: *“because they are not linked with the sources, so they are updating the data directly [...] the veracity and accuracy of the data are challenged”* (national government official). The official gave an example of a case where the school location coordinates provided in a government dataset were in the Indian Ocean.

#### *Connections and relations with data owners*

Knowing where exactly to get information was reported as a barrier. Interviewees who regularly worked with government data admitted that it was due to their developed relationship with the data owners they were able to gain that access:

*“In our case we really didn’t have any barrier, but also because we had already built relationships. And the thing I remember is the permanent secretary kept on saying that he liked our work, because we co-created it, so we didn’t build a platform outside the government. We collaborated. We were enhancing what they already had that was analogous”* (national government representative/former non-governmental organisation leader).



In a focus group, participants discussed that knowing someone in the agency is critical to be able to reach them to get the information. One community member shared his experience trying to reach the *National Environment Management Agency (NEMA)* to file a complaint about the environment, and they blocked his phone number:

*“Landline never works. They put you on hold for two hours then it hangs up. The best way to get in touch with government officials anywhere is to find their mobile numbers. And once you get their mobile numbers, you call them. And here if you pester them, they will block you”* (focus group participant).

If someone wanted to make an application, the Kenyan National Bureau of Statistics (KNBS), the national custodian of government data, provided necessary data in some cases. A written request to the KNBS was required explaining what data were necessary and why. The ATI regulation did not state that data would be free necessarily, but it had to be ‘affordable’; however, in focus group discussions, community members said when they looked for some data that the government sold, the cost could be ‘very prohibitive’ to access and use.

*Lack of trust and corruption*

Lack of trust in government and corruption came up in both focus group discussions and in most of the interviews with non-government stakeholders as a significant barrier to accessing and using government data in addition to technical challenges. Lack of trust seemed to hinder collaborative relations with the government or the use of government data to promote ‘bottom-up’ innovative solutions to the city challenges: *“A lot of the data is not trusted by people to be true”* (non-governmental organisation leader). These views were shared by different groups of stakeholders and are presented in Table 5-1.

*Table 5-1: Quotes on the lack of trust and corruption issues by different groups of stakeholders.*

Stakeholder	Quote
<b>Data journalist</b>	<i>“[data are not available] because of corruption. A lot of times when details are hidden, you're scared of what you're going to find in it”.</i>
<b>Non-governmental organisation</b>	<i>“We have a problem in Kenya where people don't trust. It's weird because they trust the media but then they don't trust the media. So anytime the media say something that they don't agree with they don't trust the media. [...] One of the mistakes we made I think just before the 2007 elections was that our media lost, and maybe because they're not corporations, but our media lost its level of bipartisanship”.</i>

<b>Independent expert/former government official</b>	<i>“I was here in 2006, 2007 and actually came on, and it was, I joined the government and we hung around a bit. Then I came back full time when about 11 years later now I have come to live here, and people keep asking me, do you see any difference between that time and now? Actually, one of the main things is these trust issues. It has more or less collapsed... with all these corruption stories and everything, people trust government even less. They see them as all those thieves. They trust their politicians even less”.</i>
<b>Private sector</b>	<i>“Anything that we're getting from the government is untrustworthy not only because the government themselves will change numbers to meet their own agendas, but they are completely incompetent so any sense of running census, surveys, you can't trust them. [...] Data isn't the concern. Quality data, the right data, trustworthy data, that's the concern. Even these small, small groups, without audits, without understanding what their process is, the data is always in question and you can't ever really overlook the fact that people will easily and happily manipulate data to get their own ends”.</i>
<b>United Nations</b>	<i>“People are so connected and want to talk and want to share that, I'm finding this a very thriving innovation-natured system. If things are not working, there must be something else. The only things that have come up so far are trust and corruption”.</i>
<b>World Bank</b>	<i>“The funny thing about corruption in Kenya is I think people are almost blind to it or blind to their own corruption, simply because they think what they're doing is for the interests of their family and for their interests of the wider clan so that there's almost a kind of implicit acceptance of corruption as the sensible thing to do”.</i>

The focus of community-led data collection often was placed on generating more accurate data to increase transparency and keep government accountable (e.g., air pollution sensor data) or data that government did not collect. The next section describes these findings.

## 5.2. Non-government data

Apart from trying to access and use government data, which, as detailed in previous sections, was challenging to access, community took action to collect and make use of its own data to address some of the city's challenges.

The Ushahidi platform was a web-based tool to crowdsource data from citizens' reports on elections post violence (this is described in Section 3.2.3). The platform became a useful tool not only for the citizens but also for the government, which was able to take action to improve public security in the areas where it was needed most.

A collaborative mapping project, Digital Matatus<sup>27</sup> aimed to map all matatu routes (public transportation minibuses). The project worked with students to collect data via GPS-enabled devices. The map was recognised by the city government and was used by United Nations Habitat for the planning of the bus rapid transit system for Nairobi.

Ma3route<sup>28</sup> was a crowd-sourced platform that utilised a website, Twitter and Facebook accounts as well as mobile phone text messages to inform the citizens of Nairobi of traffic conditions on matatu routes. It aimed to elevate urban transportation challenges ‘by democratizing timely transport information’.

In a focus group discussion, participants said that at the time community members did not need to have permission for data collection, but “*they [government] are actually putting it to a law that yes, that if you have to collect data you have to say why you're collecting that data*” (community organiser). In the other group, participants said that one should inform the government either formally or informally (if one had working relations with them) about data collection activities, which involved explaining why any data collection would be conducted. Although authorisation to collect data at the time was not required, due to security concerns in Nairobi, it was likely that local government representatives or police would approach anyone performing data collection in the city to request details of those activities if they suspected that data were being collected in the community.

This research focused on two community initiatives that were collecting and using data to address city challenges – Map Kibera, a community mapping initiative and sensors.AFRICA, an initiative to address air pollution (and other pollution problems) in Nairobi. The two initiatives are described in Section 3.2.3.

#### 5.2.1. Map Kibera – a community mapping initiative

Map Kibera aimed to address various problems that the Kibera community faced with the help of mapping data. In places like Kibera (low-income informal settlement), challenges were complex, and one led to another. In the focus group discussion with Map Kibera volunteers, they explained how challenges were interconnected, from transport, to relocation, to water shortages and sanitation problems, because proper planning was lacking:

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<sup>27</sup> Official website for Digital Matatus: [www.digitalmatatus.com](http://www.digitalmatatus.com). Last accessed on February 15, 2021.

<sup>28</sup> Official website for Ma3route: [www.ma3route.com](http://www.ma3route.com). Last accessed on February 15, 2021.

*“Now people are passing fibre optic cables and the likes, they are also destroying roads, because they are digging along the roads to put up these cables, and when this happens, you destroy the existing sewer lines, you destroy the existing water pipes and many other things, because there was no good plan for it... So that single problem of transport is escalating many others along the way” (Map Kibera volunteer).*

Figure 5-1 shows a regular day in the Map Kibera office. Map Kibera extended their work outside Kibera and in the photo staff was preparing for a mapping assignment with one of the counties. Figure 5-2 depicts maps produced by the Map Kibera team and displayed in the office, as well as a post-it note exercise on developing a citizen engagement platform.



Figure 5-1: Map Kibera Office - preparation for a mapping project.



Figure 5-2: Maps produced by Map Kibera and posted in the office.

Map Kibera team was not the only one who did this kind of work in Kenya or in Nairobi, but they believed what differentiated and distinguished Map Kibera was that the project engaged citizens, while the others were private consultants or private companies that went directly to the county and mapped the projects by themselves. A Map Kibera team member said in the interview that they engaged citizens, because they believed it was important for them to understand what the county was doing well, what the county was not doing well and to be able to bridge this gap between the public administration and the citizens to improve transparency and to promote open data. The data collected by Map Kibera were intended to be open for the public to consult, even those who had not been part of the data collection activities – this was considered an important component of the work.

### *Government collaboration*

A Map Kibera representative said the project had always collaborated closely with the government. For example, it had reportedly combined its own project data with the data from the Ministry of Education on Kenya's open data portal and hence made education information easily available for the community and the government. The Map Kibera project coordinator shared that a member of parliament (MP) used their data to build schools in Kibera (from the interview with the Map Kibera team member). Map Kibera informed the government of their activities. The government asked questions about the project and provided appropriate permits for data collection and support letters.

At the time of the study, there was no mapping data collection project in Kibera. The team was preparing for mapping in the wards of West Pokot, a different county outside Nairobi. Through this activity supported by the World Bank, Map Kibera worked with the county to map all projects funded by the county since the adoption of the new constitution in 2010 delegating responsibilities to the county government such as hospitals, road construction, streetlights, and other public assets under county responsibility. It was part of the efforts to promote a participatory budget, so Map Kibera helped to track and map county projects to see the actual status of each project according to what they budgeted in the beginning – whether they were completed, ongoing or stalled. Map Kibera had mapped two counties in the previous year, Makueni and Baringo. This mapping was part of the bigger project on participatory budget financed by the World Bank. The work involved capacity building, i.e., training citizens, mainly youth and county officials, in each county for them to be able to map the county's projects.

### *Community mappers*

Map Kibera relied on community mappers who were recruited citizens in each ward where they worked. The team explained that it was critical for them that citizens who worked on mapping knew the place and were able to move in their county and ward. The team worked with ward administrators to help recruit citizens for mapping.

Community mappers were volunteers, and as in the Ramani Huria project, they received a stipend: *“because you're getting them out of their normal, their daily hassles”* (Map Kibera representative). A small stipend was given to show appreciation for the time they gave to the exercise, to cover their lunch, transport, airtime for communication purposes. Sometimes the wards were quite large, and the mappers needed to move around a lot, so the stipend needed to cover these transportation costs.

During their mapping mission, volunteers also received a phone to use for mapping, so they did not need to have their own. They received it in the morning and returned in the evening when the mapping was done. A Map Kibera representative admitted that not having the right technology could be a barrier to the sustainability of the project. At the time of the studies, they were working with the government at the county level to map county project assets and counted on county officials to continue updating the maps.

Community mappers and citizens who were trained for mapping reportedly did not map on their own time outside Map Kibera projects, but maps needed to be updated regularly, which in turn could hinder the sustainability of these efforts. A Map Kibera representative explained that in the project in counties for participatory budgeting they were taking a different approach: the citizens who did the mapping were able to go back to the project and update the data whenever it was needed. The idea was to have the citizens continuously work on updating the information. The county government working with Map Kibera requested that through citizen engagement the citizens should be able to continue to update the information quickly, so that the county staff did not have to go to the field all the time:

*“Because after we finish this first mapping, and this first participatory budgeting that is a part of the World Bank, we would like them to be able to continue updating and to continue mapping. So, ours is basically a capacity building [for] the citizen, and [for] the county officials”* (Map Kibera representative).

In Kibera, because it was project-based, once the project was done it stopped there. The activity resumed only when there was a new project, then the Map Kibera team called mappers on site.

#### *Data collection challenges*

During data collection, as community mappers shared in the focus group discussion, the most challenging task was to get people to contribute information. This involved explaining to the community members the purpose of the data collection and finding ways to incentivise the contribution of these data. Sometimes people asked for compensation: *“People want [cash] to give out information sometimes”* (community mapper). Otherwise, people could refuse to provide information. Community mappers explained that it was important that previous mappers did not lie or did not provide monetary incentives because it created expectations of payment and made it harder to get people to volunteer information. At the same time, one of the mappers noted that mappers before Map Kibera promised incentives that did not materialise: *“And sometimes you*

*have to promise because you want the information... those were before us” (community mapper).*  
Finding ways to incentivise people was challenging:

*“When we were doing the food survey project, we were going to the different vendors, and they're like now, you're taking photos of my fruits, and what are you going to give me in return? So, what we did, we used to have money. So, you used to buy maybe a banana from them [to] create a good rapport. So, you can buy a banana, maybe go to the next vendor, Peter buys maybe an orange. So, at times you have to use some of those tactics” (community mapper).*

At times, mappers had to deal with hostility:

*“You face hostile people, they're not ready to give you information and many they're like, “If we are giving you our information, what will you pay back us with?” So, it's not really easy getting information”. — “We usually say: “Okay, for now we cannot give you money. But after we've done this, we'll give you the map and the map will be useful to you” (community mapper).*

While data collection could impose some difficulties, getting a permit from the government to collect did not seem to be a challenge. In the focus group, community mappers explained that there were two ways one generally approached informing the government of the data collection or getting their permission. One is through ‘informal means’, which involved speaking with the chief of the area where mapping was planned and receiving a letter from them. Community mappers took this letter with them in case there were any questions from the community as to whether the data collection was authorised. This was the approach Map Kibera normally used:

*“We have to inform the government office in that specific area. So, most of the time it's usually the area chief. So, we just basically let them know what is going on for purposes of security, so that if anything happens, they are able to say that I knew this team, they already informed me what they are doing, so in case of any security issues they would be able to address it easily” (Map Kibera representative).*

The ‘formal means’ required the organisation initiating data collection to be registered by the National Commission for Science, Technology and Innovation (NACOSTI), which is a government entity that oversees research activities. This was similar to Tanzania (see Section 4.2.2). When one wanted to conduct data collection, one needed to apply and receive a letter that was then presented to the area chief, who stamped the letter. In this case, NACOSTI normally

received the results of the research and/or the data. In the focus group discussion, this was considered a positive outcome as the data were being passed on to the government.

There is a divergence in East Africa as often the line between a community leader and local government officials, especially at the smallest geographic level of public administration, seems much finer than within the Global North. This is not to doubt the professionalism of local officials in East Africa, but in projects observed, they were more embedded and representative of their local community, differing from the more established institutional governance arrangements of the Global North.

#### *Data management and infrastructure*

Map Kibera data were stored in KoBo ToolBox<sup>29</sup>, a virtual cloud server. KoBo had two accounts. There was a public one and one that is more private. The free account had a limit on the surveys that could be submitted. The account that Map Kibera used was unlimited so they could store as many data collection forms as they needed. Only Map Kibera had access.

After collecting, sorting out and ‘cleaning’ the data, community mappers also uploaded them directly to OSM. The project in the counties involved collecting additional project information that was more private. Normally when Map Kibera staff got the data from KoBo, they split it into ‘project data’ and ‘points of interest’. The ‘points of interest’ data went to OSM, and Map Kibera kept the other in an Excel sheet separately. It was more private because it had some budget information, and some information that was just related to the county. So, these data were not public and were given directly to the government, the client of the project.

At the time of this study, Map Kibera and its government counterpart were still working out where the government could host these data: *“We are currently in talks with the county to understand if we give them the data, where will they be keeping it at the moment”* (Map Kibera representative).

Data were distributed to the government and community as printed maps in addition to uploading them to the OSM. Map Kibera was also building a website for each county, where they worked on participatory budget projects. These websites were to be open to both the citizens and the county representatives, so they could continue to work on them and navigate online. As described above, there was a process of splitting the data into those that were useful only for the

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<sup>29</sup> KoBo ToolBox is an open-source suite of tools for field data collection. Official website: [www.kobotoolbox.org](http://www.kobotoolbox.org). Last accessed on February 15, 2021.



county officials and some that were completely open to the public. The expectation was that once the website was built, the county would track and update their own projects to ensure accountability for the county. This was a tool that they would continue to use once the Map Kibera involvement ended.

### *Project impact*

The focus group participants explained that several things have improved in Kibera since Map Kibera started working there, which they attributed to their work: (i) the number of primary and secondary public schools and the number of students attending them increased; (ii) four roads were built – there were none before; (iii) security maps were used to recommend additional police stations.

Education was one example where Map Kibera representatives felt they achieved a strong impact. The former MP, Late Kenecott, who passed away shortly before the study, employed Map Kibera maps and data as a tool for improving education and to build primary and secondary schools where there were none according to the maps collected by Map Kibera.

The Open Schools<sup>30</sup> Kenya project started with the Map Kibera maps. The project put all schools on the map and created a profile that could be used and updated by each school. The Map Kibera representative who monitored and updated the schools map on Open Schools Kenya explained that there was also a picture of the school and they could use that page of their school as a tool to fundraise and to ask for donor support. For parents, one of the main purposes of Open Schools Kenya was to be able to see which were the available schools in their area and to send their children to the ones they thought were the best for them. The government could use those maps to see if the number and distribution of schools were sufficient for the area.

*“There was a new road construction that cut Kibera into parts, many were the schools demolished for example, and relocated. So, Zack and the mappers really tracked which were the school affected by that road construction and if they were relocated or not. And we produced a map showing how many schools, how many public, how many private were affected by that. Also, to show the people what is actually going on in the community, both for internal purposes and outside purposes. So, it's really important to keep this data updated”* (one of the founders of Map Kibera).

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<sup>30</sup> Open Schools Kenya official website: [www.openschoolskenya.org](http://www.openschoolskenya.org). Last accessed on February 15, 2021.

Although at the time of the study there were no mapping projects in Kibera, the team was following up on the events that had been happening in Kibera. For example, there was a private school that collapsed due to poor infrastructure. The government was in the process of checking all private schools to confirm whether they were suitable for students to be there, which caused the closure of some of the schools. So, the Map Kibera team intended to find out which schools were closed down and to conduct interviews about those schools to see how they were affected. Those schools were also mapped through the Open Schools Kenya project. The team also aimed to estimate the movement of the students, since the government was moving the students to some of the public schools. The objective was to understand the distance that the students had to cover, considering that some of them were moved to schools that were further from where they used to go.

The physical maps produced together with the counties were planned to be used for participatory budgeting. County officials planned to engage the citizens in the next budget for the county in each ward. And they aimed to use those paper maps to understand where there were any gaps in infrastructure and services, and to allocate the budget in a more transparent and accountable way.

Map Kibera collaborated with some other organisations and teams. For example, they worked with Carolina for Kibera, a community organisation with a mission 'to create pathways out of poverty' in Kibera. Carolina for Kibera worked mainly on the issues around security and sanitation. One of the projects aimed to improve sanitation in a specific area in Kibera. So, they teamed up with Map Kibera to get help to map the water and sanitation facilities in those areas. Based on this information, Carolina for Kibera were able to see where the needs were, the distribution of these facilities in those areas, how it was affecting the community and ultimately to support the work that they were doing in that area.

### *Community outreach*

Apart from mapping, Map Kibera had established several community projects that use data. Kibera News Network was a community media channel. They prepared blog posts and videos about life in the community in Kibera. The Network mainly used YouTube and social media such as Facebook and Twitter to post stories. The stories could be very different from each other. Some were about politics, some were 'human interest' stories, some were 'public interest' stories such as water and sanitation or waste management in Kibera. They could be positive, negative, or neutral stories:

*“Sometimes the stories are used also to hold the leader accountable. So, for example, if there is something going on, and the person responsible to handle that issue is the local administrator, or the local MCA [Member of County Assembly], we really try to feature both the citizens’ perspective, and to give the opportunity to the leader, or to the person responsible for that, to respond to the public. So, it’s really a tool that can be used to hold the leader accountable in Kibera”* (Map Kibera representative).

Map Kibera referred to this project as ‘citizen journalism’: *“whatever happens in the community, we try to report it back”* (Map Kibera representative). At the time of the study, three people were working on this project at Map Kibera who were residents of Kibera. They had not been formally trained as journalists, but through Kibera News Network they received training on the job and the experience to report from a journalistic point of view.

In some stories, Kibera News Network used the data that Map Kibera collected in Kibera and the map. For instance, for stories about security in Kibera the Network used the map of security that Map Kibera produced, or some of that data to demonstrate how many safe places there were in Kibera. On education, when the Network talked about education, Map Kibera had a large amount of data through Open Schools Kenya and used them in the videos. Map Kibera tried to leverage the data and the maps for citizen journalism wherever possible, turning it into ‘data journalism’. But in some stories, they did not have the data or maps to incorporate or embed. It depended on the story, as a Map Kibera representative explained. At the time of the study, the support for Kibera News Network came from the Open Society Foundation. The support aimed at training new youth who worked at Map Kibera to produce stories for a weekly programme.

Another aspect of the Kibera News Network that the Open Society Foundation supported was community screenings of their video episodes. Recognizing the limitations of the community to view content online, Map Kibera projected the videos that they produced in public spaces, either outdoor or indoor:

*“...because we really think that it’s important also for the citizens that are offline to be able to consume the stories, and to discuss and to build on them. So, we’re trying to reach both the youth that are mainly online, and the adults, or the youths that are offline in the community”* (Map Kibera representative).

Humans of Kibera was another project under the Kibera News Network. It was a photographic project based on a similar idea in New York City: Humans of New York, a famous

Facebook page featuring regular citizens of the city. Humans of Kibera started several years ago and every week featured a picture of a citizen of Kibera with a short story about them.

The next section will cover the second initiative in Nairobi – sensors.AFRICA.

#### 5.2.2. sensors.AFRICA – a community initiative against pollution

Air pollution kills nearly one million people in African annually (Bauer *et al.*, 2019). As this is also a big challenge in Nairobi (The Guardian, 2016) and the degree of this issue was debated often, the city could benefit from accurate and reliable data on air quality. The problem was that there were not much environmental open data in Kenya and particularly in Nairobi. In the focus group, community members discussed that such data were difficult to access in Nairobi – the government either did not have them or did not provide them. Part of the reason, a sensors.AFRICA representative explained, was the duplication of responsibilities between national and county government regarding air quality:

*“You have the Kenya Meteorological Department, which basically has all the infrastructure in terms of collection. But then they have to be sub-contracted or contracted by the county governments to actually do the collection. So, there is a sort of lack of responsibility or basically just abdication where guys go like, NEMA [National Environment Management Agency] is going to collect it, so we as a county don't have to do that. So we can basically just piggyback on their data, but then they don't get a lot of say in what they're supposed to be doing, what they're supposed to be collecting”* (sensors.AFRICA coordinator).

Relationships with the government proved to be complicated:

*“They actually view us as watchdogs in a certain way and that's the whole aim of the project, it is for people not only to get the data but also to advocate for change, and we've seen people doing that now”* (Code for Africa staff).

Recently the Nairobi county government partnered with Liquid Telecom, one of Africa's largest telecom providers, to instal air quality sensors. This partnership was facilitated by the United Nations Environment Program (UNEP) and aimed to support the county government of Nairobi to do air quality monitoring. The project was not looking at the air quality from a health perspective, but from a city planning perspective – how to plan infrastructure to reduce pollution. Together with Liquid Telecom the county government deployed only three sensors at the time of this study. sensors.AFRICA was engaged through their connection with the UNEP and was supposed to deploy their own sensors as part of this partnership. The project was still in a pilot

phase at the time of this research. The county government was supposed to adopt the initiative, then sensors.AFRICA team would do the community grassroots work to 'grow it organically'. One of the challenges was that the county government was not willing to pay for the sensors. So, UNEP donated the sensors to the county government.

#### *Data collection challenges*

The other challenge that sensors.AFRICA faced was that because they were the community organisers, their role was to speak to the people on the ground and convince them to provide electricity for WiFi and securely host the sensors. The project coordinator said that people started to put in requests, mostly from communities in industrial areas. To request a sensor and support, community members needed to go to the sensors.AFRICA website and contact the team to receive an air quality sensor. Nevertheless, citizen engagement remained a challenge for the project:

*“The biggest challenge there was that a lot of people didn't really understand why air quality matters, for them it was basically, I don't see this as a big problem, therefore, I'm not going to participate in this particular project, and even from the county government perspective, the only guys who really understood were not the [ones] planning infrastructure, but the health department. There is a huge knowledge gap”* (sensors.AFRICA coordinator).

At the time of this study, the sensors.AFRICA team was distributing sensors to the community members, local organisations and businesses for free and provided knowledge on how to assemble and deploy them:

*“Eventually what we want is for people to assemble the sensors by themselves and deploy them, fund them by themselves: buy a sensor, deploy it, then push the data to us without having to build the whole infrastructure that we have already built”* (sensors.AFRICA coordinator).

Figure 5-3 and Figure 5-4 below demonstrate an air quality sensor and a solar battery to power the sensor.

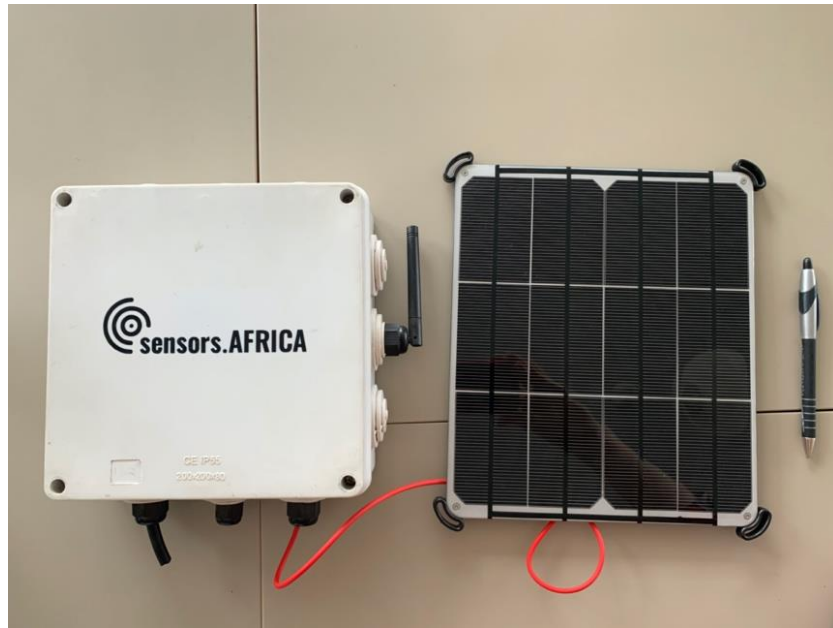


Figure 5-3: sensors.AFRICA air quality sensor (on the left) and solar battery (on the right) compared to a pen.



Figure 5-4: sensors.AFRICA's air quality sensor – internal components.

In informal settlements, air quality problems often were caused by waste burning and the operations of the industrial factories. A sensors.AFRICA coordinator shared that a lot of waste in slums is burnt as opposed to being collected and transported to a central place, so there were dump sites around poorer neighbourhoods. This caused 'environmental inequality'. Also, there were factories that were flouting the law and regulations, because people could not do anything about it.

In those poor areas, where sensors.AFRICA had installed sensors, having electricity and WiFi to support this equipment was challenging. The sensors.AFRICA team had to figure out how to make these work more robustly in Africa, especially for the communities that were mainly suffering from air pollution, such as informal settlements in Nairobi: *“because you can basically take all of them to green spaces, to people who are a little bit wealthy or middle-class where they have WiFi and electricity, but you find that they don't actually have an air pollution problem”* (sensors.AFRICA coordinator)

To address the issue of requiring GSM connection and regular payments to support it, sensors.AFRICA had partnered with Liquid Telecom to use radio signal, which was free:

*“Thanks to our partnership [...] with Liquid Telecom, we can now begin using radio for that as well... So, longer ranges, less power. Because GSM consumes a lot of power and now with the solar panels, that means that we are not also paying for electricity because you go to most places like schools and they're saying – you guys are using our electricity, therefore you need to be paying something”* (sensors.AFRICA coordinator).

Nevertheless, there was still a cost associated with the sensors for power and WiFi, so citizens needed to be very motivated to install and maintain the equipment. If it broke down, they needed to contact the sensors.AFRICA team at Code for Africa, not the other way around.

Knowing how and where sensor data were collected was important for the analysis. This could raise privacy issues if people installed sensors in their homes:

*“You can't really analyse data fully if you don't understand the source of the data, where it was collected from and then try to make sense of it using the parameters that you've been given”* (focus group participant).

#### *Data management infrastructure*

sensors.AFRICA used Code for Africa's robust technology and servers to support the data infrastructure for sensor data. Data were stored in a paid virtual cloud storage. However, in different circumstances, data infrastructure and storage capacity could be a challenge. In the focus group discussion, a university representative working on a partner project with 22 sensors and the mobile phone app explained:

*“We had a bit of an issue with our own sensor at first, running it and powering it. Then we also had an issue with storage because our storage was not able to handle at the moment more data than what is being displayed by the 22, because*

this data is relayed from them and then we have to temporarily store it in order to be able to relay it again. So, we don't have the capacity at the moment to store more than what we're showing now. But yes, sure the API is open and if we plug into that, we get bigger cloud storage [...] then we will be able to capture more data” (focus group participant).

Figure 5-5, Figure 5-6 and Figure 5-7 demonstrate sensors.AFRICA’s website and dashboards. The dashboard showed an average for the last five minutes. Added data were live.

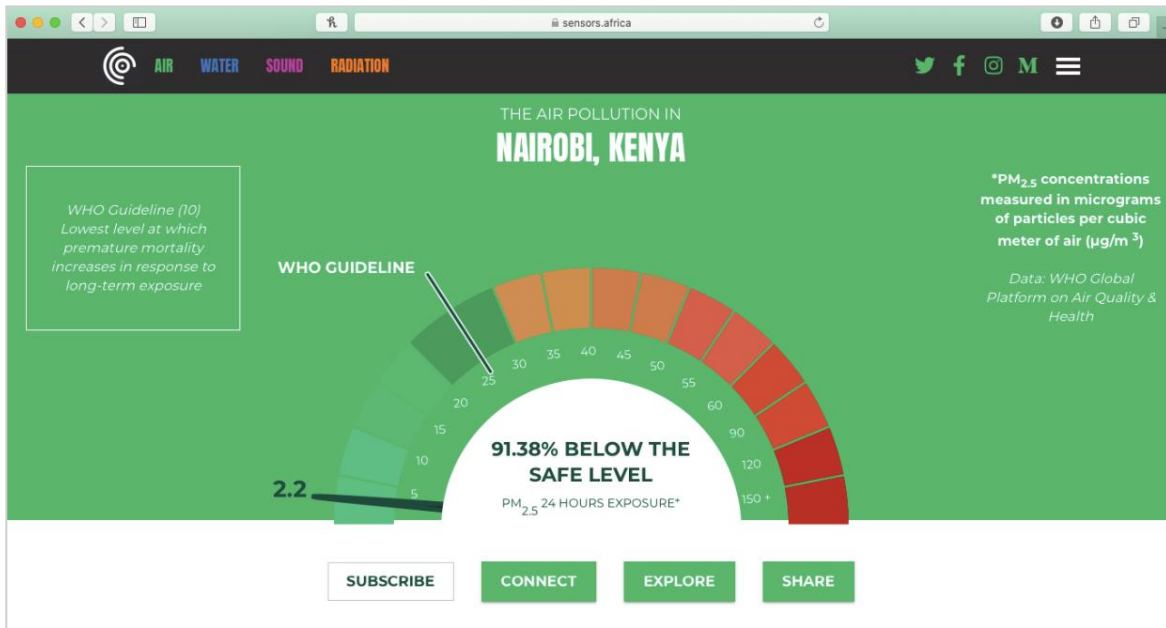


Figure 5-5: sensors.AFRICA web dashboard comparing Nairobi pollution level with World Health Organisation's recommended norms.



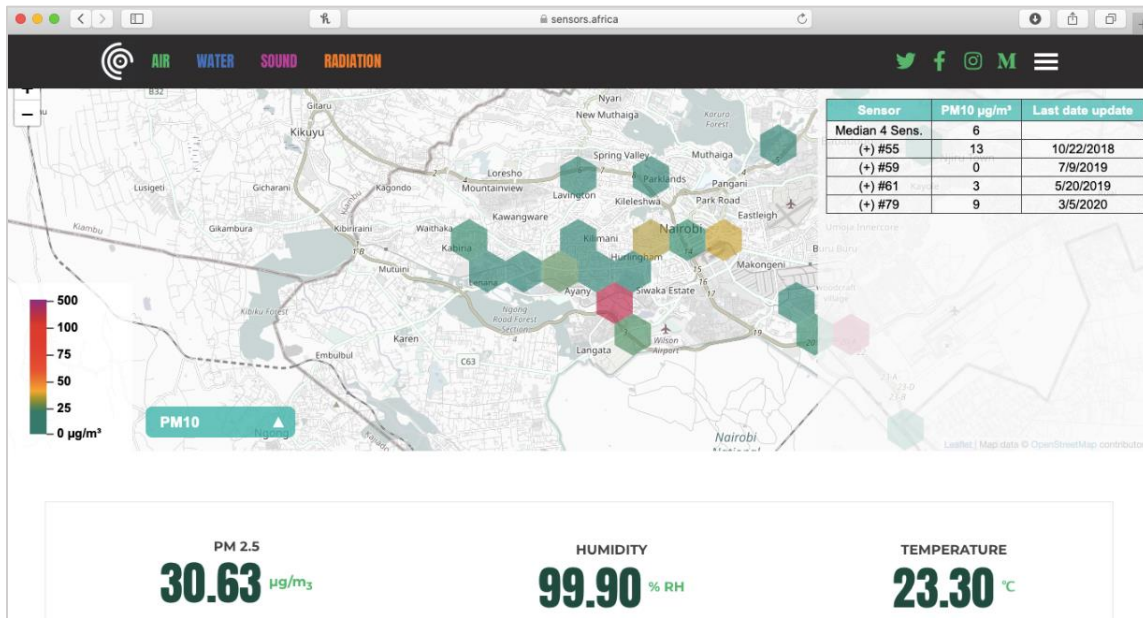


Figure 5-6: sensors.AFRICA map of all sensors with the indication of the average measurements collected.

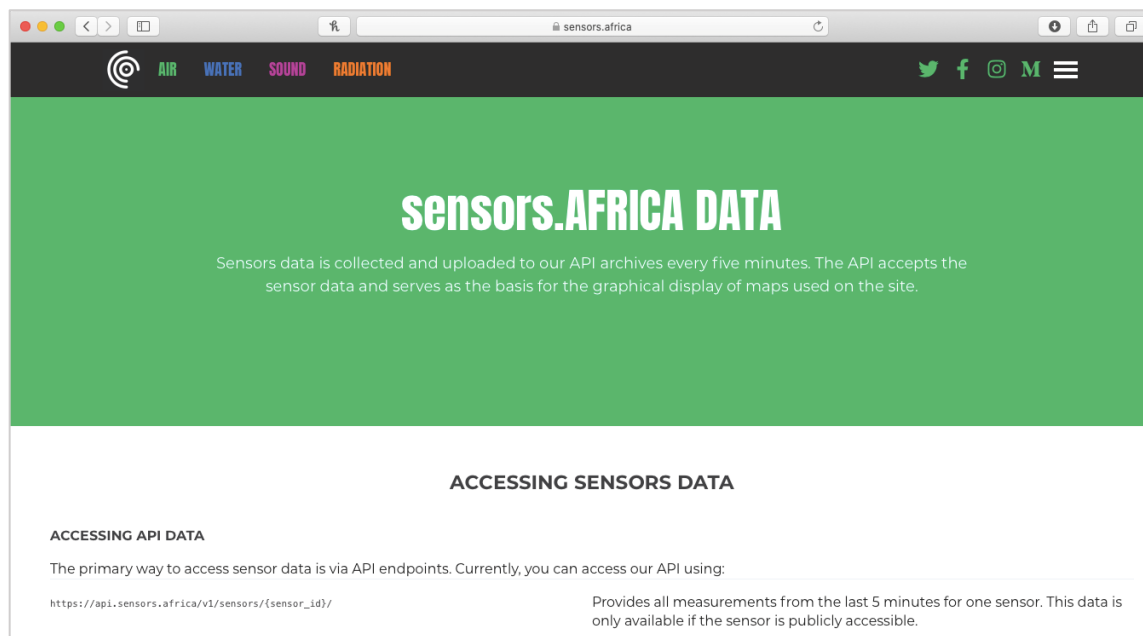


Figure 5-7: sensors.AFRICA website landing page on air pollution.

A stable internet connection was important to avoid delays and ensure access to data in real time. The university app using sensor data had to send a request every few minutes to the public application programming interface (API), which effectively caused a five-minute delay, partly because of the interconnection challenges. The university representative shared that, despite being a university, they did not have stable internet access.

sensors.AFRICA's dashboard used WHO guidelines: for PM10 it was supposed to be 50 micrograms per cubic meter within a 24-hour period, and for PM2.5 it was 25 micrograms per cubic meter within a 24-hour period. The dashboard presented the data in a way that was easy for users to understand rather than focusing on specific sensor readings. For that, the dashboard used colour indicators from green to red. The international standard is marked on the colour scale in Figure 5-5.

If something came up and the database detected issues with the data, then sensors.AFRICA tried to troubleshoot on the phone or sent somebody to the sensor location to check it out. For example, if sensors were sending values that were too high or too low, a constant, then it would be flagged as problematic. Once data were in the database, they were archived into the CSV files. This used to be done manually, but then Code for Africa's tech team created 'jobs' that were constantly running to archive these data.

All the data collected from sensors via sensors.AFRICA project were open source and public, and were accessible through APIs. The website had an archive where users could access historic data.

#### *Data use*

In the focus group discussions and during the interviews with representatives from sensors.AFRICA examples were provided suggesting that people used these data to shut down some companies that were problematic for air quality, although in some cases, these companies were re-opened several months later.

People took these data to the environmental agencies. Traditionally, citizens who complained about pollution could rely on smell or photos, so this was 'anecdotal' evidence. With the data from sensors.AFRICA, they were invited by the government to have conversations, because the government realised that there were data to back up those complaints:

*"We've had ministers actually coming to the ground to assess what's going on and giving directives to the environmental agency to tell them you need to investigate these; we need to look into this"* (sensors.AFRICA coordinator).

At first, when sensors.AFRICA was launched, they wanted to work with citizens directly and provide data to people. The project conducted awareness-raising campaigns around the air pollution problem, and anyone who had this problem was invited to participate, to receive and install an air pollution sensor for free: "...because we still had that knowledge gap in that we had to explain to everybody why air quality matters, so we ... had this small circle of trust, which was

*basically techies, guys who want to play around with gadgets, very curious people. Those are the first people who actually became custodians” (sensors.AFRICA coordinator).*

Then, the project extended partnership to schools. In collaboration with The Global Learning and Observations to Benefit the Environment (GLOBE) Program<sup>31</sup>, a NASA affiliated initiative, sensors.AFRICA gained access to a large number of schools. They took sensors to schools, and then these schools could use those data for their own data science and data literacy campaigns within the schools. Then, the project partnered with universities and media houses.

Through the Code for Africa, sensors.AFRICA worked with the students in Nairobi. They conducted IoT workshops where they showed the students how to build the sensors, how to analyse and interpret the data, and then relay that information to their communities. As part of this collaboration, lecturers together with students developed an app using the sensors built in the university and data from sensors.Africa, and the sensors collected data for the researchers to analyse.

Investigative data journalists were one of the key audiences. Then, there were requests from people and resident associations to use these data. The next section will cover findings related to citizen participation in Nairobi.

### 5.3. Citizens in Nairobi

The devolution process initiated with the new constitution in Kenya aimed to empower citizens to make decisions about their communities. Decentralisation of decision power was accompanied by a push for a more ‘engaged’ citizenry for enhanced accountability and service delivery through ‘bottom-up’ public participation approaches. For that, the newly established Ministry of Devolution developed formal legal requirements for the government to follow to ensure that the public participated in decision making.

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<sup>31</sup> The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education programme that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process and contribute meaningfully to our understanding of the Earth system and global environment. Official website: [www.globe.gov](http://www.globe.gov). Last accessed on February 15, 2021.

### 5.3.1. Public meetings and newspaper notices

One of the key requirements for any public decision to be legitimate was to inform citizens of the public meetings and projects via newspaper notices – at least two per issue in question. Different community organisations and special interest groups looked for those notices and advertised them on social media and radio stations, otherwise, as many interviewees noted, those notices did not get attention.

Although there seemed to be a push for public participation through devolution, there were challenges on both sides – government and citizens – as suggested by the interviewees. Interviewees both from inside and outside government reported a number of challenges with the implementation of public engagement mechanisms. Similar to Dar es Salaam, Nairobi was not homogeneous, with large slum areas on the one hand, and the ‘high-end’ (wealthy) areas on the other where very different public engagement practices applied. This seemed to create a challenge for city-wide data-driven initiatives and how the interests of different groups were represented.

Adopting the new public participation paradigm and the devolution process was ‘challenging’ for the government:

*“So far, it's been the amount of challenges, in that when you're setting up a new system and a new structure, then it becomes a bit of a challenge. Because being the pioneer, there are a lot of changes that just come with it, which, first you can look at the finances and then the education of the people”* (local government official).

From citizens, uptake of engagement opportunities was also slow:

*“They cannot understand it from a true level and because of that, there's not really much engagement around it so even when the government calls for public engagement activities around some of these projects, people don't turn up for them because they don't understand them”* (non-governmental organisation leader).

Regular community meetings organised by a chief took place, but rather for deciding on operational issues in the community, which might or might not be raised to a higher level of government:

*“The chief is the one who organises the regular community meeting. When they organise that regular community meeting and the citizens say whatever it is that is*

*important to them, the chief does not have the power to do a lot of things. For example, the chief does not have the resources to allocate money towards a hospital and so on and so forth. You'll find that at chief level or even assistant county commissioner level what will happen is that they will bring operational issues to the government's attention"* (non-governmental organisation leader).

However, it was not based on voting but rather served as a platform for discussion of common issues and if people wanted to communicate specific concerns directly to the government, they went straight to the governor, an elected official, rather than lower levels of government.

Non-government study participants and community members in focus groups criticised how public participation was organised by the government:

*"Somebody can go to court and demand that this project should stop because there was lack of public participation. But there lies a problem. The government does not plan for it"* (focus group participant).

The constitution affirmed public participation as one of the key principles in Kenya's democracy. For engaging the public in decision making about budget allocation, the government used posters advertising the time and place of meetings. Focus group participants discussed that oftentimes the place of the meeting changed at the last minute, and the posters were replaced on very short notice, even on the day of the meeting. Community members reported frustration with how those meetings were organised and advertised, which drove many people away from participating in those forums. The focus group discussants believed that the public engagement guaranteed by the constitution was not 'enforced'.

It was also discussed that in Nairobi people valued their time over going to public meetings. In communities outside big cities, however, people participated more, and the participation of communities in budget allocation meetings in those areas was noted as growing.

#### *Resident associations and 'barazas'*

At a local level, citizens were often organised in resident associations, especially in 'high-end' neighbourhoods. One such association, the Kilimani Project Foundation<sup>32</sup>, was formed to

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<sup>32</sup> Kilimani Project Foundation is a membership-based not for profit organisation founded to promote creativity, aliveness, tenacity and neighbourliness of an affluent area of Nairobi called Kilimani. Official website: [www.kilimani.co.ke](http://www.kilimani.co.ke). Last accessed on February 15, 2021.

promote interests of the 43,000 people who ‘live, work and play’ in Kilimani, Nairobi (according to the Foundation’s website).

More informal ‘barazas’ (a traditional form of public meeting) were common for low-income informal settlement areas, which although located in the heart of Nairobi, were often organised more like villages.

### 5.3.2. Role of citizens in collecting and using data

With some challenges and in the early days of the implementation, the perceived role of citizens in generating and using the data for tackling city challenges was prominent as it was rooted in the new public participation framework that Kenya had adopted:

*“...where they come in when now they’re analysing this data to help them in what we call public participation. Anything has to have public input. And they cannot input for they don’t have the information”* (ward administrator).

*“And for me it is imperative, especially now, so now you’re not going to wait for the government to give it to you, you better start doing this for yourselves. It’s important for citizens to collect their own data, because they can use it to make demands for better service”* (focus group participant).

The ward administrator also explained how in his view ‘smart city’ initiatives needed to ‘come from the residents’: *“take for example Kilimani, Kileleshwa, Westlands, sit down and say, you know what, we need an open data system, and the county needs to do that for us, they make a budget for it”*.

For community initiatives including data collection from the communities, the government required them to have a permit, although in general obtaining it did not seem difficult or problematic, and the government did not get involved in the implementation of data collection.

Citizens were expected to have a role and even the responsibility to generate their own data and use government data to keep the government accountable and provide verification of government data. The following quotes from participants of focus group discussions demonstrate this:

*“Citizens have a really big role to play when it comes to data. The role is mostly on accountability. When you think about how the government produces its statistics, how the private sector produces its statistics or numbers, it has to come from you. It has to come from me. It has to come from a citizen somehow”*.

*“They should be able to adopt technologies that gather that data. I should be able to switch on my location in my phone if I'm in traffic, that way Google can tell, so many people are in traffic, there must be congestion here. I should be able to share the status of what's going on. An example of such a phenomenon is fitness. You see the way people run, and then they show you ‘I have run’, using this to inspire and challenge others ... You're only collecting information, and sharing it, and using it to inspire others and to challenge others”.*

*“We know, for example, the economic conversation around open data doesn't make sense in the global south. So, don't tell me we make ten companies worth 10 billion. It does not. That was the argument that was being pushed. It doesn't work. You've said it, “Who will make millions of dollars from open data?” It's not the same. It's not the same business case. The business case I think for us, it's more the transparency, the reducing of wastage, the strengthening of voice. I think for me it's more the soft, the soft issues around what open data can do in terms of space. That's why Tanzania now is right there”.*

It was discussed that the role of citizens was to collect data, also to make challenges visible to the government, so that the government could take actions to address them. However, this also raised some issues. For example, since people in informal settlements occupied those areas illegally, they often were afraid to take action, to raise issues with the government, as they feared being evacuated: *“We don't know, we do not have enough information such that even when the government wants to push me out because I'm in an industrial zone, I'm always like you say, in fear of taking any action”* (focus group participant).

#### 5.4. Stakeholder interactions

As discussed in the previous section, unlike in Tanzania, the government in Kenya were not directly involved in data collection, nor provided close oversight of the data collection activities. In interviews with government representatives, they reported that they saw their role in facilitating and supporting community groups:

*“For post-2012, the new terrain of engagement where you have the local government, in our case Nairobi City County, being the custodian of public service delivery. [...] we simply convene this multi-stakeholder ecosystem, right? And so,*

*a lot of them have interesting initiatives. What we try to do is ensure that their initiatives are not siloed, and that we catalyse a lot of the actions that they do”* (national government representative).

#### 5.4.1. Civil society

In focus group discussions, participants emphasised that the government did not accept citizen-generated data and insisted on using their own data despite all the drawbacks of government data that were described earlier in this chapter. Especially when it came to disputes over issues such as noise pollution, the government was reluctant to use any data that was not gathered directly by the government, especially county-level government, as was reported by community members in the focus group discussion.

A national government official supposed that the government’s attitude towards citizen-generated data was changing thanks to many people who came from civil society and were advising the government on those issues:

*“So, they’ll tend to accommodate even the informal means of doing it, so long as the content they get, even if they do not recognise and acknowledge that this one was generated by Map Kibera, but it will be acted upon, which is still fine”* (national government representative).

Although some community members in a focus group discussion were sceptical about the government’s willingness to be responsive to the community’s requests and collaborate, collaboration with civil society was noted to be stronger in Kenya than in Tanzania, particularly at the national level. Kenya’s membership in the OGP was used as supporting evidence. OGP required engaging civil society as equal stakeholders in advancing open government agenda and action plan in the country.

#### 5.4.2. International aid institutions and donor stakeholders

While Nairobi was a regional host to many donor organisations, the involvement of donors in smart city projects seemed either equal or less than that of the private sector companies. In the interviews with government representatives, the role of foreign aid institutions in the smart city transformation of Nairobi was described as minimal or non-existent: *“They don’t have any role. They’re bringing confusion”* (national government official).

Indeed, donor institutions were perceived as acting in silos, and were criticised for imposing their own ideas, which was not perceived as conducive to building an ecosystem around smart development. To coordinate these efforts, the government created the Development



Partnership Forum (DPF) that was supposed to create an alignment between donors and how they funded Kenya's national priorities. The national government convened the DPF and presented national priorities, for which funding was required. Under the new government, the Vision 2030 and Big Four Agenda were developed with the focus on manufacturing, food security and nutrition, universal health coverage and affordable housing. Donors were encouraged to bring resources to fund those priorities.

With regards to data, donors reportedly did not fund data for the government, but instead created platforms and dashboards to display existing data or data created under their projects. Similar to Tanzania, those projects were criticised for being short-term and lacking sustainable results:

*“Technology is nothing if it does not have people. A lot of donors then are funding projects that people do not use because the project has been designed, it has been designed in such a way that it is about the building of the app but it's not about building the capacity of the people or changing the culture of the people to use them, which tends to be a much longer-term activity”* (a non-profit organisation leader).

Some interviewees found donors helpful in some cases to generate data, however, it was also noted that some donor organisations did not make their data available despite promoting the open data concept, which was problematic:

*“Actually, development agencies, because they fund so much of the research, all they do is make the final report, not the actual raw data available. I asked them for the raw data, they told me there are 4.5 million dairy cows in Kenya. Can we find out where they are? which counties you know what I mean and they're like, “Well that's our data that's owned by the consultant or the proprietor of the data”, and get this, this is maybe interesting for you. They're like, we paid to collect that data so why should we give it to you”* (private sector representative).

In addition to the lack of funding for data collection, these donors did not seem to support digitising of data, which did not bring visibility.

Donors were considered by the interviewees to be custodians of data that could be helpful to citizens. Many donor institutions had their platform with project data and required the government to submit data according to their requirements, which were different for each donor.

## 5.5. Conclusions

The objective of this chapter was to report empirical evidence and findings from the second case city, Nairobi. They were reported using the same structure as the previous chapter on Dar es Salaam, covering topics related to data processes, citizen participation and stakeholder interactions.

In summary, the government in Nairobi appeared less involved in community-based initiatives than in Dar es Salaam, and community members voiced more concerns with corruption and trust issues with regards to government data and decision making. Although official processes were put in place to engage citizens, communities found them ineffective and not realised properly to have meaningful engagement.

A lot of data were reportedly available online, although scattered, and study participants reported many challenges around access to government data. The division of functions between national and county (city) government regarding various city services played an important role in how official city data were handled and circulated, which many participants including local government representatives found at times conflicting and not conducive to accessing city data easily or at all.

Citizen-led data collection was seen as an alternative source of data to counter government data, which were either difficult to obtain or were not trusted. Citizen-generated data were used mostly to bring the government's attention to particular city issues that needed addressing.

The findings reported in this chapter along with the findings from Dar es Salaam reported in the previous chapter provided the basis for thematic analysis, which will be presented in the next chapter.

## Chapter 6. Analysis and application

The previous chapters provided a thorough account of the data gathered in two cities. In this chapter, those findings are analysed thematically through the prism of the research questions.

As Dar es Salaam and Nairobi are expanding rapidly with several sustainability challenges that could undermine the well-being of their growing populations, a smart city approach could be used to address some of these challenges. Although there was not a long-term or coherent strategy to how the city should develop as a smart city or use technologies and data-driven solutions to tackle urban challenges, there were a number of initiatives that worked on the community level and employed data to support their activities.

This chapter is organised into seven themes (bottom row of Figure 6-1), which emerged from the analysis when the two cities were compared and contrasted to each other, as well as the literature on the same issues in the 'Global North,' guided by the research questions set out in the Introduction.

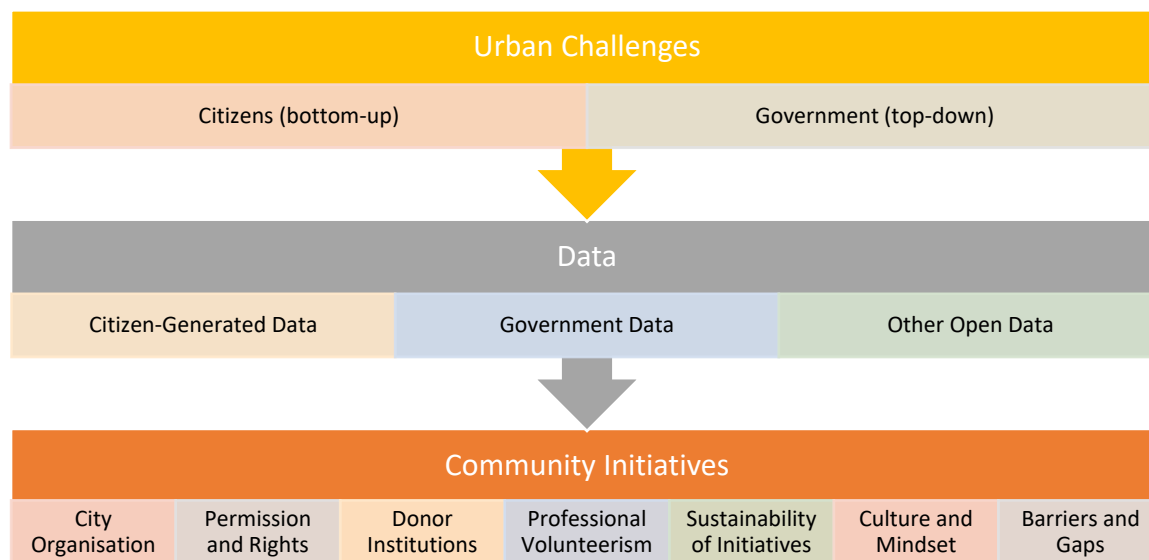


Figure 6-1: Thematic areas of analysis.

### 6.1. City organisation

The two cities that were selected for this research have a great deal in common. In addition to being the largest cities in their respective countries, both had a large percentage of informal settlements, i.e., 'slums', which operated more like villages and created a certain community dynamic:

*“Culturally, the slums operate like villages. Very cordial, very familial, very helpful to each other, that sort of thing, but if you go to more middle-class... or the higher you go up the social ladder, you'll find neighbours have never met for years. They don't even know each other”* (non-governmental organisation leader).

These areas generally were impoverished and did not have the same advantages as cities. They lacked connectivity, and the use of technology was significantly lower than in the more developed areas of the city. Moreover, as was evident from the name ‘informal neighbourhood’, people often lived there without a permit, which impacted both their rights, and their capacity to exercise those they had, and to access and use data in doing so.

Furthermore, both cities had complex political and administrative systems, where the city government was the opposition to the national ruling party. In the case of Dar es Salaam, in addition to the mayor for the city region, there were also mayors for each of the five districts within the city. In the case of Nairobi, city management functions were shared between national and city government levels. Different stakeholders considered these complexities as a ‘barrier’ to the management and accessing of city data.

International open data experts and representatives of foreign aid institutions interviewed considered the complex city governance and organisational structure in combination with political tensions between the central and local government as one of the key challenges in establishing and coordinating a smart city. This was also viewed as the main ‘barrier’ to establishing the right policies and developing a vision for Dar es Salaam as a smart city. City governance structures and politics formed one of the key themes.

Data experts also identified the lack of leadership within the government in both cities to champion the smart city and a data-driven agenda for the city as one of the most critical challenges to achieving it. The cities’ complex governance and political tensions between the national and city governments, as they belonged to different political parties, appeared to be one of the reasons. In interviews with the government and community stakeholders, there was no consensus on who should coordinate this agenda in the government: national government, regional commissioner or at the municipal level.

Both Tanzania and Kenya had adopted a ten-cell leadership system, a socialist regime ‘self-reliance’ approach to community development (the ten-cell leadership system is explained in Section 4.2.2). Kenya followed the Tanzanian example. While in Tanzania, and particularly in Dar es Salaam, the system still works in many places and is considered a semi-formal form of

governance, there was no such evidence in Kenya, particularly in Nairobi. In Dar es Salaam, study participants described the wajumbe (politically appointed ten-cell leaders) as “*the ones who really know the problem of their people, compared to them who sit in the office*”, despite the fact that the ten-cell leaders were not part of the official formal government.

In Tanzania, from the interviews and focus group discussions, it was evident that it had become more difficult for the current governance model at the local level to keep up with the rapidly expanding city. As a response to the increase in the city’s population, the Tanzanian government made a formal change, that each ten-cell leader would be responsible for 50 households. The former system where communities were well-organised and managed by community representatives at the lowest level was described as not working as well. There seemed to be a strong need for citizens to be involved, but the government held authority and retained control over data and solutions. The citizens could organise under the government’s tight supervision and with their participation, or separately from the government, i.e., hiring a contractor and collecting their own data. There did not seem to be much opportunity to work collaboratively with the government, e.g., collecting the data, which would help the government to act/improve the services, unless these efforts were a part of a programme with an established donor institution or organisation such as the World Bank or Nipe Fagio.

The lowest level of official government in Tanzania is sub-ward, however, the informal ten-cell leaders responsible for 50 households in many areas of Dar es Salaam remained key to government data collection efforts. Expert interviewees suggested that this organisational structure could be leveraged for producing and using very granular data and for engaging citizens in using it. However, some local government interviewees expressed concerns that strong ties between these local leaders and the national party could impede collaboration with the local government on data exchange and disclosure, as they were from the opposition party. Besides, the lack of digital data at the lowest level and the absence of a mechanism to share data back to the local leadership and community seemed to obstruct such engagement. So, having the granular data empowered the government at the level where it became available and could be used, but not the communities who generated it. Therefore, the potential was not fulfilled, due to strong government control and lack of sharing.

In Kenya, the lowest level of official government is ward administrator or chief (around 50,000 people); everything below that size was self-organised by communities. Community-level organisation was still strong, although it did not seem to fit into a formal Ujamaa ten-cell leadership system – at least in Nairobi, where the system worked only ‘loosely’ in slums. Community leaders

still had a strong influence there. In other parts of Nairobi, especially wealthy 'high-end' areas, communities seemed to organise themselves into residents' associations – formally registered non-governmental organisations that represented community interests.

Both countries had a strong tradition of community-level support and coordination. They also had established mechanisms for local participation, either through wajumbes or through the public participation processes in the new constitution (Kenya). In both cities, the community-level leadership was still associated with the government, although it was not formally part of it, so community initiatives blended with the government.

As discussed earlier, the process of devolution and transfer of authority and decision-making powers to the lower levels of government was central to the discussion of city organisation and public participation. This is also considered one of the global trends in urban governance, but the extent and form of devolution highly depend on how much power the central government has and how much support it provides to lower government levels (DiGaetano and Strom, 2003): *“Centrally organised political parties and interest groups and a widely shared preference for uniformity in key policy areas has resulted in a more centralised system”* (DiGaetano and Strom, 2003, p. 369).

In Tanzania, the national government continued to have a lot of authority, and evidently, devolution did not translate into more effective grassroots processes and involving communities in decision making (Massoi and Norman, 2009).

Like many other African states, before the new constitution in 2010 and the vote for devolution in 2013, Kenya was considered an 'over-centralised' state (D'Arcy and Cornell, 2016). In Nairobi, the government interviewees reported that they were trying to work out effective public participation through the use of technologies. Although the devolution had started relatively recently and at the time of this research it was too soon to know what it had achieved, the reflections from the other stakeholders and community members offered an array of examples that the government's efforts to engage the communities did not translate into effective participation.

Indeed, governance, and specifically data management functions and the relationship between stakeholders, are considered one of the key elements in developing a smart city (Ma and Lam, 2019). Considering the tensions between the central and local levels of government, strong government authority (especially in Tanzania), questionable degrees of the success of devolution processes in both countries and a reported lack of leadership to take on the agenda of smart cities and open data, both cities were not well positioned to move quickly towards a 'smarter' city.

## 6.2. Access to information: permissions and rights

While both Kenya and Tanzania were among the first African countries (and remain among relatively few) to launch their national open data portals, neither one was able to sustain and develop the initiatives further once donor support for the project ended. Nevertheless, at the time it demonstrated political willingness and commitment to providing data and information to the citizens.

In both Dar es Salaam and Nairobi, study participants explained that any data collection by community members or groups required requesting and receiving permission from the government. In Nairobi, there seemed to be more confidence that the permit would be granted, and for established groups such as Map Kibera informal ways to receive permission existed, such as agreeing with the local leader.

In Dar es Salaam, the government could reject a data collection exercise if the data were being collected to look into 'controversial issues', such as gender-based violence (an example given in a focus group discussion). Study participants from different non-government stakeholder groups seemed to agree that to get a permit to collect data you needed to explain to the government exactly why you were collecting those data and how you intended to use them. Data could appear 'controversial' to the government for any reason. One of the strategies that emerged in Dar es Salaam to collect necessary data was to focus on the issues that the government was also interested in and that would not appear threatening to the government, e.g., flood prevention or solid waste management.

In Nairobi, in general, the government seemed to be more open to data collection by the community, but the need for permits served to keep the government aware of those efforts. Similar to Tanzania though, in Kenya community members found it difficult to access or collect data on issues that could be considered specifically politically troublesome for the ruling party or could uncover instances of corruption.

In Kenya, the ATI Act was published in 2016 in support to every citizen's constitutional "*right of access to information held by the state*" (Kenya Constitution, Article 35). Although the Act had been enacted, for the most part, the study participants either did not know about the Act or that it was official already, or they found the procedures of the act ineffective, i.e., could not receive the data they requested. In some cases, it became apparent that they did not attempt to use the Act to get the data they were interested in because they assumed it would not be fulfilled as prescribed in the Act, and they attempted to get the data through the sources they trusted rather than going through an official ATI request. Moreover, a regulatory review assessing the legislative

framework for access to information in Kenya published in 2020 concluded that Kenya lacked a legal and regulatory framework conducive to the successful implementation of the ATI Act 2016, and certain Kenyan laws obstructed access to information despite having the Act in place (Kabata and Garaba, 2020).

In Tanzania, at the same time, the access to information regulation was not conducive to conducting data work. The Statistics Act 2015, which regulated the generation and publication of official data, was heavily criticised by the international community, including the World Bank. The independence of researchers was claimed to be hindered by the Act (Paget and Africa, 2017). Since then, the Act was amended under the pressure of international organisations and local stakeholders. In 2018, the Tanzanian government lifted criminal liability for publishing non-official data and allowed people to collect and disseminate statistical information as well as clarified procedures for obtaining and publishing national data. At the time of this research though, focus group participants and non-government interviewees felt that they could not collect or request many types of official data, especially those that would be considered ‘controversial’ by the government. Community members in one focus group believed it was the government’s responsibility to do everything related to data.

In both countries there seemed to be hurdles in leveraging present regulation to collect and access the data.

### 6.3. The role of donor institutions

Although both countries moved to a lower-middle-income class country position, Kenya and Tanzania continued to be recipients of significant donor support – ranked 4th and 5th respectively for the total amount official development assistance (ODA) received in 2018 (World Bank<sup>33</sup>). Such countries’ economies are usually characterised by the large influence of donor organisations and agendas, and by virtue of being their largest cities and centres of economic activity, so were Nairobi and Dar es Salaam.

Donor projects around the use of data had been shaping the agenda of data-driven development in countries with emerging economies, especially in Africa. Data and ICT innovations had started to be mainstreamed in donor interventions (Bothwell and Hellen, 2015), and including such elements often became a requirement for receiving donor funding for

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<sup>33</sup> Official World Bank data from: <https://data.worldbank.org/indicator/DT.ODA.ALLD.KD?locations=ZG>. Retrieved on August 15, 2020.



development projects, along with citizen participation. Open data became a trend that has been promoted by many development institutions, which explained why in both countries considered for this research the open government data initiatives were supported by the World Bank and were seen as donor projects. Figure 6-2 demonstrates a conceptual model of open data in a developed country versus a developing one, where international donor organisations sit at the top of the pyramid, thus playing a prominent role in the ‘top-down’ direction.

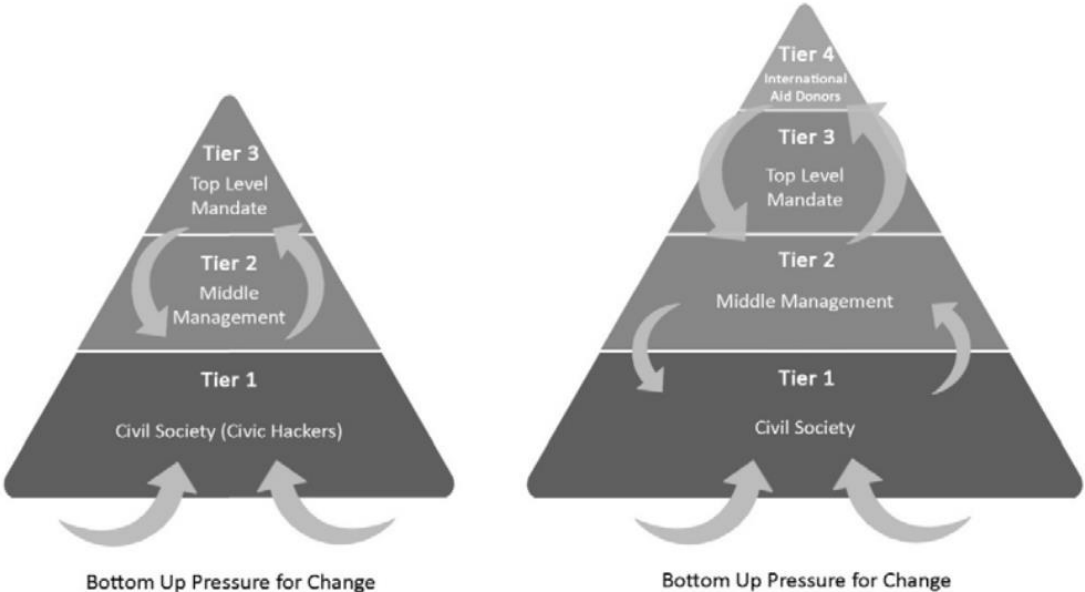


Figure 6-2: A conceptual model of open data in developed (on the left) and developing (on the right) countries (Rahemtulla et al., 2012, p. 19)

Nevertheless, the understanding and appreciation for data, and specifically for open data among the different development institutions and even within the same institutions themselves, were not homogenous. Some initiatives that ran in parallel could undermine each other’s efforts to promote open data, or duplicate the country’s efforts, which put an additional burden on the beneficiary to comply with the requirements of the donor. For example, while the World Bank spearheaded open data initiatives and was building an ecosystem around open government data in Kenya and Tanzania through a national open data portal and policy work, the African Development Bank (AfDB) launched a pan-African portal for statistical data called the Africa

Information Highway<sup>34</sup>. AfDB was working with the national statistics agencies to upload all their data to the portal, while the national open data initiative was required to do the same, but through a different system using a different set of procedures, approvals, and coordination with the government and donor. It should go without saying that those initiatives should be complementary and allow for seamless data flow if appropriate coordination between the parties was established.

In interviews with government officials, it was stated that different donor organisations and even different departments of the same donor agencies often sent conflicting requirements for data and reporting, which did not justify putting efforts into opening all the data online. They had to produce different data in different forms, and the lack of capacity and human resources within the government to comply with different reporting requirements in different donor agencies meant that they had to prioritise requests and initiatives. While donor institutions promote open data, they did not use these data themselves, and transmitted highly customised data requests to the governments for various needs. Also, government representatives interviewed for this research noted that donor data were not open. So, if the government wanted to access the data collected through projects implemented by donor agencies, it was cumbersome and sometimes impossible.

Another issue was 'fatigue' from data collection, and particularly through donor initiatives. In research, there is a phenomenon called 'respondent fatigue', which happens when research participants get tired of a survey and the quality of data they provide becomes worse (Ben-Nun, 2011). In international development work, we can speak about 'data extraction fatigue' of aid recipients who regularly serve as subjects of studies, either in preparation, implementation or evaluation of various projects. With data-driven projects, this fatigue became worse as people kept wondering what they were getting in return. As the results of this were not always tangible or immediate, it was difficult to motivate people to continue to participate and contribute data.

The reality of citizen-generated and citizen-reported data in both Tanzania and Kenya was different, as it was often facilitated by the government and donor institutions (directly or indirectly through funding). Most of the 'community' data work seemed to be donor-driven. Despite the desire and attempts to adopt and ground such initiatives in the local context, data-driven solutions often were being imposed, disregarding local culture and the traditional ways of doing things. This

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<sup>34</sup> The Africa Information Highway is a statistical data portal for Africa developed by the African Development Bank. Official website: <https://dataportal.opendataforafrica.org>. Last accessed on October 13, 2020.

created different incentives for people to participate other than improving their city, hence did not create sustainable solutions.

The flipside of donor-driven community work was that, specifically in Tanzania, the government did not trust (or approve) projects where a donor or another established organisation was not involved especially in the initiatives which deal with data collection and use. The role of the organisation was seen in managing and training the community – only then was the initiative seen as valid. On their own, the community ‘lacked the capacity’ to organise themselves and use data to solve any issues they were facing.

Unlike the creator of the Zimbabwe Bush Pump technology, Dr Morgan, who deliberately disassociated his name from the pump and left it to the community (De Laet and Mol, 2000), in many cases development partners had strict guidelines on how to mention their contributions, and despite promoting community ownership prominently associated themselves with the projects. This was driven by funders’ organisational interests in being recognised for the support they provided, but at the same time, this undermined local ownership and became ‘another project’ that was done ‘for’ the community rather than with them.

Despite the attempts to customise approaches to the local context or ensure local ‘ownership’ of data-driven ‘community’ solutions, such projects were perceived as donor-driven and often did not fit in with the local culture and traditional ways of doing things. For example, during an earlier water mapping project the author was involved with, it was discovered that the local communities did not show water points to foreigners as they believed a water point discovered by a foreigner would dry up. In later projects, a community mapping approach was adopted. However, as evident from examples in this research, often community mappers did not come from the same communities where they mapped and did not know the nuances of those communities. They sometimes found it difficult to connect to people to collect data from them, so the approach could undermine the purpose. This is a common problem for development projects and is not unique to technology and data, however, due to the complexity of the subject, it seemed even more relevant for these projects.

#### 6.4. Professional volunteerism

Looking into community data-driven initiatives was not possible without looking at the forms of civic engagement that the communities are accustomed to, and possible formats of public participation and collaboration with the state and supporting governance structures.

Volunteerism in Tanzania was not associated with a 'greater public good', but with individual interests, which in many cases were tied to the expectations of eventual compensation. The interviewee from one of the key community initiatives organisations in Tanzania described how mapping project participants were disappointed that data collection exercises they were engaged in voluntarily did not materialise into a paid job, which was their expectation from the beginning. People did the work for the project expecting to be reimbursed or rewarded in some way for their efforts. Although the original idea behind the OpenStreetMap was that people did the mapping of their communities in their free time and this is how maps kept being updated, this did not materialise in the same ways in Kenya or Tanzania.

The approach for community mapping in both Map Kibera and Ramani Huria was to train community mappers (youth from the communities and university students) and then engage them in mapping activities when there was a need either for a new project or in a flood event. These volunteers received modest daily allowances to cover the costs of transportation, meals and communications for the days of mapping. Although the amount was small, some community mappers in the focus groups explained that it was difficult to find a job (particularly when a student or right after graduation), so they often did not have any other income, and depended on these mapping opportunities and allowance.

In the interview with one of the leaders from Nipe Fagio, she explained that the volunteers for clean-up activities never get paid. One of the approaches that the organisation adopted, though, was to engage local community leaders to organise the community members for the clean-up. There is a legal provision in Tanzania to attend community clean-ups mandatorily on Saturdays. Although it was not very well enforced, it could be leveraged to motivate the community to attend Nipe Fagio clean-ups through community leaders and local government. This was not surprising, as *"legal instruments [were] routinely invoked to enforce compliance with government demands for participation in development in many districts"* (Green, 2010, p. 1241).

In the interview with a community organisation leader in Dar es Salaam, he explained that the government projects claimed to involve communities, but they did that through a 'vertical' approach, which came from the council and the municipal director down to the ward level and the mtaa leaders: *"for any intervention we do we respect this vertical approach because that's where, if you want your things to go up to the council, you have to follow that"* (community organisation leader).

In her interview<sup>35</sup>, Theresa Pardo, Director of the Centre for Technology in Government (CTG) at the University of Albany said: “*We expect citizens will engage. We expect that they will add value to the political process, to the decision-making process. And we expect that they will use information that is available from the government*”. This idea about a ‘citizen-led’ smart city relies on having the will and resources such as free time to participate and contribute to the betterment of one’s own city communities. Is this the case in the African countries? While it could be a fair expectation in the societies of the Global North, perhaps it was not in countries such as Kenya and Tanzania, where the majority of people lived in poverty, and public engagement had developed from an obligatory function and continued to be reinforced by international development approaches.

In their paper on volunteer work in Kenya and Tanzania, Brown and Green (2015) explained the nature of community participation, which was rooted in how those societies were organised in colonial times. Then, community work was mandatory as a way of contributing to development projects and tax obligations. Independence declared in these countries in the early 1960s rebranded these mandatory activities into ‘volunteerism’. However, ‘participation’ remained compulsory and legally enforced: “*in Tanzania as the responsibility of communities for their own development [...] and in Kenya through the ideology of harambee*” (Brown and Green, 2015, p. 66). Mandatory participation in development activities continued to be enforced, binding together the notion of ‘unpaid labour’ with the projects of international donors, especially through the ‘good governance’ agenda actively advocated for by international organisations (Brown and Green, 2015).

Brown and Green (2015) talked about ‘professionalisation’ of volunteerism in Kenya and Tanzania, meaning that participation in community work was perceived as a way for future professional and career opportunities: “*Becoming a volunteer as a recognized status within a funded development intervention is now sought after as a means to perform a professional role, as a potential step on the road to a formal job*” (Brown and Green, 2015, p. 65).

Voluntary activities, aimed as support to service delivery, fundamentally changed the perception of this work and became a path to stay connected to either an international development organisation, an NGO or the government, rather than being done out of ‘community

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<sup>35</sup> Interview with Theresa Pardo, Director of the Centre for Technology in Government (CTG) at the University of Albany, for the GovLab (April 2013). URL: <https://youtu.be/m5B7NEo9MRI>. Last accessed on February 21, 2021.

solidarity'. This could seem like a paradox, because both countries have a very strong sense of community. They organise in self-support groups, especially in villages and slum areas of large cities such as Kibera in Nairobi or Tandale in Dar es Salaam. But this did not seem to translate into the 'smart' projects with data and community engagement, especially those initiated or supported by international development donors.

Brown and Green (2015) explained further that Kenyan and Tanzania youth volunteers often worked side by side with American or European volunteers, who came from Western universities or programmes such as the Peace Corps<sup>36</sup> or Voluntary Service Overseas<sup>37</sup> and received generous stipends to live and work in African countries. Therefore, local volunteers formed the perception that this work should be paid, hence the expectation that these activities would lead to more prosperous opportunities in the future.

While the volunteer work was not formally compensated in the form of a salary, oftentimes local volunteers received cash allowances or other benefits for their labour in the projects, which may still be equal to a salary, similar to those provided for community mapping. Due to the lack of other employment in overcrowded cities, youth that gained certain skills through these projects waited for similar opportunities, such as community mapping assignments, to be called upon. The shared characteristic between the two countries was that the project volunteers aspired to 'professionalise', i.e., to separate from the community and turn their work with the communities into a professional situation (Brown and Green, 2015). The difference between the two countries, as Brown and Green (2015) observed, was that in Kenya volunteers were "*strategically mobile, moving between different volunteering opportunities, whereas in Tanzania the success of volunteers is tied to the success of the organisations to which they are affiliated and is mediated through personal and clientelistic relationships to larger organisations*" (Brown and Green, 2015, p. 77). Nevertheless, in both countries, for the most part they continue to be 'professional volunteers' who mediate between government or international aid institutions and communities based on compensation (Brown and Green, 2015). This was also an observation in the focus groups with community members, when the study participants referred to citizens as 'they', which

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<sup>36</sup> Peace Corps is a United States government-run volunteer program, which provides international development assistance. Official website: <https://www.peacecorps.gov>. Accessed on October 14, 2020.

<sup>37</sup> Voluntary Service Overseas is a not-for-profit international development charity organisation, which is funded by a large number of partners with key contributions from the United Kingdom's Department for International Development (DfID). Official website: <https://www.vsointernational.org>. Accessed on October 14, 2020.

indicated a separation between them as volunteers and the actual community who benefited from their community work.

Volunteerism, which should be the basis of community projects, therefore was closely associated with the activities of donor institutions and government, which was the opposite to the Global North, “*where neoliberal reform is shifting the provision of social services in the opposite direction: away from government agencies and to NGOs and voluntary organisations*” (Brown and Green, 2015, p. 70). Instead of empowering the communities, these initiatives have given more control and influence to the state (Brown and Green, 2015), especially in matters of data.

### 6.5. Sustainability of community-led data-driven initiatives

Urban sustainability and sustainability of data-driven projects were the two ways in which ‘sustainability’ was considered and discussed in the interviews and focus group discussions for this research. On the one hand, the efforts of the initiatives described in this thesis aimed to address city challenges related to social and environmental sustainability in their respective cities with the help of data. These are considered key problem areas, along with economic development for smart cities (Hollands, 2008; Huber and Hilty, 2015). Working on addressing an urban sustainability challenge through data-driven interventions and community participation was a selection criterion for choosing projects for this research. However, the evaluation of how well those projects addressed particular challenges such as flooding, solid waste management, pollution, provision of health and education services, etc. was not within the research scope of this thesis.

On the other hand, a prominent theme that came through in the research was the sustainability of the community projects themselves, as ongoing efforts and participation were necessary to continue the activities. This theme is discussed in this chapter.

Oftentimes, community data collection and data use efforts presented ‘pilot’ projects and ran as long as there was funding to support the project. Nairobi was a hub and the pilot city for sensors.AFRICA: “*whatever we learn from here, we are hoping we can take that to elsewhere as well*” (sensors.AFRICA representative). Map Kibera and Ramani Huria both piloted their approaches in some areas in Nairobi and Dar es Salaam with the support from international development institutions, then worked on other areas where there were opportunities. While Nipe Fagio was an established initiative for community clean-ups in Dar es Salaam, it was also receiving donor support to pilot mapping tools and technology applications in their operations.

Green (2014) suggests that Tanzania generally has been a testing ground for many development projects as it qualified as a 'good recipient' of foreign aid and is considered to have 'more intimate' relations with international development than other countries in Africa. In development assistance, such funding can be available for projects for a short period (usually one to three years) and then more funding is necessary to scale up these efforts. With the community engagement data-driven project, the idea was that the community would carry on after they have learned and understood the benefits that data brings. The projects we looked at continued to require funding, however, or realised that particular data tools were only useful for the activity they were a part of, and hence discontinued using them in their operations (such as Nipe Fagio's mapping using the World Clean-up app – see Section 4.2.3).

All initiatives described in this thesis, albeit utilizing foreign aid grants, worked with the 'locals', so the people who were doing the work on the ground were African, and particularly Tanzanian and Kenyan. This is the approach that donor organisation took to 'localise' development and ensure community ownership of the work and the data they collected. In turn, this was supposed to lead to the sustainability of those efforts, where the community would step in to continue projects. However, this research demonstrates that project staff and volunteers sometimes were not 'local enough,' and struggled to connect to the actual communities where they were collecting data or conducting other activities (for example, deploying air pollution sensors). Community mappers and community cleaners who participated in this research did not see themselves as part of the community, often referring to the beneficiaries of the community initiatives they were working on as 'they'. The project or government often were seen as an enabler or implementor rather than the community: *"Smart City initiatives in developing countries are typically top-down (government-led) rather than bottom-up (citizen-driven), constituting a potential issue with local relevance and sustainability"* (Estevez, Lopes and Janowski, 2016, p. vi).

While such initiatives were often seen as government-owned, from the government perspective, they were associated with the main funder or organiser. As such, for Ramani Huria, the World Bank was seen behind the initiative as a 'trusted' organisation. Nipe Fagio also had established strong relations with the government. The same was the case for Map Kibera, which described established ties with the local leaders as well as municipal governments where they had mapping projects.

Community mapping groups emerged to address specific needs in the community but diversified either to other issues (such as waste management – Ramani Huria in Dar es Salaam)



or to other geographic areas (such as other county projects – Map Kibera in Kenya). In both cases, access to funding continued to be a requirement.

Both Tanzania and Kenya were considered ‘early successes’ for open data programmes, but these initiatives died down once the support from international development institutions ended. These projects were initiated by the World Bank and supported by other development partners as pilots, with the expectation that the government would continue to publish data and the community would use government data. While the in-depth analysis of why these pilots did not pick up and continue was outside the scope of this study, the overall impression that the study participants in Dar es Salaam and Nairobi shared was that the issue of sustainability of ongoing efforts was a big challenge when it came to donor-financed data projects.

Many cities in the Global North had started smart city pilots, which aimed to serve as a proof of concept for scaling up later, but most of them eventually failed (van Winden, 2016). Would community members in Dar es Salaam and Nairobi collect or use data in a way that would continue when funding ended? At the time of this research, the answer was ‘no’. But this is not to say that the programmes did not have a positive impact, although this should be evaluated separately, as a rigorous evaluation was often overlooked. In some cases, the objectives were re-framed, e.g., Ramani Huria added a focus on the students and one of the objectives was to develop future talent, where the community members became data providers to the student mappers. The project also formed a local organisation, OMDTZ, that could provide data collection services and training to other projects and government on a contracted basis. In Kenya, Map Kibera had taken a similar approach. They also were able to facilitate relations between the World Bank and local government, as they could better relay the ideas to the government officials in the local language and discuss with them the specifics of the data collection project more effectively. In addition, complementary community activities, which Map Kibera organised, such as Kibera News Network and Humans of Kibera, which sometimes included data where relevant, but not always, proved effective in engaging the community.

#### 6.6. The issues of ‘culture’ and ‘mindset’

The issues around Tanzanian and Kenyan, or sometimes described by study participants as a more generally African, ‘culture’ and ‘mindset’ were identified as a challenge to the development of the smart city and open data. The examples which study participants provided varied from taboos in Tanzania to discuss certain topics in public and in general being a more reserved culture, hence opening data was difficult, to non-working traffic monitoring cameras in

Nairobi as an example of a smart city project that did not work as intended, which was described as the 'African way'.

Communities' perceptions and citizens' 'mindset' were central to describing how people related to data. In both cities, culture was described as 'anecdotal' or 'story telling' and not 'data-driven': "*it's of no use for an ordinary person*" (a focus group participant). However, at the same time, focus group participants and some interviewees shared views that communities traditionally had used data in their decision making, but not necessarily in the way proposed by the data-driven initiatives. The argument could be made once again that the community initiatives did not fully grasp the local culture and context and did not incorporate them into the design of their interventions. As Chang (2008) explains in his book *'Bad Samaritans'*, it is impossible to determine whether a particular culture is good or bad for the country's economic development. Just a century ago, Japanese people were blamed for being lazy, too independent, emotional and not forward-thinking, and this was expected to impede the country's development. And today Japan is one of the more advanced economies in the world. Similarly, a century and a half ago the Germans were known for being laidback, dishonest and easy-going rather than serious and hardworking (all considered 'bad' cultural characteristics for economic development) – all of which contradict what Germany has achieved (Chang, 2008).

The data were disconnected from the ways people were accustomed to making decisions in their local communities, so it created an impression that 'culture' was a barrier to 'smart' development. In both countries, study participants referred to the 'cultural' problem of not being willing to share data, especially in the government.

In Tanzania, part of what participants considered culture was the expectation that the government should and would 'take care' of the services, so citizens waited for the government to act rather than taking action to improve their own conditions. When the government failed to provide, communities organised in small groups to support each other, and conveyed to each other their disappointment in the government. However, often this disappointment was not actioned into formal complaints or other forms of addressing the government, which was also claimed to be a 'cultural' feature of Tanzanian society.

In Kenya, trust in the government and trust in the data that were being provided to the citizens were claimed by participants to be the biggest cultural challenge for accessing and using open data. In general, Kenyan and Tanzanian cultures were described as very different, where Tanzanians were more 'reserved' and 'not entrepreneurial', which was believed to be a barrier to

opening data, and Kenyans were more 'open', 'outgoing' and 'entrepreneurial' and, as opposed to Tanzanians, more conducive to open innovation.

Another aspect of culture as reported by the community members was related to large areas of informal settlements or slums in both cities, and the mindset of the people who lived there. As suggested by the name of these neighbourhoods, people occupied those areas informally and were often perceived as illegal. This determined what they thought they could and could not demand from the government, including government data. They also could not relate to some problems data-driven initiatives aimed to address. For example, sensors.AFRICA's project, aimed to improve air quality, reported a low acceptance rate in the poor neighbourhoods of Nairobi. While this was considered an issue of mindset or culture, it is yet a contextual problem – in the areas where people live in poverty, they struggle to connect to challenges that do not affect them immediately daily.

Overall, these statements implied the view popular outside the academic world that technology is an attribute of more advanced cultures. Hence, this portrayed the African countries as 'lagging behind' and they needed to catch up to be able to enjoy the same technological developments as the countries in the Global North. This view assumes a single path of development, where all countries are progressing towards the same endpoint (Steers, Meyer and Sanchez-Runde, 2008).

Culture is a complex phenomenon, which could be "*conceptualized as shared symbols, norms and values in a social collectivity such as a country*" (Lee, Trimi and Kim, 2013, p. 22). The influence of culture on technology adoption is an area that sparks a great deal of interest by academics, yet lacks substantive theory or empirical evidence (Steers, Meyer and Sanchez-Runde, 2008), especially in the less developed contexts. However, the literature suggests that some challenges described by the study participants in both countries as 'cultural' are not unique to the African context when it comes to open data and innovation. Studies in South Korea found that some cultural aspects need to adapt to develop better acceptance of open and data-driven development (Steers, Meyer and Sanchez-Runde, 2008; Yun *et al.*, 2020).

While culture, people's perceptions and the mindset of local communities have some impact on how technology and innovation approaches work in different contexts, perhaps 'smart' solutions need to adapt better to the realities of the local context. Then, culture would not be seen as a 'barrier' but rather, part of the context that should be taken into account when 'smart' interventions are being designed and how data are being used. The next section will address perceived 'barriers' in more detail.

## 6.7. Barriers and ‘gaps’

Many discussions during the interviews and focus groups centred around challenges or ‘barriers’ to becoming a smart city or to collecting, accessing and using data to address city challenges. Various ‘gaps’ were stated and needed to be addressed for these interventions to work and to achieve the desired outcomes. The cultural barriers described in the previous section were one of the many on that list.

The talk of barriers was strongly connected to the position of the speaker, i.e., the stakeholder group they represented, and their own experiences, objectives and beliefs. There is not a ‘neutral’ means of identifying barriers without recognising the speaker’s position. For example, if the stakeholder was the user of government data, then the barrier to using government data could be that the government did not provide granular data. If the stakeholder was from the government, it could be either that the granular data were not available in a digital format, or that the data were being kept by a different government agency, or available at a different level of government. For international experts, it could be the capacity and willingness of average citizens to use the data.

International donors and local organisations that relied on foreign funding adopted project log frames (an evaluation tool based on pre-set indicators, which sometimes did not change over the years of the project) and desired outcomes, that indicated the success or failure of the project. However, these were often based on desk research and programme objectives. They often lacked an understanding of the reality on the ground. As mentioned earlier in this chapter, the project ideas were often identified before communities could get involved and contribute. Evaluation log frames (a tool commonly used for project evaluation in international development practice) already include consultation activities as an indicator. Moreover, barriers and gaps to achieving specific project objectives often served as a justification for a project to be approved in the first place (i.e., this project will contribute towards creating a more conducive environment for local innovations).

This view is technologically deterministic in nature. It has pre-identified ‘problems’, which technology and data would address. However, “*technical change is an unremittingly social, and thus contextual, localised and temporally specific, process*” (Shove, 1998, p. 1109). As Shove (1998) suggests:

*“What is missing is an appreciation of the social contexts of [...] action and of the socially situated character of technical knowledge. As we shall see, reinstatement*

*of these missing elements has knock-on consequences for the rest of the conventional package” (Shove, 1998, p. 1108).*

Indeed, as a consequence of the delivery of a technology-driven project, normally comes a final report on why the interventions with data did not work with a list of barriers and ‘gaps’ that needed to be addressed if the intervention was to scale up or be repeated more effectively. In fact, most likely these challenges have deeper roots than project interventions could aim to address. Therefore, these interventions should take into account what Shove (1998) calls ‘sociotechnical regimes’ that dictate what courses of action technologies can take.

This view often constitutes the position of the donor and implementation agency and indicates the barriers that a particular organisation or team faced in the delivery of a programme. As before, it often missed the voice of the community. For the community to use the technology, it should fit into their “*alignment of technical, organisational, and societal aspects*” (Shove, 1998, p. 1109).

National open data programmes in Kenya and Tanzania, for example, were analysed by the international expert community who found there were ‘gaps’ in the implementation, such as lack of leadership, lack of capacity, lack of engagement with the data users, etc. This analysis was based on how these portals worked or should work in the Global North. But the context in Kenya and Tanzania was different and hence the design was flawed from the outset and cannot be evaluated against other countries with such a different context.

The potential of technology cannot be independent of the context in which it operates. Hence, there were no barriers, but rather the state of the socio-technical regime, which defines how technology could be implemented. In addition, a language barrier was evident during the research, as many terms used in the vocabulary of community projects within the Global North (such as ‘open data’ and ‘smart city’) do not exist and do not translate directly into local languages.

## 6.8. Conclusions

This chapter brought together empirical evidence and findings from the two previous chapters and presented seven key themes identified through the thematic analysis as key to understanding the implementation of citizen-led data-driven initiatives supporting sustainable urban development on the ground in two African cities.

The lack of technical capacities in government and at the community level to utilise technology and data solutions, insufficient resources, and deficiencies in infrastructure, which impeded data-driven efforts, were reported in both cities. However, the key themes discussed in

this chapter were related to social and political context, which as this thesis has demonstrated, were mainly responsible for how communities were able to access and interact with data in order to address the city challenges they faced. Therefore, the implementation of technology and data by communities appeared to be highly contextual (i.e., influenced by city organisation, existing regulations, local traditions and culture), associated with specific stakeholder groups and their objectives (i.e., donor participation, barriers to using data) and in turn, had implications on the sustainability of community data-driven initiatives.

While numerous parallels could be drawn with the Global North, a fundamental difference seemed to be that data and technology in those countries were aimed at improving services that already existed or providing new services. However, in the countries of the Global South, many essential services were lacking, so the use of data was a means to get the government to provide those basic services in the first place.

Oftentimes, the implementation of technologies cannot have a clear-cut 'yes' or 'no' answer – it is mixed. International development actors working on smart city and data innovations projects need to take stock: what are the contributions the technology and data have made so far to improve the lives of the citizens, and how did the actual communities engage and benefit from them? Continuous evaluation and honest reporting are a necessary step to justify further investments.

Based on the analysis presented in this chapter, the next chapter will provide the final conclusions, address research questions, and provide recommendations to different stakeholder groups in line with the findings of this research.

## Chapter 7. Conclusions, limitations, and future work

In the rapidly urbanising world and with the unprecedented growth of data in cities, advocates of employing data-enabled technology and technology providers for better and 'smarter' cities promise effective solutions for addressing urban challenges. In smart city literature, citizen participation is claimed to underpin these solutions in order to respond to their needs. This thesis looked at the smart city concept and community-led initiatives using data through the prism of two cities in East Africa – Dar es Salaam, Tanzania and Nairobi, Kenya – and attempted to respond to research questions set out in the Introduction.

As the concept of the smart city has been gaining popularity in literature and practice among city administrators, private sector companies, consultants, and international development institutions, the term has been defined differently by different stakeholders. Yet, it provides enough common ground for various parties to be able to discuss and collaborate on smart city projects (i.e., the smart city as a boundary object), albeit with their own goals and agendas in mind as the conceptualisation of smart city ideals remains stakeholder specific.

Among different definitions of smart city technology is one common factor, where data underpins its functionality. As described in Chapter 1, collection and use of large amounts of city data can cause various concerns related to surveillance, security and privacy of personal data, bias and discrimination. At the same time open data (i.e., non-personal data related to city infrastructure, operations and services) has been positioned as key to urban innovations supporting smart cities.

Another key element to smart cities is 'smart citizens', whose participation in the design of smart cities has not lived up to the expectations. In the majority of the cases, smart city projects remain largely top-down initiatives, i.e., government-led. As the smart city design and implementation strongly depend on the context (e.g., country's economic development and political regime), so does the institutionalisation of public participation approaches.

In the neoliberal philosophy preferred in the Global North, the smart city concept relies heavily on citizens' will to participate and 'give back' to the community through volunteerism. One example is a citizen from Colorado State who in his spare time developed a website called Vaccine Spotter showing open COVID-19 vaccine appointments across the US. He used his skills as a software engineer, data on vaccine availability from various pharmacies and time outside his main job to create a tool to help people looking for available vaccines in every state. This is often the idea behind community-based data projects initiated in the Global South by donor institutions

from the Global North. As we saw in Chapter 2, volunteerism, upon which these projects were based, could have a different connotation in the international development practice. This could often translate into the lack of sustainability of community-led projects funded by foreign donors, particularly projects concerned with innovations such as using data-enabled technology.

To respond to research questions, a qualitative research design was developed that involved various qualitative data collection methods (expert interview, observation, contextual inquiry, and focus group) to investigate two case study cities as set out in Chapter 3. Within each city two community-led initiatives were selected for analysis to examine how communities accessed and used data to address urban sustainability challenges their communities faced – flooding, solid waste management, air pollution and service delivery in informal settlements.

First, interviews were conducted in Dar es Salaam. Generally, tensions between national and city-level governments were highlighted, which seemed to complicate data collection and exchange between government and other stakeholders, including releasing data publicly. Government data collected at the community level often were digitised and aggregated at the higher levels of government but were not available to the representatives of lower levels of government and communities. The government also provided close oversight to ‘community’ programmes, especially if they were collecting or using data in their activities, and often had to participate in or monitor these activities.

In Nairobi, similarly there were tensions between central and county governments, which seemed to impact how government data were collected and circulated, however the government seemed to require less oversight over community-led initiatives dealing with data. Permissions for data collection were also in place, although reportedly easier to obtain than in Dar es Salaam, and sometimes informal agreements with local community leaders were sufficient to collect data from the communities.

Once the initial scoping was done and initiatives were identified, they were investigated through follow-up studies – observations, contextual inquiry and focus groups. Although there are considerable differences between the two cities in terms of cultural and political contexts, which was evident from the scoping interviews and literature, study participants reported similar challenges, for example in obtaining data from the communities (i.e., communities expected to be compensated for providing data) and getting community buy-in to collect and use the data on particular issues (i.e., air pollution). These studies helped unpack Research Question 1: *How do cities in the Global South currently employ data-driven approaches to support citizen-centric sustainable urban development?* This is described in Section 7.1.



Through analysis of the data from both cities, seven key themes emerged. While the cities have a different political and cultural landscape, within the themes, they shared a number of characteristics. Particularly, in both cities a large percentage of the population lived in informal settlements where local community leadership, which was not officially part of the government, often was associated with the government, hence participation in community activities could be perceived as obligatory. If it was a donor-funded initiative, there was an expectation of compensation for participation in community activities, such as allowances or stipends for data collection. These themes are captured in Figure 6-1 and they guided the response to Research Question 2: *How should cities in East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?* This is described in Section 7.2.

The findings related to the research questions set out in this thesis are complex and not straightforward. As demonstrated, there were many stakeholders involved in the community-based projects employing data approaches, including donor institutions often providing financial and organisational support to such initiatives, and they had different and sometimes conflicting priorities. Particularly, it was evident that the challenges in dealing with city data were stakeholder specific. For example, the lack of access to granular data from the government for local communities described by non-government data users was countered by the lack of equipment and resources in the government to collect, process and provide these data to the public, or the perceived lack of capacity in the community to analyse and use such data. The following sections describe how this thesis addressed the research questions.

### 7.1. Research Question 1: How do cities in the East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?

In line with the supporting questions set out in the Introduction, this section presents the conclusions with regards to Research Question 1 comparing and contrasting the two case cities examined in this research. The structure of this subsection follows the structure in Chapter 4 and Chapter 5, which described findings from Dar es Salaam and Nairobi, respectively, and responds to the supporting questions:

- *How are data generated, circulated, and used (government and non-government)?*
- *How do citizens get involved and participate in this process?*
- *What are the stakeholders' roles in this process?*

### 7.1.1. Government data

In both countries, non-government data users indicated that finding useful, accurate and up-to-date government data was challenging. Even exchange of data between government entities at different levels, particularly in digital form, was reported by government participants as complicated and sometimes not possible. Particularly, lower-level government officials found it difficult to obtain data they needed from the higher levels of government, although they were frequently requested to provide data upwards. Often, data were aggregated when passed onto the higher levels of government in the process of digitization, and therefore, granular data, which could be used for comparative analysis between communities, were not available at the local level.

Neither country had an open data policy, although national open data portals had been launched a while before and were not maintained. Regulations for access to information seemed problematic in both countries.

The National Statistics Act in Tanzania used to forbid collecting or publishing any data other than the official government data. Even after the law was amended (e.g., criminal liability for publishing non-official data was removed from the Act) there was little awareness of what the Act actually permitted to citizens and community groups in terms of data access, collection, publication and use. Community members in the focus groups admitted that they considered it the government's business to deal with data based on the regulation, so they did not feel empowered to collect their own data (unless it was part of an organised effort approved by the government – e.g., initiatives like Ramani Huria) or use government data.

In Kenya, study participants had little trust in their ability to request data effectively through the ATI Act. Non-government study participants indicated that they had little trust in the government, so the data collected by communities primarily aimed to challenge the government and demand accountability. Corruption and lack of trust towards the government data collection process and how communities were being involved in the decision-making process (especially, through newly established devolution procedures) seemed to hinder collaboration. Community members and activists felt a strong need to collect their own data where official data were not available, to bring up issues, demand government accountability and improvement of public service.

In Nairobi, non-government study participants expressed doubts that government data were properly collected through smart city devices, such as CCTV and traffic monitoring cameras,

and used effectively to improve city's operations. Often, they doubted those devices were functional at all. Government study participants also did not fully comprehend the capabilities of digital devices collecting data or did not know who were collecting these data within the government, where they could be accessed and how.

Staff and volunteers of community initiatives and representatives of other non-government organisations in both cities felt they needed access to data that government collected to help address the problems their communities were facing, and that this could be facilitated through a city open data portal.

#### 7.1.2. Non-government data

In both cities the community initiatives that were examined in this research collected their own data. In Tanzania, those efforts, led by either a donor project (Ramani Huria) or a non-profit organisation (Nipe Fagio) largely engaged with the government and supported the government. For example, Ramani Huria provided the maps they produced to local government offices and Nipe Fagio used mapping data to plan for clean-ups organised jointly with the government. In Kenya, however, the emphasis was on ensuring government accountability, demanding government action to address challenges (sensors.AFRICA) or providing services to under-served populations (Map Kibera).

The examples above reflect the characteristics of the political regime described in both cities. In Dar es Salaam, the government required full awareness and control or participation in any initiative organised by the community (or for the community by other organisations). Also, as described, it was impossible to obtain a permit to collect data for 'controversial' subjects, hence community initiatives often had to craft requests to satisfy the government agenda and focus on those issues that the government approved or required support to address. On the other hand, in Nairobi, the main issue was the lack of trust in the government. Community members felt much more empowered to collect the data, where government data were lacking, to shed light on government deficiencies in service delivery or inappropriate management of public issues.

Data collected through the mapping initiatives, although recorded through digital devices (mobile phones or tablets) and hence in digital form, often required estimation from the data collector. For instance, for flooding events, Ramani Huria mappers collected data on the levels to which areas were affected: ankle/knee/waist/chest or above that. In the case of Nipe Fagio, data collection required mappers to estimate information about the size of a rubbish point, the estimated effort to remove it, and the type of waste. In these circumstances, data becomes

subjective to the people collecting the data and cannot be standardised or easily compared. These measurements provided a basis for planning in a particular situation and at that scale those estimations made sense, but they are inconsistent with the type of data used for smart cities (see Section 1.2 – Data-driven cities). ‘Facts’ start out as very messy, contestable things, but get turned into these artefacts which are very hard to challenge (Latour and Woolgar, 1986).

Dealing with data collection always involves uncertainty, and when it comes to large information systems, standardisation of data often causes oversimplification (Bowker and Star, 2000), reducing significance when taken out of context. sensors.AFRICA project, which was collecting sensor data, reported that there were unexplained spikes of pollution in datasets at odd times, which appeared to be the result of how and where sensor devices were placed (for example, near the smoking area). Smart cities data shift from rudimentary, yet intuitive, forms to more controlled but less relevant or accessible on the ground, particularly in low-tech environments often observed in East Africa.

Finally, the relations between community data collectors and community members from whom data were collected demonstrated that underneath all the tech and rhetoric, data collection is about social relations. Peneff (1988, p. 528) suggested that “*personal ways of approaching respondents, adapted to each social group, worked far better than official procedures and produced a low rate of nonresponse*”. This was demonstrated by community mappers in both cities who found that socialising yourself towards the community was a good practice to get the data.

### 7.1.3. Citizen participation

Public participation is key to any community initiative, and there is an assumption based on the culture in the Global North that people would engage voluntarily in data collection and in community initiatives towards improving their neighbourhoods. In both cities, participation oftentimes was regulated. For example, in Tanzania there were mandatory community clean-ups every Saturday, and community members and local businesses could be fined for not attending. As mentioned before, Nipe Fagio, which was a community-based organisation, often relied on government or local leaders, wajumbe, who were a semi-government structure to organise people for clean-up activities. In the case of donor-driven community-based initiatives, donor institutions also relied on the government and often provided additional incentives such as allowances and stipends for the work, or the ‘professionalisation’ of volunteering discussed in Section 2.2.2. The nature of community involvement was different from what could be expected in the Western model, where the smart city concept relied heavily on voluntary citizen participation and

contribution to society.

In Tanzania, both initiatives had developed a good relationship with the government and had 'political backing'. In the case of Ramani Huria, the community mapping initiative, it was perceived by the community and the government as a World Bank project. Nipe Fagio, the community clean-up initiative, had been around for a long time and collaborated with the government closely as well, often calling on local government and community leaders to organise community members to participate. These relations had been created around issues that were 'non-controversial' – flooding and solid waste management – and were in the government's interest to address. It was noted, however, that collaboration with the government, especially related to data, was challenging if initiatives wanted to work on more 'controversial' subjects (e.g., gender-based violence).

In the Western model of smart cities, citizens are expected to contribute their time towards improving services that already exist. While city administrators in the Global North debated whether it was fair to restaurants to take away their parking space for an Uber stop or whether predictive traffic signal would make roads less safe for pedestrians or bicyclists (Green, 2019), the African cities where buses were the only means of transportation did not have bus stops where people actually needed them.

In both the cities examined in this research, especially in the informal settlements, which were the bigger part of the cities, basic services (water, security, education, health) were non-existent, hence the main objective of the data-driven initiatives was to either support provision of the basic services or bring the issues to the government's attention, so that they prioritised those services. Oftentimes, it meant using community inputs to fill the gaps where government capacity was lacking (e.g., providing higher accuracy maps than the government for planning and service delivery).

When community initiatives for mapping data collection like Ramani Huria or Map Kibera were organised, community mappers were paid allowances, so they considered this to be a paid job rather than community service. A vivid example was provided by an interviewee from a Tanzanian local community organisation, who said that in one of his projects community members stopped collecting data because the expectation was that at some point they would be getting remuneration for their data collection efforts, and they were not. This is a big difference from the Global North, and hence a leap from the smart city concept described in Western literature. It could also impact the quality of data collected by the community in such a project, as the motivation for such participation was different.

Community members who participated in the studies often used the phrase an 'African way' to describe their culture, which in their own words was not data-driven, but rather a culture of 'storytelling'. This is not unique to Africa, however. In his book '*Power Cues*', Nik Morgan (2014) explains that facts and figures do not stick in people's mind, but stories create a much more 'sticky' memory as they connect to human emotions. In addition, in focus groups with community representatives, the participants revealed that communities in fact often used data traditionally, for example in their community meetings and for collective decisions, but it was in a different form than what was envisioned by data-driven initiatives. Hence, it is important to understand how and where data use could be appropriate for the community to be able to make sense of it. So, culture in itself did not present a barrier, but rather, what came to people's mind when they first heard the word 'data'.

Community members involved in donor projects referred to the community as 'they', so in the role of 'volunteer' they did not see themselves as part of the community. They also found it difficult to collect data in areas where they did not live. So, while every project claimed to be 'local' and indeed employed local staff and volunteers local to the cities, more often than not they were not from the communities where the projects operated.

#### 7.1.4. Stakeholder interactions

A significant lack of trust between government and community in both countries evidently undermined citizen engagement. In Tanzania, the government was reluctant to trust the community with collecting the data, so they had to participate and provide 'technical expertise' where citizens were believed to be incapable. In Kenya, the citizens did not trust the government so they did not expect that the government would share the data, or if data were shared, they did not trust that the data were accurate.

Since both countries were significant donor aid recipients, their data-driven projects and initiatives were also often organised by the foreign aid assistance institutions such as the World Bank, UN agencies or FCDO (former DfID) and they were impacted by the donor agendas. This was driving a problem of lack of local ownership and sustainability of these projects. For example, in both countries, the open data initiatives were launched in collaboration with the World Bank, but once the funding ran out, the programmes stalled. These organisations often tried to be a middleman between community and government, however, their mandate was to work with the government, so while advocating for bottom-up approaches, they really worked with the government.

## 7.2. Research Question 2: How should cities in the East Africa currently employ data-driven approaches to support citizen-centric sustainable urban development?

Through thematic data analysis Research Question 2 was addressed, and related conclusions are described in this section.

### 7.2.1. City organisation

Local data are important for accessing global finance systems, however, the benefits do not reach the primary data producers at the local level, and they “*typically remain disconnected (Mori et al., 2014; Wickremasinghe et al., 2016) from decision-making*” (van Schalkwyk, 2020, p. 136). This is worrisome because instead of providing opportunities to the disadvantaged populations (such as those living in the slums of Dar es Salaam and Nairobi), technology and data can bring more disparity by empowering the powerful even further: “*rather than making possible a more equitable distribution of resources, the network society is one in which exclusion is structurally manifest and the gap between the rich and the poor, the powerful and the marginalised, the metropolitan and rural, is certain to widen*” (van Schalkwyk, 2020, p. 136).

Data collected from the local level and transferred to the national level help the government to achieve its objectives but do not spill over at the local level, so the communities remain disconnected, as this research demonstrated. The government as an authoritative data collector and user, having access to the most granular data from local communities and with improved capabilities, would be more equipped to use the data than the citizens. This creates the very plausible risk of creating a Big Brother society in African cities (see Section 1.2).

In both cities complex city politics and organisation were demonstrated and made data management more complicated. Also in both cities, both lower levels of government and community members reported difficulties in accessing data that had been collected from them. Making city structure and data governance mechanisms more transparent and supporting government data flows not only from the lower levels up but also ensuring that these data are shared back to local governments and communities in a usable way could help address issues related to this theme. This would also ensure that data is not accumulated within certain levels of government and that powers and controls are distributed.

### 7.2.2. Access to information: permissions and rights

Access to information regulations does not require proactive disclosure of government data. Citizens normally request data from the government using ATI and the government need to

respond within a certain timeframe. These types of regulations do not promote a sharing culture within the government, which can take a longer time with more sensitive requests or reject providing data under some pretext even in the Western countries (Roberts, 2002). Both countries need to update their regulations regarding data access to make a shift towards a proactive data disclosure at the national and city level. It was reiterated by many international open data experts and local data users that both cities will benefit from having an open data initiative, and it needs to be backed by appropriate regulations.

Policies need to be communicated to the communities. It was evident that in both cities a communication gap entailed misunderstandings and misconceptions of what was or was not permitted based on the National Statistics Act in Tanzania and the ATI Act in Kenya. Only clear communication will help to promote sharing and use of data, increase trust, and enable bottom-up approaches, but it requires actions from the top down.

### 7.2.3. The role of donor institutions

International aid institutions and donor organisations drove numerous innovations and data-related work for the local communities. Should they continue funding innovation projects? The answer is yes, but a coordinated approach to supporting the enabling environment for innovations is required:

*“...areas that must be addressed include low levels of data literacy affecting the demand for data, policy makers’ lack of incentives for and interest in using data, low trust in the quality of public intent data, and lack of infrastructure for accessing and using the data. These investments and initiatives rely on one another, and so failure to succeed in one area jeopardizes the overall value that data can bring” (World Bank, 2021, p. 7).*

How can data serve the urban communities, which are characterised by high rates of poverty and informality, and infrastructure deficiencies, in the absence of a supportive regulatory environment? Thus far, data collection has not delivered on its promise and has not demonstrated benefits for the citizens at a desirable scale in LMICs. This is not to say that it cannot, but development institutions funding these initiatives should have realistic expectations of what data can do in the context of African cities. Rather than adopting technological solutions designed elsewhere, which require significant changes and bridging the ‘gaps’ to make them work, more effort needs to go into understanding where and how data can make a difference given the local context.



#### 7.2.4. Professional volunteerism

As demonstrated in this thesis, the language that has been adopted in the international development work regarding community-based work and volunteering often carried a different connotation in the local context (see Section 2.2.2 – Volunteerism). At the same time, both countries have very strong community support traditions. But this did not connect to the efforts of the international donors. Understanding and adapting to the local context will be key in supporting local communities.

In an interview with a community organiser in Nairobi, she said:

*“Utu, that idea of caring for something more than yourself... because people have been taught, and it's a very capitalistic, every man for himself and God for us all. People have forgotten that there are things called commons, things that we have to protect, take care of, and safeguard, because if we don't, then we're the ones that ultimately suffer. This means protecting our public hospital, our public schools, making sure that public roads are maintained and taken care of, our police officers, our prisons, the things that nobody ever thinks about, but they're almost like the organs of life in a community. Whether it's in the city or in a county or in a country, if these things don't work, you can't survive”.*

This story was circulated through social media. An anthropologist showed a game to the children in an African tribe. The first child to reach a basket of delicious fruits near a tree trunk would get the basket. After the start signal, the children held hands and walked together until they reached the tree and shared the fruit. When asked about it, the children answered: *“Ubuntu!”* In their language, it meant ‘humanity’ (also ‘utu’ in Swahili – in Tanzania and Kenya). It is ‘a comprehensive ancient African worldview’, sometimes translated as *“I am because we are”*, which *“encapsulates moral norms and values such as “altruism, kindness, generosity, compassion, benevolence, courtesy, and respect and concern for others”* (Letseka, 2012, p. 48). Persons living in communities that embrace ubuntu would be treating each other with justice, fairness, respect and compassion.

Community development work should be rooted in the existing culture and the altruistic traditions of these countries, instead of adopting labels, models, and perceptions from abroad. Community-led work should appeal to the local tradition of community support and build on them. For that, understanding local context is critical, as well as recognising that work in local communities should be led by the people who live and experience the realities faced within them.

#### 7.2.5. Sustainability of community-led data-driven initiatives

Related to the previous section, work in communities should be done through the organisations that already have relations and are trusted in communities, who are communities themselves. This thesis demonstrated that oftentimes 'local' project volunteers were not local to the areas they served, so more effort should be directed to working on the 'hyperlocal' level of community. While all the initiatives strove to do that, Map Kibera seemed to be the one most connected to the communities where they conducted the projects. Their office was in the neighbourhood where the work was being conducted and the mapping volunteer rosters included mappers who lived in those communities. However, as Map Kibera expands their reach and moves around the country for other projects the aspect of 'locality' will need to be addressed to ensure sustainability.

Developing good trusting working relationships specifically between the government with the local community groups should be a priority. As long as the donor institutions serve as mediators in this relationship, sustainability will remain questionable as the interventions come to an end. In this regard, Nipe Fagio in Tanzania sets a good example of working with community leaders and local governments directly. Map Kibera was successful in leveraging local connections and relations with the government in mediating between the World Bank project and government.

Unlike the other three initiatives considered in this thesis, Nipe Fagio started as a community-based initiative to address a particular problem using the traditional methods, and only later started to adopt data approaches to enhance their work. Uniting the community around a common issue rather than around collecting and using data, and looking to marry traditional approaches where useful, could be a good strategy to work in the communities and develop something they would want to carry on in their neighbourhoods

The local initiatives need to be in the driver's seat supporting the local data ecosystem. Local organisations like OMDTZ organised by Ramani Huria and Map Kibera have established sustainable business models, where they can support data collection efforts outside the main project, including by request from the government, to continue their mission operations. Local teams should advise donors, provide support in developing the agenda and be ambassadors of the local community needs, and not vice versa. In addition, non-data community activities, such as Map Kibera's Humas of Kibera and Kibera News Network, should complement data-driven project to connect to the community and engage citizens in a more meaningful way.

#### 7.2.6. The issues of ‘culture’ and ‘mindset’

Using technology and data for development is more complicated than fixing people’s mindset in order to accomplish the goals of development. The Global North should not impose their cultural norms as a prerequisite for development. The work of international aid institutions using technologies is often aimed to disrupt:

*“The use of technology in relief and development work is disruptive. It involves a major shift in the way we carry out our work. Such change is messy. But the rewards of making it are becoming more and more evident – to poor and vulnerable people, their governments, their business communities, and the NGOs that serve them”* (Bothwell and Hellen, 2015, p. 4).

The Western cultures have embraced the disruption and smart city agenda without a critical review of technologies, accepting them as intrinsically good and valuable, and have faced their own challenges and policy dilemmas. This does not have to be the only way. Africa can do it differently.

#### 7.2.7. Barriers and gaps

Speaking of barriers and gaps to the implementation of technology and data-driven approaches that worked somewhere else (i.e., in the Global North) implies that technology is central to the solution. Trying to fit a concept or technology in a different setting disregards the context. Since the environment will never be exactly the same, and especially in the context of LMICs, city challenges should be looked at first from the perspective of the local context. This should not imply that policy or infrastructure improvements should not be recommended and implemented – quite the opposite – but designing interventions based on successful experience elsewhere without taking into account existing conditions has not proven effective.

Research demonstrates that *“wealthier cities and those with more ‘open’ democracies exhibit higher investments in fields that are related to the development of innovative capabilities”* (Neirotti *et al.*, 2014, p. 24). Most African cities are neither rich nor ‘open’, and Dar es Salaam and Nairobi were no exceptions. But there were technological solutions such as M-Pesa and Ushahidi (see Section 3.2.3 for details) that have worked in the past, not only within the country but also on the continent and beyond. Both solutions were developed in Kenya, which indicates that the country context has what it takes to create citizen-led smart city innovations.

In Dar es Salaam, the Ramani Huria project pivoted their original objectives towards improving local skill base (working with university students – see Section 4.2.2 for details), and similarly sensors.AFRICA initiated classes in local schools when the original idea of working directly with citizens proved challenging in Nairobi (more on this in Section 5.2.2). This formed pockets of critical infrastructure and expertise across the city with great potential to evolve. What can be learned from them and how could it be leveraged to improve community-led and data-driven work? How could these examples help the ‘smartification’ of African cities? ‘Smart’ interventions should be designed from the beginning so that they work in a particular context.

The next section presents some implications of these findings for different stakeholder groups and what they should consider doing going forward.

### 7.3. Implications

World Bank Group’s president David R. Malpass said in the World Development Report 2021 (World Bank, 2021, p. xi): “*the perspective of lower-income countries has so far been largely absent from these global debates [on data governance] and urgently needs to be heard*”. The Report called data a ‘double-edge sword’ where on the flipside of the potential of data to improve people’s lives “...*data accumulation can lead to a concentration of economic and political power, raising the possibility that data may be misused in ways that harm citizens*”. Indeed, the perspective of lower-income countries, and particularly the voice of the citizens in those countries, has been missing and needs to be heard. This research is one step in that direction.

#### Government

In both cities, government and non-government study participants leaned towards a bottom-up approach towards smart city development discussing data indicatives. However, conditions need to be created first from the top down, so that communities could feel empowered to access, collect and use data.

First, the government needs to make it clear in the governance structure who is responsible for which type of city data. Improving communications around governance and data management structures would make it much easier for citizens to engage and participate in data-driven decision making. This includes improving mechanisms for citizen engagement.

Second, data-related regulations need to be in place supporting proactive data disclosures and providing citizens with the rights to collect their own data and challenge government data and decisions. Taking risks related to data into account, governments need to continue to work on

legal frameworks that would protect the citizens and enable their access and use of data. Therefore, implementing policies to enable access to data and to collect data freely, making sure that these policies work and clearly communicating these to the public will send a strong signal to the communities that the government is open to collaboration and bottom-up innovations.

Third, the government needs to create positive incentives for people to engage with data, rather than restricting the types of data (i.e., 'controversial' data) that community initiatives can collect or implementing cumbersome processes to gain permission to collect their own data and reinforcing a culture of technology acceptance where people are comfortable sharing, accessing and using data. While culture can influence the economic development of the country, it is the economic development that shapes culture more (Chang, 2008). Chang (2008) suggests that culture is immutable and can be changed through: (i) economic development; (ii) ideological persuasion; and (iii) policies and institutions. In the case of innovation projects with community participation, often the only instrument used is persuasion. Persuasion alone does not produce tangible results to demonstrate the effects that could be achieved through the use of technology, so the right policies and a strategic approach to economic development are important to enable the use of these technologies, which will subsequently shape the culture.

Finally, trust on both sides (government and community) is key. The government needs to share control and build trust with the communities. This goes beyond data to overall good governance practices and building relations with the citizens, where citizens feel empowered, and their voices are heard. As Chan (2013) suggests, the government's role is to facilitate various parts of society to meet every citizen's needs. This includes the creation of an enabling environment for that, which did not seem to have materialised in either country yet, as well as clear and open communication.

#### *International aid institutions and donor organisations*

Many questions regarding technology remain unresolved. Considering the risks and negative impacts from data-enabled tools seen in the West, how can these technologies bring better solutions to the cities in East Africa, where corruption, trust issues and poverty define the context? How can we help facilitate the innovation and progress that will most benefit the citizens? Planting seeds of data-driven innovations requires careful consideration of social and political conditions to avoid bigger issues in the future, because if "*designed carelessly or inappropriately, technology can inhibit or even derail it*" (Green, 2019, p. 14).

Smart city technologies are new to municipalities around the world (not only in the LMICs) and as they are developing rapidly, as is our understanding of them, it is important to make the right decisions now as they will have implications for years to come (Green, 2019). International aid and development institutions play an important role in supporting countries in East Africa, and more broadly in the Global South, as they decide how to employ technologies and data in their cities, and they have a big responsibility to help carefully assess those decisions. Rather than following the modern convention that smart cities are inherently good, falling into the trap of a false dichotomy of smart vs. 'dumb' cities (Green, 2019), they must engage in the debate and truthfully investigate what is the best way to employ smart technologies and data to achieve a democratic and equitable future in African cities.

As discussed earlier, often large donor institutions and NGOs are not best positioned to carry out community-based work, therefore partnerships with local community-based initiatives and NGOs must be formed. In doing so, donors should understand what 'local' level is necessary for their intervention. Donors should seek to engage local initiatives that already have roots within the community and support what they were locally set up to do. However, this also means that donors will need to relax their expectations of what the results would be and accept that the course might be different from what was originally envisioned.

#### *Community-based initiatives and organisations*

As was discussed, international aid institutions and large donor organisations are not best positioned to drive community work, as their mandate often is top-down working with governments, so the burden falls on non-governmental and community-based organisations with their extensive experience working in the communities to ensure that the needs of communities are not ignored. These organisations need to be actively involved and use their experience to help develop better cities in Africa through engaging citizens and considering the sociotechnical context. Open data is often called a leapfrogging opportunity for LMICs. This leapfrogging will not be achieved without taking into consideration the current state of these countries and looking at what actually worked and helped them to leapfrog there before, and this is where community-based organisations should play a role.

Particularly in Nairobi, resident associations and organised groups seemed to have a better impact and response from the government; however, this was seen more often in richer neighbourhoods, such as the Kilimani Project Foundation (see Section 5.3.1). Projects like Ramani Huria and Map Kibera also managed to secure government recognition and made themselves relatively sustainable by building a role in the communities, adjusting their objectives

to their needs, and supporting other local initiatives and local government in data collection. These provide some useful models for communities and citizens' groups to follow in order to become more involved and vocal in addressing issues their communities are facing.

In both cities, but especially in Nairobi, more collaboration rather than confrontation should make it easier to engage with the government. Citizen engagement is a new concept for the government as well, and through collaboration and support, those methods could evolve and institutionalise the way that works for communities.

#### *Citizens and community volunteers*

There are many opportunities for citizens to learn transferrable skills in data and technology through these initiatives. As described above, digital skills development became a big part of both Ramani Huria and Map Kibera. sensors.AFRICA also worked with local universities and schools to enable knowledge transfer to the students. Citizens and communities have these opportunities to get training and build experience. They should get involved in projects in their areas to develop future career opportunities, while at the same time keeping a balance with doing good for their own communities.

Specifically in Dar es Salaam, citizens need to be more proactive in challenging government decisions and data. While the government needs to share control in order for bottom-up approaches to be feasible, it is a two-way street, where community members need to actively participate and not leave everything up to the government.

#### *Private sector organisations*

Private sector organisations were represented in the expert interviews, but they were not involved in the community initiatives examined in this research. However, when it comes to city data and smart city projects, private sector firms play a big role. First, they work with governments to propose smart solutions, which generates enormous amounts of city data. Second, they can fill in the gaps in data collection and service delivery.

As indicated, a number of smart city initiatives in partnership with the private sector had been launched in Nairobi (see Sections 5.1.1 and 5.1.4, for example), but there was little transparency and lack of awareness even among government study participants as to how these technologies work and most importantly, what data they were collecting and how they were being used. The private sector should make explicit what data are collected, make them available to the government and suggest making them public. They should also showcase how these data are

used by local communities and businesses to demonstrate how these technologies are making a difference to remain on the cutting edge of thinking with smart city discourse.

### *Academia*

Most of the research on smart cities and data-driven development continues to be done in the Global North, where technologies are developed and employed. However, African countries have accumulated rich experience by applying technologies, albeit not designed with them in mind (Nyabola, 2018), including in urban contexts. Academics in Africa need to contribute towards an African view on smart technology and develop frameworks suitable for African cities to adopt technology and data, while making the voices of citizens count. The following section will present some potential avenues for further academic research.

#### 7.4. Limitations and future work

In research, and particularly when employing qualitative research approaches, interpretation of the data is key to analysis. Therefore, understanding and outlining the limitations and biases that these data contain is essential in minimizing misinterpretation (Boyd and Crawford, 2012).

This thesis examined the implementation of community initiatives on the ground. Qualitative research methods chosen for this research provide the best approach to studying the reality from the viewpoint of the study participants and understanding their 'situated actions', though there are some limitations to such approach. The limitations within this PhD research were three-fold:

1. Internal limitations in the presented studies (i.e., language barrier, access to community members, duration of the studies, and researcher's background);
2. Issues related to the generalisability of the results (i.e., the limited number of cities and projects, data used by community initiatives); and
3. New circumstances since the research was conducted – the global COVID-19 pandemic.

These limitations are discussed further in this section and in turn suggest areas for future work.

Firstly, the studies were about community-led initiatives, so the community perspective was key to understanding how these initiatives are run. Due to researcher's lack of proficiency in the local language, Swahili, especially in Tanzania it was difficult to communicate directly to the



communities, the majority of whom did not speak English. Besides, due to the limited time in the country, I had to rely on a partner organisation to recruit participants for focus groups based on the presented requirements. As a result, based on the English language requirement and on the access the partner organisations had, the more active members of the community were invited to participate, who were connected to the organisation and regularly participated in various initiatives, led by donor institutions. While their perspective was valuable and provided important insights, the voice of local communities still lacked representation.

As stated in Section 3.1 the personality of a researcher is a critical factor and can impact the results of the research. The researcher's connection to development work and institutions (particularly, the World Bank) could affect how people perceived the research and what information they provided. Although precautions were taken to detach the objectives of this research from the work that the researcher was involved in on the ground (e.g., study participants were explicitly informed that this is an independent research project and their response to the study would not affect their relations with any institution, including the World Bank), it is fair to assume that some responses could be affected, nevertheless.

There would be value in running additional focus groups with community members who were either connected to various initiatives or who did not actively participate in any initiative to find out why. Future studies could go a level down to the community level and investigate those views. This could be achieved through employing a local Swahili-speaking independent researcher.

Secondly, every country and city have unique characteristics and context. While there were some similarities between the two case studies, they could only be understood in the particular context of these two countries and cities. Also, only data used by citizens and community initiatives, whether collected by them or accessed from the government and other sources, were considered as part of this research. However, there are many more data applications by the government that were not discussed here, where data were used or could be used to improve decision making and improve cities.

In interpretive research approach of social constructivism, which guided this PhD, using qualitative methods findings cannot be generalised or predicted as is expected in positivism, but 'transferability' can be achieved to some extent due to also existing "*similarities in human experience*" (Otoo, 2020, p. 70). More African cities need to be studied in order to understand which of the results could be transferable and applied to other contexts within the continent. Moreover, the case studies represented countries with a similar economic development level. It

would be useful to see how they compare to countries in Africa from higher and lower economic development groups. Another potential avenue for future research could take a look at data applications used by city governments and how they affect urban sustainability challenges. Other regions of the Global South could also be considered such as Latin America and Asia to have a broader view across various regions.

Finally, data collection for this PhD research was completed prior to the global COVID-19 pandemic. It does not take into account any changes that might have occurred in the processes discussed due to the pandemic, for example, how community data collection processes were affected by the social distancing requirements. In addition, following Tanzanian president John Magufuli's death during the pandemic in March 2021, Vice-President Samia Suluhu Hassan took office as the first female leader of the country (BBC News, 2021). At the time, she was expected to continue to serve out her predecessor's presidential term for four more years to 2025, and her political agenda was unclear.

Future research could investigate if and how the COVID-19 pandemic affected community data-related practices. As Manufuli's government had a strong influence on how data-related subjects were dealt with in the government, it would also be worthwhile to see if this changes with the new president.

## 7.5. Personal reflection

This PhD research was guided by social constructivist views (Section 3.1), which relies on researcher's 'interpretation' of the data transmitted by the study participants and requires a researcher to reflect on their own position in the research. This section, therefore, provides a reflection on the personal ontological position of the author: "*ontology relates to the values a researcher holds about what can be known as real and what someone believes to be factual*" (Ryan, 2018, p. 43).

It was important that all my potential biases are explicit, hence I described my background in detail in the reflexive statement in Section 3.1.1. My work as an international development practitioner motivated me to undertake this research, and throughout my PhD research I continued to be engaged in projects aimed to promote the use of technology and innovations to address development issues in less developed countries.

My position as an academic researcher and an international development practitioner provided me a unique opportunity to take a deeper look into the work, which I have been part of professionally for nearly a decade. Hence, I was wearing two hats: a researcher and a practitioner.

This experience on the one hand helped further this research and gain insights only acquirable with this expertise. And on the other hand, it made me more aware and critical of the implications of using Western paradigms in a non-Western context. Data and digital technologies cannot deliver the same outcome because the context and reality on the ground in particular localities – countries, cities, communities – are different.

As a researcher I made all efforts to achieve neutrality on the subject area and to the views expressed by all participants. This is reflected in my thorough and honest report of my data and insights in Chapter 4 and Chapter 5, and analysis in Chapter 6. Participants of this research project generously shared their views and ideas, so I have made my best effort not to disclose anything that could be used to identify individuals. Security and privacy of personal data is a value that I hold on to strongly.

As a practitioner, I am part of the reality on the ground and cannot be separated from it. While my research demonstrated that each group of stakeholders held their ‘truth’, I believe through dialogue, acknowledging different positions, it is possible to move towards a consensus and have more effective ways of collaboration and the implementation of the ‘smart’ technology in the context of LMICs.

While my dual position was unique, I believe it is a necessary one. International development organisations often claim an ‘objective’ view whereas they are bound to their political and ideological agendas, which are formed within the Western value system. In my conclusions and recommendations, I put my hat as an international development practitioner on and presented a pragmatic view with the consideration of my findings, which can offer direction to stakeholders who operate in the reality where Western paradigms are applied in non-Western contexts, such as the countries in East Africa, and will continue to be applied given how they have developed and sustained.

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# Appendices

Appendix 1: Methodology for Smart City Ranking of European medium-sized cities (Giffinger et al., 2007, pp. 13–14).

Smart cities - Ranking of European medium-sized cities

## 3 Methodology

### 3.1 Selecting cities

As written in the previous chapters the focus of this ranking lies on medium-sized cities. However, there is no common definition of a medium-sized city. For this study we chose to understand medium-sized cities as cities often also understood as “second cities” on a European scale, cities which are mainly not recognised very well on a European scale but often of crucial importance on a national and regional scale. As a starting point we chose to focus on cities with a population between 100,000 and 500,000 inhabitants. The most comprehensive overview of cities or functional urban areas (FUA) in Europe provides the Espon 1.1.1<sup>2</sup> study incorporating almost 1,600 entities in Europe<sup>3</sup>.

For the further selection of a feasible sample two main arguments were considered according to the project’s aim and its timeframe: Cities should be of medium size and they should be covered by accessible and relevant databases. For these reasons three knock-out criteria were elaborated in a first selection phase on the basis of the Espon 1.1.1 study. Additionally, the fact if a city is covered by Urban Audit - a European wide database on cities - is decisive for the benchmark as for reasons of data availability. Hence 94 cities remained.

Tab. 2: Selection criteria

Crit.	Description	Cities (FUA)	thereof covered by Urban Audit
-	Starting point - functional urban areas in Europe	1,595	244
1	Population 100,000 - 500,000 (to obtain medium-sized cities)	584	128
2	At least 1 university (to exclude cities with a weak knowledge basis)	364	101
3	Catchment area less than 1.500,000 (to exclude cities which are dominated by a bigger city)	256	94

In a second step the project team did some further adaptation and elaboration of the city sample regarding data accessibility and quality. Also some cities which actually are of medium-size but situated in a denser populated area and therefore having a catchment area slightly larger than 1.5 mio. were included. Finally 70 cities were chosen for the sample.

<sup>2</sup> Nordregio (2004) ESPON 1.1.1: Potentials for polycentric development in Europe; Project report, Luxembourg: European Spatial Planning Observation Network Coordination Unit.  
<sup>3</sup> The Espon 1.1.1 study included the EU27-member states plus Norway and Switzerland

### 3.2 Identifying indicators and data sources

All indicators that jointly describe the factors of a smart city are derived from public and freely available data, obtained from the following databases:

Tab. 3: Databases used, number of indicators

Database	Spatial level	Basis for indicators
Urban Audit (CORE)	local	35
Espon 1.4.3 project (FUA level)	local-regional	3
Espon 1.2.1 project (NUTS3 level)	regional	1
Eurostat database (NUTS3)	regional	1
Eurostat database (NUTS2)	regional	8
Eurostat database (NUTS0)	national	1
Various Eurobarometer special surveys (NUTS0)	national	24
Study <sup>4</sup> on creative industries in Europe (NUTS0)	national	1

In total 74 indicators were selected for the evaluation, whereas 48 (65 %) are based on local or regional data and 26 (35 %) are based on national data. The inclusion of national data was necessary to broaden the database but also because very interesting data is available on that level. We tried to use the most current data as possible. However, as for reasons of data availability we also had to include older data, finally ranging from 2001 to 2007. Furthermore several datasets were complemented from other sources by individual research by the project team so that we finally could achieve a coverage rate of 87 % for the 70 cities by 74 indicators. The complete list of indicators is available in the annex.

### 3.3 Standardizing and aggregating data

To compare the different indicators it is necessary to standardize the values. One method to standardize is by z-transformation (see formula). This method transforms all indicator values into standardized values with an average 0 and a standard deviation 1. It has the advantage to consider the heterogeneity within groups and maintain its metric information. Furthermore a high sensitivity towards changes is achieved.

Fig. 4: z-transformation

$$Z_i = \frac{x_i - \bar{x}}{S}$$

To receive results on the level of factors, characteristics and the final result for each city, it is necessary to aggregate the values on the indicator level. For the aggregation of indicators of factors we consider also the coverage rate of each indicator. A certain result from an indicator of an indicator covering all 70 cities weights therefore a little more than an indicator covering only 60 cities. Besides this small correction the results were aggregated on all levels without any weighting. The aggregation was done additive but divided through the number of values added. That allows us to include also cities which do not cover all indicators. Their results are calculated with the values available. Still, it is necessary to provide a good coverage over all cities to receive reasonable results.

<sup>4</sup> Ministère de la culture et de la communication, Délégation au développement et aux affaires internationales (DDAI). Département des études, de la prospective et des statistiques (Depts): L'emploi culturel dans l'Union européenne en 2002. Données de cadrage et indicateurs. Paris, 2005

