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Editing by Write to the Point

Cover design and illustrations by BWD Advertising

Available online at [www.sacities.net](http://www.sacities.net)

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# Introduction

*Jonathan Wilson and Jokudu Guya, South African Cities Network*

The smart city approach has been recognised for its wide-ranging principles and flexibility that allow cities to tailor approaches to the local and national challenges facing them. Countries considered to be smart have adapted the smart agenda to respond to local challenges (Mosco, 2019). Similarly, South African cities need to interpret the smart city concept to respond to their local challenges, in particular service delivery, poverty, inequality and poor technology.

This paper series attempts to use practical examples and experiences to work towards an understanding of what a smart city means for South African cities through smart governance. Smart governance, a key characteristic of smart cities, is the central theme of this paper series, as it allows us to explore how the smart city approach can benefit South African cities.

This collection of papers and case studies form part of a larger research programme on innovation at the South African Cities Network (SACN). Its aim is to begin conversations within South African cities about the role and definition of a smart city, and how the concept can be used to respond to urban challenges.

## Smart Cities in South Africa

Globally, smart city strategies have been adopted to manage urban challenges through the use of technologically driven solutions. In both the 2019 and 2020 State of the Nation Addresses (SONAs), President Ramaphosa emphasised the role that smart cities and the Fourth Industrial Revolution (4IR) could play in managing the challenges of urbanisation in South Africa. The smart city vision, which is presented as the solution to South African challenges, is one of high-speed rail, glossy new buildings and cities, and fast technology.

This tech-obsessed approach has led many South Africans to question the value of the smart city in comparison to the country's pressing challenges, such as the housing crisis, water shortages and the widening poverty gap (Marrian, 2020; Areff, 2019; Horber, 2019). Compounding the scepticism about smart cities is the fact that South African cities have different approaches to engaging with the smart city concept. Therefore, before examining smart city issues and projects, it is essential to understand the role of smart cities in a South African context, given that cities, literature, legislation and policy have not defined this understanding.

The SACN has been interrogating the future of cities and their transition to smart cities from 2013, when formal conversations began with the City of Johannesburg (CoJ) about the role that cities should play in becoming smart. Since the President's 2019 SONA, interest in smart cities has been growing, with different organisations and institutions developing projects and responses to the need for a smart city agenda.<sup>1</sup> Yet despite the significant strides made, most smart city responses have been achieved in silos, leaving unanswered the question "What is the South African smart city agenda?". The SACN's contribution to the conversation has been to shift the focus away from international definitions of smart cities, having observed that the least explored discourses are about how smart cities can benefit South African cities (Backhouse et al., 2020).

The South African smart city is not one that focuses on the use of technology or the aesthetic benefits that support global competitiveness (ASSAf, 2020; Backhouse et al., 2020; Petzer et al., 2020;). The South African smart city is one that is embedded in value-driven and locally embedded smart city principles (Backhouse et al., 2020). Municipalities need to drive smart city agendas through their local powers, functions and legislation, while national government needs to guide cities by creating conditions for innovation, supporting implementation through laws and regulations, and inspiring cities to innovate (ibid).

Although Backhouse et al. (2020) make the case for a smart city agenda and provide a useful starting point for defining smart cities in the South African context, what is missing is a clearer understanding of the current city contexts and possible smart city interventions at the local level. City governments are driving smart city projects and interventions, and this existing work needs to be captured because implementation happens at the local level. With the renewed interest from the Presidency on how smart cities can aid many of the country's social,

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<sup>1</sup> Organisations such as the Council for Scientific and Industrial Research (CSIR) have developed a programme of work on inclusive smart cities in South Africa, and ASSAf convened a smart city discussion session to encourage cities to identify challenges that can help inform a smart city agenda

economic, and sustainability challenges, this publication is an attempt to deepen the understanding of smart cities by drawing upon innovative, smart governance practices within the SACN's participating cities, to collectively help inform smart city solutions for South African cities.

## A Governance Framing for Smart Cities?

The role of governance in smart cities is vital given their decision-making power (Pereira et al., 2018). This suggests that a capable government is one that can effectively adopt "smart" principles to respond to urban challenges. As such, the smart city concept provides a different approach to improving how government delivers services or engages with civil society.

With South Africa's governance challenges continuing to worsen in terms of service delivery, urban poverty and inequality, smart governance offers a way forward for South African cities. This publication uses a governance framing, and an understanding of a smart city as one that leverages technology to improve the quality of life in cities, to argue that smart governance is has a foundational role to play in building smart South African cities.

## Understanding governance

Every city needs to achieve a base level of smart administration to ensure efficiency, good governance and service delivery, to support the ease of doing business and provide a positive experience for residents. (Backhouse et al., 2020: 20).

In looking at how smart solutions might aid governance-related issues, what is needed first is a common understanding of governance. While *Government* is the vehicle through which societal interests are pursued, *governance* refers more broadly to the multiplicity of arrangements between elected leaders, societal actors and service providers that make up the system. Governance consists of both governing (through bureaucratic systems and processes) and managing (through political processes) competing public and private interests and stakeholders. The efficacy of governance is measured by the quality of local services and institutions, the democratic participation of local citizens and communities in policy-making, and the accountability of elected and public representatives. Well-governed cities are efficient, manage their finances prudently, are sustainable, and are accountable to their citizens.

Governance can be unpacked through the following four dimensions:

- 1) The *capability of the state*: the capacity to assess, plan, develop and implement innovative programmes to meet local needs.
- 2) *Cooperative governance and the all-of-society approach*: the cooperation between national, provincial and local spheres of government and collaborative problem-solving between local government and the actors that shape cities (communities, the public and private sectors, and learning institutions).
- 3) The *political-administrative interface*: the interactions between the municipal administration and its Council made up of elected councillors representing political parties.
- 4) *Public integrity*: the set of ethics, norms and values expected of public servants in government.

For governance to be effective, the above four dimensions are key pillars. As indicated, the base level for effective governance is a smart administration. Therefore, if smart city solutions are to find relevance in South Africa, they must contribute to effective governance that makes cities more inclusive, more sustainable and productive, and contributes towards transforming their historical legacy. So, what does *smart* governance mean in this context?

## Defining smart governance

Literature often defines smart cities in relation to urban innovation, whereby ICTs are used intelligently to deal with the ever-growing urban problems of cities. Cities are increasingly seeking smart technologies as the solution in a context where governments are required to be more innovative (and reduce operational costs), while operating in a connected environment and engaging numerous internal and external stakeholders in solving societal problems (Janssen & Estevez, 2013).

Early definitions of smart cities premised success on a city's ability to adopt technological solutions. Cities in developing countries, desperate for quick and efficient solutions to their challenges, were sold vendor-led approaches. These often benefitted the smart city technology vendors more than the city residents and broader

society. However, globally, smart cities have begun shifting towards human-centric approaches and definitions of a smart city:

- In Spain, the City of Barcelona has built its smart city around participation and citizen involvement.
- In New York City, participatory budgeting processes have included the use of open platforms to involve urban residents in identifying areas and projects for development.
- In Scotland, Glasgow has installed closed-circuit TV cameras to monitor activities in public spaces through an operations centre, in order to improve urban safety.

*Smart governance* is one of the multiple components of a smart city. It involves using innovation, combined with digital technologies, to improve government service delivery and societal inclusion.<sup>2</sup> Managing the dynamics of smart cities requires new models of governance, as well as strong coordination by government, to support cooperation among citizens, private organisations, non-governmental organisations and other government entities (Testoni & Boeri, 2015). This calls for cities to implement smart governance solutions that use intelligent and adaptive solutions for future decision-making and increase the means for open and participatory government (Scholl & Alawadhi, 2016; Scholl & Scholl, 2014). Building on this, this paper series defines smart governance as *the ability of government to make better decisions through the combination of ICT-based tools and collaborative governance for the purpose of achieving their developmental mandates*.

In examining how smart governance practices can aid South Africa's urban challenges, this paper series argues that smart governance is the foundation upon which alternative smart city solutions can be leveraged. The papers and case studies are used to unpack four themes:

- How **data and evidence** are used to support decision-making for service delivery and policy planning.
- How **participatory citizenship** is promoted through multiple levels of public engagement.
- How governments use **open data** to improve transparency, accountability and communication.
- How governments position **ethics and values** within smart governance framework.

## Key lessons

The papers and cases studies have offered the following key lessons on smart governance for South African cities:

1. Effective data management and systems allow for the proactive use of evidence-based decision-making in cities and should be the foundation of smart city developments.
2. Cities should drive an open data agenda to increase transparency, accountability and communication with citizens.
3. New models of governance are needed within smart cities that place citizens at the centre and go beyond purely information dissemination to active collaboration and participatory citizenship.
4. Smart city development plans must align with existing city strategies, such as the Integrated Development Plan (IDP), to find resonance at a municipal level and drive implementation.
5. An ethical framework needs to be developed that protects the rights and values of citizens within smart city development and avoids increasing inequality and exclusion.

## Overview of the Paper Series

To introduce the paper series, Sireena Ramparsad's paper, "Smart governance in South African cities", examines open urban data as the foundation for building smart cities. The paper seeks to understand the role of urban data management and systems in shaping cities through informed decision-making and argues for the development of open data portals and platforms for smart governance across South African cities.

In South Africa, two cities (eThekweni and the City of Cape Town) have introduced open data platforms (ODPs), which Luke Boyle interrogates in his paper "Laying the foundations for open data in South African municipalities". Although the two cities adopted different approaches, the paper highlights some key lessons for cities seeking to implement smart governance initiatives such as ODPs. The aim of the paper is to help pave the way for other metros in South Africa to experiment with similar initiatives.

As these papers show, many South African cities have adopted the "smart city" idea, but the citizen voice is largely absent in smart city policies and plans. This is the focus of Kevin Foster's paper, "Smarten up: Paths to bottom-up smart cities the risks of top-down smart governance". The paper argues cities have adopted a top-

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<sup>2</sup> <https://intact.org.za/themes>

down approach, which does not encourage participation and carries the risk of deepening inequality. Instead, cities should adopt a bottom-up approach and learn from initiatives by civil society and NGOs how to use technology to put citizens at the centre of participatory governance.

The fourth paper compares smart city initiatives in the City of Cape Town and the City of Johannesburg through the lens of local government policy tools – the IDP. In “Unpacking smart city development in Cape Town and Johannesburg”, Rashiq Fataar uses the cities’ IDPs to understand where smart city visions find resonance at the local level. An initiatives-based framework is used to assess the smart city initiatives, with the objective of offering insight into the thinking behind smart city strategy and project development in South Africa.

The last paper in the series, “Applying an ethical lens to smart applications” by Monique Damons, explores the ethical challenges facing cities in South Africa. While the smart city approach is seen as a way to improve service delivery and citizen inclusion, the moral and ethical implications have largely been neglected. The paper proposes a possible formative ethical framework, as a starting point for examining the impact of smart urban development.

In addition to these papers, further insights are provided through four case studies, which highlight smart city initiatives that seek to improve decision-making, resource management, public transport and waste management.

1. The Durban EDGE ODP uses dashboards and stories to present data and insights on eThekweni. It is an example of using technology to provide accessible and valuable information to decision-makers and other stakeholders in a manner that is interactive and up-to-date.
2. The Community Tapestry is a multi-sectoral, evidence-based, decision-making tool for social development and spatial transformation, developed by the Social Surveys Institute. It is an example of a tool that improves resource management, as users are able to access multiple layers of detailed social and economic information at a precinct scale.
3. Go Metro is an app that was developed to improve public transport in South Africa and responds to the need to monitor fleet and access public transport more conveniently. The case study demonstrates how the app was used for the University of Cape Town’s Jammie Bus Shuttle service.
4. The City of Johannesburg uses smart governance tools to communicate with citizens and encourage public engagement and collaboration. This case study suggests the adoption of smart governance approaches to improve the City’s solid waste management.

These papers and case studies emphasise the importance of a bottom-up approach and a nuanced, context-specific smart city agenda. It is hoped that they will encourage debate and stimulate thinking about the meaning of “smart cities” in South Africa and smart governance solutions to the challenges facing cities.

Moving forward, the outcomes of this paper series will be used in combination with the SACN’s discussion paper on smart cities (Backhouse et al., 2020), to inform the terms of engagement with smart city stakeholders within the SACN’s participating cities and national and civic partners. The success of these engagements will drive further research into the other components of the smart city (smart environment, smart mobility, etc.) and assist in the collaborative drive towards smart and sustainable cities and settlements in South Africa.

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# Smart Governance in South African Cities

*Sireena Ramparsad*

## Introduction

Smart city principles and initiatives are shaping South African cities through the use of urban data to improve smart governance and evidence-based decision-making. This happens at different levels of sophistication among South African cities that are responding contextually. The concept of smart cities evolved from being techno-centric to being people-centric, where technologies are used to tackle social problems. Central to smart cities is smart governance, which includes citizen participation in sustainable collaborative processes based on ICT and urban data. Important drivers are data exchange and communications, while key factors of success are stakeholder relations, the ability to cooperate, and the structure of the collaborations.

This paper provides an overview of the status of data management systems in South African cities, with an emphasis on how to embed data management and systems within local government. It also makes the case for using data as a tool to understand the status quo of economic and social activities and to make decisions. The paper seeks to understand the role of urban data management and systems in shaping cities through informed decision-making, as well as the current ecosystem giving light to challenges facing cities in implementing/adopting smart city developments linked to smart governance.

## Urban Data for Decision-making

Cities are complex, with many interconnected systems (human, digital and physical) and areas where ICT can play a pivotal role in future development. Data is collected in some form or another on the daily functioning of every dimension of a city, from city management to economic, social and physical activities and infrastructure. The aim is to reach government's socially driven goal of improving quality of life and managing day-to-day city operations to ensure such quality is upheld for all citizens.

Urban data, which is also referred to as urban informatics, is defined as "a resource that is the basis for informed decisions in daily administrative business on optimizing urban processes and/or the usage of urban resources, in strategic decisions on urban development, etc." (Lammel et al., 2016: 1). Data drives city strategic planning and assists city managers with decision-making. It enables better inter-departmental and inter-agency operations, more efficient interaction with citizens and the benchmarking of city processes and resources (e.g. response times to complaints), all of which lead to improved services and support to citizens (Deloitte & Touche, 2015).

Urban data is available in many types and formats, from sensor systems to user-generated content, government data, private sector data, arts and humanities data, and a blend of data (Thakuria, 2017). To understand the extent of data sources and how they are used in practice, Table 1 provides examples for each data type and their users.

**Table 1: Types of urban data and user communities**

Type of Urban Data	Examples	User Communities
Sensor systems (infrastructure-based or moving object sensors)	Environmental, water, transportation, building management sensor systems, connected systems, Internet of Things	Public and private urban operations and management organisations, independent ICT developers, researchers in the engineering sciences
User-generated content ("social" or "human" sensors)	Participatory sensing systems, citizen science projects, social media, web use, GPS, online social networks and other socially generated data	Private businesses (use this data to inform marketing strategies, customer/ client-focused strategies), public organisations, independent developers, researchers in data sciences and urban social sciences
Administrative (governmental) data (open and confidential micro-data)	Open administrative data on transactions, taxes and revenue, payments and registrations; confidential person-level micro-data on employment, health, welfare payments, education records	Open data: innovators and researchers Confidential data: government data agencies, urban social scientists involved in economic and social policy research, public health and medical researchers
Private sector data (customer and transactions records)	Customer transactions data from store cards and business records; fleet management systems; supply chain systems, customer profile data from application forms; usage data from utilities and financial institutions; product purchases and terms of service agreements	Private businesses, public agencies, banks, independent developers, researchers in data sciences and urban social sciences
Arts and Humanities Data	Repositories of text, images, sound recordings, linguistic data, film, art and material culture, and digital objects, and other media	Urban design community, historical, art, architecture and digital humanities organisations, community organisations, data scientists and developers, private organisations
Hybrid data (linked and synthetic data)	Linked data including survey-sensor, census-administrative records	Urban planning and social policy community, government data organisations, private businesses and consultants

Source: Thakuriah (2017), Author (2020)

Decision-makers use the different types of data presented in Table 1 to understand their respective markets, target interventions and optimise scarce resources. For example, government uses administrative data (records and information) to inform its resource and infrastructure planning, while private companies use user-generated content to align strategies and supply-chain triggers based on affordability and preferences. Data enables better governance and can result in improved infrastructure and resource planning, internal performance management and budgeting and prioritisation. Some examples of the data used by cities to make decisions are provided below.

- Most major cities make information accessible on their websites and through online e-services tools. Cities can use data collected through their website to respond to citizen needs, which improves governance. For example, in eThekweni, citizens can use an online form to report faults at the electricity department and email regular meter readings to the municipality.
- The eThekweni Municipality is one of two cities in South Africa to develop an open data platform.<sup>3</sup> The platform is a repository of data gathered from local municipal departmental databases and economic forecasting platforms such as Global Insights and Quantec. Developed by the Municipality's Economic Development and Investment Unit, the platform's aim is the dissemination of economic intelligence and insights, to enable informed decision-making.
- Cities use geographic information systems (GIS) to spatially map information about infrastructure, services, population and household densities etc., to assess service provision and equitable service delivery, and to direct capital investments. The eThekweni Municipality uses GIS data for planning the provision of social and community services. Its GIS shows the agglomeration of economic and social activities, and spatially illustrates where (for example) concentrations of unemployed people are situated. The data inputted into the system is sourced from various datasets including the National Census, municipal mapping and shapefiles from the land surveying department. The system also produces spatially referenced plans for different stakeholders, such as crime blocks for sector policing by SAPS and Metro police, as well as maps for land transaction processes that can be used by the internal Real Estate department for negotiations.
- Cities can use data gathered through public participation to inform policy development and future planning. The City of Johannesburg's Nodal Review Policy reviews nodal boundary changes using data collected from a public participation process and a modelling exercise. The aim is to align current planning to SPLUMA and other planning documents, to respond to current realities in the City and to provide a strong foundation for evidence-based planning. Data was collected from three groups: interested and affected stakeholders (developers, consultants, associations, city departments, etc.), the general public, and the internal planning department, and then collated using GIS, and analysed.

<sup>3</sup> See the paper by Luke Boyle (page 14).

## Urban Data in South African Cities

Urban data is still in its infancy and lacks depth and maturity. In South Africa, country-wide data is available from various sources, including the Stats SA (National Census); credit bureaux; deeds offices; economic and financial reporting platforms, such as Quantec and Global Insights; national departments, such as the Department of Human Settlements, Water and Sanitation; private organisations and NGOs that collect and present data. Within municipalities, departments produce a range of datasets relating to citizen transactions and utility usage. However, despite the many sources and types of data available, there is no coherent, sustainable and consistent data culture and strategy across municipalities in South Africa.

The general lack of data maturity inhibits smart governance by undermining the ability of local and national government to make informed, empirical-based decisions. The reasons for this lack of data maturity include the limited emphasis placed on using data for decision-making, not working hard enough to make data and information available to the citizens (lack of transparency and openness), few data champions, limited ICT systems, inefficient (and often manual) data collection, and no measuring of data progress. Table 2 summarises the key data governance challenges faced by South African cities that hinder smart governance and smart city development initiatives. The challenges are assigned to six different yet related categories: technological, methodological, theoretical, political and inter-governmental reporting, as defined by Thakuriah (2017).

**Table 2: Key data challenges for cities**

Category and characteristics	South African cities
Technological Urban information management (internal and external) Information generation, capture and processing Data archiving, curation and storage Dissemination and discovery	One of the key challenges in South Africa is lack of centralised and integrated data management systems across all departments at a municipal level for data to be collected and reported on. While these sometimes do exist in different organisations, it is often used in silos in formats specific to the organisation which cannot be borrowed. In addition, the lack of capacity and expertise to do this is amiss with data champions being scarce if at all available. eThekweni Municipality has recently appointed a Chief Digitisation Officer
Methodological Data preparation: information retrieval and extraction, data linkage/information integration, data cleaning, anonymisation, quality assessment and credibility Urban analysis: methods for data-rich urban modelling and data-driven modelling; ascertaining uncertainty, biases and error propagation	IT soft and hard infrastructure and systems and data strategies are not explicit within and across departments and often not prioritised. Cities lack the skills, e.g. statisticians and personnel to determine the reliability and integrity of data. Different city departments have their own reporting platforms, which leads to inaccurate and inconsistent data. Municipalities adopt different approaches to data collection, which results in a lack of consistent coverage across data indicators.
Theoretical Understanding metrics, definitions, concepts and changing ideologies and methods to understanding "urban" Determining validity of approaches and limits to knowledge Deriving visions of future cities and the links to sustainability and social justice	South African cities do not have a common theoretical approach The lack of knowledge about data collected across departments and indicators used per department allows for data to be sourced from private data providers at a cost.
Political Data entrepreneurship, innovation networks (relationships) and power structures Value propositions and economic issues Data access, governance framework and provenance Data confidentiality, security and trust management Responsible innovation and emergent ethics Data sharing Budget and capacity constraints	Strategic managers and politicians do not understand the value of data. As a result, most municipalities either do not have a data manager position or appoint one on an ad-hoc basis, end up paying for data that they may already have, and paying service providers to analyse information that must be sent to provincial and national government. Municipal departments are resistant to the sharing of data, while national departments are not always willing to share information with municipalities – and yet this is often a key missing element that can ease municipal burdens of data collection and/or reporting. Legislation drives the restriction of data sharing. Without the correct legislative support, data cannot be shared to those municipalities or departments that need access. Even when partners have data that can be shared, they lack the necessary relationships and communication with stakeholders who can benefit from the data.
Inter-governmental reporting Reporting to provincial and national departments	Cities are heavily over-burdened with compliance reporting and data requests from other spheres of government. This often results in the outsourcing of important data processing and analysis, which costs money and jeopardises the quality of the analysis. At an intergovernmental and interdepartmental level, there is a lack of data integration of data and protocol sharing. Differing departmental mandates within a city result in fragmentation and duplication of efforts and inconsistent reporting.

Source: SACN (2017); Thakuriah (2017); On-line Survey (2020)

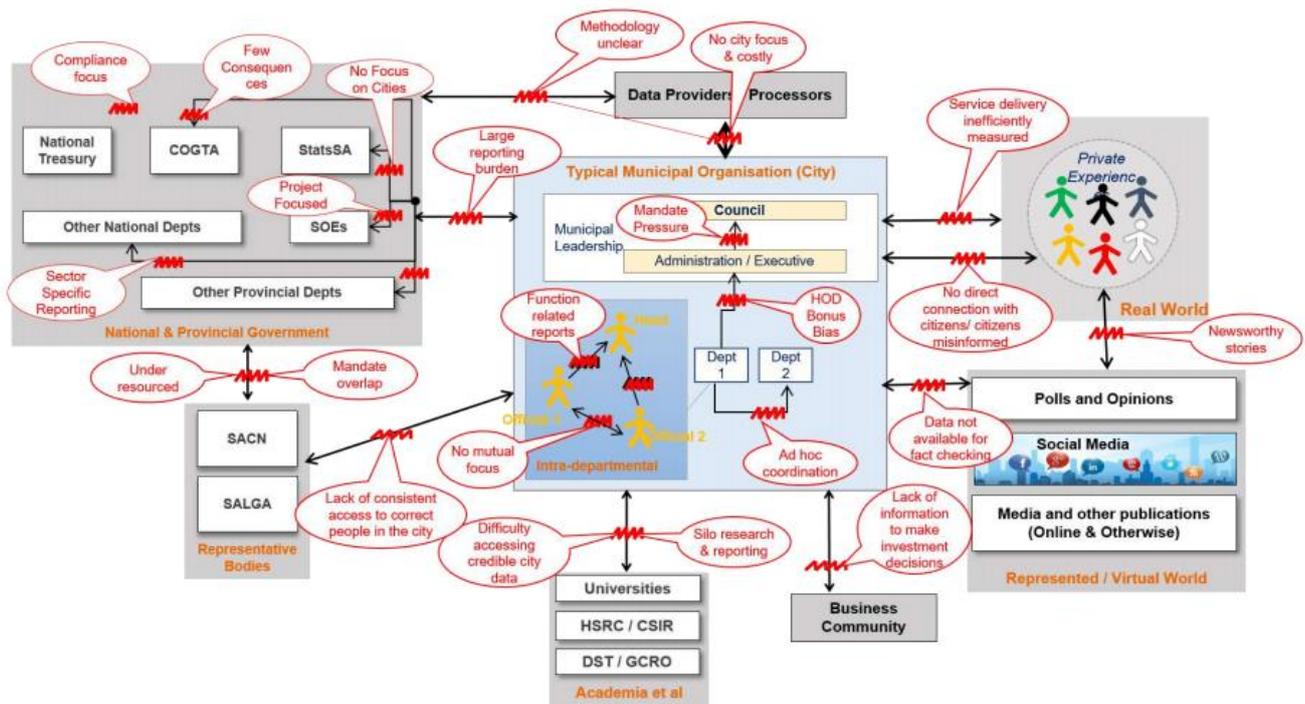
To address the challenges with city-level data in Table 2, in 2017, the South African Cities Network (SACN) produced the Common Data Framework for Cities (CDFC) Business Plan in partnership with its participating cities. Noting that cities face challenges with collecting, efficiently analysing, using and managing data, the CDFC is intended to guide cities by establishing a reference list of city indicators and definitions, an online platform for city indicators, working groups for peer learning, templates for reporting requirements, as well as facilitating capacity building.

The following components have been developed:

- The Code Book, which is a set of common indicators and statistics among cities.
- SCODA (South African Cities Open Data Almanac), which is an open source information system.
- SACCD (the South African Council for City Data), which facilitates the implementation of the framework.

Figure 1 shows an example of a South African city's data ecosystem,<sup>4</sup> extracted from the CDFC. It is merely a rough rendering, to begin to understand the South African data ecosystem, and is not intended as a true reflection of any particular city in South Africa. Nevertheless, despite only beginning to show some of the relationships between different administrative sectors and stakeholders, the ecosystem is useful for understanding the flow of information and some of the shortfalls. What is apparent is the wealth of information sources available – the CDFC found that cities must report on over 2000 indicators a year to provincial and national departments. However, the extent to which these indicators are used to inform decision-making is unknown.

Figure 1: Example of a South African city's data ecosystem



Source: SACN (2017)

While the CDFC's focal point is on municipalities, the private and NGO sectors need to be included in the economic and social strategies of assistance. Ownership taken at all levels in a municipality is of utmost importance when addressing data management system integration, capacity building and improving general data culture. The task of improving data culture needs to be complemented by uninterrupted network systems and infrastructure and access to software.

<sup>4</sup> In an attempt to understand the city data environment, this rendering by SACN was informed by SACN engagements and work with participating cities.

## Managing Data to Drive Decision-Making

The data challenges highlighted above hinder cities from becoming “smart cities”, as data is the key to understanding urban environments. To better manage city planning going forward, cities will need to work with data in a more systemic manner, which will require capacity, knowledge management, data champions, working groups, open data platforms and an improved data culture. In improving data management, five steps need to be followed internally to convert the collected raw data into intelligence that will inform decision-making:

- Data collection: identify, clean and collate data, and protect sensitive information.
- Data publication: publish and disseminate data in a way that is openly accessible with appropriate permissions and supporting documentation.
- Data uptake: Connect users to data and incentivise officials to incorporate data into decision-making.
- Data impact: Define data-driven policies and decision-making.
- Measure success and performance of data impact and address key gaps.

Table 3 lists potential actions that can be taken at each of the five steps identified above to address challenges facing South African cities in better managing data for decision-making.

**Table 3: Potential actions to address identified challenges**

Category of challenge	Potential actions	Data collection	Data publication	Data uptake	Data impact
Technological	Database and open data platforms Collaborative data strategy Data champion (need to define authority and accountability) Data management systems E-services	X	X	X	
Methodological	Capacity building on data culture Quality management and control of data Data protocol	X	X	X	
Theoretical	Data champion and strategy Road show to explain data requirements in context	X	X	X	
Political economy	Relationship building and networking between departments Access and confidentiality policies Buy-in and uniformity	X	X	X	X
Inter-governmental reporting	Data requirements to be understood between departments, formats need to be determined and efforts streamlined Data champions needed	X	X	X	X

To successfully manage data, the following aspects should be taken into consideration:

- A process to identify, clean and collate data, with a data privacy policy to protect sensitive information.
- A process to classify data and store data, using a standardised format that is accessible at an interdepartmental and intergovernmental level.
- The publication of data in a user-friendly manner, with appropriate permissions and supporting documentation.
- The instillation of a data culture, through ongoing data sensitivity and awareness training/capacity building.
- A monitoring and evaluation framework and programme.
- Decision-making based on data for understanding civic challenges.
- The development of a data protocol that is aligned to the monitoring and evaluation programme.

Cities can be guided by various examples of data standards, indicators and platforms, including:

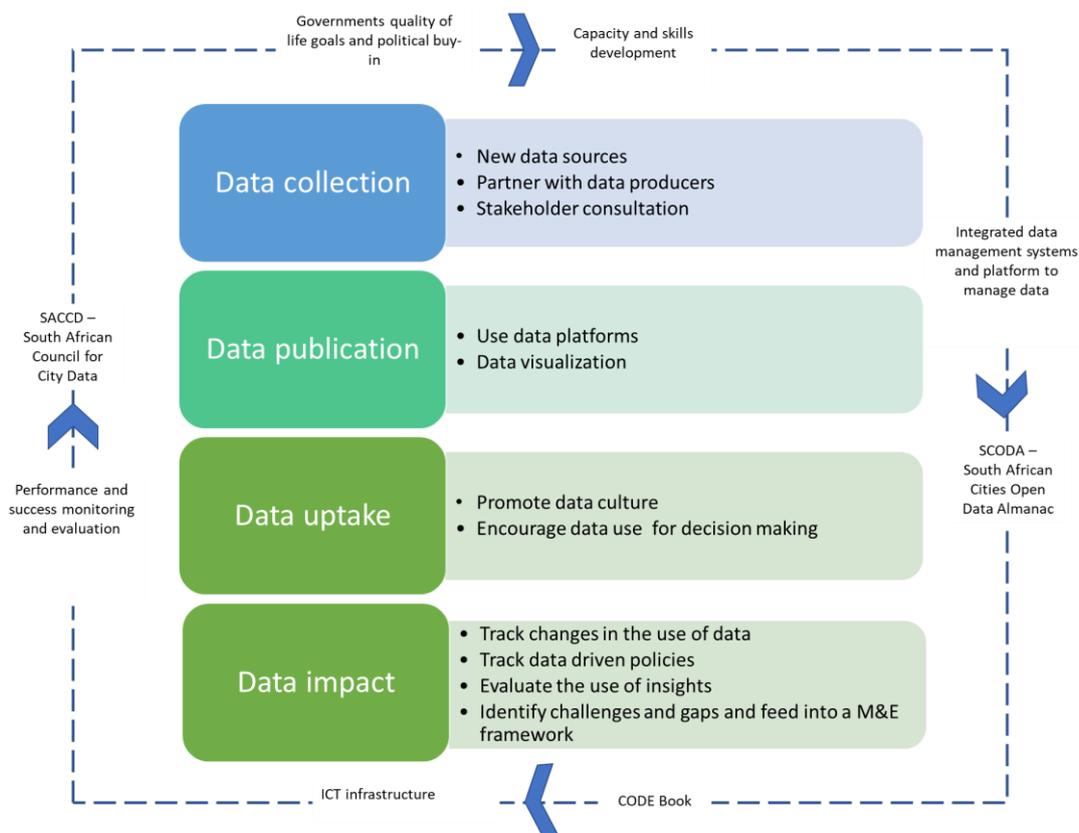
- The International Monetary Fund’s Data Quality Assessment Framework (DQAF), which is a good example of data quality standards.
- The ISO Standard ISO 37122:2019 for sustainable cities and communities, which provides indicators for smart cities.
- “The Code Book”, published by the SACN, which contains a growing list of common city indicators and associated metadata.
- Platforms: Innovate Durban’s [innovators dashboard](#), Open Cities Lab, [South African Cities Network SCODA Open Data Platform](#), eThekweni EDGE portal and Centre for affordable housing finance in Africa’s online [dashboards for examples of open data dashboards](#).

## Conclusion

Data management is the foundation of smart cities. Data enables better governance and can result in improved infrastructure and resource planning, internal performance management, and budgeting and prioritisation. However, in South Africa urban data lacks maturity. Cities may have access to many types of data from many sources but lack a coherent and consistent data culture and strategy across municipalities. To address challenges with city-level data, the SACN has produced a common data framework for cities and an open data almanac.

If cities are to leverage smart city initiatives, such as metering and automation, and to promote a data culture and data maturity in decision-making, an understanding of data management and improved data management systems are necessary. Figure 2 illustrates a suggested data management framework, which would assist cities to improve capacity, provide a central open data platform, and define uniform indicators and platforms for stakeholder engagement.

Figure 2: Proposed data management framework



Source: Author (2020)

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# Laying the Foundations for Open Data in South African Municipalities

Luke Boyle

## Introduction

Municipal governments across the globe are forced to address increasingly complex mandates, social inequalities and economic growth in a context of unprecedented environmental and economic uncertainty (Baud et al., 2014; Tomor et al., 2019). In Africa, these complexities are exacerbated by accelerating rates of urbanisation and the subsequent proliferation of urban poverty. As a result, African municipalities are progressively looking towards technological interventions to assist in efforts to exploit the opportunities and address the challenges emerging in a rapidly urbanising continent. To this end, smart city development in Africa has become an increasingly topical field, and many African cities have embarked on exciting digital journeys in pursuit of grand visions of urban futures.

Technology can support the co-production of urban strategies and implementation, and bring much-needed non-government resources to support the state. This new collaborative approach to urban development, where “government is a platform”, requires a radically different view of how a city operates in order to accommodate the engagement between technology, citizens, institutions and the built environment. Urban data platforms are central to this “government as a platform” agenda (Barns, 2018: 7), providing the medium on which to base collaborative problem-solving. Municipal governments are essential for the development of urban platforms, as they produce vast and diverse urban-related datasets that could be made available for public use. This is typically done through online repositories, which are commonly known as Open Data Portals (ODPs). Interest in ODPs has exploded. ODPs provide opportunities for municipal governments to develop meaningful solutions to intractable urban problems, to support economic development, and to open up government institutions, so that they can be held accountable to their constituents. Consequently, ODPs are seen as a necessity for any modern city looking to remain relevant and competitive in the data age.

The allure of smart city development and ODPs is firmly on the political agenda in South Africa, and several municipalities have already embarked on ambitious plans to drive economic and urban development through open data. However, these initiatives have been largely untested in a context of overburdened and fragmented municipal governments with little experience and acumen in driving comprehensive data strategies. To this end, this paper is based on two case studies<sup>5</sup> that examine ODPs instituted by the City of Cape Town and eThekweni. These two cities are the only municipalities in South Africa that currently have ODPs in place. Although the generalisability of these case studies is limited, they provide some understanding of what is required to establish successful ODPs in South African municipalities. In doing so, this paper intends to help pave the way for other metros across the nation to begin experimenting with initiatives that support models of smart governance.

## Background

### Smart cities and smart governance

For the purposes of this paper, a smart city is understood as a city that leverages the strategic use of enabling technologies to support key urban development objectives. Central to this concept is smart governance, with its principles of open information sharing and use, collaborative decision-making, and improvement of service delivery through the support of intelligent technologies (Gil-Garcia et al., 2014). Municipal government’s role in smart governance is to provide the vehicle to set up the platforms, plans, policies and procedures to enable the city, as a collective, to solve problems and function efficiently (The Innovator’s Forum, 2019). The desired outcome is increased input and feedback (involvement) from citizens and businesses within a city, where decisions are made and services are delivered via a two-way exchange of resources and ideas, which increases a city’s capacity to deliver/facilitate services and make effective decisions.

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<sup>5</sup> Data was collected through semi-structured interviews with key stakeholders involved in Open Data and Smart City projects in the study cities who were selected using expert sampling and included: ICT consultants, city officials, and members of NGOs. This data was complemented by secondary data, in the form of policy documents and online sources. NVivo was used for the qualitative analysis of the data to identify emergent themes.

On a practical level, this requires creating a medium where information and ideas can be openly exchanged by urban actors, particularly citizens, in order to collectively and collaboratively provide solutions to urban issues. One way is through a central platform containing data from various sources that can be openly accessed, distributed, modified and used by anyone without restriction or cost – these are the central principles of open data. Open data does more than simply provide significant opportunities for civic participation; it also drives accountability and transparency, and is considered a key component of smart city development. Indeed, the definition of a smart city is shifting to include open data as a central theme, with an open data portal seen as crucial to facilitating the practical integration of relatively abstract smart city goals (Barns, 2016).

## Open data and its role in smart city development

Data has long been used as an input for making informed decisions pertaining to cities (Kitchin, 2016). However, with the explosion of networked digital technologies brought about by the Fourth Industrial Revolution (4IR), cities are beginning to look at new and innovative ways of using data to improve the well-being of people living in cities. Data-driven urbanism is now considered to be the key mode of production for smart cities (ibid). New data-driven techniques provide invaluable insights to municipal officials looking at allocating resources effectively and responding to the growing needs of urbanising regions. Data can also enable new modes of urban governance and facilitate more efficient, sustainable, competitive, productive and open cities (Ju et al., 2018). Indeed, data is increasingly being seen as one of the cornerstones that can weave together the requirements and desires of smart cities (Dlamini, 2019).

Municipal governments produce a significant, broad array of data that is relevant for investigating urban issues and optimising how urban activities are governed and managed.<sup>6</sup> Municipal governments will be required to play a much more active role in managing their data assets that will also augment the role of government as a platform provider (Barns, 2016). Open data is widely propagated as a means of strengthening the collective intelligence of cities by enabling companies, innovators, non-governmental organisations (NGOs) and citizens to extract value from this data. (Meijer & Bolívar, 2016).

Open data refers to data that is publicly available and structured so that it can be used, reused or modified by anybody, for any purpose, without any legal or licensing restriction (Barns, 2016; Dvir, 2018). Open data can be produced by governments, non-profit organisations and even corporate entities. However, it is largely understood as government data. Governments are considered to be the central drivers of open data because they provide the policy mechanisms that enable open data and sit on vast amounts of data that has public value. In the context of city government, the term “open data” refers to city data that is made available to the general public, typically through an online platform. A primary intention is that the data will be used to better solve collective problems and drive innovation in service delivery. The benefits of effective ODPs include the following:

- They provide opportunities for economic growth and development in cities, creating market efficiencies and attracting investment, as well as paving the way for data-driven practices to frame responses to challenges facing urban governance (Boyle, 2019).
- They promote greater citizen engagement by granting citizens access to information about their local government area and government services.
- They drive transparency of public institutions, thereby creating a certain level of political accountability (Barns, 2016).

Today, open data is regarded as one of the most important public policies. Therefore, it is not surprising that ODPs are viewed as a top policy priority for cities looking to remain competitive and attract talent and investment. Yet despite the importance and benefits of ODPs, these initiatives are still novel and the impact, barriers and opportunities of ODPs at the municipal level are not understood (Conradie & Choenni, 2014). This research attempts to respond to this by contributing to the limited research relating to ODPs in municipalities in South Africa.

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<sup>6</sup> For more on this topic, see paper by Sireena Ramparsad (page 7)

## The Case Cities: Cape Town and eThekweni

### The City of Cape Town – Open Data Portal

In 2015, the City of Cape Town (CoCT) was the first city in Africa to launch an ODP and is possibly the only municipality in South Africa that has the in-house infrastructure and skills to establish an ODP without outside assistance. The CoCT is largely considered to be a leader in innovative governance practices among South African municipalities, and so there is pressure to maintain this identity and the resources and institutional maturity to allow such initiatives to develop more organically. The motivations were underpinned by a strong commitment to making data open and fostering transparency within the city, while also transitioning towards a more data-driven organisation.

The CoCT appears to have prioritised getting out as many datasets as possible that can be used for a multitude of purposes. Therefore, the city's ODP is arguably quite supply-side driven, as shown by the number of datasets (142) currently available on the portal. These datasets are grouped into 15 categories, ranging from finance and economic development, to transportation and spatial planning.

### eThekweni – Durban EDGE ODP

Durban EDGE (Economic Development and Growth in eThekweni) is an ODP that was established through eThekweni's Economic Development and Investment Unit. The unit's aim is to provide intelligence and insights about the city's economy in the hope of enabling informed decision-making that will support economic development, economic transformation and job creation. The Durban EDGE portal<sup>7</sup> was developed as a means of disseminating the unit's economic intelligence to a broader audience. Thus, its development was primarily motivated by a need to provide more effective mechanisms for sharing information. However, interviewees intimated that the project also gained support because it was perceived as enhancing the city's status as a municipality proactively engaging with smart governance programmes.

The Durban EDGE portal currently has 14 datasets available. These datasets relate specifically to economic aspects of the city, such as labour data, property data, electricity data, business licensing data, and educational data. Lacking the skills and capacity to implement a broader open data programme, eThekweni deliberately kept the portal small and enlisted the help of partners, Open Cities Lab (OCL) and the South African Cities Network (SACN), who were critical to the establishment of the portal. A unique attribute of the Durban EDGE ODP is that it has considered end user requirements – the data provided and the way in which it is provided are influenced by what economic intelligence people want to see. This is exemplified by the portal's dashboard, which visually represents the city's key economic indicators, enabling access to quick and easy economic intelligence without having to download and analyse lengthy and complex datasets.

## Findings

### The institutional benefits of open data

ODPs are about sharing information externally, as well as optimising information usage within municipal governments. A direct result of establishing an ODP is an improvement in how municipal governments operate. The process of opening data establishes procedures for internal alignment and cross-departmental synergies, which breaks down institutional silos and improves efficacy and efficiency. It leads to capacity building in data, skills development and the opening of channels for data analytics and evidence-based decision-making. The journey of opening data also forces municipal governments to consolidate their data and develop better, citywide strategies for data governance. Another aspect is that ODPs within public organisations foster internal transparency and accountability, which is sometimes more effective at improving public processes than being open to public scrutiny.

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<sup>7</sup> For further details on the Durban EDGE Platform, see case study by Jokudu Guya and Jonathan Wilson (page 43).

## Institutional barriers to open data portals

Although the Cape Town and eThekweni ODPs have different objectives and scale, their implementation requires similar institutional and technical arrangements. Challenges include limited capacity and skills and the institutionalisation of open data practices.

- **Limited capacity and skills:** Establishing an ODP requires a lot of upfront work, which overburdened and underfunded South African municipalities may have difficulties in resourcing. The data needs to be collected, cleaned and organised, which takes a lot of time, and systems need to be established to pull data across various city agencies. Other requirements include digital skills across the city government, technical skills to build the digital infrastructure, and data science skills to curate city data so that it is usable by the general public. Resourcing the above activities in Cape Town and eThekweni was challenging, and some cities just do not have the skills to implement an ODP without significant support from outside of the public sector.
- **The institutionalisation of open data practices within city governments:** The lack of a common understanding of the importance and value of data and open data is the main barrier to embedding open data practices in the operations of every city department. Extracting data is difficult when departments are siloed and not used to collaboration, and may even be territorial with their data. Both Cape Town and eThekweni struggled to match open data requirements with their organisational structure and operations. Another barrier is that politicians and city officials are reluctant to embrace open data because of the fear that opening data to the public and to other city agencies and spheres of government (provincial and national) may lead to a greater level of scrutiny. However, an encouraging finding was that cities are having to become more proactive about open data because of pressure to make data open – this illustrates how open data is succeeding in making city governments more accountable.

## The importance of political support for open data

A crucial element is to have open data champions in city government, ideally sitting at the political level because politicians have more influence and licence to take a risk on an untested intervention. For instance, the Mayor heavily supported and championed the City of Cape Town's ODP at the time of its launch. Having a political champion can create the policy commitment to lay out the practices, protocols and budget assignments, and to develop the necessary skills to launch an effective ODP. Although this can be achieved, to some degree, at the administrative level, the journey is a lot longer and harder because city officials will struggle to overcome institutional barriers without political support. Challenges in gaining political support for ODPs often relate to the difficult balancing act municipalities must perform as they respond to the myriad pressing priorities in cities. However, the research found that aligning ODPs to development objectives or institutional goals assists in garnering political support.

## Civic participation and accessibility and relevance of open data

A fundamental issue to emerge from the research was civil society's limited participation in ODPs, especially related to the accessibility and relevance of open data. Accessibility refers not only to the ability to access the data through the portal but also the ability of the open data user to understand and utilise complex datasets. For example, CoCT budget data is very complex and requires an in-depth knowledge of municipal procurement systems. As a result, many important urban stakeholders do not engage with municipal open data. This brings into question the "openness" of data and open governance principles when only a few highly skilled people use the open data. In terms of relevance, the CoCT's ODP has been criticised for focusing on supplying open data that does not consider the data needs of citizens. Compounding the situation is that municipalities lack awareness of the channels through which citizens access information, which is not typically through ODPs. Open data needs to be accessible and useful to its users. To address these issues, the Durban EDGE ODP offers a dashboard, providing both the complete datasets and more digestible information that does not require analysis. As a result, eThekweni has been better able to align datasets with citizen demand, although the narrow focus does mean that the portal lacks applicability in a broader sense.

## Lessons for Other Municipalities Looking to Implement Open Data Portals

### Open data is about institutional change, not technological advancement

What is clear from the case studies is that it is not enough for a city to have an open data policy. Implementing an open data policy requires supportive structures, skills and institutional/political commitment. Therefore, municipal governments must recognise early on that ODPs and other smart governance initiatives hinge on developing the institutional requirements necessary to unlock the full potential of innovative new models of governance and technology. The first step is to look at the institutional structures required to execute an ODP and how to align the ODP to their current structures. Municipalities should view the establishment of an ODP as an institutional capacity-building project with a smart governance outcome. This would entail getting the right skills in place, aligning the institutional structures with open data and creating better integration among departments.

### Municipalities need to embed the principles of open data

The central feature of an effective ODP is having a city government that can easily share and store data across city agencies. Therefore, cities need to look at ways of developing the structures and practices that support this objective.

- **Have a champion and a data governance strategy:** Any city serious about implementing a successful ODP needs a dedicated team or department that is responsible for establishing and operating the portal. *At the political level*, a champion is needed who can link ODPs to the broader development goals set out by the IDP or other policies, thereby creating the “business case” for open data. *At the administrative level*, a data governance strategy is needed, which aligns the political objectives of data and ODPs with an overarching citywide strategy, and outlines municipal data practices and protocols. Awareness of the value of open data can be created through linking open data to departmental mandates, key performance indicators (KPIs) and city administrative functions. A data culture within city government is also needed.
- **Demonstrate/illustrate the value of open data:** To be sustainable requires more than having policy mechanisms in place. What is needed is for the city, as an institution, to value the concept of open data, so that an army of city officials can rally behind the programme and ensure its success. The best way to get officials to buy into open data is by demonstrating how better data governance can improve the way they work and the way the municipality as a whole works. Demonstrating value can be something as simple as showing a department how recording their data in a coherent format allows another department to analyse that data and provide useful insight, which can be used to improve their function.

### Municipalities need to be strategic about open data

South African municipalities have significant service delivery backlogs and resource constraints, and so there must be a clear and obvious need to support open data, especially if it means diverting resources away from priorities, such as sanitation and housing provision. Cities need to examine their core priorities and rationalise the prioritisation of open data. They then need to define their capacity and requirements for supporting open data as a city priority. Some municipalities may need significant resources, which may not currently be a realistic or appropriate aspiration. Therefore, city governments should have a deep understanding of their context and what they hope to achieve with an ODP, to examine whether it is the most appropriate use of public funds and to manage their ambitions and expectations around open data.

- **Develop partnerships:** Most South African cities do not have the skills and infrastructure to execute an ODP. Partnerships help capacitate government by transferring data skills, as shown in eThekweni where crucial partnerships provided the skills, consultation and resources to develop the Durban EDGE ODP.
- **Understand that open data is an incremental process:** A comprehensive ODP takes years of commitment and various iterations – it cannot and should not be built in a day. Furthermore, cities do not need to have an all-encompassing ODP in its first iteration. In fact, as the eThekweni case highlights, it is often preferable to work within municipal limitations to produce something that is well-formulated and then build from a firm (but small) base.

## Balancing demand side and supply side of the open data equation

When devising strategies to open up municipal data, the supply and demand for open data are equally important considerations. There needs to be a commitment to engage with “openness” and make as much data available to the public as possible, as well as a recognition of the data needs and utilisation of data by various citizens. This means considering how citizens interact with data and which channels they use to access information. This balance underpins the utility of the ODP, which should be a fundamental objective for municipalities. In essence, smart governance is about creating an enabling environment for citizens to engage with city governments and collectively solve urban issues. Therefore, smart governance in South Africa needs to go beyond just providing a platform and reflect deeper considerations related to facilitating the use of, and engagement with, such a platform.

## Conclusion

ODPs are a staple for any democratic government institution in the modern age. As such, developing these portals in South African municipalities is an important aspiration. The two cases have illustrated the great work that some South African municipalities have undertaken to engage meaningfully with smart governance and open data. The two municipalities took different approaches towards developing their ODPs: Durban went small and did something well-considered that pivoted centrally off partnerships, whereas Cape Town’s experience is characterised by its in-house expertise and an ambitious commitment to opening up and providing a large number of datasets.

As is often the case with smart city transformation around the world, the research found that what holds South African municipalities back is not an inability to meet technological requirements, but an inability to provide the institutional arrangements needed to support an ODP. When implementing ODPs, governments need to consider that partnerships are central to providing the skills and resources necessary for their success. Additionally, citywide strategies for data governance and ODPs need to be embedded within the institution and strongly aligned with broader city objectives. Furthermore, these strategies need to be supported by political champions and a data culture with an intrinsic understanding of the value of sharing, collaborating and analysing data. Finally, the process of transitioning to smarter models of governance is an incremental one. Municipalities should gradually develop the skills and structures across their organisation to support the incorporation of technology and more innovative systems of governance.

The above speaks more broadly to the issue that South African municipalities may face when looking to implement trending smart governance initiatives (such as ODPs) without thoroughly interrogating the contextual and institutional considerations required for them to succeed. Understanding these considerations is central to unlocking more meaningful and appropriate opportunities for smart city development in South Africa.

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# Smarten Up: Paths to bottom-up smart cities and the risks of top-down smart governance

Kevin Foster

## Introduction

South African cities have adopted the idea of the “smart city” as a vision to work towards. This idea is found in their vision statements and strategic documents, and is encouraged by national government. From the late 1990s, cities began implementing e-governance strategies, through digitising government services and creating effective one-stop shops for city customers (CSP & InTAcT, 2018). This evolved into using enterprise risk management systems to improve efficiency, aid institutional decision-making and provide infrastructure for citizen connectivity, such as fibre optic networks and Wi-Fi in public places (ibid). Currently, smart cities typically refer to the retrofitting of new technology on existing infrastructure, systems and governance models (Shelton et al., 2014). Smart city projects are aimed at addressing urban challenges, for example, smart metering to improve revenue controls, real-time mapping, public transport integration and integrated public safety platforms. Cities become “smart” through integrating data from different kinds of sensors, into a single virtual platform, often working with technology companies on already developed products or software.

The state (national, provincial and local governments) is leading the smart city narrative together with enthusiastic technology companies that are keen to provide technologies and services. The focus is on improving institutional efficiency or on governing – rather than empowering – citizens. Policies ignore how technology could make it easier for citizens to comment on city policy, to hold the state to account, and to solve problems identified by the state. This paper finds that the citizen voice is largely absent from the smart city narrative expressed in national and city policies and plans, and argues that top-down governance does not encourage participation and carries the risk of deepening inequality. It shows how bottom-up participation, through smart activities being undertaken by civil society and non-governmental organisations (NGOs), can support and improve city governance, and offers lessons for how cities can use technology to put citizens at the centre of participatory governance.

## The Smart City Narrative in South Africa in 2020

A scan of policy statements and documents suggests that the smart city narrative remains top-down and is focused either on a vision of technocentric, first-world cities, in the image of European or Asian cities, or the business process of the city as an institution and governing how ratepayers use services.

### The national narrative

Nationally, the smart city focus appears to be on large, flashy infrastructure projects, governance efficiency of services and making connectivity available to citizens. The narrative is clearly top-down and driven by elites, as illustrated in President Ramaphosa’s first State of the Nation Address (SONA)<sup>8</sup> after the 2019 elections. In his speech, he referred to being influenced by conversations with ministers and foreign presidents and outlined his vision of the smart city in South Africa. It included “high-speed trains” linking “megacities and the remotest areas of our country”, and South Africa building an entirely new city “with skyscrapers, schools, universities, hospitals and factories”. He concluded his SONA by asking whether the time has arrived “to build a new smart city founded on the technologies of the Fourth Industrial Revolution”. However, he did not ask whether this is what South Africa wants, nor what this means in the South African context.

South Africa has a draft National e-Strategy (entitled *Digital Society SA*) that aims to transform “South Africa into a full digital society marked by a widespread diffusion, uptake and usage of ICTs in the whole society”, which is crucial for interventions that “accelerate growth and facilitate economic and social inclusion”. However, the strategy is light on detail about smart cities and smart governance, and contains just one mention of “Smart city” (on page 15). Its focus is mainly on the provision of broadband to communities and the smart delivery of services such as electricity and transport (DTPS, 2017). The strategy makes no mention of how citizens can engage with smart services and how technology can enable citizens to participate in governance.

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<sup>8</sup> <https://www.gov.za/speeches/2SONA2019>

## The city narrative

The smart city concept features in many of the city visions contained in their integrated development plans (IDPs) for the 2016–2021 cycle. For example, Buffalo City seeks to be “a well governed city: a smart and responsive municipality that plans and efficiently delivers high quality services and cost-effective infrastructure”. One of its key performance objectives is to “develop and establish a smart city concept for the city” (BCMM, 2016). Ekurhuleni’s IDP contains the vision of being a “Smart, Creative and Developmental City”, but offers little other insight of how to become one (EMM, 2016). The City of Johannesburg has a more developed idea of its vision. One of its strategic priorities is: “Smart City and Innovation”, which seeks to:

- Improve social development, through providing internet access in places of learning.
- Generate service delivery efficiency, via smart metering for water and electricity services, e-services, and widespread access to broadband.
- Find ways for better decision-making, through integrating citywide data into a single view, allowing for holistic planning, preventative actions and improved responses in areas such as safety and mobility.
- Increase economic activity, through providing the necessary technology and connectivity for businesses and entrepreneurs to thrive.
- Promote active citizen participation and engagement, through a user-friendly Joburg Application or App.
- Create a sustainable and liveable environment, via technological options that improve resource use, and allow for planning aligned to urban trends and pressures (CoJ, 2016).

The City of Johannesburg’s vision starts to address ideas of citizen engagement, but the mode, an app, is limited.

According to city officials, the impetus for smart city initiatives comes either from external events, such as the 2010 FIFA World Cup, or from the top, driven by politicians and growth and development strategies. In Johannesburg, the former mayor Parks Tau initiated the Smart City Strategy to accelerate service delivery, increase productivity, and enhance economic development in tech-oriented services.<sup>9</sup>

Although the intent to improve participatory governance, by engaging with citizens through technology, is better at city level than at national level, policies are largely developed in the absence of citizens. For example, the City of Johannesburg’s new smart city strategy will only go out for public comment once it has been approved by Council.<sup>10</sup> In addition, the mode of engagement, through an app, suggests that the impetus is greater convenience, either for the city or residents, rather than improved engagement. Apps have been found to be a relatively ineffective way for cities to engage with citizens in South Africa thus far, as shown by the very limited number of downloads compared to city populations (Foster, 2019).

## The Risks of Top-Down Smart Cities

Top-down smart governance for cities has two risks for participation:

- The level of public engagement, both in decision-making about governance systems and the way in which residents interact with the technologies that the city is asking them to engage with.
- Deepening inequality and splintering urbanism, where technology makes participation easier for those who already have access and harder for those who do not.

The experience of introducing e-services offers some insight into how the public will engage with smart city technologies. A study of the spatial distribution of access to technology in South African cities, and eThekweni in particular (Odendaal, 2011a; 2011b), examined the experience of a web development process for community organisations and the engagement of street traders with city technology. It found that digital access is not universal and that, even if it were universal, uptake depends on several variables, including culture, language, personal experience with technology, and psychological barriers (Odendaal, 2011a). The blunt implementation of technology can lead to uncertainty and loss of confidence in interactions with the city (ibid). Therefore, inappropriate smart governance initiatives could risk weakening the role citizens play in city governance and lead to “splintering urbanism” or dual cities (Graham & Marvin, 2001).

South Africa already shows signs of splintering urbanism, such as gated communities, office park developments, skywalks and indoor malls, and unbridled smart governance risks deepening this dualism. In smart cities, splintering urbanism manifests through both the uneven distribution and the nature of technologies, which are

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<sup>9</sup> Email correspondence with Monique Griffith of the City of Joburg, 24 February 2020

<sup>10</sup> ibid

easiest to use for those with access to and experience of the technology. This leads to the benefits of technology being unevenly distributed, with highly capable spaces bundled together with premium infrastructure, while other spaces are marginalised. For instance, using apps for public engagement, bill payments and meter monitoring improves the convenience of engaging with the city for those already well equipped to do so. For those who cannot engage with the technology, their services do not improve and may even worsen, as resources get diverted into the new technology (Graham & Marvin, 2001).

## The Bottom-Up Smart City

The purpose of public participation is “to build inclusive citizenship by making a once-exclusive state inclusive, open, and responsive to the needs of the majority previously excluded and discriminated against” (Oldfield, 2007: 488). Public participation strengthens the rights and voice of citizens, while public influence over policy-making and institutional accountability helps communities to achieve self-determination. However, public participation in South African cities is characterised by many shortcomings, including a lack of trust between administrations and communities, poor access to information and irregular engagement (Foster, 2019). Bottom-up smart city activities can help arrest some of the failings of participation in South African cities, improving information and the regularity and reliability of engagement between administrations and citizens.

While cities have been developing their plans and talking to technology companies about transitioning to becoming smart, residents, civic organisations and NGOs have been using technology to become smarter at holding cities to account. Civil society is using technology to improve participation and service delivery, and to engage citizens who do not have easy access to technology and the city.

## Improving public participation

DearSouthAfrica is an online platform that allows individuals to make submissions on legislative and local government issues, based on the Promotion of Administrative Justice Act (PAJA) No 3 of 2000. In terms of PAJA, each comment must receive an individual response from the administration, whereas a petition (even with thousands of signatures) is treated as a single submission by the administration. What makes the platform different from typical mass participation processes in South Africa is that it enables individual comments to be submitted, allowing for far more individual voices to be heard. For instance, in 2017/18, about 61 000 individual comments were submitted in response to the first notice of the City of Cape Town’s proposed drought levy, compared to an average response rate of between 500 and 800 comments – the platform uses linguistic analysis to ensure that the same individual does not submit multiple comments on a single issue.<sup>11</sup> Its approach strengthens the citizen’s voice in policy-making and demands responsiveness from administrations, as they are bound by law to consider and respond to all submissions (Foster, 2019).

Social media is leveraged to get members of community groups, activist groups and armchair activist groups to respond through the platform.<sup>12</sup> All comments received are published on the website, which widens the discussion beyond a two-way engagement between the city and a commenter. The DearSouthAfrica approach makes participating in public participation more convenient for those with access but does nothing to improve participation for those without access. Nevertheless, it illustrates two key points for smart participatory governance in South African cities: (i) build on platforms that residents use (in this case Facebook), and (ii) invest in the city’s ability to analyse and adequately respond to participatory inputs – this is where the real potential for “smartness” in participatory governance lies. Therefore, cities should focus on developing systems to process, analyse and respond to large numbers of individual inputs, based on participatory governance principles, that enable cities to provide a substantive response, rather than to simply acknowledge the communication.

## Engaging disenfranchised citizens

Organising for Work is a Cape Town-based volunteer unemployment movement that leverages city infrastructure (libraries and Wi-Fi) to assist job-seekers in promoting their CVs and connecting directly to employers through a web-based platform. The movement runs eight branches out of libraries on the Cape Flats. Members are assisted to develop and upload their CVs online, and to negotiate the initial part of the employment

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<sup>11</sup> Interview with Rob Hutchinson, DearSouthAfrica (11 September 2018).

<sup>12</sup> The founder garnered a significant following on Facebook and Twitter through his activism against e-tolls. This following included a network of groups, particularly on Facebook, which would receive information about other campaigns that the founder was involved in. This led to the establishment of the DearSouthAfrica web platform.

process, such as interviews. For example, requesting initial interviews by phone, to reduce the travel cost burden on the job-seeker.<sup>13</sup> Organising for Work is making the city smarter from the bottom up through leveraging the city's ICT infrastructure and using a simple web-based platform.

The experience of Organising for Work confirms that many citizens struggle to access technology and internet connections. Small complications lead to them disengaging from the process and becoming unlikely to return, try again or trust the system. Left alone, job-seekers struggle to engage with the platform, especially in the beginning. Therefore, to maintain citizens' engagement with the platform, Organising for Work uses volunteers who act as intermediaries between the web platform and the job-seekers. Users are also discouraged by bad experiences not linked to the platform, such as running out of data, being timed-out of networks or network instability.<sup>14</sup> Therefore, cities need (i) to make sure that their technological systems are easily accessible for citizens, particularly the disenfranchised, and that human intermediaries are available to assist; (ii) to take particular care in developing technological interfaces for participatory governance, as an unsuitable platform, developed without iterative input from citizens, is unlikely to succeed.

## Lessons for Smart Governance and Participation

If citizens are to be at the centre of the smart city and technology used to improve governance and participation, the city needs to be thoughtful about the technological options and the implications of options chosen.

### Prioritise accessibility and availability

Cities should make access to technology as easy as possible because users disengage easily, particularly if they are new to the technology or struggle to access it. Therefore, when developing public access Wi-Fi systems, cities should prioritise accessibility of the service over monitoring access to the service. Monitoring increases the difficulty of access, as demonstrated by the Organising for Work example. Equally, cities should allow civic organisations to use public infrastructure – both physical and network infrastructure – to support participatory governance initiatives. This means allowing the public to use technology platforms and innovations at no cost and organisations to operate from and store technology at city sites, such as libraries (which would have the additional benefit of increasing traffic at libraries).

### Build on technologies that people are familiar with

To enable participatory governance, cities need to have technological tools that interface with residents, which means building on technologies that are familiar to users, where possible. For example, if the aim is to have two-way communication with residents, the city should look at technologies that residents already use, such as WhatsApp. Cities should also develop tools through an interactive, iterative approach with the users of the technology, rather than take technology from off the shelf or built by a service provider that does not take into account the context of the city's users when they engage with the technology.

### Let civic organisations fill the gap

Civil society can play an important role, as shown by the fact that the most effective use of technology for participatory governance has come from civic organisations. This is something that cities should welcome, as they can use information from civil society's planning and programming to develop trust in technological systems as a means to interact with cities. Cities can enable civic organisations to assist them in building participatory governance systems by using open source platforms. This would allow civic organisations and other city administrations to improve and customise the technology to suit their users. It would result in learning across city administrations and among citizens.

### Don't forget the human element

Many residents of cities are still reluctant, nervous, or discouraged users of technology, and will need the assistance of intermediaries for years to come. The use of technology intermediaries should be encouraged early on and ongoingly. Cities need to invest in supporting their residents to interact with tech platforms by providing human assistance.

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<sup>13</sup> <https://www.dailymaverick.co.za/article/2020-01-21-using-barack-obamas-organising-model-to-tackle-sas-unemployment-crisis/>

<sup>14</sup> Interview Ayal Belling 20 February 2020

## Remember that smartness lies in the backend of participatory governance

The real efficiency that technology can bring to participatory governance lies in the ability to process, analyse and respond to large numbers of inputs. The bottom-up smart city needs to invest in this side of the participatory governance process. Systems such as DearSouthAfrica have the ability to overwhelm a city's ability to respond to the public, and this will continue unless cities find ways to deal with the volume of input. Smart technology can process the volumes of citizen inputs, categorise them based on a set of principles, and respond on the basis of their inputs. Systems to do this have been experimented with around the world, for instance, Barcelona and Madrid used Decidem for the equivalent of their IDP process (Kola & Jordan, 2019).

## Conclusion

In South Africa, smart city policies have been developed through a top-down approach and focus on improving efficiencies and on governing, not empowering, citizens. The citizen voice is largely absent, with cities identifying little investment in improving participatory governance through smart cities. This top-down governance approach does not encourage participation but weakens public engagement. It carries the risk of deepening inequality and splintering urbanism, or dual cities where those with access benefit, while those without access are further marginalised. In contrast, bottom-up participation can support and improve city governance.

Cities can learn how to use technology to put citizens at the centre of participatory governance from the activities of civic organisations and NGOs. Cities should focus on building systems that can effectively handle participatory inputs received through existing processes and the public's preferred methods. These systems and their analytical capability can be used to provide real feedback and build trust in tech-based methods of public engagement. As tech-based participatory methods are introduced, cities need to commit to providing human intermediaries to support users of the technology. To avoid deepening the technological divide, the aim must be to build for users without access, not for users with access. Continuous engagement with tech-based participatory systems can be encouraged through providing as much free Wi-Fi as possible, wherever possible, with low barriers to access. Such a bottom-up approach not only encourages participation and problem-solving by citizens but also facilitates the development of inclusive, innovative smart cities.

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# Unpacking Smart City Development in Cape Town and Johannesburg

*Rashiq Fataar*

## Introduction

South Africa does not currently have an integrated national smart city strategy, and as a consequence the move towards smart city status is largely driven at the local level. For municipalities, the Integrated Development Plan (IDP) is the chief legally prescribed governance instrument. Each municipality is obliged to design, adopt and implement an IDP every five years in order to achieve its expanded constitutional mandate.

The IDP was conceptualised in 2000, as a means of integrating different levels of government in development planning, with a specific focus on undoing the stratification and fragmentation embedded in the apartheid spatial planning approach. However, the IDP has become more insular in its application and is largely used by local government for planning and directing future development without integrating the different levels of government (Fuo, 2013).

Within this legislative context, the smart city vision for a municipality could be articulated to some extent in the city's IDP, with more specific objectives and initiatives provided in a separate strategy. The IDP is the overall framework for developing the area and follows a participatory process that is aimed at involving citizens. Therefore, if the implementation of smart city programmes is to be an integral facet of the city's development, smart city objectives or visions should be clearly embedded and integrated within the IDP.

In South Africa, smart city thinking most often takes the form of information and communication technology (ICT) initiatives, which are intrinsically linked to the municipality's organisational culture, priorities and objectives, and strategic vision. Dedication to that vision is reflected in resource allocation and capacity building.

The paper examines the evolution of smart city thinking within the cities of Cape Town and Johannesburg, and how the smart city concept features in their IDPs. It unpacks smart city development in the two cities, through a comparative analysis, in order to better understand the value of a coherent vision for smart cities and the support for smart city strategies and projects, as reflected in the cities' organisational structure and budget allocations. Cape Town and Johannesburg were selected as case studies based on their comparable population, socio-political importance, governance structures and financial/economic resources.

## Evolution of Smart City Thinking

To compare the smart city performance of Johannesburg and Cape Town, an initiatives-based framework provides a qualitative approach (Table 1). It is adopted from a framework used to compare the smart city performances of Seoul, Singapore, and Iskandar Malaysia (Adnan et al., 2016). The framework assists in comparing cities with different smart city approaches and range of initiatives, and where limited quantitative data is available.

**Table 1 : Matrix for ranking a city's level of provision in six categories**

Smart...	Basic (1)	Medium (2)	Advanced (3)	State of the Art (4)
Economy	Facilitation of local economic activities (infrastructure, facilities, economic support system)	Economic growth and value creation	Innovative economic growth	Integrated economic hub
People	Provision and accessibility to basic level of infrastructure and programmes for the training and education towards enhancement of skills and knowledge	Provision and creation of elaborate human capital improvement environment with physical and nonphysical platforms for the advancement of knowledge, skills and sharing ideals	Creation of a conducive ecosystem that attracts and develops human capital through physical & nonphysical platform with advanced technological features for the advancement of knowledge, skills and sharing ideals towards a caring and open mindset	Development and creation of a conducive ecosystem that attracts and develops human capital through the adoption of state-of-the-art ICT and technology-driven educational and training towards a cosmopolitanism, caring and open mindset
Governance	Provision of basic public and social services	Public participation in decision-making	Public-private partnership	Fully transparent government with ICT that provides real-time policy conveyance and input
Mobility	Basic transportation and connectivity to ease movement	Full accessibility and some connectivity that further enhanced movement	Full accessibility and full connectivity together with an efficient traffic management system	Full accessibility and full connectivity together with a sustainable traffic management system
Environment	Provisions for safe and clean environment	Protection of the environment	Enhancement via green technology in the environmental management system	Usage of ICT in the sustainable environmental management
Living	Provision of communal amenities and cohesive social environment	Provision of extensive communal amenities and cohesive social environment	Availability of varieties and options for global communal amenities with cohesive social and living environment	Creation of comprehensive global communal amenities with cohesive and integrated social and living environment towards community well-being

Source: Adnan et al. (2016: 17)

The above matrix was used to analyse the IDPs of Cape Town and Johannesburg (Table 2).

**Table 2: Evolution of different smart city dimensions in Cape Town and Johannesburg**

IDP	2003		2008		2013		2017	
	Cape Town	Joburg						
Economy	0	0	0	NI	2	3	3	0
People	1	1	0	NI	3	1	1	2
Environment	0	0	0	NI	3	3	1	0
Governance	1	0	0	NI	1	1	2	4
Mobility	0	0	0	NI	3	0	3	3
Living	0	0	0	NI	0	0	0	0

0 : no initiatives in this smart city dimension

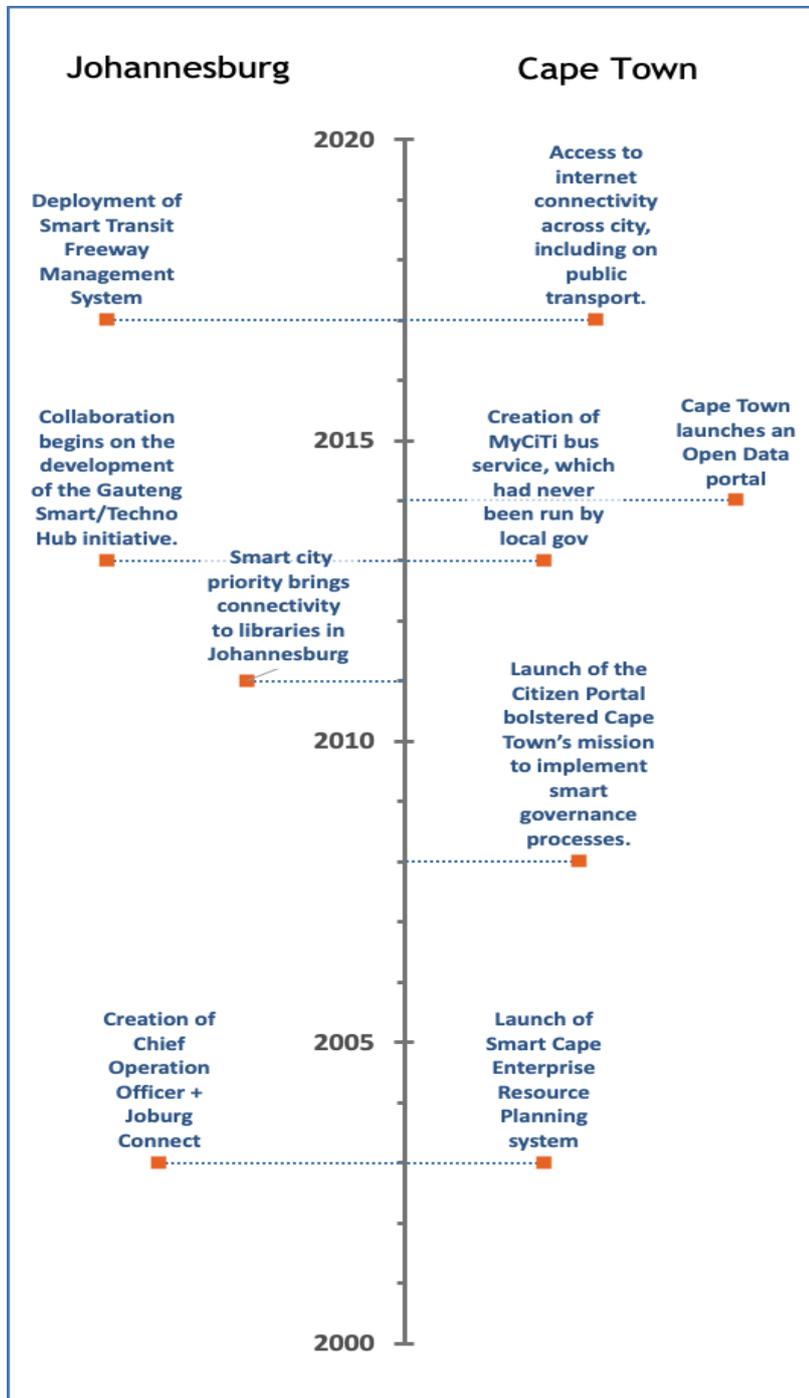
NI : no information collected

The smart city concept was first mentioned in Cape Town's 2002 IDP and in Johannesburg's 2013 IDP. For Cape Town, the smart city was one of its strategic goals, but recommendations for implementation were limited to using technology to improve the connectivity and efficiency of government officials and making actors in the public sphere more accessible to the public. The 2003 and 2008 IDPs provide little to no reference to smart initiatives, but this does not mean that policymakers were not concerned with ICT. Cape Town had very early on joined forces with private players to promote the development of technological hubs (Pollio, 2020). The increase in smart city dimensions from 2013 reflects the change in thinking about the city, from a perspective of economic growth to one of creating technology strongholds linked to economic development and facilitating transport (easing of traffic flow and accessing real-time public transport information).

In its 2017 IDP, the smart governance dimension was limited to collecting information on citizens' expectations. In Joburg, the 2013 IDP understood smart city as a way to provide adapted and efficient services to citizens in a sustainable way. The 2017 IDP defines smart city as the use of data and IT to improve the governance and is illustrated, for example, by the launch of an Intelligent Operations Centre. This appears to be an extension of

certain projects that were not part of the creation of an intelligent city at the time. For example, the Information Technology Department and the Chief Operations Officer have been present in the IDP since 2003. It is unclear whether the current conception of the smart city is the result of political voluntarism or of previous measures that predisposed the city to focus on smart governance. Figure 1 provides a visual representation of the defining moments in smart city development in Cape Town and Johannesburg.

Figure 1: Defining moments in smart city development



The extent to which these smart city initiatives and plans are embedded within the city's IDP influences whether or not budgetary and other resources are formally allocated to smart city and ICT projects. In both Johannesburg and Cape Town, a high level of scepticism exists within the public, private and civil society sectors about smart city strategies, which are seen as inwardly focused or merely a means for paying licences for software. A concern is that the smart cities sector has immense potential for the business sector but is undeveloped and uncoordinated.

Although Cape Town and Johannesburg demonstrate a commitment to smart cities, stakeholders in both cities highlight the following challenges:

- The lack of intellectual depth among officials and leadership – city officials and residents need skills development and training.
- The disconnect to unemployment challenges – smart cities may be a fashionable concept, but South Africa needs low-skilled jobs.
- Systemic high levels of corruption that create a volatile and unstable working environment – officials or departments may be unable or disincentivised to undertake innovative projects or initiatives, which may be brought under further scrutiny or risk an unfavourable audit outcome.

## Current Status of Smart City Thinking

The two cities have taken different approaches to smart cities, which is reflected in their policies, organisational set-up and budgetary allocations.

### The smart city vision

Johannesburg's smart city strategy aims to transform both the city government and citizens to become actors, with the intent of addressing its broader goals while addressing socio-economic conditions and improving service delivery. The orientation of the City of Joburg towards a smart city is "to position itself as an agile city, which has the capacity to rigorously overcome its problems and future challenges" (Bwalya, 2019).

In the Johannesburg's 2017 IDP, the Smart City programme is one of the city's nine strategic priorities – the implementation of smart city interventions is part of a defined strategy, developed by local government and adopted by the Mayoral Committee in 2013. The inclusion of a Smart City vision in the IDP means that there will be an associated budget, although this does not necessarily ensure the quality of the projects that come out of the vision. A smart city is defined as a city "that utilizes IT and data to improve the efficiency of urban services and infrastructure and incentivises the development of innovative small businesses". The Smart City Office's revised strategy states that:

The City of Joburg is digitally transforming to become a citizen-centric, inclusive smart city that makes decisions and governs through technologically enhanced engagement with citizens who have universal access to services and information that enhances pro-poor socioeconomic development and efficient service delivery that makes the City safe, sustainable, liveable and resilient.

Its smart city policies are aimed at improving public services through technology and at addressing broader challenges, through forging partnerships with knowledge partners, technology companies and academic organisations.

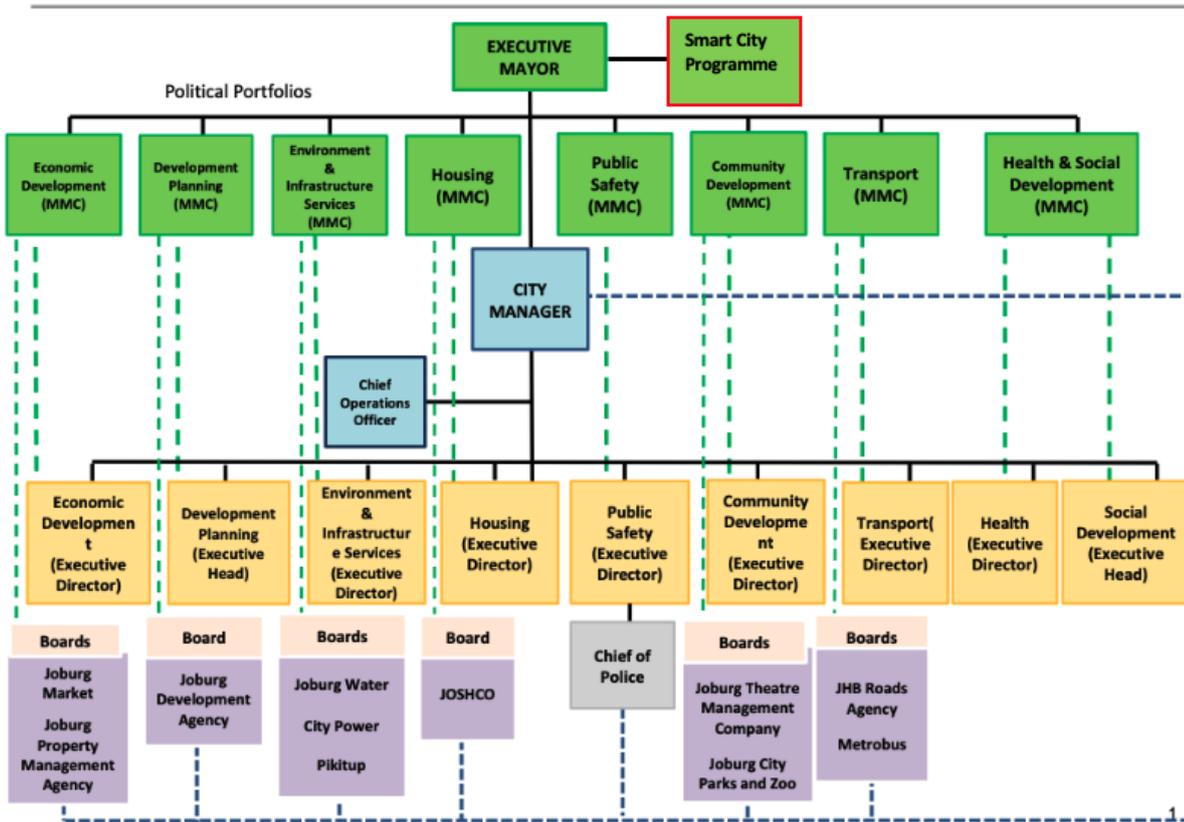
Cape Town has a more inward focus on ICT operations and emphasises digital and connectivity infrastructure. How this relates to urban and social development priorities is unclear. The city seems to be pursuing a policy that is focused on making the city work better through technology, with officials insisting on referring to a digital city strategy, rather than a smart city strategy (Boyle & Staines, 2019). The Cape Town Smart Cape initiative, which was established in 2013, defines smart governance as digital governance strategies that use ICT to improve service delivery, stimulate innovation and improve citizen-government interaction. The aim is to improve digital infrastructure, through a government-provisioned fibre network, and to improve digital inclusion; and the focus is rolling out IT infrastructure in public spaces such as municipal libraries. The goal is for Cape Town to be the most connected city in Africa, and the four pillars of focus are digital governance, digital citizen, digital infrastructure and digital inclusion.

Smart governance is focused on improving security and police performance through the use of technology, improving the efficiency of transport, digitalising the procurement process for greater public sector transparency, and improving the efficiency of monitoring and evaluation. The other major focus area is infrastructure, through improving citizen access to digital services for a more participatory governance process.

## Organisational structure

Where smart city initiatives are housed within the city's organisational structure may reflect the governance motivations or political intent. The intersectional nature of smart city projects requires different departments and stakeholders to collaborate with joint human and financial resources. In Johannesburg, the Smart City programme within the IDP was adopted by the Mayoral Committee in 2013, thus responsibility for implementing smart city initiatives remains within the Mayor's office (Figure 2). Locating the Smart City programme within the Mayor's office and having leadership that is focused on it shows that Johannesburg prioritises smart cities. However, more could still be done to operationalise and ensure that a smart city vision is driving the work of all city departments.

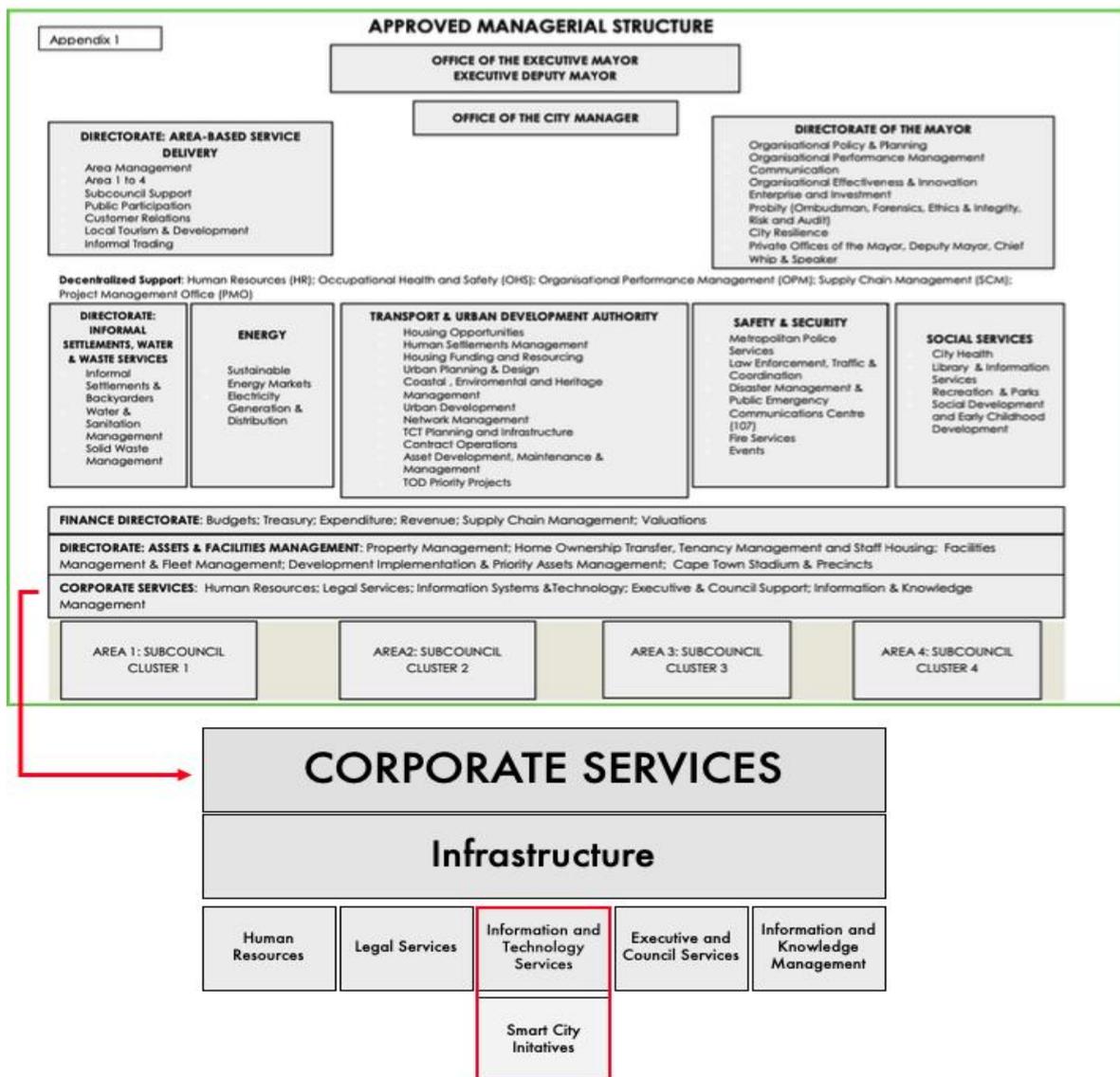
Figure 2 : Location of Smart City Programme within City of Johannesburg



Source: City of Joburg

In Cape Town, the smart city initiative is driven by the Infrastructure Branch's Information and Technology Services (I&TS) department, which is located in the Corporate Services Unit. Corporate Services are responsible for driving the city's strategy and governance systems and coordinating the use of data. In 2019, the I&TS Department put together a broad initiative for implementing smart city development. Cape Town's positioning of smart city initiatives within infrastructure means the focus is on improving the function of the government, not on driving the direction of the entire city. There is less leadership, and efforts are more likely to be disorganised and uncoordinated.

Figure 3: Location of smart city initiatives within City of Cape Town



Source: City of Cape Town

## Financial and human resource allocation

Johannesburg's 2019/2020 budget focuses on aligning with the IDP and prioritising innovation and efficiency through a smart city programme. Budget allocations for smart city development are as follows:

- Most of the budget is intended for improving ICT equipment and software, and for enhancing access to ICT infrastructure, such as free Wi-Fi services. The budget is expected to increase moderately over time.
- Financial resources are allocated to improving the system of recording and monitoring council and committee activity and creating a smarter and more efficient procurement process.
- Some financial resources are allocated to smart infrastructure, specifically to smart, automated prepaid meters in the energy services sector.
- Over R700 000 (R729 872) is allocated to ICT and technological development for improving service-delivery. This amount is projected to increase over the years.

However, the overall budget allocated to the Smart City and Innovation IDP priority is projected to decrease by almost half over the next two financial years.

Cape Town's 2019/2020 budget does not clearly allocate financial resources to the development of smart city initiatives. However, it does allocate resources to smart technologies, even if these are not explicitly listed as an item in the budget. For example, smart dashboards connected to fibre internet at electrical substations.

## Conclusion

South Africa does not have an integrated national smart city strategy, which has resulted in cities, especially the metros, becoming the drivers of smart city programmes. To understand how the smart city concept has evolved and is being implemented at local level, the IDPs of two metros – Cape Town and Johannesburg – were analysed. The IDP is the legislative tool for city planning and development and, therefore, should include some articulation of the city's smart city vision and programmes. The extent to which smart city programmes are embedded within the IDP also influences the allocation of budgetary and other resources.

The first mention of “smart city” was in Cape Town's 2002 IDP and Johannesburg's 2013 IDP, and the smart city concept has evolved differently in the two cities. In Johannesburg, the Smart City programme is one of the city's nine strategic priorities in its 2017 IDP, with the aim of not only improving service delivery but also enhancing pro-poor socio-economic development. Cape Town has a more inward focus, emphasising digital rather than smart strategy, with the aim of improving service delivery and citizen-government interaction through ICT, but without a clear link to urban and social development priorities.

In Johannesburg, the Smart City programme is the responsibility of the Mayor's office, while Cape Town's smart initiative is driven by the I&TS department, which is located in the Corporate Services Unit. Johannesburg allocates a budget to the Smart City and Innovation priority in its IDP, although this is expected to be halved over the next two years, whereas Cape Town does not allocate budget specifically to smart city projects. However, Cape Town does allocate resources to smart technologies, but these are not explicitly listed as budgetary line items.

The research finds that neither city has a valued and coherent smart city approach. The City of Joburg includes a smart city vision in its IDP but allocates inadequate financial resources to the Smart City Office. In the case of Cape Town, the emphasis is on digital, not smart, although resources allocated could be considered significant because of the focus on hard infrastructure, which would likely attract a larger scale of resources. Nevertheless, while including the smart vision city within an IDP cannot guarantee resources (as per the Municipal Systems Act of 2000), the IDP may be the only route through which resources could be ring-fenced and guaranteed over successive years in the annual budget, guiding line departments and ensuring reasonable political support.

Both cities recognise the need for both infrastructure development and human development in smart city approaches, but this focus is limited to using ICT-based tools to create communal amenities with cohesive and integrated social and living environments (a key part of addressing apartheid spatial transformation). The focus on “hard” or “soft” infrastructure for each city may historically be more related to existing, available resources and the relative success of its projects e.g. Bus Rapid Transit (BRT) projects. Neither city has a clear economic sector focus or geographical area identified for smart city initiatives or projects.

Both cities seem cautious in their approach to partnerships with projects outside of their local ownership or control. Formal collaborations with the private sector (in particular start-ups), which may be beneficial, are limited due to procurement barriers. For example, Cape Town's smart city initiatives would benefit from partnership with the Western Cape Government, Transnet and others, but the current approach does little to incorporate other public sector actors. Glaringly absent from both cities' IDPs is past or current private-sector-led smart city proposals, such as Modderfontein in Johannesburg and Wescape in Cape Town.

The case studies of Johannesburg and Cape Town provide lessons for cities seeking to become smart cities.

- A coherent vision for smart cities in the IDP framework is valuable and enables the municipality to allocate resources for smart city initiatives.
- Resources are available for learning how to avoid operational delays in setting up smart city initiatives. Examples include roundtables through the SACN Knowledge Management Reference Group (KMRG)<sup>15</sup> and innovation festivals such as the Fak'ugesi African Digital Innovation Festival.
- Smart city strategies can be driven by soft infrastructure, not only hard infrastructure that requires significant resources. Soft infrastructure refers to developing social capital and knowledge and enhancing public participation. For example, the City of Joburg's Smart Citizen programme.
- Smart city initiatives need to address more directly the “smart living” dimension, which promotes spatial integration. This means the need for integrated housing, public spaces and tolerance between different socio-economic backgrounds and race groups.

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15 <http://www.sacities.net/learning-platforms/reference-groups/knowledge-managers-reference-group>

- Cities should pilot and test smart city projects in a designated precinct or public building before rolling out across the city, and incentivise companies and research institutions to participate. For example, Bellville in Cape Town and the Lanseria Smart City initiative.
- Cities should adapt and support existing interventions and projects, both within and outside government, and look at improving them using ICT-based innovations. For example, Cape Town's Empower Shack Project uses algorithm technology for re-blocking informal settlements, while Johannesburg Housing Company's Rent Touch Payment Screens makes rent payment quick and convenient. Another example is the African Centre for Cities' E-Taxi system, which aims to create an online ride-hailing platform for minibus taxis.
- Municipalities, especially those with smaller populations and limited resources, should take a collaborative and partnership-based approach. Pooling resources with other government agencies, start-ups, corporations and research institutions may be more efficient than forming an office or department dedicated to smart cities. For example, the Amsterdam Smart City has over 160 partners.

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# Applying an Ethical Lens to Smart Applications

Monique Damons

## Introduction

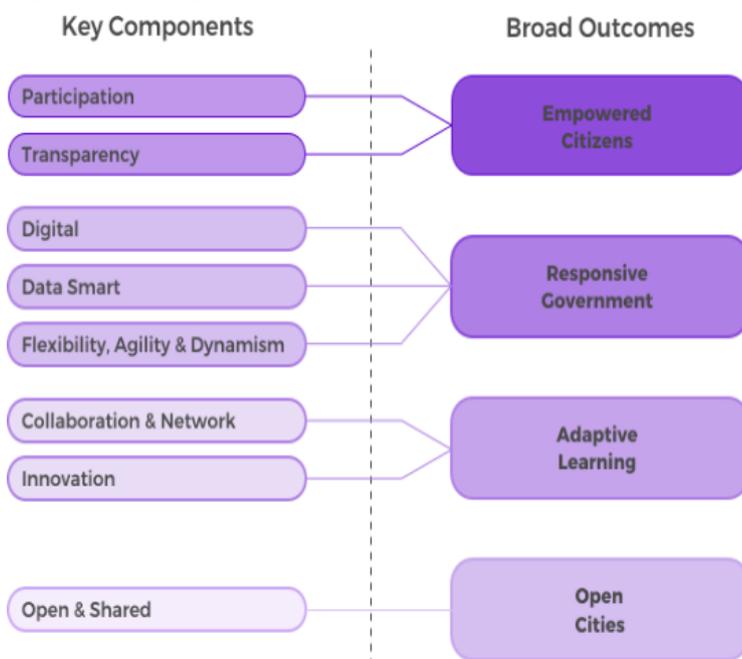
The 4IR is fundamentally changing the way in which people live, work and relate to each other. It represents a new stage of human development, facilitated by major technological advances that hold both promises and risks (WEF, 2020). The 4IR has the potential to increase income levels and improve the quality of life for people across the globe (Schwab, 2016). People's lives could become more pleasurable and efficient thanks to the technological developments and innovations that have produced new products and services. With the decrease in transportation and communication costs, logistics and global supply chains will become more effective, and the cost of trade will decline, all of which will open new markets and drive economic growth (ibid).

However, the 4IR could also yield greater inequality – its biggest social dilemma – by disrupting labour markets, as a result of greater automation, leading to an increasingly segregated job market, divided into “low-skill/low-pay” and “high-skill/high-pay”, with a few in the middle. The other growing divide will be between those whose wealth comes from capital gains and those whose wealth depends on labour. The greatest beneficiaries of 4IR will be those who provide intellectual and physical capital – the investors, shareholders and innovators (ibid).

The 4IR provides an opportunity to help people to harness technology to create a more inclusive, people-centred future. Cities are at the coalface of the rapidly changing technological, social and economic effects of 4IR and must be empowered to reap its benefits. They will need to ensure that the efficiencies provided by advancing technology is balanced by innovative public policy, and that decisions are based on sound values.<sup>16</sup>

In the midst of the 4IR, the “smart city”<sup>17</sup> approach to urban development has emerged across the globe. In South Africa, this has occurred particularly in metropolitan municipalities. City decision-making within a smart context is based on the principles of smart governance. Smart governance involves the simultaneous use of innovative practices and digital technologies, to improve government service delivery and citizen inclusion (National Treasury, 2018). When applied in cities, key components of smart governance can lead to broad desired outcomes (Figure 1).

Figure 1. Smart governance components mapped to outcomes



Source: National Treasury (2018)

<sup>16</sup> <https://www.weforum.org/projects/cities-and-the-fourth-industrial-revolution>

<sup>17</sup> Also interpreted as “cyberville”, “digital city”, “electronic city”, “flexicity”, “information city”, “telicity” and “wired city” (Mohanty et al., 2016). Definitions of smart cities are provided in the introduction to this paper series.

However, although the smart concept has gained significant traction, questions and concerns have begun to emerge around its ethics and application. Given the growing need for more dialogue, knowledge and understanding of the ethics of smart city trajectories and related smart mechanisms, this paper seeks to contribute to thinking about the ethical dimensions of smart applications in relation to South African cities.

## Ethics and the Smart City

In view of the rapid pace of urbanization today, the moral stakes—which are always better clarified and defined through the ethical lens, but which are also always accompanied by significant practical stakes—have become too high and precarious to stay ignored any longer (Chan, 2019: 5).

The city is fast becoming a potential primary source of emerging ethical predicaments, and yet the moral and ethical implications of urbanisation have been largely neglected. In contrast, the social, political and environmental challenges of urbanisation have received due consideration across research disciplines (Chan, 2019). The moral significance of certain urban dilemmas, such as environmental justice, and gentrification and the associated threat of evictions, may be well developed, but there are no ethics that are suited to understanding the specific challenges of the city (ibid).

The smart city approach to urban development presents several moral dilemmas, including:

- The possible violation of the personal privacy of urban dwellers through increased data surveillance and geo-surveillance (Kitchin, 2016).
- The possible influencing of the behaviour of citizens through increased knowledge of user preferences (Yates, 2017).
- The (unintentional) exclusion of certain social groups in the city, depending on how data can be harnessed (Glasmeier & Christopherson, 2015).
- The intentional targeting of certain social groups (Graham, 2011).

Smart approaches, which were intended to make everyday life more efficient, appear to have worsened differences among urban dwellers and, therefore, inequality in the city. This is particularly concerning in developing countries where poverty and inequality require reversal rather than facilitation. For example, the 100 Smart Cities initiative in India demonstrates how poorly thought-through application can exacerbate poverty and inequality at both intra- and inter-urban scales.

In 2014, the Indian government launched the 100 Smart Cities initiative, with the aim of improving the quality of life through high-tech infrastructure, mass transit, energy efficiency and transparent government. The 100 cities included nine satellite cities with a population of four million or more, 44 cities with a population of one to four million, 17 state and union territory capitals, 10 cities of tourist and religious importance, and 20 with a population of half a million to a million. As resources were redirected to these cities, other areas experienced shortages. Sub-standard cities were abandoned and overlooked, as energies were focused on enhancing the exclusive and already sustainable upper-class cities. The result was a widening of the separation of classes: “This unbalanced advancement of the middle and upper classes is a direct ethical concern revolving around smart city implementation” (Clever et al., 2018: 7).

In South Africa, urbanists have begun to vocalise the risks of smart urban development and its potential to further entrench urban spatial segregation and inequality (Musakwa & Mokoena, 2017; The Young Urbanists, 2019). For example, Johannesburg, Ekurhuleni and Cape Town have used ICT to improve governance, citizen participation and municipal responses to service delivery problems. However, the digital divide in South Africa means that this has undoubtedly limited the participation of certain groups in municipal affairs and their access to certain services, in particular those with poor access to (or unskilled in using) ICT tools, thereby contributing to increased inequality (Musakwa & Mokoena, 2017). For these and other reasons, urbanists are calling for a rethink of smart cities in South Africa, moving away from the idea of building new smart cities, towards a smart approach that is focused on the needs of citizens and further developing existing cities (Musakwa & Mokoena 2017; The Young Urbanists, 2019).

## Ethics and Smart Applications

Concerns relating to smart applications, which could affect urban citizens, can be categorised according to societal, implementation and data challenges (Clever et al., 2018). The list of concerns in Table 1 is not exhaustive but represents a first step towards identifying and classifying concerns.

**Table 1: Concerns related to smart applications**

Societal concerns	Implementation concerns	Data concerns
<p>The creation or exacerbation of inequalities (in wealth, skills, demographics, resources) among people.</p> <p>The creation or exacerbation of inequalities (in funding, skills, resource allocation, location) among cities.</p>	<p>Poor conformity of services, resulting in poor integration and sub-optimal/inefficient use of resources.</p> <p>Communications infrastructure unable to handle a growing amount of work, leading to possible privacy breaches and selective service offerings.</p> <p>Slow/no procurement of application system updates, leading to possible biases, discrimination and privacy concerns.</p>	<p>Unauthorised/unauthenticated data access.</p> <p>Data security breaches and leaks.</p> <p>Data-sharing biases in relation to people, locations and organisations)</p> <p>Poor or no data-sharing agreements or protocols</p> <p>Improper data use and data profiling</p> <p>Violation of privacy/personal liberty rights (poor data anonymisation).</p>

Source: Clever et al. (2018); Kitchin (2016); Goodman (2019)

Applying an ethical lens implies that an ethical analysis is needed before making decisions around concerns related to smart applications. Such an analysis is usually done using a framework and should answer two questions: On which ethical standards is the analysis based? How are these standards applied to the design of applications? An ethical analysis can occur at multiple stages of the application development process: the design, implementation and post-implementation (impact) stages. When the aim is to avoid or mitigate the negative impacts of poorly designed or implemented smart applications, then ethical decision-making would take place at the design stage of the development process, which would also involve planning for implementation.

An ethical framework needs to be context-specific and aligned to the purpose of the institution, so as to inform the nature and level of the ethical standards that need to be adhered to. In this instance, an ethical framework would be aligned to smart applications that should serve the development priorities of South African cities. These priorities are based on the city's Integrated Development Plan (IDP), which is the most important local planning framework and is aligned to the National Development Plan's outcomes. Integrated development planning aims to achieve the following outcomes:

- To improve service delivery (volume and efficiency), particularly in the least serviced and most impoverished areas.
- To strengthen democracy through the active participation of stakeholders to enable democratic and transparent decision-making.
- To help overcome apartheid legacies.

Several existing urban ethical discourses could further be used as a basis for the ethical approach of a framework. However, such discourses<sup>18</sup> tend to be based on, or developed from, more traditional Western ethical approaches and tend to be biased towards one approach. For instance, the just city movement is based on the justice approach and so might not provide a holistic ethical basis to inform effective decision-making. Hence a Western ethical approach would be more suited, which is also the basis of the ethical principles for public sector enshrined in the Constitution of the Republic of South Africa 1996, Chapter 10. This is explained below.

<sup>18</sup> According to Chan (2019) the foundations of the ethical dimensions of the city or in other words urban ethics are insufficient, but can be supported by five key associated discourses: The just city movement; the urban turn in ethics (urban ethic, urban ethics, the ethical city and the ethics of the urban); ethics of the built environment; environmental design and behaviour; and urban ethics in the Anthropocene.

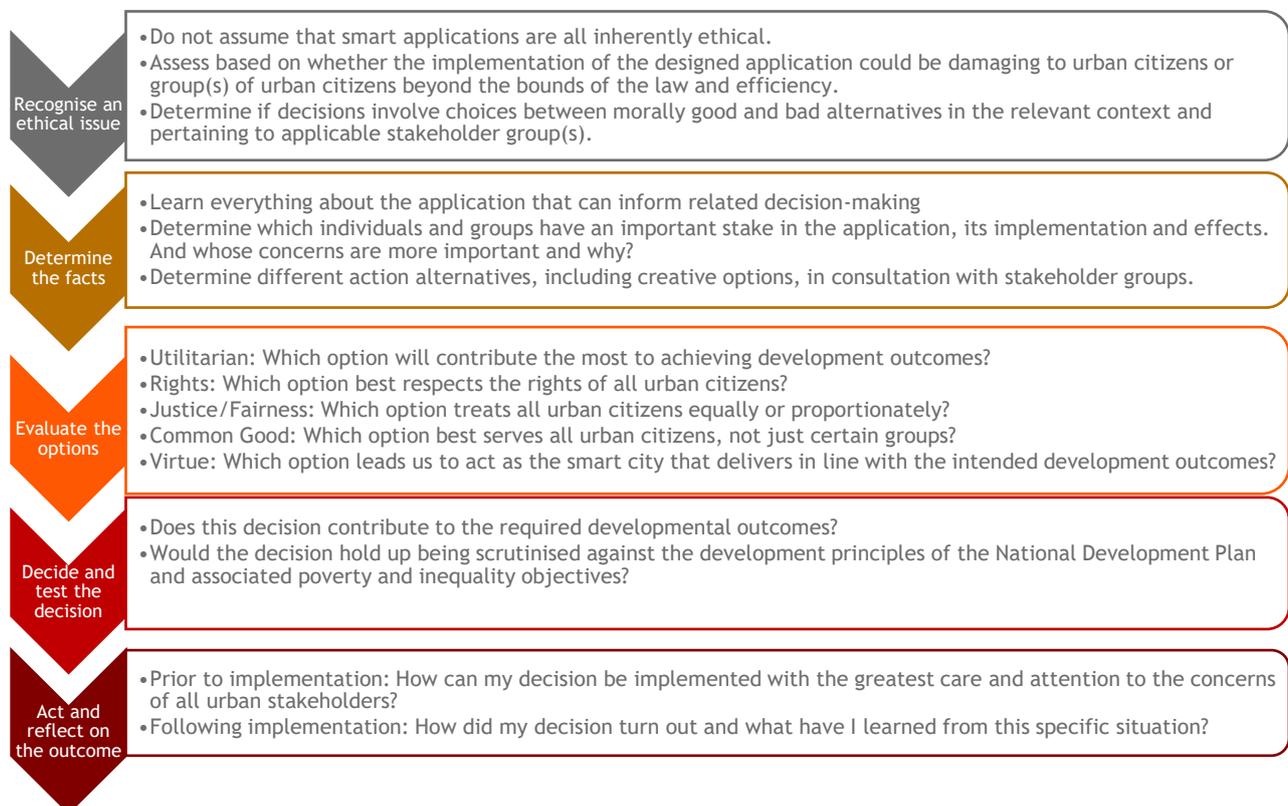
## Towards an Ethical Framework

Ethics in the South African public sphere is based on the principles of Western or liberal democracy, which is in turn based on Western philosophy. Within the Western philosophical context, Velasquez and Andre (2015) outline five different approaches to values for dealing with moral issues:

- The Utilitarian Approach: Ethical actions are those that provide the greatest balance of good over evil and the greatest good for the greatest number. This approach was conceived in the 19<sup>th</sup> Century by Jeremy Bentham and John Stuart Mill to help legislators determine which laws were morally best.
- The Rights Approach: Ethical actions must not violate the rights of the individual, as people have dignity based on their right to choose for themselves, which encompasses aspects such as the right to the truth and to privacy. This approach has its roots in the philosophy of the 18th-century thinker Immanuel Kant.
- The Fairness or Justice Approach: Ethical actions must not show favouritism and discrimination but treat everyone in the same way. This approach stems from the teachings of the ancient Greek philosopher Aristotle who said that “equals should be treated equally and unequals unequally”.
- The Common Good Approach: Ethical actions must benefit all and recognise common goals, while respecting the freedom of individuals to pursue their own goals – examples of common goods include affordable health care, effective public safety and an unpolluted environment. The notion of the common good originated more than 2000 years ago in the writings of Plato, Aristotle, and Cicero.
- The Virtue Approach: Ethical actions based on the assumption that all people strive towards certain ideal virtues, such as honesty, courage, compassion, generosity, fidelity, integrity, fairness, self-control and prudence.

This paper proposes that decisions should be guided by an ethical decision-making framework based on traditional Western ethical approaches with ethical standards aligned to the development priorities of cities. An example of a possible formative framework is presented in Figure 2. It is based on the Markkula Centre Framework (2020) approach but with standards aligned to the developmental context of South African cities. The purpose of the framework is to assist urban decision-makers to start thinking about the ethical aspects of smart applications, and thereby hopefully minimise the likelihood of negative ethical outcomes, such as the exacerbation of inequality among citizens.

Figure 2: Formative ethical decision-making framework for smart applications



## Conclusion

We are a long way from fully understanding the impact of ethical issues in smart cities, while the technology is moving so fast making it difficult to focus on these aspects and find the proper solutions. As a result, it is now time to start considering these issues more seriously and trying to make them part of the process rather than addressing them as an afterthought (Clever et al., 2018: 19).

In response to the call from Clever et al. (2018), this paper aims to contribute to thinking around ethics when making decisions about smart applications in South African cities, which ideally would result in better decisions toward the attainment of smart governance outcomes, among others.

The 4IR offers both opportunities and risks to cities that are striving to meet South Africa's developmental goals. Technological advances may improve people's quality of life and make day-to-day life more efficient, but they may also worsen differences and increase inequality. For cities, the smart city approach to urban development is seen as a way to improve service delivery and citizen inclusion. However, the moral and ethical implications of this approach have largely been neglected. In South Africa, smart urban development could further entrench spatial segregation and inequality. Other concerns relate to implementation, such as infrastructure being unable to handle growing demand, and unsecure data usage leading to possible security breaches or privacy violations.

To guide decision-making on smart applications, the paper proposes a possible formative ethical framework, which is based on traditional Western ethical approaches with ethical standards aligned to the development priorities of cities. The concerns raised and the framework included in this paper provide a starting point for analysing decision-making around smart applications using an ethical lens. However, further work, in particular empirical research, is needed on the ethical dimensions of the South African city and the ethics of smart decision-making and applications. Furthermore, it should be noted that if the concerns and framework are determined as feasible for use in current local government environments, then they would need to be adjusted to fit the specific city's purpose and context.

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# The Durban EDGE Open Data Platform: Redefining data use in eThekweni

*Jokudu Guya and Jonathan Wilson*

Data plays a pivotal role in the way urban environments function, how decisions are made, and the value of information produced. Cities are home to various pieces of data, which give a story about what is happening in a city and its surrounds. Unfortunately, as the eThekweni Municipality's Economic Development and Growth eThekweni (EDGE) team discovered, the information is typically collected but poorly stored and disseminated. In response to this challenge, the City invested time and resources into disseminating the information through quarterly and yearly publications. Yet historically this information was poorly absorbed by the targeted audiences.

To address the poor uptake of information, the eThekweni Municipality invested capacity in the development of the City's first open data platform (ODP) – the Durban EDGE. The aim of the platform is to provide information in accessible formats for different societal actors with varying backgrounds and needs. This case study highlights how, through open data, a city department has managed to lay the foundations for improved use of information within and outside their municipal offices.

## The Durban EDGE

Established in 2011 by the then Economic Development and Investment Promotion Unit, the EDGE team is located within the City's Economic Development Department and tasked with producing cutting-edge economic information and intelligence for the municipality. The Durban EDGE ODP uses datasets, dashboards and data stories to present economic data in an accessible manner. The EDGE team used to produce a lengthy quarterly report containing in-depth information about eThekweni's economy. However, although this report provided vital information that the business sector and eThekweni community found valuable, its dense structure did not always effectively respond to data queries received by the department. As requests for this information continued to grow, it became clear that few people were reading the reports used to package and disseminate information.

In its search to find updated and innovative ways of disseminating their data, the EDGE team chose to take advantage of an offering from the South African Cities Network (SACN) and partners to develop a city-based version of the South African Cities Open Data Almanac ([SCODA](#)) platform. SCODA presents data and analyses of information for its member cities and is one of four components of a Common Data Framework for Cities developed by the SACN to support cities in improving their data practice and management. The platform was developed through a partnership with Open Cities Lab (OCL, formerly Open Data Durban), a non-profit organisation that shares the vision and objective of transforming data practice in South African cities.

## Features of the Durban EDGE ODP

The Durban EDGE ODP is a tool that supports economic decision-making. Through continued collaboration between eThekweni and OCL, the CKAN19-based [Durban EDGE ODP](#) was designed and developed to provide information suitable for users with different levels of data literacy through three mechanisms: datasets, dashboards and data stories.

### Datasets

Datasets refer to a collection of data that can be sorted, manipulated or categorised for the purpose of understanding and analysing the information provided. Users are able to find datasets easily, as the EDGE team has categorised the data into organisations, economic groups, tags and formats, with the intention of adding further categories over time. Datasets that can be found on the portal include labour, property, electricity, business licensing and education.

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<sup>19</sup> CKAN, which stands for the Comprehensive Knowledge Archive Network, is an open-source free software used by developers to build ODPs.

Figure 1: Example of datasets from the Durban EDGE ODP

**Rentable Office Data**  
Total rentable area in square meters and office vacancy rates (percentages) for key metros (Johannesburg, eThekwini, Tshwane, Cape Town, Nelson Mandela Bay) and eThekwini nodes...  
XLSX Updated May 11, 2020 | Created October 24, 2018

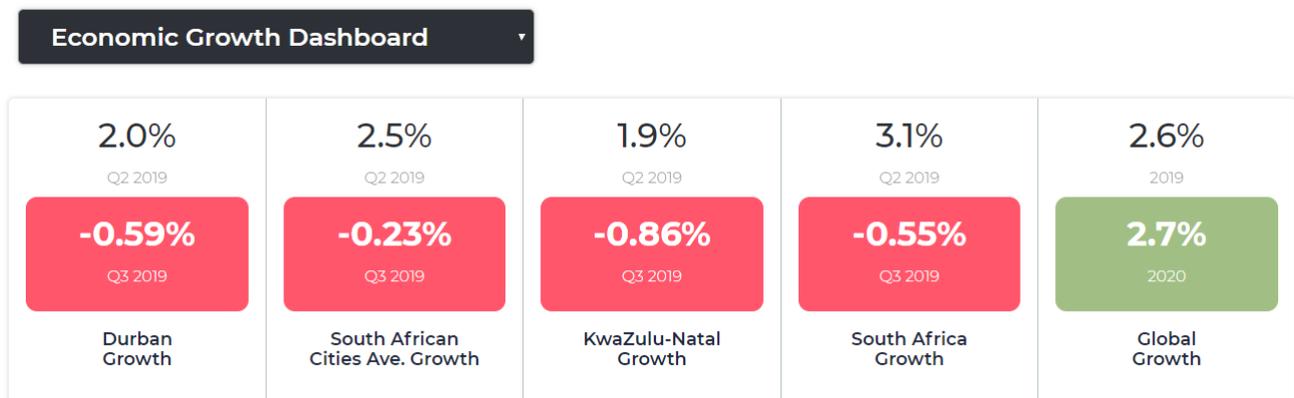
**EThekwini Building Plans**  
Number of building plans submitted and approved monthly and annually per property type and geographic region in eThekwini Municipality. Source: EThekwini Municipality...  
XLSX PDF Updated May 11, 2020 | Created April 8, 2019

Source: <https://edge.durban/>

## Dashboards

Dashboards offer a visualisation of key pieces of data that enable readers to make sense of information at a glance. The Durban EDGE ODP currently has two dashboards – economic growth and unemployment – that give an overview to help users understand the economic and unemployment situation in Durban without having to explore the many datasets in the ODP.

Figure 2: Example of a dashboard from the Durban Edge ODP



Source: <https://edge.durban/>

## Data stories

Data stories allow for data within the portal to be conveyed as a narrative and are found on the home page. These reports and articles draw from the dashboards, datasets and other sources of information in the country, the province and communities in eThekwini. The information represented in data stories reflect developments in the local, national and global economy.

Figure 3: Example of data stories from the Durban Edge ODP



Source: <https://edge.durban/>

Conveying information through these mechanisms, eThekweni is able to offer a library of downloadable data that is accessible to a multitude of users. The data can be manipulated for further analysis and provides a fair and regularly updated representation of the economy, as well as narratives related to economic performance.

## Transforming Data Practices in eThekweni

The Durban EDGE is the first ODP in South African municipalities aimed at transforming the use and relevance of municipal data. Its main objective is to improve both open access to data and decision-making, and has resulted in the following benefits:

### Information sharing

Given the desire to share the vast amount of data held within the department, a key objective of the Durban EDGE ODP is to provide the data that informs the reports and insights on the eThekweni economy. In sharing information in formats such as CSV, Excel, and PDF, users are able to manipulate, analyse and visualise data from their perspectives (i.e. civil society, business, academia) and discover more about the economy without being restricted to the insights of the EDGE team.

### Accessibility

The Durban EDGE ODP has been designed to be a user-friendly platform that is accessible to various actors in society. Accessibility was identified as a key feature of the platform, given the intention to make economic data available to multiple user groups. Functionality thus became important so that users can access data on the go – the Durban EDGE ODP can be accessed from a desktop or a mobile device. Fundamentally, its purpose is to provide all data on a single platform, allowing users to access available data in one place.

### Relevance

A detailed report requires information to be gathered, analysed, written up, edited and then a final document produced, which is a lengthy process and leads to the dissemination of outdated information. By digitalising the report, the EDGE team can provide users of the site with updated, current (therefore relevant) information, which allows for a clearer story of the eThekweni economy. Providing relevant information should result in informed decision-making that helps build the economy where it is most needed.

## Insights

Initially, the information for the Durban EDGE platform was disseminated through a quarterly report. In an effort to make the information more accessible and useful, the EDGE team chose to disseminate information using narratives or data stories. Unlike the dashboards, which provide raw data in an appealing manner, presenting information in the form of narratives means that users can find information with insights in the articles posted on the home page. Narratives provide the EDGE team with the ability to offer insights, available in a report, in a manner that is readable and informative to users who may not have the skills to read and analyse raw data.

## Improved data management

The siloed approaches to data management within eThekweni, and many other South African municipalities, have led to several challenges, including access to data from other departments, data recorded in uncoordinated formats, duplication of data and the hoarding of data. The process of opening data to the municipality and the eThekweni community is a step towards fostering engagement and limiting challenges in data practices and processes.

As these benefits show, the collaboration between OCL and eThekweni has enabled the transformation of data practices and processes within the City through the Durban EDGE ODP.

## EDGE and COVID-19

In November 2019, the eThekweni Council approved the launch of the Durban EDGE ODP. Since then, the EDGE team has both expanded the platform across departments within eThekweni and built internal capacity to function independently. This achievement was emphasised in the response to the Coronavirus pandemic, following the declaration of national lockdown on 15 March 2020 in order to reduce the spread of COVID-19. It has highlighted the importance of using data to drive decision-making and effective communication with citizens.

The EDGE team updated the platform and engaged with key local government representatives on decision-making. On 20 March 2020, just five days after the declaration of a national state of disaster, a data story on COVID-19 and its impact on the eThekweni economy was published on the Durban EDGE ODP. The data story examines the impact on the economy in terms of growth rate, household expenditure, trading, value chains, tourism, foreign direct investment and employment. The analysis presents an outlook on how the economy has been – and will continue to be – negatively affected by the projected spread of COVID-19.

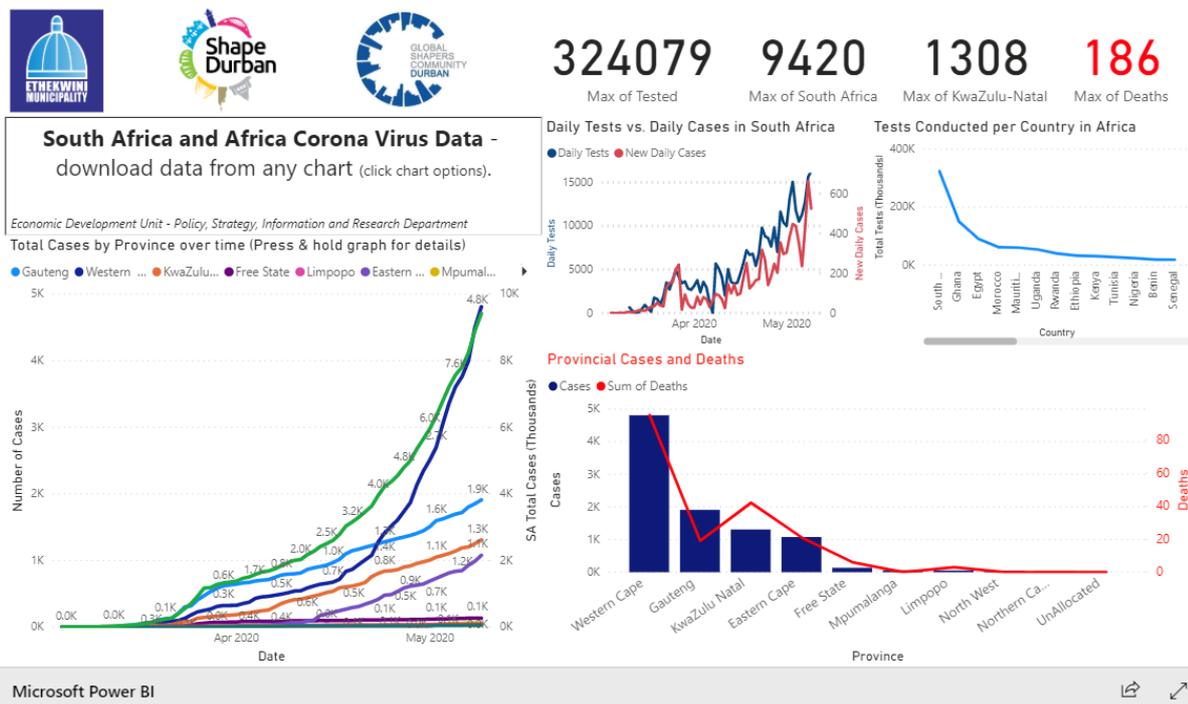
Figure 4: COVID-19 data story from the Durban EDGE



Source: <https://edge.durban/>

Furthermore, through the internal capacity, practices, and processes established, the EDGE team was able to use the platform to visualise and communicate the risk of the virus and provide access to COVID-19 business relief information through additional dashboards developed entirely in-house. This response shows that the Durban EDGE ODP is able to act with agility and respond directly to the needs of society in a time of crisis, and that the City has increased capacity to use open data to respond to complex challenges.

Figure 5: COVID-19 South Africa dashboard from the Durban EDGE



Source: <https://edge.durban/>

## The Importance of Open Data Portals

In the context of smart governance, a city uses technology as a conduit to respond to complex challenges. The Durban EDGE ODP emerged out of the Economic Development Department’s need not only to improve internal functioning, but also to engage with external departments, and to take an all-of-society approach to sharing information. Its success lies in its ability to improve decision-making, as well as data governance, and to begin to address the issue of silos within a municipality.

The Durban EDGE ODP is an example of how a municipality can adopt ICT tools that support smart governance principles at a local government level. Improved data governance at the local level can result in more innovative solutions to community challenges, service delivery challenges, and relevant investment into the economy. The platform is a great example of how data can be used to encourage innovative and smart solutions to urban challenges, therefore highlighting one way in which technology can be used to grow South African cities.

# The Community Tapestry: A multi-sectoral, evidence-based, decision-making tool for social development and spatial transformation

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South Africa is known for its good policies and its lack-lustre implementation. One such policy arena is the spatial transformation of cities. Good implementation capacity rests fundamentally on the ability to **plan, target and monitor the impact of interventions**, all of which depend on having the right data and interpreting this data appropriately. In addition, an essential requirement of effective spatial transformation is the ability to plan and track outcomes at a sufficiently **low level of spatial disaggregation**. As high levels of socio-economic and infrastructure inequality are often found within a neighbourhood, suburb or township, or even within a ward, effective spatial targeting requires data to be analysable at the small area layer (SAL), which represents a relatively homogeneous “community” of 500–2000 households. And ideally, the data would be collected repeatedly over time, to see a trend and be able to measure impacts. However, regularly generating data at this level of spatial disaggregation is usually very expensive, as it conventionally requires a very large sample.

Furthermore, although effective spatial transformation is led by government policy and infrastructure investment, it also requires the active participation of the private sector and communities. Yet currently, there are virtually no platforms for a **shared evidence-base** from which multiple sectors can coordinate and hold each other accountable for promised investments and overall policy implementation.

What is needed is to design a system that makes SAL-level data generation affordable (and therefore accessible to decision makers) and that provides a shared base of information and insights to actors in all sectors – government, corporate and civil society – so that they have the tools to:

- Take informed policy decisions that support holistic development.
- Allocate resources for maximum spatial and social transformation.
- Coordinate poverty alleviation, business development and spatial transformation initiatives for mutual benefit.
- Reduce resource wastage from duplication or contradictory interventions.

## The Community Tapestry Platform

The Community Tapestry is an interactive web-platform that expands accessible information for development planning and spatial transformation across communities and across multiple economic and developmental sectors. It does this by integrating secondary and primary data at community level and presenting insights through data visualisation and storytelling.

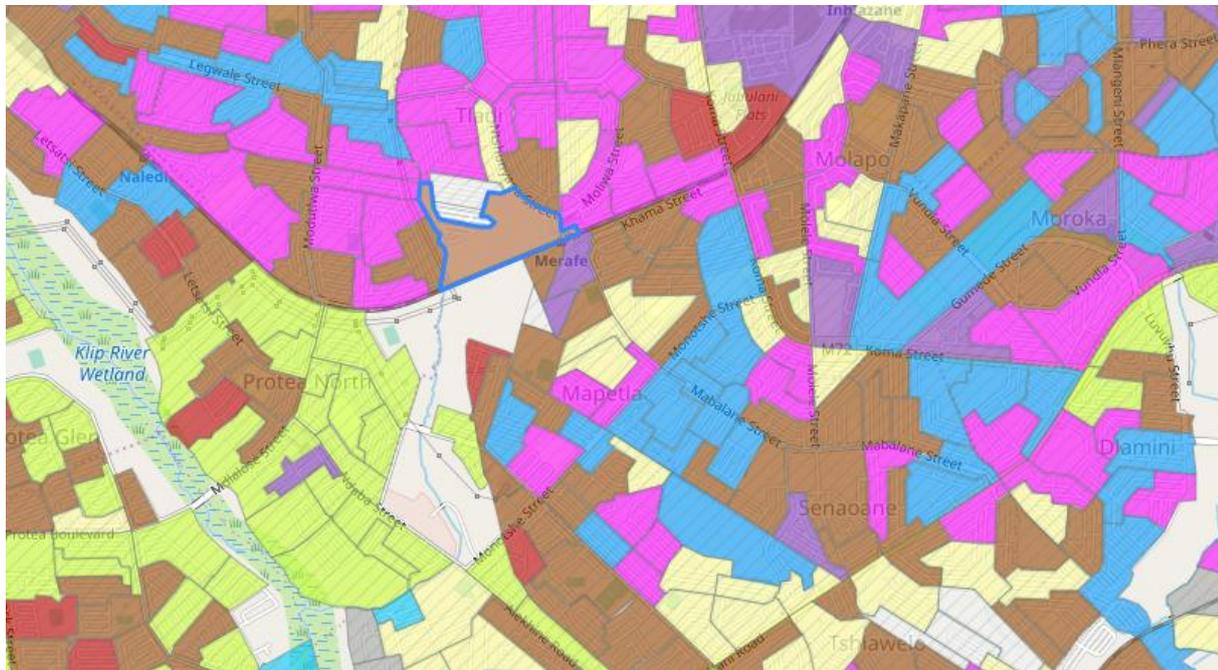
The Community Tapestry was initially developed as a means of surveying populations that were hidden or unknown, and so for whom there was no sampling frame. Social Surveys Africa developed a typology of communities following the logic that individual experiences were likely to be similar in similar contexts and different in different contexts. As an example, four people with the same demographics (35-year-old black women with two children earning R4000 per month) have very different experiences if they are respectively living in a rural village, an informal settlement, a township and a well-off suburb. And the difference of experience goes beyond a simple distinction by rural/urban or by the average income of an area. There are vast differences in context between townships and within any township, as anyone who regularly spends time in townships and informal settlements knows.

Therefore, Social Surveys Africa took an empirical approach to developing a typology of communities, using census data to generate three indices:

- An index of socio-economic welfare (e.g. income levels, employment rate, education levels, etc.).
- An index for infrastructure availability (water, electricity, refuse removal, etc.).
- An index for income diversity (or inequality) within each of the 84000 SAL-level neighbourhoods in the country.

When each neighbourhood point was mapped onto the three-dimensional space created by the three indices, the points naturally grouped themselves into 16 “clusters”. Each cluster represents a distinct type of community that exists in South Africa.

**Figure 1: Protea North, Soweto and surrounding areas with Community Tapestry Clusters**



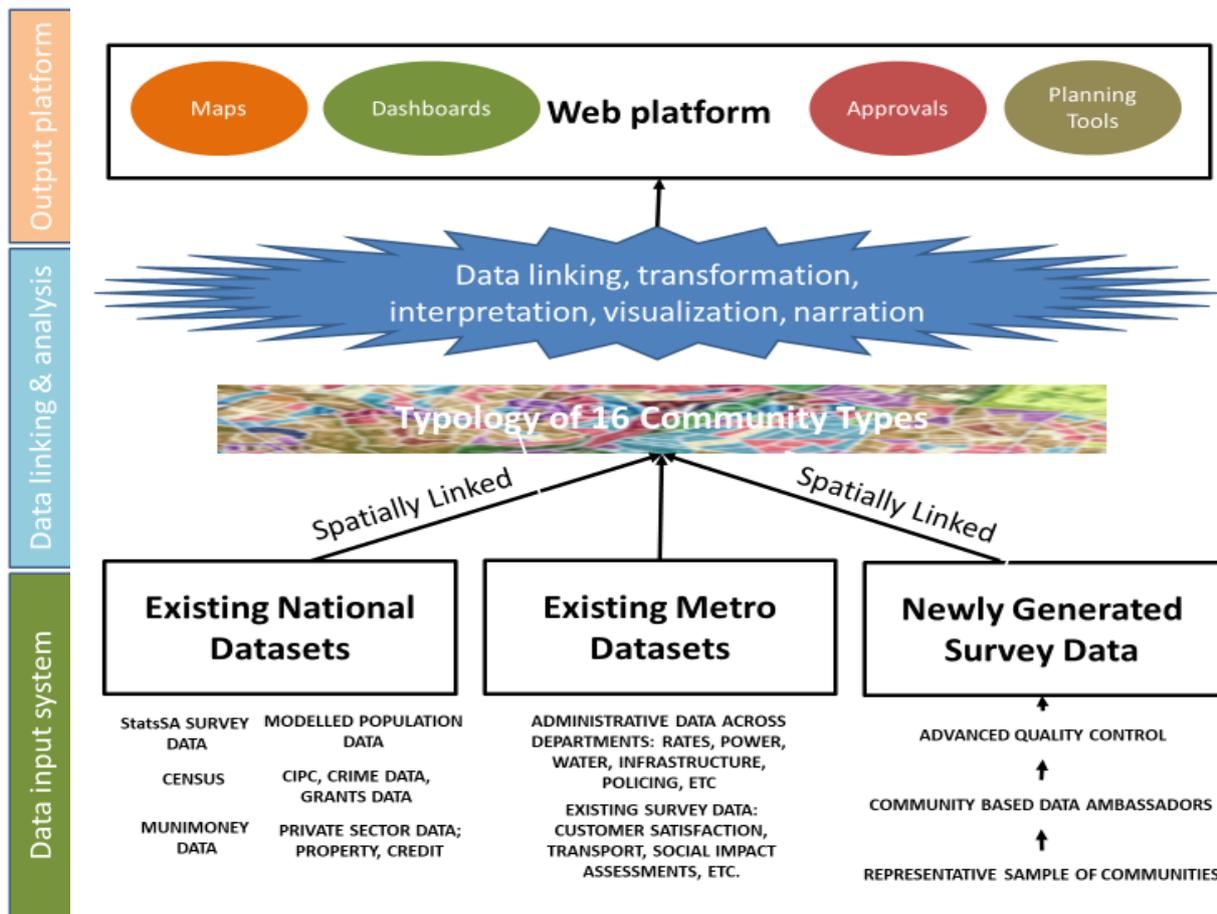
*Note: Each colour represents a different type of community context.*

Apart from its initial purpose, as a sampling frame, this typology provides the foundation of a broader online platform which integrates three levels:

- A data input system, from existing and newly generated datasets.
- A data linking and analysis system, through the unique typology of communities and advanced data science and programming approaches.
- A data interpretation and decision-support output platform, which combines multiple formats to enable clear data storytelling and interpretation for maximum decision-making support by a wide range of users.

Put together, these three levels address the challenges of resource-efficient data sources and a shared multi-sectoral evidence and insights platform.

Figure 2: The Community Tapestry Platform



## Data input system

The input component of the platform creates resource efficiencies by reducing wastage and duplication through compiling secondary data and introducing an efficient surveying process for generating new primary data. Specific benefits of the platform include the following.

- **The efficiency and value of existing and future data are increased.** At present, money and effort are wasted when large datasets are only used once, and when insights from one analysis are not linked to other data. The Community Tapestry integrates social data from primary and secondary sources, across multiple thematic areas and across time, and links data points from different sources to a shared spatial reference system (the Community Tapestry typology at SAL level). This means that valuable insights from investing in past, current and future data generation can be maximised, rather than datasets languishing unused in silos.
- **The social data gap is bridged.** There is currently little social data that is up-to-date and spatially disaggregated to the community level to inform evidence-based governance at national and municipal levels. The Community Tapestry includes the generation of new primary data through repeated nationally representative “Gauge” surveys. This data provides inputs for key social policy areas, including achieving the sustainable development goals, implementing the National Health Insurance system, and building up township economies.
- **Data patterns can be extrapolated.** The typology of 16 distinct types or “clusters” allows information about a sample of communities to be extrapolated with predictable levels of accuracy to other communities within the same cluster. This means that spatially disaggregated information can be provided with a relatively small sample, since reliable information can be extrapolated from the sample without including every local area. Therefore, a national sample of 24 000 can provide a strong evidence-base for neighbourhood-level effects.
- **Youth are employed and capacitated through data collection.** Hundreds of previously unemployed young people are employed to collect primary data in the “Gauge” surveys in their respective areas of residence, which include the poorest and most marginal areas of the country. The training builds not

only surveying skills but also digital literacy and community engagement. The presence of data “ambassadors” in their own communities who both generate the data and feed the results back to local community members, enables cost-effective surveying (reduced need for transport and accommodation costs) as well as community ownership and use of the results.

- **The data-generation infrastructure is shared and sustainable.** The Community Tapestry system acts as a decentralised engine for primary data generation and spatial interpretation that other research stakeholders and evidence-users can use for their own surveys or data generation needs. This significantly increases the collective time and cost efficiency of generating social evidence in the country.

## Data linking and analysis system

The key to the power of the Community Tapestry platform is a data linking and analysis system which connects the various input datasets to the common spatial framework of the Community Tapestry clusters at SAL level and therefore to each other. The greatest benefit of this is that:

- **Data can be extrapolated and linked.** Each new dataset with spatial information is tested for whether its indicators follow the patterns predicted by the Community Tapestry typology. So far, virtually all tested indicators have shown a highly reliable predictive pattern (at either 95% or 98% predictive validity) from one sample of localities to other localities within the same typology cluster. This means that datasets collected in one set of places can be analysed together with datasets collected in other areas, provided they are both linked to the same underlying framework of community type clusters.

## Data interpretation and decision-support platform

Core to the Community Tapestry is an accessible online “front end” through which a wide range of users can access and visualise relevant data and insights to support evidence-based decision-making without requiring advanced technical knowledge in data analysis.

- **Data is given meaning through storytelling and visualisations.** The innovation is that the site combines the interpretative power of representative quantitative data with the emotional and identity-building power of stories.
- **Data access is democratised.** By giving community-based organisations access to information about their own communities, the Community Tapestry is a tool that enables communities to carry out their own social audits, which can be used to hold all spheres of government accountable, and to self-organise through planning and prioritisation processes.
- **Insights are shared and accessible.** The shared platform allows stakeholders from a range of sectors, including township residents and businesses, local government, civil society and the private sector, to access the same ready-to-use information about underlying economic and social conditions. The availability of fast, responsive and affordable data, collected through the Community Tapestry system and represented in accessible visual and narrative ways, also enables a wider group of public and private agencies and organisations to access empirical data and make better evidence-based decisions.

These innovations make the Community Tapestry a scalable and affordable (and therefore sustainable) mechanism for generating and interpreting high quality, spatially nuanced, community-level evidence generation for social development. This is a key missing link in municipal smart governance, which currently lacks the means to take evidence-based decisions at a community level because of the lack of appropriate data inputs and sufficient technical capacity for data interpretation. Finally, the explicit multi-stakeholder and community-oriented nature of the platform integrates a consultative and participatory dimension into municipal decision-making, which increases not only the smartness but also the substantive justness of governance.

# Smart Fleet Management and the Governance of Bus Rapid Transit Fleets in South African Cities

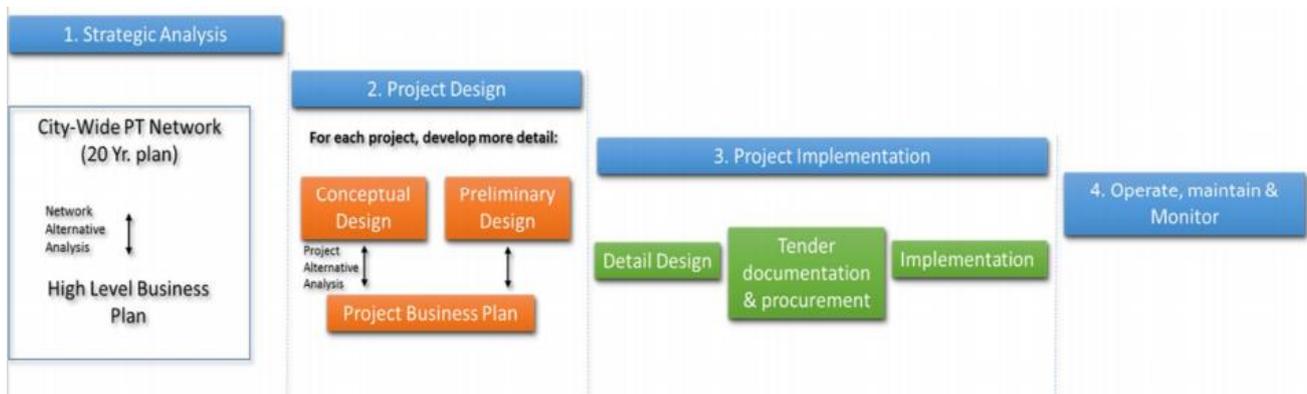
Prian Reddy, GoMetro

## Introduction

Bus Rapid Transit (BRT) is a road-based mass public transport system, which is designed to move large numbers of people effectively and speedily, and to link different parts of a city as part of an Integrated Rapid Public Transport Network (IRPTN). In South Africa, the cities of Johannesburg, Tshwane, Ekurhuleni and Cape Town have developed and implemented some form of BRT, and other cities are in the planning stages of implementing a BRT system.

As Figure 1 shows, the BRT project development cycle comprises four stages: (1) strategic analysis, (2) project design, (3) project implementation and (4) operations, maintenance and monitoring. An ICT-based smart fleet management system should be implemented in stages 3 and 4. Such a system will assist cities to benchmark the performance of BRT operators in a transparent and accountable manner.

Figure 1: Four stages of the BRT project development cycle



Source: National Treasury (2018: 23)20

Tables 1 and 2 show the implementation and operational capabilities that are required during Stage 3 and Stage 4 respectively for an ICT-based smart fleet management solution.

Table 1: BRT implementation and operational capabilities required during Stage 3

Required functions	Key responsibilities	Capability and capacity needs
Procurement of contractors to operate public transport service	Preparation of bid documents including specifications and evaluation criteria Management of the procurement selection process Management of the selected contract	Technical training or experience in procurement procedures that meet government requirements and are sensitive to public transport requirements A minimum of one procurement professional
Management of contractors to operate public transport service	Ongoing management oversight of contractors	Technical training or experience in management oversight procedures A minimum of one professional

20 <https://csp.treasury.gov.za/Resource%20Centre/Conferences/Documents/CSP%20Tools/Public%20Transport%20and%20Urban%20Mobility/Consolidated%20IPTN%20Guidance%20V4%20Jan%202018.pdf>

**Table 2: BRT implementation and operational capabilities required during stage 4**

Required functions	Key responsibilities	Capability and capacity needs
Asset management	Development of a maintenance plan for the ongoing maintenance, renewal, and replacement of public transport assets to ensure that they operate in a state-of-good-repair until they reach their useful life.	Technical training or experience in asset management A minimum of one professional
Financial management	Recording and reporting of expenses incurred related to government grants Maintenance of an accounting system for accurately recording and reporting all public transport expenditures and revenues Development of one-year, five-year and ten-year financial plans Preparation of monthly reports of actual and budgeted expenses and revenues	Technical training in accounting and financial management A minimum of at least one professional with these capabilities
Operations performance management	Management of a data collection and reporting system regarding the resources expended, service provided and service consumed	Technical training in performance monitoring A minimum of one professional

## GoMetro

GoMetro is a Cape Town-based smart mobility start-up with extensive experience in conducting public transport surveys to measure operational sustainability. An operational analysis conducted for several South African cities identified one of the governance challenges to be the monitoring and evaluation of all BRT operational agreements entered into between cities and private bus operators. The BRT system has been rolled out in South African cities as a public-private partnership: cities are responsible for building and maintaining the infrastructure (special lanes, stations, depots, control centres and fare collection system), while private operators provide services on a long-term contract, managing buses and staff. An ICT-based smart governance solution would enable the performance of all operational arrangements to be monitored and evaluated. A technology-based platform would ensure transparency and accountability with regards to the awarding of BRT operational contracts to private bus operators.

To ensure compliance with the contracts, cities needed access to operational data related to the procurement and management of contractors to operate public transport services, asset management, financial management and operations performance management.

GoMetro Fleet was developed as a technology-based response to solve the governance challenge of monitoring and evaluating BRT operational agreements between cities and private bus operators. The benefits of such a system and a framework for implementing this solution in South African cities is explored through the case study of the University of Cape Town (UCT) Jammie Shuttle in Cape Town. The case study examines the GoMetro Fleet features, which responded to the need for contract monitoring and performance evaluation, and how this system was successfully implemented for the Jammie Shuttle.

## The UCT Jammie Shuttle, City of Cape Town

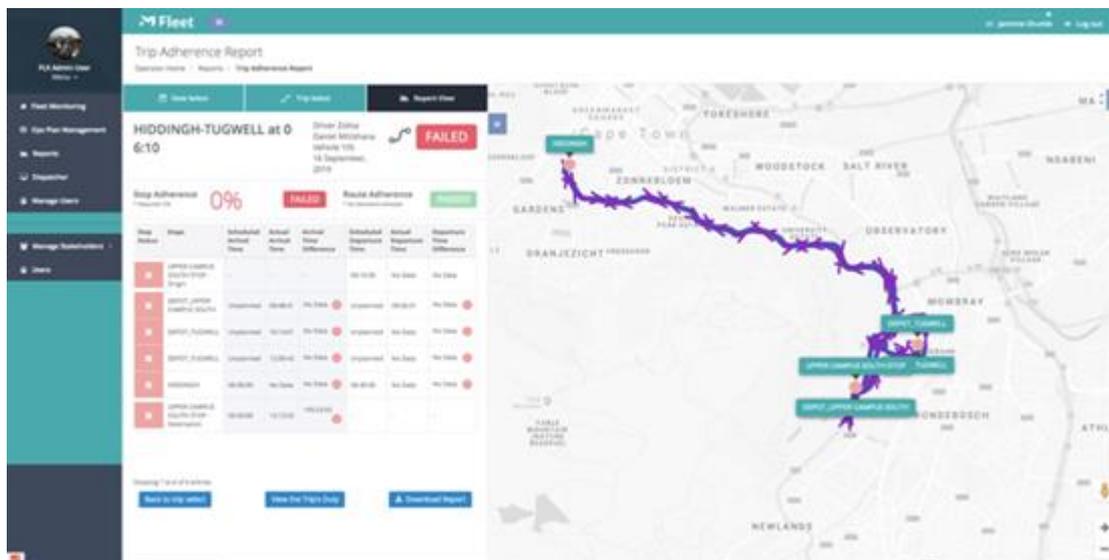
The Jammie Shuttle is a bus service for UCT that consists of a fleet of 26 buses, which run to a strictly controlled schedule. The service is available on 16 routes and has three operational plans (normal service, consolidation/exam service, vacation service). The service operates 24 hours a day, seven days a week in normal service. During peak periods, the Jammie Shuttle carries more than 20 000 passengers.

The GoMetro Fleet solution is used to monitor and optimise operations of the Jammie Shuttle. This smart fleet management web-based platform uses GPS tracking units installed on each bus in the fleet, which provide by-the-second accurate location and on-time information. It uses telemetry data to monitor fleets and allow operators to optimise operations. The software's core functionalities are:

- Live vehicle tracking and monitoring
- Schedule, route and trip adherence
- Labour management
- Asset management
- System optimisation, including route, fleet size, driver behaviour and revenue modelling.

Figure 2 is an example of a route performance profile from the GoMetro Fleet software that shows an on-time and on-route analysis of the Hiddingh-Tugwell route.

Figure 2: Example of a route performance profile for Jammie POC Hiddingh/Tugwell route



The UCT Jammie Shuttle’s routes, stops and schedule and duties were formalised and digitalised, resulting in an updated General Transit Feed System timetable that could be integrated into a journey planner mobile application.

In addition, the GoMetro mobile app and real-time analytics were developed for UCT, in response to safety issues reported by students waiting at bus stops late at night and in the early hours of the morning, as well as increased traffic congestion that resulted in delays of the Jammie Shuttle. The real-time journey planner app is called GoMetro Move. Figure 3 provides some images of the app’s mobile interface, while Figure 4 shows the route optimisation, fleet size optimisation and revenue modelling components of the GoMetro Fleet management platform.

Figure 3: Mobile interface of the GoMetro Move journey planning app

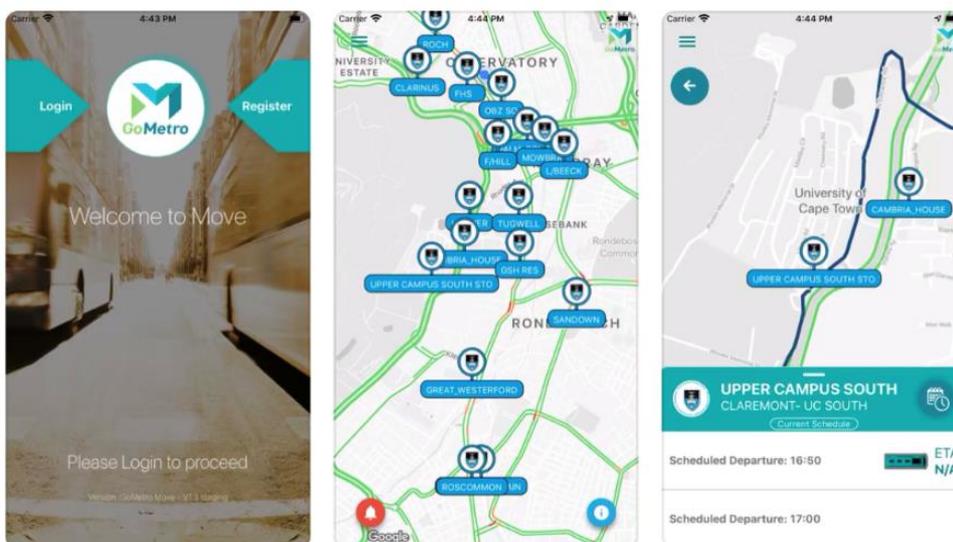


Figure 4: Mobile interface of the GoMetro Move journey planning app

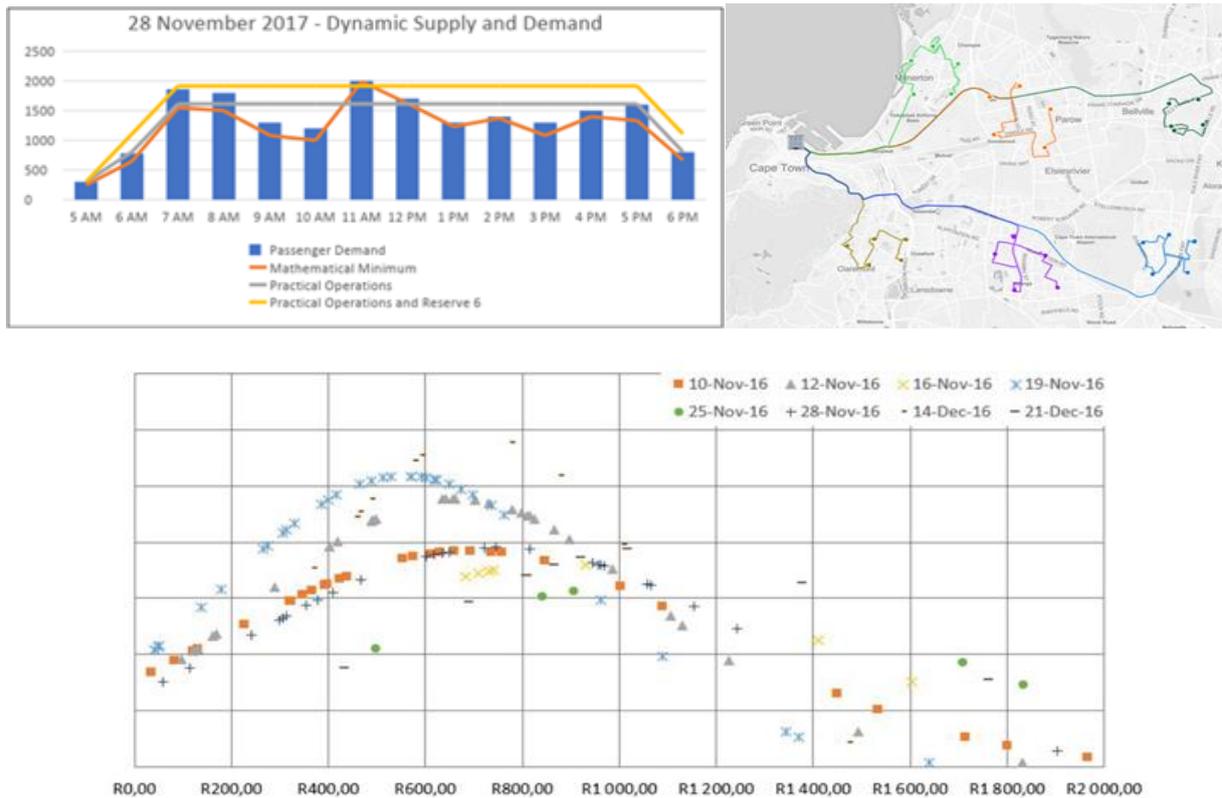


Table 3 provides a matrix that evaluates the effectiveness and applicability of the GoMetro Fleet solution and GoMetro Move app for monitoring and evaluating the performance of operational agreements entered into between cities and private bus operators. It shows that the GoMetro smart fleet management solution meets all five implementation and operational capabilities of the BRT system in the context of the Jammie Shuttle.

Table 3: Operational agreements between cities and private bus operators

Smart fleet management feature	BRT implementation and operational capabilities required				
	Procurement of contractors to operate public transport service	Management of contractors to operate public transport service	Asset management	Financial management	Operations performance management
Live vehicle tracking & monitoring		✓	✓		✓
Schedule, route, trip adherence		✓			✓
Labour management		✓			✓
Asset management		✓	✓		
Route optimisation	✓				✓
Fleet size optimisation	✓		✓		✓
Driver behaviour optimisation		✓			✓
Revenue modelling optimisation				✓	
Journey planner app		✓			✓

Table 4 explains how GoMetro Fleet technology can solve common BRT governance challenges.

**Table 4: Solutions to BRT governance challenge**

GoMetro Fleet feature	Specific challenge that is addressed	How is this achieved?
Live vehicle tracking and monitoring dashboard	Vehicle theft, misuse, monitoring and recovery	GPS tracking units linked to the GoMetro Fleet Platform installed in each vehicle
Schedule, route, trip adherence dashboard	BRT operations mismanagement	The tracked vehicle movements overlaid against the scheduled operations plan to measure adherence.
Labour management dashboard	HR & payroll mismanagement	Drivers hours worked logged via a telemetry data stream, which is integrated with Payroll
Asset management dashboard	Poor visibility of what assets are owned and how they are used	Real-time database of vehicle assets, status and maintenance schedule
Route optimisation and trip builder	Excessive mileage and fuel consumption	Optimised route lengths and trip and stop durations to decrease mileage and fuel consumption
Fleet size optimisation and scheduler	Inefficient fleet size and manual paper-based scheduling and dispatch	Smaller more efficient fleet and replacement of paper-based scheduling
Driver behavior optimisation	Poor quality of driving	Driver behaviour scorecard to measure performance
Revenue modelling optimisation	Poor financial controls	Revenue modelling dashboard
Journey planner app	Lack of passenger information and of a platform for the public (passengers) to hold government accountable for quality of BRT services	Integration of timetables into a real-time passenger information mobile app, with complaints and feedback option on the journey planner app

## Conclusion

Smart governance, in the form of an ICT-based solution for monitoring and evaluating the performance of contracts between cities and private operators, facilitates and supports better planning, decision-making and operational efficiency. This is achieved by harnessing the power of big data through telemetry data streams from tracking units installed in each vehicle. These data streams feed into a software or web-based platform, which benefits both city governments and the BRT operators.

Smart fleet management enables South African city governments to be transparent and to hold private bus operators accountable for their performance. With easy access to operational performance reports, cities are able to create profiles of operators and their contract compliance. This database can be used in future tender adjudications, to highlight operators who performed well or poorly in previous contracts. Furthermore, cities can use the financial management, asset management and operational performance management reports to decide where to allocate or redistribute funding. This data can also be used to build a case for additional BRT operational funding from other spheres of government.

A smart fleet management solution is also of benefit to the private bus operators and can mitigate the three greatest challenges facing municipal bus fleet operators: vehicle theft, hijacking or damage; abuse of vehicles by drivers (such as using vehicles for own purposes or not declaring cash fares that are collected); and high maintenance costs due to poor planning. This is because of the following features.

- Vehicles are fitted with tracking units that continuously generate operational data, which can be used to monitor and manage adherence to the operational plan, with the in-vehicle accelerometer measuring sensitive changes in location, speed, harsh braking and impacts.
- A centralised operations dashboard that provides critical operational data, alerts and reports, which can be used to plan preventative maintenance and fleet productivity.
- Smart dashboards and driver education tools that can dramatically improve fleet management and address issues related to efficient and successful fleet operations.

Figure 4 offers a proposed framework for implementing smart fleet management across all BRT bus fleets in South African cities.

Figure 4: Framework for implementing smart governance of BRT fleets

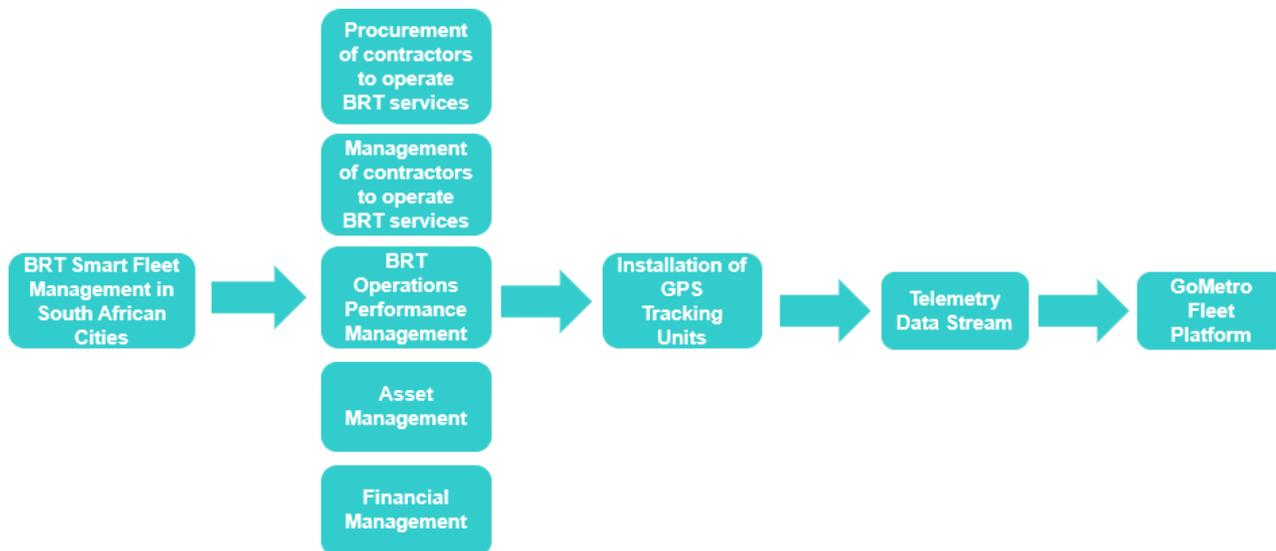
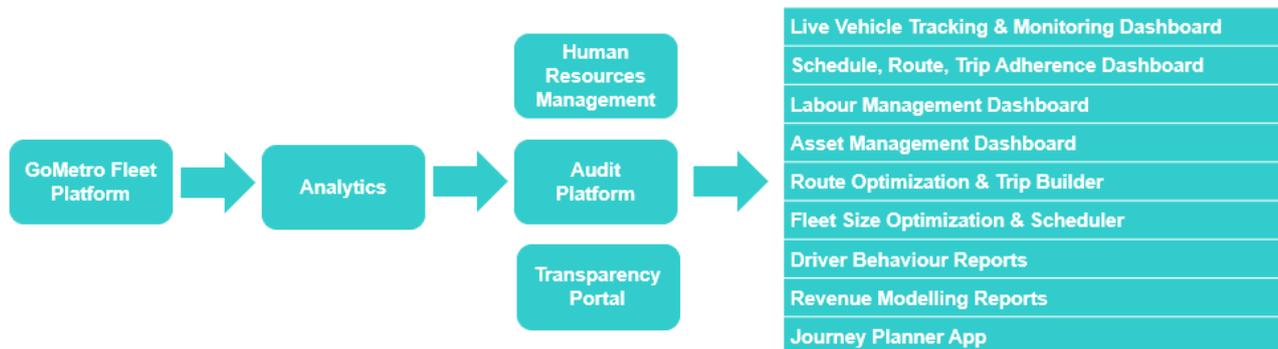


Figure 5: GoMetro Fleet as a platform for the smart governance of BRT fleets



The implementation framework outlined in figures 4 and 5 illustrates that smart governance of BRT fleets is possible through combining telemetry data streams from in-vehicle GPS tracking units and the GoMetro Fleet platform. The BRT fleet telemetry data streams, which are transformed via a web-based analytics platform, provide live vehicle tracking and monitoring that cities can use to hold private bus operators accountable for contract compliance. The Move journey planner mobile app shows the live location and estimated time of arrival of buses and, paired with a complaints and feedback platform, can be used to hold BRT operators accountable for the quality of transport service provided to citizens. The case study of the UCT Jammie Shuttle shows that GoMetro Fleet is a suitable and applicable technology response to the governance challenges experienced by BRT services in South African cities.

# Smart Governance for Municipal Solid Waste Management

Vincent Siwawa

## Introduction

The City of Johannesburg (CoJ) faces enormous challenges to transform itself into a city of prosperity, social inclusion and environmental sustainability. Johannesburg is the country's economic hub and an "arrival city" for work seekers from other South African regions and many other African countries. This rapidly increasing population results in a proliferation of informal settlements on the outskirts of the city (Orange Farm, Alexandra), increased waste generation and illegal dumping, and overcrowding in the inner-city. The CoJ's limited waste management infrastructure and resources are under pressure from high waste-generation rates, a shortage of landfill space for waste disposal (CoJ's landfills sites have a combined lifespan of less than six years) and poor waste disposal attitudes of the citizenry.

In response to these challenges, the CoJ has adopted various strategies to reduce waste that goes into landfill, including alternative waste treatments (waste to energy, biogas and landfill gas) and waste minimisation (separation at source, office recycling, waste pickers, education and awareness, and buy-back centres). Despite having a Zero Waste Goal to divert 70% by 2012 and eliminate the waste problem by 2022, the city's predominant method of waste management remains landfilling because alternative technological solutions appear to be more expensive. The CoJ uses smart governance to communicate with citizens and to encourage public engagement and collaboration, using technology and ICT tools. This case study examines how the CoJ uses smart governance to support solid waste management.

## Smart Governance through ICT Tools

The CoJ's smart city strategy<sup>21</sup> brings together the traditional functions of government and business and the use of new communication channels (ICTs – social media & websites) to achieve social inclusion of urban residents in public services.<sup>22</sup> Social media tools serve as two-way communications, enabling the municipality to disseminate information and productively interact with citizens about service delivery initiatives. These tools have the potential to improve the free flow of information, and to encourage diverse views and debates.<sup>23</sup>

The CoJ and PikitUp, a privatised municipal-owned entity that provides waste management services in the city, have deployed a variety of tools for engaging with citizens, from websites to social media platforms. Local politicians also use social media channels to disseminate and share information with their residents about their ward programmes and city waste management initiatives, such as ward cleaning and separation at source (S@S) campaigns.<sup>24</sup>

Websites serve as a one-way communication channel to spread information about waste management strategies such as recycling, waste bylaws and the S@S initiative, with the aim of building support for these policies or strategies. Websites are also used to gauge public opinion and engagement towards the city policies and strategies, such as the Zero Waste Goal. However, as a one-way communication ICT tool, websites simply lower the barriers to access of information about city waste management policies and strategies for those with access to the internet – and finding information on municipal websites is not always easy. The CoJ and PikitUp websites do not contain openly available tools for waste recycling performances and stakeholder participation. However, waste performance data for the CoJ and Gauteng is accessible at the Gauteng Waste Information System (GWIS) (<http://www.gwis.gpg.gov.za/>), which falls under the Gauteng Department of Agriculture and

21 [https://www.joburg.org.za/documents/\\_Documents/Intergrated%20Development%20Plan/Integrated%20Development%20Plan%20%28IDP%29%20201920%20Review/Annexure%20A\\_2019\\_20%20FINAL%20IDP%20May.pdf](https://www.joburg.org.za/documents/_Documents/Intergrated%20Development%20Plan/Integrated%20Development%20Plan%20%28IDP%29%20201920%20Review/Annexure%20A_2019_20%20FINAL%20IDP%20May.pdf)

22 <https://www.africanconstructionexpo.com/wp-content/uploads/2019/07/Monique.pdf>

23 Tomor Z, Meijer A, Michels A and Geertman S. 2019. Smart governance for sustainable cities: Findings from a systematic literature review. *Journal of Urban Technology*, 26:4, 3–27.

24 The websites are: [www.pikitup.org.za](http://www.pikitup.org.za) and [www.joburg.org.za](http://www.joburg.org.za); twitter handles are @CleanerJoburg and @CityofJoburgZA. Examples include the Mayor of CoJ (MayorGeoffMakhubo/ on Facebook and @geoffmakhubo on twitter and a local councillor: CllrSarahWissler/ on Facebook, @sahara67 on twitter, as well as a website ([ward23jhbsouth.co.za/](http://ward23jhbsouth.co.za/)).

Rural Development. The GWIS aims to provide the public, business, industry and government with access to information on the management of waste within the Gauteng Province. Routine data is captured on the tonnes of waste transported, treated, landfilled and recycled in the province on a monthly and annual basis. Having this information also available on the CoJ and PikitUp websites would improve access to information/data and interactions between government and customers.

## The Role of ICT Tools in Improving Service Delivery

Social media channels can assist governments to align with society's needs and provide for transparency, accountability and stakeholder participation. These online forums allow the public to engage in debate and to give information to the municipality about solid waste collection schedule changes or uncollected refuse, thereby enabling the city to respond in real time. ICT-enabled governance supports collaborative governance by encouraging people to participate in awareness campaigns and clean-up campaigns related to waste management. Through social media channels (Facebook and twitter), PikitUp, the CoJ, ward councillors and the Mayor collectively reach nearly a million followers, out of an estimated city population of eight million residents. The CoJ's Facebook page has 119 003 followers, while CoJ and PikitUp have 965 565 and 28 798 followers respectively on twitter.<sup>25</sup> However, the level of online citizen engagement is not as high as might have been expected, given that the CoJ provides free Wi-Fi hotspots to improve universal access to the internet for residents. The use of ICTs also raises questions about exclusion, as the deployment of these tools limits participation to those with access to digital devices.

These ICT tools facilitate smart governance and have also enabled the emergence of a group of very active participants advocating for environmentalism and sustainability, which has strongly influenced municipal waste management service delivery. Although the CoJ has adopted ICT tools to engage with other waste management stakeholders, the city has failed to use these tools to engage with waste pickers. This may be in part because of the lack of a national framework to guide the implementation of smart city strategies that include informal waste recyclers. Generally, there is a lack of government funding and or support for informal waste recyclers. Informal waste recyclers are digitally less skilled and prefer traditional (face-to-face) participation but need to be integrated within the smart city framework of municipal solid waste management. There are estimated to be more than 200 000 individual informal recyclers in the CoJ alone, and so ICT tools and processes are needed to involve these stakeholders who are an integral part of recycling and waste management.

As the above illustrates, technology-supported governance initiatives do not result in high levels of citizen participation but do disseminate information, whereas broader and deeper civic involvement occurs through grassroots processes. Examples of these processes include ward-based cleaning initiatives, S@S, consultation meetings, cooperatives/SMMEs, and education and training programmes. Therefore, to ensure the participation of informal waste recyclers and the "unplugged" citizens who are not on social media, both ICT tools and traditional grassroots approaches are required. This will lead to authentic participation of citizens in decision-making and policy changes.

The CoJ also needs an enabling framework for smart governance that would strike a balance between protecting traditional waste management models and paving the path for adopting intelligent waste management mechanisms for example, automated waste-bin management systems and pay-as-you-throw through the Internet of Things (IoT) and application of spatial technologies (e.g. GIS, GPS), identification technologies (e.g. RFID, barcodes), data acquisition technologies (e.g. sensors, imaging) and data communication technologies (e.g. GSM, Wi-Fi and Bluetooth). These technologies can enhance smart governance of waste in CoJ through collaborative mapping, route optimisation, and the monitoring of illegal dumpsites and landfill sites. Smart city strategy in waste management strengthens the pre-existing participation patterns and technological segregation. Citizens are able to use social medial channels to offer useful and helpful suggestions for government agencies, contributing to better-informed policy decisions, and to hold the municipality accountable for failing to provide services in their areas/communities.

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<sup>25</sup> As of 5 April 2020, the CoJ had 131 601 followers on its Facebook page and 974 200 followers on twitter, but these may also include non-residents of CoJ. On same day, PikitUp had 29 600 followers on twitter.

## Conclusion

Smart governance brings together the traditional functions of government and business and the use of new channels of communication (ICTs – social media, websites and e-governance) with the aim of tackling urban issues based on the principles of sustainability. To harness the benefits of smart governance in solid waste management, the following is recommended.

### Introduce integrative policies and reform national policies

Government should produce a smart city policy, which would include a unified definition, structure, functions and outcomes, to act as a guideline for cities in South Africa in order to reduce siloed implementation of smart city projects. In an attempt to be modern, cities are increasingly adopting technocentric solutions that are costly, inappropriate and inefficient for waste management practices. Regulations are needed that not only formalise the role of informal recyclers, but also clearly spell out the responsibilities of each municipal solid waste stakeholder, including government support for effective waste management.

### Integrate informal waste pickers in municipal waste management system

The municipal hierarchical structure, priorities and policies result in the side-lining of informal waste pickers in the municipal waste management systems. Specifically, city policies often exclude them from doing business with municipalities because they are individuals. Cities need to encourage waste pickers to work collectively and form cooperatives or SMMEs in order to be able to tender for municipal solid waste management contracts. Alternatively, the municipality could require a private waste management company to include informal waste picker cooperatives when bidding for a contract. Such actions would enhance the integration and participation of waste recyclers in the waste management system together with the government and private sector.

### Improve the coordination of waste management activities

Sustainable and inclusive waste management requires an integrated, holistic and multi-stakeholder approach that optimises synergies between state-led, market-driven and community-based strategies through supporting information sharing and engagement with all stakeholders in the municipal solid waste system.<sup>26</sup> National policies and guidelines have been developed for the integration of waste pickers. At the grassroots level, greater attention needs to be paid to replicating and upscaling emerging but still isolated best practices, such as organising informal workers into cooperatives or employing them in microenterprises or public-private partnerships. In addition, mobile apps designed for informal waste pickers would enable them to identify the closest collection centre, communicate among cooperatives, arrange to deliver recyclables and improve their visibility.

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<sup>26</sup> [https://newclimateeconomy.report/workingpapers/wpcontent/uploads/sites/5/2018/09/CUT18\\_Leeds\\_Waste\\_Final-1.pdf](https://newclimateeconomy.report/workingpapers/wpcontent/uploads/sites/5/2018/09/CUT18_Leeds_Waste_Final-1.pdf)

# List of Acronyms

4IR	Fourth Industrial Revolution
BRT	Bus Rapid Transit
CDFC	Common Data Framework for Cities
CoCT	City of Cape Town
CoJ	City of Joburg
CSP	City Support Programme (National Treasury)
DQAF	Data Quality Assessment Framework (International Monetary Fund)
EDGE	Economic Development and Growth in eThekweni
GCRO	Gauteng City-Region Observatory
GIS	Geographic Information Systems
GWIS	Gauteng Waste Information System
I&TS	Information and Technology Services (Cape Town)
ICT	Information and Communications Technology
IDP	Integrated Development Plan
IoT	Internet of Things
IRPTN	Integrated Rapid Public Transport Network
IT	Information Technology
KMRG	Knowledge Management Reference Group (SACN)
KPI	Key Performance Indicator
NGO	Non-governmental Organisation
OCL	Open Cities Lab
ODP	Open Data Portal
PAJA	Promotion of Administrative Justice Act
S@S	Separation at Source
SACCD	South African Council for City Data
SACN	South African Cities Network
SAL	Small Area Layer
SCODA	South African Cities Open Data Almanac
SMME	Small, Medium and Micro Enterprise
SONA	State of the Nation Address
UCT	University of Cape Town