Data and the Localization of Sustainable Development Goals in Africa: The Case of SDG 11 in Lagos and Accra

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Abstract

This chapter examines the critical role of data for the localization of the Sustainable Development Goals (SDGs) in Africa, with a specific focus on SDG 11 (Sustainable Cities and Communities) in Lagos and Accra. The chapter argues that while the importance of digital technologies and data for the implementation of the SDGs has been acknowledged, data inequality remains a fundamental challenge. This inequality reflects existing global socio-spatial inequalities. If not carefully considered, these can be perpetuated even further. The chapter builds on results of the ongoing research project, SCiLeD: Standardizing City-Level Data-Gathering for Achieving SDG 11 in Africa, to examine the concrete processes, challenges, and opportunities available for African cities to implement data innovations aimed at localizing SDG 11. It draws on lessons learned and provides future directions based on how the SCiLeD project applied a transdisciplinary research approach for co-designing and co-producing knowledge. This approach allowed for the generation of data that is disaggregated to the neighborhood level, involving community mappers and profilers to reflect and respond to local needs and realities, thereby illustrating its transformative influence and potential toward achieving SDG 11 in African cities by 2030.

Keywords

SDG localization · SDG 11 · City-level data · Lagos · Accra · Transdisciplinary research (TDR)

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8.1 Introduction

In the past few years, the importance of digital technologies and data innovations for the implementation of the United Nations Agenda 2030 has been increasingly acknowledged. Early calls for a "data revolution for sustainable development" (UN 2014) have been recently complemented by an emphasis on the crucial role of a "digital revolution" to support transformations to sustainability (Corbett and Mellouli 2017; Pappas et al. 2018; Sachs et al. 2019).

More recently, the crisis resulting from the COVID-19 pandemic has brought about an accelerated adoption of digital technologies in many parts of the world, which have enabled many people to carry on social, economic, and education activities amid restrictions of physical contact. However, the pandemic crisis has also clearly shown how the most marginalized and impoverished people globally were the ones to feel its most severe impacts: they were less able to benefit from the use of digital tools and less represented in the data used for decision-making. As underlined by the Sustainable Development Goal (SDG) Report 2020, "huge data gaps still exist in terms of geographic coverage, timeliness and the level of disaggregation required" for assessing country-level progress toward the SDG targets and indicators (UN 2020a, p. 4). The report also states that investments in data and innovation are key to responding to the crisis and supporting policy making and enabling progress toward the SDGs. Similarly, the UN Research Roadmap for the COVID-19 Recovery (UN 2020b) calls for investments in data systems and infrastructure, considering them the linchpin to the implementation of impactful research efforts to support just and effective recovery. To this we would add that investments into data innovations for localizing the SDGs today not only provide an essential instrument to assess achievements of countries in relation to the SDGs but have also the potential to create a solid evidence base and a digital infrastructure which will be essential for a post-2030 Sustainable Development Agenda.

However, despite the acknowledged importance of data innovations and digital infrastructures, we would like to argue in this chapter that a fundamental problem for SDG data innovations needs to be explicitly addressed: data inequalities reflect socio-spatial inequalities, which, if not carefully considered, can imply that SDG data will enshrine and perpetuate those inequalities (Ulbrich et al. 2019). This fact is behind an apparent paradox related to data, which can be well exemplified in the context of cities, and thus directly relevant to SDG 11 (Sustainable Cities and Communities). On the one hand, the recent surge in the use of digital technologies and emerging sources of data (e.g., low-cost sensors,

high-resolution satellite imagery, data generated by citizens using mobile phones) has given rise to ideals of "smart cities" (Przeybilovicz et al. 2018; Townsend 2013), which are built upon powerful artificial intelligence algorithms to make sense of the resulting "big data." This would enable fine-grained and sophisticated understandings of urban dynamics to support policy and decision-making based on the unprecedented availability of urban data (Kitchin 2014), thus enabling a "new science of cities" (Batty 2013). However, in an apparent paradox observed in the context of crisis management (Restrepo-Estrada et al. 2018), a related and frequently overlooked phenomenon happens simultaneously to the perceived overabundance of data, namely, an information dearth. Existing data about cities frequently lacks geographical and temporal coverage, and the putative abundance of data is concentrated in some well-known urban areas (frequently wealthy areas of Western cities), whereas for many other areas and decision-making tasks, there is a real lack of actionable information that is able to support decision-making.

A practical consequence of this Janus-faced problem of urban data can be found in the very first target of SDG 11: "by 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums." Notwithstanding the need to track progress in SDG 11.1 with data on the number of people currently living in deprived urban neighborhoods, we presently lack an internationally agreed definition of "slum area" or standardized data for reporting on the physical locations and characteristics of these areas (Lilford et al. 2019), with current methods for mapping them being siloed and disconnected (Thomson et al. 2020). Not surprisingly, analyses of existing official datasets in large cities of the global South have observed that the data available is often concentrated in wealthy areas, with poor and deprived neighborhoods having much less digital footprint (Macaya et al. 2020). To the welcome emphasis on the importance of data innovations and data infrastructures of current policy discourses mentioned above, we thus would like to emphasize the need for data innovations which not only produce high-quality,

timely, and comprehensive data for policy making, but which address existing inequalities by also enabling currently marginalized voices to use data generation as an opportunity for shared learning and for empowering local transformations (de Albuquerque and de Almeida 2020).

Against this backdrop, in the remainder of this chapter, we investigate the following questions: what are the key challenges and requirements for data innovations that support the SDGs to be truly equitable, inclusive, and empowering? How do these challenges and requirements manifest in African countries? In order to investigate these questions, we present results of an ongoing research project SCiLeD: Standardizing City-Level Data-Gathering for Achieving SDG 11 in Africa, which enables us to discuss the concrete challenges and opportunities of the African cities of Accra (Ghana) and Lagos (Nigeria) to implement data innovations aimed at localizing SDG 11. The chapter concludes with a summary of key lessons learned and future directions for research and practice.

8.2   Background: Sustainable Development Agendas and African Countries

African countries have been active players and partners to several global aspirations such as 2030 Agenda for Sustainable Development, the Paris Agreement on climate change, the Addis Ababa Action Agenda (AAAA) on financing for development, the Sendai Framework for Disaster Risk Reduction, and the New Urban Agenda. This is motivated by the aspiration of the continent to achieve sustainable development as demonstrated in the African Union Agenda 2063: The Africa We Want. Governments of several countries in Africa have, however, demonstrated a lack of national and local institutional capacities in the implementation of these aspirations amid growing inequality and poverty. Many cities in Africa are confronted with evidence of inequality and poverty including water shortages, poor sanitation, inadequate housing, and increasing rates of air pollution, traffic congestion, and

health challenges. Rapid urban population growth and urbanization continue to diminish the capability of city governments to tackle urban development challenges, which are particularly exacerbated by inequality, poverty, and uncontrolled development of urban slums. In West Africa, rapid growth of urban population and urbanization are creating large urban centers which pose a big challenge for city governments lacking the required resources for sustainable development. These have contributed to the deterioration of quality of life, high level of poverty, inequality, and the proliferation of slums.

This case study focuses on two West African cities—Accra and Lagos—the largest cities in Ghana and Nigeria, respectively. They also share common history, having started as small coastal fishing settlements between the fifteenth and sixteenth centuries, to later become prominent colonial administrative centers and more recently serving as national capitals. They also have common sociopolitical antecedents in their formation as colonial urban centers, which became the basis for the rapid urbanization and population growth experienced by them (Akinyele 2014; Songsore and Stephens 2008). Although these two African cities have common chronicles, they also differ significantly in terms of population size, demography, and culture which have distinct social, economic, and environmental dimensions. Slum/informal settlement development is one of the biggest urbanization challenges confronting Accra and Lagos. Yet, the two cities account for a huge percentage of economic growth, industrial activities, and contributions to gross domestic product (GDP) of their respective countries (Filani 2012).

8.3   Case Study: Agenda 2030 in Accra and Lagos

Accra and Lagos are both being transformed in ways that allow them to become more sustainable and competitive and better able to tackle urban challenges (Filani 2012). Unfortunately, they both have huge data deficits despite several agencies involved in the collection of economic and

environmental data. Furthermore, typical economic and environmental data in these cities are collected in silos and in different time periods and frequencies, stored in different formats, and used for varied purposes, thus failing to ensure safe, inclusive, resilient, and sustainable cities and communities. Thus, it is obvious that social and spatial inequalities are strongly connected with data inequalities especially in slums and informal settlements in Accra and Lagos. This may make it difficult for these two big West African cities to measure, track, and monitor progress toward Agenda 2030.

Agenda 2030 was launched in 2015 to tackle various social, economic, and environmental dimensions of development challenges including inequality, poverty, climate stresses and shocks, as well as the proliferation of slums. Within this context, our work in Accra and Lagos focuses on the urban-specific SDG 11 and its aim to "make cities and human settlements inclusive, safe, resilient and sustainable." Transforming urban slums through efficient land use planning, improved housing quality, reliable transport system, adequate public space, affordable waste management, and others is highly central to SDG 11. They are also interconnected with other goals in Agenda 2030 including SDG 3, 6, 8, 9, and 13. Reliable and accurate data on the underlying distributions, patterns, trends, or disparities inherent in cities are critical for urban planners, researchers, and governments to effectively measure, track, and monitor implementation and performance of Agenda 2030.

8.4 The Standardizing City-Level Data-Gathering for Achieving SDG 11 (SCiLeD) Project

Motivated by the goal of addressing the urban data gap in Africa, the Standardizing City-Level Data-Gathering for Achieving SDG 11 in Africa (SCiLeD) project aims to generate city-level data with respect to the proportion of urban population living in slums, in informal settlements, or with inadequate housing in the West African cit-

ies of Lagos and Accra. The project was inspired because of the recognition of the missing gaps in the administrative records, official statistics, census, and surveys collected by ministries, departments, and agencies in many African countries. Most available data do not contain information about fringe urban dwellers and communities including slums and informal settlements; hence they are often masked in highly aggregated national, regional, municipal, or district data. This often makes decision-making, planning, and policies difficult and unable to address the needs of the more than 65% urban population living in slums and informal settlements. The lack of evidence in terms of accurate, relevant, and suitable data hampers city governance and intensifies poverty, inequality, and the proliferation of slums and informal settlements in Africa.

The approach adopted is the transdisciplinary research (TDR) which connects governments, academia, businesses, civil society organizations, and communities. The aim is to produce, share, and use data as well as incorporate multiple perspectives and sources, shared or social learning, reliability, and empowerment (Moser 2016; Osborne 2015; Lang et al. 2012). This is to safeguard the participatory process of integrating urban data and address the twin problems of information overload and information dearth. Information overload refers to high-volume data streams and unstructured data, among others, while information dearth refers to a lack of spatial and temporal coverage of datasets and low integration into decision-making. The TDR approach for participatory urban data collection and governance in Accra and Lagos followed a series of interrelated activities. First, in each city, there was a focal point bringing together key experts from governments, academia, businesses, civil society organizations, and local communities which became the Local Think Tank Group (LTTG) of the project. This group started by reviewing the SDG 11 targets and indicators and aligning them with the aspirations and priorities of the participating cities, namely, Lagos and Accra.

Based on this exercise, the LTTG selected five targets out of the total ten targets of the SDG 11,

namely, housing and basic services with slum upgrading (SDG 11.1), sustainable transportation (SDG 11.2), participatory urbanization and planning (SDG 11.3), air quality and waste management (SDG 11.5), and disaster risk reduction (SDG 11.6). Relevant stakeholders within these sectors were identified, mapped, and selected for engagement (see Table 8.1). Some of the criteria

Table 8.1 SDG 11 stakeholders and their relevance

Stakeholders	Relevance
City government officers	City government officers are key stakeholders because they make, approve, and implement urban policies; deliver and manage local services; wield enormous power and influence on the nature and quality of urban development; track progress; and monitor performance of progress toward achieving SDG 11
Academic urban researchers	Urban researchers in academia are significant stakeholders because they are the custodians of knowledge; control processes and technical skills associated with the co-design and co-production of knowledge; and disseminate knowledge
Civil society organizations (CSOs)	CSOs are relevant stakeholders: through advocacy activities, they may demand or are invited to participate in the process of co-design and co-production; they influence behavior and actions through grassroots mobilization
Local communities	Local communities organized through organizations such as the Nigeria Slum/Informal Settlement Federation and the People's Dialogue on Human Settlements, Ghana should be the principal beneficiaries of SDG implementation; they are service user and best informed about local needs and assets
Private businesses	Private businesses are key stakeholders involved with agenda setting because they are interested and informed about how things ought to be done to improve the quality of life among the poor vulnerable groups and communities
Local media	Local media are relevant stakeholders because they are responsible for informing the public; publishing performance indicators; and dissemination of information

for the selection included interest, influence, organizational mandate and/or activities, as well as those affected by these issues.
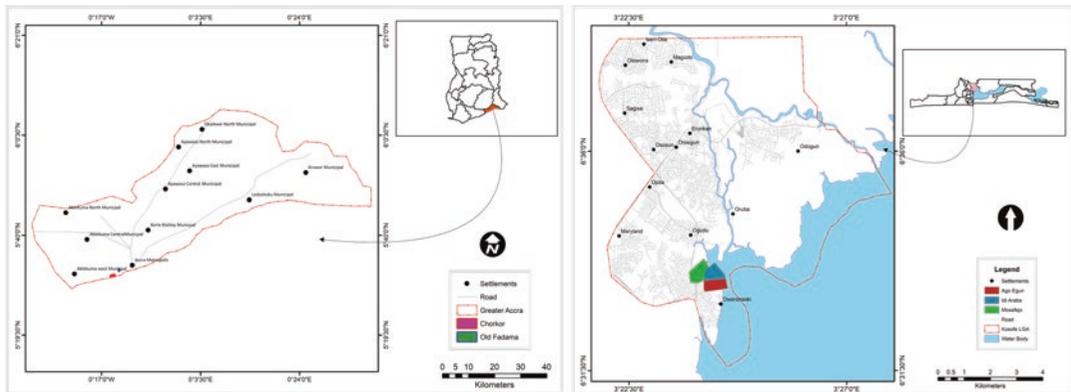
The third step in the process involved convening an inception workshop which brought together government ministries, departments and agencies, academia, civil society, international organizations, the media, and the Slum Dwellers International (SDI) Nigeria Slum/Informal Settlement Federation and Ghana Federation of the Urban Poor. These actors were arranged according to the various sectors to form thematic clusters. Five thematic clusters were formed— housing and basic services, sustainable transportation, participatory planning, air quality and waste management, and disaster risk reduction. During the inception workshop, an institutional survey was concurrently conducted by administering structured questionnaires to the participants to examine the status of urban data in the context of the SDG 11 and the selected targets and indicators.

After the inception workshop, the survey continued by administering the same set of questionnaires on an additional number of organizations which were identified as relevant in each cluster. The specific objectives of the institutional survey were to (1) identify and characterize major institutions involved in urban data governance; (2) assess the state of urban data governance practices and constraints by institutions; (3) examine the performance of the selected institutions with respect to data collection, storage, sharing, and integration; and (4) determine which of the FAIR (findable, accessible, interoperable, reusable) data principles were used in urban data governance. These principles represent key elements of good data governance which enhance data discovery and innovation and data integration and reuse by the community of knowledge producers and users (Wilkinson et al. 2016).

By leveraging their grassroots presence and experience in profiling and mapping activities, the Slum Dwellers International (SDI) Nigeria Slum/Informal Settlement Federation led the household survey and slum mapping in selected slum communities in the two cities (see Fig. 8.1).

Fig. 8.1 Selected slum communities in Accra (left) and Lagos (right)

In Lagos, three waterfront communities were purposively selected because they were prioritized by the city government, civil society organizations, and the local community stakeholders as of primary interest to ongoing and future urban development projects. These communities included Mosajejo, Idi Araba, and Ago-Egun in Oworonshoki, Kosofe Local Government Area. Kosofe is the third largest Local Government Area with a population of 682,772 (Nigerian Population Commission 2006), while the population of the other selected communities is estimated between 250 and 4000 persons. These communities are full residential areas with high population densities and inadequate access to urban basic services. They are located close to the Lagos Lagoon where the land is freehold and ownership is by inheritance. The housing condition is generally poor owing to construction materials and space allocation.

Two medium and large slum communities were selected in Accra, namely, Old Fadama and Chokor. The enumerators and mappers were selected from the communities, trained, and equipped with tablets loaded with questionnaires on open-source software (KoBoCollect) by the supervising SDI-approved CSOs, namely, People's Dialogue on Human Settlements, Ghana, and Justice and Empowerment Initiative, Lagos. A research team from the Universities of Ghana and Lagos led the data cleaning, analysis (quantitative and qualitative), and presentation

using graphical charts and photographs. After this, small area mapping was led by the urban modelers and students of the two universities in the team with contributions from community profilers/mappers to map slum boundaries and facilities and assets in the selected slum communities.

The last step involved two-phased post-fieldwork engagement strategies. The first phase of this engagement consisted of giving data back to the communities, and the second was the technical validation workshop. Giving data back to communities involved dissemination and sharing of the outputs of data analysis in the form of graphical charts and maps. The graphical and pictorial communication gave insight into the conditions of slum communities and households. It further created awareness about their needs and empowered residents to use the data to engage local authorities to negotiate and influence their envisaged futures. The technical validation workshop in turn enabled stakeholders from both scientific and non-scientific communities to interrogate, verify, and validate the outputs of the study.

8.4.1 Key Outputs of SCiLeD

Some of the outputs of the transdisciplinary research process show the benefits of the participatory process of collaborative knowledge

co-design and co-production. It also highlights the pathway for departing from the traditional siloed approach in urban data governance. Based on consensus agreements by the stakeholders on cities' priorities and preferences in Accra and Lagos, five SDG 11 targets with their respective indicators were selected. These formed the core themes for the project, which resonated well with stakeholders and propelled their buy-in throughout the lifecycle of the project. The process of stakeholder identification, mapping, and engagement was used to create a community of data producers and users. These form the basis for understanding the urban data ecosystem on the one hand and the urban data value chain on other hand.

The process of community-led slum mapping and profiling in this project increased participatory data collection which includes and empowers marginalized communities to obtain evidence which they can use to negotiate with city authorities for improved service delivery and well-being. In Lagos, for instance, the city government uses data from community-led participatory slum profiling and mapping to make decisions about revitalization. The priority community and issues in the report guided the city government in making informed decisions and design sustainable solutions. The disaggregated data provided insights into the intensity of the urban challenges and needs, which were previously masked in the aggregated data. The local communities and the civil societies also used the disaggregated data to pinpoint areas requiring urgent interventions and guidance on the nature of the interventions.

The assessment of the institutional capacity for SDG tracking and monitoring in turn provided important insight into practices such as data collection mandate, methods, collaboration, analysis, storage, retrieval, sharing, and constraints including ownership, stewardship, and accessibility, which define action plans for improved urban data governance. Table 8.2 is the result of an institutional survey on the status of urban data in Accra and Lagos. It describes institutional data management practices in the two cities across different sectors according to

selected SDG 11 targets, namely: SDG 11.1 (Housing and Basic Services), focusing on five institutions in Lagos and four institutions in Accra; SDG 11.2 (Sustainable Transportation), focusing on four institutions in Lagos and three institutions in Accra; SDG 11.3 (Inclusive and Sustainable Urbanization), focusing on five institutions in Lagos and two institutions in Accra; SDG 11.5 (Disaster Risk Reduction), which examines four institutions in Lagos and six institutions in Accra; and SDG 11.6 (WASH), where three select institutions were examined in Lagos and two select institutions examined in Accra. The five targets were selected because they were the top five ranked sectors of Accra and Lagos by the TTLG. The assessment was conducted with respect to how the institutions in the selected sectors manage their data in terms of data processes, the application of FAIR (Findable, Accessible, Interoperable, and Reusable) principles, and the levels of data collection.

The results of the survey showed that there are variations in data management practice within and across institutions in the two cities, represented in Table 8.2 with the symbol ($\sqrt{}$) indicating presence of a practice, while symbol (O) indicates an absence. For instance, data processes, the application of FAIR principles, and the levels of data collection in the housing sector were not uniform within and across both cities. The same applied to the sustainable transportation sector, the inclusive and sustainable urbanization sector, disaster risk reduction, and the WASH sector. Overall, all selected institutions in Accra corroborated the application of FAIR data principles, while institutions in Lagos did not conform to the use of FAIR data principles. This implies that just as there are variations in institutions in both cities, variations also exist in data processes, the application of FAIR data principles, and levels of data collection within and across both cities. It is therefore evident that there is a lack of harmonization in urban data management within and across the cities, which represents a major challenge to the capacity of city government institutions to implement SDG 11. The creation of small area maps through

Table 8.2 Institutional data management practices in Accra and Lagos (source: authors)

Lagos

Targets	Sectors	Institutions Lagos	Disaggregation	Aggregation	Conversion	Validation	Sorting	Summarization	FAIR principles	National	Regional/state	City level	Neighborhood level	Neighborhood level	Slum/informal communities
SDG 11.1	Housing	Lagos State Building Control Agency (LASBCA)	O	O	O	O	✓	✓	✓	O	O	O	O	O	O
		Lagos State Physical Planning Permit Authority (LASPPPA)	✓	✓	✓	✓	✓	✓	✓	O	✓	✓	✓	✓	✓
		LAGOSHOMS	O	O	O	O	O	O	O	O	O	O	O	O	O
		Ministry of Physical Planning and Urban Development (MPPUD)	O	O	✓	✓	✓	✓	✓	O	✓	✓	✓	✓	✓
		Ministry of Housing	✓	✓	O	✓	O	✓	✓	✓	✓	✓	O	O	✓

Accra

Institutions	Disaggregation	Aggregation	Conversion	Validation	Sorting	Summarization	FAIR principles	National	Regional/state	City level	Neighborhood level	Neighborhood level
Ghana Standards Authority	O	O	O	O	O	✓	O	O	O	O	O	O
Ghana Statistical Services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	O	✓
Land Use and Spatial Planning Authority	O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ministry of Works and Housing	O	O	O	O	O	✓	✓	✓	O	✓	O	✓

SDG	Theme	Agency								
SDG 11.2	Sustainable Transport	Federal Road Safety Commission (FRSC)	O	√	O	O	√	O	O	O
		Lagos Metropolitan Area Transport Authority (LAMATA)	O	√	O	√	√	√	√	√
		Lagos State Waterways Authority (LASWA)	O	O	O	O	O	√	O	O
		Ministry of Transportation (MOT)	√	√	√	√	√	√	√	√
SDG 11.3	Participation Planning	Lagos State Office for Disability Affairs (LASODA)	O	√	O	√	O	√	O	O
		Ministry of Justice	√	√	√	√	√	O	√	√
		Ministry of Wealth Creation and Employment	O	O	O	√	O	O	O	O
		Office of the Public Defender (OPD)	O	O	√	O	√	O	O	O
		Ministry of Women affairs and Poverty Alleviation (WAPA)	O	O	O	√	√	O	O	O

Agency (Accra)										
Greater Accra Passenger Transport Executive (GAPTE)	√	√	√	√	√	√	√	√	O	O
Department of Urban Roads	√	√	√	√	O	√	√	√	O	O
Electoral Commission	O	√	O	O	O	√	√	O	O	O
Ministry of Employment and Labour Relations	√	O	√	√	√	√	√	√	O	O
Ministry of Gender, Children and Social Protection	√	O	√	√	√	√	O	O	O	O

(continued)

Table 8.2 (continued)

SDG 11.5	Disaster Risk Reduction																
	Lagos State Fire Service	O	O	O	√	√	√	√	√	√	√	√	O	√	√	O	O
	Lagos State Emergency Management Agency (LASEMA)	O	√	O	√	√	√	√	√	√	√	O	√	O	O	O	O
	Lagos State Environmental Protection Agency (LASEPA)	O	O	√	O	O	O	O	O	√	√	O	√	√	√	√	√
	Ministry of Environment	O	O	O	√	O	O	√	O	O	O	√	O	√	O	O	O
SDG 11.6	WASH																
	Lagos State Water Corporation (LSWC)	O	√	√	√	√	√	√	√	√	√	√	O	√	√	O	O
	Lagos State Urban Renewal Agency (LASURA)	√	√	√	O	O	O	O	O	√	√	√	√	√	√	√	√

Organization																
Ministry of Environment, Science and Technology	√	√	O	√	√	√	√	√	√	√	O	O	O	O
Ambulance service	O	O	√	O	√	√	√	O	O	O	O	O	O	O
Amnesty International	√	O	O	√	√	√	√	√	√	√	√	√	O	√
Ghana Red Cross	O	O	√	O	O	O	O	√	O	O	O	O	O	O
Ghana Police Service	O	O	O	√	O	√	O	√	√	O	√	O	√	√
Ghana National Fire Service	O	O	√	√	O	O	O	O	O	O	O	O	O	O
Water Research Institute	O	O	O	√	√	√	√	√	√	√	√	√	O	O
WaterAid	√	√	√	√	√	√	√	√	√	√	√	√	√	O

the SCiLeD project in turn highlighted the need for disaggregated data on economic and environmental deprivations and needs for sustainable urban development.

8.5 Important Outcomes of SCiLeD

Given the outputs stated above, the following are the related short-term and long-term outcomes of the SCiLeD processes.

8.5.1 Data for Action

The short-term outcomes of using data for action include awareness, cooperation, improved capacity, knowledge exchange, and social/shared learning about local needs and assets for sustainable development. The selected SDG 11 targets (11.1, 11.2, 11.3, and 11.4) sit well with the stakeholders as they align with the local priorities in the two cities and selected communities. Meanwhile, existing data are not disaggregated by local communities and their households and gender, which makes it difficult to use them for the SDG 11 indicators. There is increasing recognition of the need for community-level data collection and disaggregation which were previously unavailable for selected slums and informal settlements. There is also increasing interest by city government to ask relevant questions in the survey questionnaire used for slum profiling so as to capture indicators which address issues that affect slum/informal settlements. This enables place-specific prioritizations and guidance on interventions, as well as tracking and monitoring of performance. Co-design and co-production of knowledge also enhanced trust in the quality and accuracy of the data leading to its uptake for decision-making by city governments. The long-term outcomes of using data for action increased participation in decision-making, empowerment for improved well-being, and advocacy for change in slum communities.

8.5.2 Knowledge-Driven Solutions

The short-term outcomes of knowledge-driven solutions for building and managing marginalized people and places include linking data to decision, awareness of alternative solutions, and translating knowledge to actions. For instance, it resulted in a plan for the long-term translation of knowledge to actions including teaching behavioral change in the context of water, sanitation, and hygiene (WASH) which aligns with SDG 11.1. Another plan consists of overturning the scarcity of clean water in slum neighborhoods in Lagos by optimizing the use of ultraviolet circular surface sanitization equipment for a plug-and-play system to achieve sanitization within 60 s in the context of COVID-19. This entails wastewater disinfecting using an advanced oxidation process assisted by ultraviolet lamps, followed by biological treatment and/or chlorine disinfection to make water suitable for handwashing. Knowledge of this solution has resulted in a partnership for innovation involving existing stakeholders (civil society, academia, and local communities) in Lagos and new partners from the United Kingdom (academia and private sector). This has led to an opportunity to evaluate the project's impact and willingness to pay for services in the slum neighborhoods.

8.5.3 Networking for Upscaling

The short-term outcomes of building networks and promoting integrated solutions as exemplified in the SCiLeD project have led to collaborations, cross-learnings, and partnerships at all levels. By leveraging a transdisciplinary approach, we now have a growing community of slum mappers from local communities, local experts, tertiary institutions, research organizations, businesses, and funding agencies connected together to redefine our slum data observatory and an urban data ecosystem in general toward achieving the SDGs. New paradigms, tools, technologies, and platforms are beginning

to integrate local, regional, and global resources, including technical, human, and financial, for slum mapping. This could redefine the future of SDG monitoring and implementation. The long-term outcomes of networking for upscaling will increase funding for knowledge production, global awareness about slums, and best practices in slum data observatory, among others.

8.5.4 Science for Society

Transdisciplinary research aims to identify and implement solutions for difficult sustainability issues and to foster social learning. The SCiLeD project brought together a multidisciplinary team which comprised natural and social scientists with specific knowledge and skills in social and environmental issues from two different countries and multi-sectoral stakeholders with diverse socio-cultural backgrounds. The short-term outcomes of science for society include an increased role for communities, the design of local solutions, improved usability of local knowledge, and evidence for the utility of citizen science for SDGs. This leads to the long-term outcomes of evolving a fair and equitable society and of doing research for societal impacts.

8.5.5 Science for Policy

Transdisciplinary research aims to bridge the recognized gap between scientists and policy actors through the involvement of non-scientific partners in research projects. The SCiLeD project team comprised experts and practitioners from the government organizations in Accra and Lagos who participated in four interrelated activities. These include (1) initiating, framing, and designing of the transdisciplinary process such as forming the team, framing the research problem, and co-designing the methods; (2) identification, mapping, and engagement with relevant stakeholders; and (3) selection of suitable tools and

procedures for collection and uptake of knowledge. The short-term outcomes include effective decision-making and timely response and action, and the long-term outcomes include equitable allocation of resources, effective tools for slum revitalization, and data-driven solutions.

8.6 Key Lessons Learned

The transdisciplinary research approach used in the SCiLeD project instilled a culture of collaboration, openness, and trust among participants. It emphasized the importance of data about people and place while empowering the community to tell their own story. The project demonstrated that the coming together of governments and slum communities to create solutions is a possibility. On the flip side, bringing together diverse communities of data producers and users is not without its challenges. These include challenges around harmonizing different perspectives, priorities, mandates, and methods, which led to delays in decision-making and project time overrun.

Clearly, everyone must act to improve the living conditions and quality of life in slums and informal communities. The importance of inclusive and participatory approaches to finding solutions cannot be overemphasized. The experiences in SCiLeD underscore the challenge of multiple partners and their divergent perspectives, highlighting the difficulty in synthesizing the various perspectives and priorities which emerge when bringing together different stakeholders. It also creates a platform for productive debate on urban issues, generates ideas on alternative approaches to urban data governance, and strengthens science for policy and science for society research collaborations. Furthermore, it opens a new horizon for inclusive discussion and reimagining of urban data governance as key components of urban governance especially in ensuring safe, resilient, and sustainable cities and communities in Africa.

8.7   Agenda 2030 in Africa: Challenges and Opportunities for Research and Practice

The case studies of localization of SDG 11 in Lagos and Accra clearly imply important challenges and opportunities for research and practice.

8.7.1   Connecting Stakeholders and SDG Data Systems

One of the main challenges observed in the case study above, and in practical SDG data initiatives, is the challenge of connecting different stakeholders, their perspectives, and various data generation processes and systems. In response to these challenges, the IDEAMAPS (Integrated Deprived Area Mapping System) network was launched in 2020 with funding from a UK Research and Innovation (UKRI) grant. This was a departure from the siloed approaches to SDG data generation which include aggregated surveys, field-based mapping, manually digitized imagery, and machine-learning computer modeling. The network is piloting in three African cities: Accra, Lagos, and Nairobi. Accra and Lagos were included in the network so as to build on the gains from the SCiLeD project, including established institutional collaborations (between the Universities of Lagos and Ghana), trained slum mappers, established presence in local communities, proven skills of technology-driven slum profiling, cordial relationships with city government officials, and an active group of student volunteers. Nairobi was selected primarily as part of the process of building collaboration among African cities in the UK Research and Innovation (UKRI) grant. We partnered with the African Population and Health Research Center (APHRC) in Nairobi, where the principal investigator of the IDEAMAPS project is based, and local slum profiling and community mappers in Kibera, Nairobi, one of the largest slums in Africa, thereby leveraging their vast knowledge and experience.

The rationale for the network derives from the need to further harmonize several official statistics for planning and decision-making, which are usually aggregated at the city, district, or national level, whereas data from censuses, household surveys, vital registration, and health records are available at the individual or household level. Data from Earth observation, Geographic Information System (GIS), field observation of small areas, and big data may also be found at the neighborhood level. Despite the usefulness of these different sources of data for specific purposes, they are not well integrated.

The novel approach which is being developed by IDEAMAPS harnesses the various sources of data by bringing together neighborhood, city/regional, and national stakeholders to collaboratively collect data at the neighborhood level on economic and environmental data, using an interactive interface to depict the degree of deprivation and to support advocacy, planning and investment, and monitoring of SDGs (Thomson et al. 2020). As such, the IDEAMAPS project aims to produce integrated data for community advocacy, urban planning, and SDG monitoring which can assist various stakeholders to do their work more efficiently. Through the project, community stakeholders should be able to access timely, relevant information about their neighborhood(s) that would otherwise be inaccessible so that they can achieve tenure security, improve connectivity to core urban centers, negotiate with city government about their needs and aspirations, and initiate self-improvement projects. The IDEAMAPS data can also support national governments to effectively set priorities and accurately track and monitor SDG 11. Similarly, the data can help local governments understand the spatial extents of slums, informal settlements, and other deprived areas so that the whole city is integrated, well planned, and served. Other stakeholders including scientists, businesses, and civil society groups can make use of the IDEAMAPS data to monitor the outcome of development policy and programs on different aspects of societal challenges including health, education, and housing.

8.7.2 Citizen-Generated Data for SDG Monitoring and Empowerment

There is an increasing recognition of the critical contribution of citizen science data or simply citizen-generated data to researchers and, policy actors, and for SDGs (de Sherbinin et al. 2021; Fraisl et al. 2020; Fritz et al. 2019). Using the traditional data sources to measure the 244 SDG indicators may create barriers for developing countries to monitor and track progress toward the SDGs due to the low data availability and high costs of traditional data production (Fraisl et al. 2020; Bowser et al. 2020). According to the Global Partnership for Sustainable Development Data (GPSDD 2016), the cost for 144 developing countries to generate data for SDG indicators (in the so-called Tiers I and II) is estimated at US$ 283 billion per year up to 2030. Citizen-generated data have the potential of being available at higher frequencies and spatial disaggregation at a lower cost and with additional benefits. Citizen-generated data have been described as public participation in scientific research, since it can involve five dimensions of participation: contract, contribution, collaboration, co-creation, and collegiality (Shirk et al. 2012). Some of the common approaches to citizen-generated data in the literature include community-based participation (Asaba and Suarez-Balcazar 2018); community and participatory mapping (de Albuquerque et al. 2019); participatory sensing (Coulson et al. 2018); citizen sensing (de Albuquerque and de Almeida 2020); crowd sourcing (Howe 2006; Nov et al. 2010); community-based monitoring (Conrad and Hilchey 2011); volunteered geographic information (Sieber and Haklay 2015); and citizen-generated data (Datashift 2017). Although the value of citizen-generated data has been recognized, there has not been enough empirical validation of citizen contributions to SDG monitoring at an indicator level.

As we have clearly observed in our case studies in Lagos and Accra, citizen-generated data and citizen science projects are important initiatives helping to encourage community-based

participation in SDG data collection, stewardship, and sharing. Community volunteers are getting more excited about the role of data in addressing community challenges by negotiating with city authorities using local evidence as well as for implementing and monitoring SDGs. Community-based participation in data generation has the potential not only to democratize data production but also to enhance informed decision-making. Community-led initiatives can thereby provide local evidence about their needs and aspirations which can be used to assist governments to make decisions. In this manner, community-led data generation would be able not only to give visibility to the local situation and priorities of communities but also to align this with SDG indicators which are disaggregated at the neighborhood level, thus helping to implement the principle to "leave no one behind."

For this vision to work though, it will be important to consider carefully how communities are engaged in SDG data generation and usage (de Albuquerque and de Almeida 2020). Citizen data generation can be as much an opportunity for closing existing data gaps, as well as for empowering communities to redefine which aspects of their socio-ecological environments should count as data for SDG monitoring. A frequently forgotten issue when discussing the localization of SDGs is that the definition of what counts as data for a given SDG indicator may depend on the context and is frequently open for varying interpretations (Ulbrich et al. 2019). In this manner, in addition to the important aspect of strengthening the institutional capacity of statistical offices in African countries to generate and use SDG data, emphasized by actors such as the Global Partnership for Sustainable Development Data, we contend that it will be imperative to think of capacity building for SDG data in broader terms.

Local capacities in citizen-generated data initiatives should be recognized, as well as institutionalized and integrated into government statistics and records. This can only be accomplished by creating enabling political and policy environments for community-led initiatives which integrate them into the co-production of

processes of SDG localization meaningfully (Coaffee et al. 2021; Croese et al. 2021). This implies the need to look for new approaches to dialogue with communities and recognize their particular interests and worldviews instead of instrumentalizing them as "blind" sensors that generate data that is only relevant and intelligible for others (De Albuquerque and de Almeida 2020). Last but not the least, to truly democratize SDG data, we must also decolonize funding for research to ensure that sustainable development data definitions and processes are generated in the global South.

8.8 Conclusion

Agenda 2030 represents a set of ambitious goals which define our collective development aspirations. The aspiration of SDG 11—to ensure safe, inclusive, resilient, and sustainable cities and communities—sits well with the priorities and aspirations of African cities, where rapid urban population growth and urbanization are stretching governance capacity. As such, cities remain the epicenter for the intensification and management of global challenges which are threatening the achievement of the SDGs in Africa.

With less than 10 years left to tackle poverty and inequality amid the escalating impact of the COVID-19 pandemic, climate change, and economic recession, it is imperative to align with the philosophy and principles of SDG 11. The UN Decade for Action hopes to mobilize everyone, everywhere; demand urgency and ambition; and supercharge ideas to find solutions. To achieve this, there is a need to mobilize and partner with governments, businesses, civil society, and communities in knowledge co-design and co-production. Given the fact that existing data in Africa are highly aggregated, largely unreliable, mostly inaccessible, and generally nonspatial, we must move on to a new urban data governance paradigm which makes data Findable, Accessible, Interoperable, and Reusable (FAIR).

The transdisciplinary approach, and the activities used in the SCiLeD project and by extension the IDEAMAPS project, has demonstrated the possibility of identification, mapping, mobilization, and collaboration of various stakeholders in diverse sectors, disciplines, and cities in Africa. The project has also harnessed the strengths of different stakeholders to overcome their weaknesses toward standardizing city-level data-gathering for achieving SDG 11 in Africa. The project further resolved the lack of trust and transparency which have characterized urban data governance in Africa by emphasizing how to simplify existing data ecosystems and value chains among diverse sectors, disciplines, policy actors, civil societies, and the slum communities. The transdisciplinary approach to data collection and governance as exemplified in the SCiLeD project has further generated data that is disaggregated to the neighborhood level by involving community mappers and profilers. The data therefore reflects and responds to local needs and realities and, because it is accessible, has facilitated the use of data for empowering neighborhoods and places to contribute toward specific interventions that are inclusive, innovative, and sustainable. In this way, data is not only useful for tracking and monitoring progress but also for exhibiting the transformative influence and potential toward achieving SDG 11 in African cities by 2030.

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