



## Role of Development Finance Institutions in Smart Cities

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## Acronyms

4IR	Fourth Industrial Revolution
AfDB	African Development Bank
AFD	Agence Française de Développement
ASEAN	Association of South East Asian Nations
ASToN	African Smart Towns Network
CIMI	Cities in Motion Index (IESE)
CITIIS	Cities Investments to Innovate, Integrate and Sustain
CoGTA	Cooperative Governance and Traditional Affairs
CoJ	City of Johannesburg
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DFI	Development Finance Institution
EC	European Commission
EDGE	Economic Development and Growth in eThekweni
EFSI	European Fund of Strategic Investments
EIB	European Investment Bank
ETA	eThekweni Transport Authority
GDP	Growth and Development Plan
GHG	Green House Gas
GIZ	German Development Agency
ICT	Information and Communication Technologies
IDP	Integrated Development Plan
IMF	International Monetary Fund
IoT	Internet of Things
ITU	International Telecommunications Union
IUDF	Integrated Urban Development Framework
JICA	Japan International Cooperation Agency
KfW	German Development Bank
MDB	Multilateral Development Bank
MOU	Memorandum of Understanding

NDP	National Development Plan
NPC	National Planning Commission
PMO	Programme Management Office
RAS	(World Bank) Redeemable Advisory Services
SACN	South African Cities Network
SDG	Sustainable Development Goal
TOD	Transit Oriented Development
U4SSC	United for Sustainable Smart Cities Initiative
WB	World Bank

## **Abstract**

This paper provides an overview of the concept of Smart Cities in a global, African, and South African context. It maps a few international and national initiatives as well as initiatives framed by the Smart Cities. The centrality of ICT in Smart City development is shifted to providing services that support a sustainable and inclusive city. The City of Johannesburg provides an empirical study that could inform the development of Smart Cities in other regions in South Africa. Finally, the study provides guidelines for the DBSA to strengthen its support of the Smart City Initiative in South Africa.

## **1. Introduction**

This paper outlines the role Development Finance Institutions (DFIs) have played in the development of Smart Cities and maps opportunities for the Development Bank of Southern Africa (DBSA) to consider for uptake in the development of Smart Cities in South Africa. This paper supports and complements the work undertaken by the DBSA's Coverage team working on the Smart City initiative with the World Bank, the Department of Cooperative Governance and Traditional Affairs (CoGTA) and four metropolitan cities (City of Johannesburg, City of Tshwane, City of Ekurhuleni, and eThekweni). The paper defines the role of DFI investment in the creation of Smart Cities and clarifies the potential role for the DBSA in Smart City development in South Africa.

The paper starts with a background of the role of DFIs as they relate to the Sustainable Development Goals (SDGs) and the Paris Agreement. Section three explores literature on the role of DFIs broadly and their role in Smart City development projects, more specifically. After discussing the case of Johannesburg in section 4, the paper concludes by outlining the findings.

## **2. Background**

African cities will be the main drivers of growth in the future and the destination for almost 60% of the African continent's population (OECD/SWAC, 2020). This view is echoed in the African Union's Agenda 2063 that highlights the role that African cities will play in the future development of the continent and its people. Climate change has resulted in poor agricultural outcomes forcing people to leave the rural areas for cities. Poor infrastructure in rural areas has also led to people moving to cities.

Mass migration to cities has resulted in strained city infrastructure. Cities therefore need to be made smarter, more efficient, and sustainable. This means prioritising changes to infrastructure development through enabling technologies in the sectors of construction, energy, water, and waste management (Barclays, 2020). This perspective is important for the work of the DBSA in the development of Smart Cities.

**Figure: 1 Rethinking Smart Cities: Prioritising Infrastructure**

The Post Lockdown mindset	Growing Sustainability Commitments	New funding Incentives	Development of Key technologies
<ul style="list-style-type: none"> <li>• Shift to WFH or hybrid</li> <li>• High speed/resilient technology required</li> <li>• Pressure to build more resilient/safe cities</li> </ul>	<ul style="list-style-type: none"> <li>• Pressure of global emission targets (e.g. Paris Agreement)</li> <li>• Several 'Green Stimulus' packages announced</li> <li>• Growing pressure to address the ESG agenda</li> </ul>	<ul style="list-style-type: none"> <li>• Emerging business models to incentive funding from companies</li> <li>• Advertising data monetisation</li> </ul>	<ul style="list-style-type: none"> <li>• Edge computing as a potential changer</li> <li>• SG aiding industrial automation</li> </ul>
Urbanisation remains a key driver: <b>70%</b> of the population expected to live in cities by 2050	A minimum <b>\$3.7trn/yr</b> of infrastructure investment is required into 2035 just to support expected urban growth rates		75% of the EU building stock is energy inefficient, while <b>only 1% is renovated</b> each year

Source: Barclays (2020)

Initially, the Smart City concept provided a framework for a specific vision of modern urban development that recognises the growing importance of information and communication technologies (ICTs) as drivers of economic competitiveness, environmental sustainability, and general liveability (Smart City Journal). ICT has often been conflated with Smart Cities. In this regard, Albino, Berardi and Dangelico (2015:4) clarify that the term “smart” is often replaced by “intelligent” or “digital”, which limits the definition of a city to those qualities. Other definitions do not point to the “smartness” of the city but rather to programmes that improve services and costs through “infrastructure and service strategies that are informed by affordability constraints and drawn on technical and institutional innovations (including in the informal economy)” (Cartwright *et al.*, 2018:4).

The African Centre for Cities (ACC) at the University of Cape Town and the South African Cities Network (SACN) in Johannesburg are the leading domestic think-tanks on the development of cities. The ACC extended its initial focus on “Smart Cities” and “World Class Cities” to include how people live and access the cities in which they live (Tavengwa and ACC, 2012; Tavengwa *et al.*, 2013). The ACC has collaborated on studies in Ghana, Tanzania and the broad African urban development sphere (Cloete *et al.*, 2019; Pieterse, 2019; TULab, 2019; Battersby, 2020).

The SACN has completed a report on Smart Cities in South Africa that goes beyond the link to technology and calls for social inclusion and development. Both the ACC and the SACN participated in drafting the Integrated Urban Development Framework (IUDF) for South Africa in collaboration with the Department of Cooperative

Governance and Traditional Affairs (CoGTA), the German Development Agency (GIZ) and the South African Local Government Association (SALGA). The IUDF discussion document dealt with South Africa's spatial, regional and urbanisation trends.

The concept of a Smart City must be seen in a holistic manner where it is not solely focused on the technology or big data that drives cities and the services they offer but includes the ways in which people, spaces, services, skills and culture co-exist within that space. The 2020/21 CoGTA Annual Performance Plan lists the Department's objective to prepare a Smart City framework for South Africa by March 2021 (CoGTA, 2020a). The framework will build on the 2016 IUDF that aims to manage urbanisation, facilitate economic development, drive job creation and improve living conditions for everyone in South Africa.

The current District Development Model (DDM) was introduced to drive collaboration through a One Plan where the District is the 'landing strip' for economic and social development (CoGTA, 2020b). It is clear, in the South African context that urban development models consider the role of the city as a provider of services and a facilitator of collaborative platforms that go beyond technology.

Cities have taken up the responsibility for developing urban spaces, but this cannot be done in isolation from other development partners. Multilateral Development Banks (MDBs) such as the International Monetary Fund (IMF) and the World Bank (WB) have highlighted the role of DFIs in financing development under the umbrella of the Sustainable Development Agenda 2030 – especially Sustainable Development Goal 11 that deals with Sustainable Cities and Communities.

Twentieth-century urbanisation has led to debates about the kinds of cities African countries need and suggestions on who should fund them. The Africa Agenda 2063 outlines a vision for Smarter Cities driven by technological innovation and a focus on people-centred development that adapts to changing global contexts such as the ICT revolution. However, there is a need for a Smart City framework that could assist with creating transport networks that facilitate the safe movement of people and goods while enabling communication with government through smart applications.

Generally, the Billions to Trillions framework highlights the advisory and technical services MDBs could play to ensure good governance, sound planning and practical implementation strategies (World Bank, 2015). In addition to these services, MDBs



and DFIs could act as convenors to facilitate debates on urbanisation and the development of cities across the world, as they did in the climate change frameworks that are now the norm rather than the exception. National Development Banks (NDBs) or Public Development Banks (PDBs) are closer to their clients and therefore better placed to provide advisory service, planning, implementation and monitoring and evaluation for local government structures. By providing those services, they would create a coherent and integrated system of services for cities and people.

South Africa has a few urban development initiatives with the potential to inform Smart City development within the country. The IUDF provides the policy foundations for urban development in South Africa's high urbanisation trends to provide inclusive, resilient, sustainable cities and towns (IUDF, 2016). In 2013, the SACN embarked on a Smart Cities discussion with the City of Johannesburg to develop a shared concept of what a Smart City entails in the African and South African contexts. That work has culminated in a published 2020 Smart Cities paper series.

The CoGTA and the World Bank collaborated to develop a National Smart City Initiative for South Africa that will be implemented in the five big metropolitans (Cape Town, Johannesburg, Tshwane, Ekurhuleni and eThekweni). The initiative aims to provide better, streamlined and efficient services to citizens. The initiative would define a Smart City at a localised level in order to meet the demands of the citizens and the needs of the city itself.

In the post-2008 financial crisis period and the adoption of the SDG framework and Agenda 2030, DFIs have been instrumental in preparing cities for the 4IR and the use of technology for automated services to citizens. Despite 4IR being at the top of the developmental agenda, digital and ICT services should provide the support system to provide better transport, energy, water and sanitation and social services such as education and health.

The DBSA's Coverage team is working on the Smart City Initiative with the World Bank, CoGTA and four metropolitan cities (City of Johannesburg, City of Tshwane, City of Ekurhuleni and eThekweni). This paper focuses on the City of Johannesburg because the DBSA has a long history with the CoJ based on lending and supporting the city's infrastructure and development programmes. The CoJ has its unique peculiarities, which make for an interesting study. The commonalities it has with other

Smart Cities in South Africa create an opportunity for generalisations of an analytical nature.

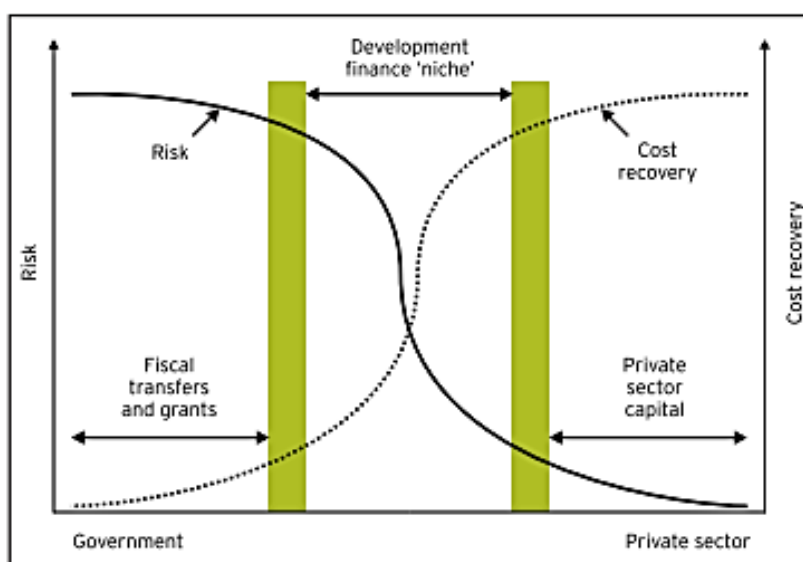
### 3. Literature review

Three areas are documented in this section. First, the general role of a DFI; second, a general discussion of the concept of a Smart City within a global and then South African contexts. Thirdly, the roles that DFIs have played in the development of the Smart City concept is discussed. Fourth, the City of Johannesburg's recent Smart City programme and the role the DBSA has played in that regard are discussed.

#### 3.1 Role of a DFI

Several scholars have outlined the roles of DFIs. The role of DFIs has been placed between the roles of multilateral institutions like the World Bank and government funders and the private sector (Thorne, 2011). Figure 2 shows the niche allocated to government that would cover all the grant making or public finance coming directly from government for development projects. At this stage of the project, risks are high, and these would be absorbed by grants. As the risk declines, DFIs could de-risk the projects even further and begin to finance projects at concessional rates or through blended finance instruments. Finally, once the projects have been de-risked, DFIs could 'crowd-in' private sector investors or developers.

**Figure 2: Role of Development finance Institutions**



Source: Barry Jackson (2006) in Thorne (2011).

Stiglitz and Greenwald (2014) argue that governments have a role to play in supporting learning in societies as the private sector cannot fill that role. DFIs or PDBs have the capacity to support a knowledge economy through social programmes in the health and education sectors and simultaneously provide countercyclical finance during times of crisis (Griffith-Jones and Cozzi, 2016). Currently, this point is particularly important in the development of a Smart City because cities would need to adopt technology to assist them becoming more efficient and effective rather than assume that infrastructure and services automatically create a working and livable city.

Following on from the idea of DFIs providing countercyclical finance and other support during crises, the role of DFIs in attracting private sector investments in high risk projects could be expanded to include new developments in infrastructure, urban development and other innovative projects (Giordano and Ruiters, 2018). The authors' argument on the need for DFIs to take on risks during crises could be extended and applied to the current liquidity crisis across the African continent and even in relation to lending to financially vulnerable municipalities to aid city development and urban infrastructure.

The traditional DFI role is one that operates countercyclically to protect markets against crises or acts to counter market failure (Griffith Jones and Te Velde, 2020). For example, the Bretton Woods institutions, namely the WB and IMF, were established to deal with the post-World War II reconstruction programme in Europe. In theory, DFIs assume different roles to those of commercial banks and provide finance that combines sources of finance that could create concessional rates for more socially or developmentally focused projects. DFIs have often been accused of not fulfilling their role in supporting countercyclical growth (Griffith-Jones and Te Velde, 2020).

If the Smart City concept is limited to technology, the role of DFIs could crowd in the private sector into the technology field by assisting developing countries with their SDG objectives (Runde *et al*, 2019).

The technological revolution or the fourth industrial revolution (4IR) provides a platform for Smart City development and should be characterised as an enabler of development. For this reason, as argued earlier, the Smart City concept should

facilitate inclusion holistically and thereby support technology as an enabler for social and economic development (Backhouse, 2015).

There are three main discourses about Smart Cities, namely, infrastructure-based services, business-led urban development and social inclusion, learning and development (Backhouse, 2015). In developing countries, these three perspectives are all important, however, the latter perspective has been less of a focus in the discussions on 4IR. Inclusivity and sustainability needs to remain at the centre of development debates, and particularly those led by DFIs, PDBs and MDBs. Social inclusion could be delayed if programmes focus on technology as drivers of city development rather than as an enabler.

The DBSA, as a national DFI provides the backbone infrastructure for economic and social development. Energy, ICT, water and sanitation, and transport could contribute to the development of Smart Cities and, through the DBSA's financing instruments, they are well placed to fill the gap between the MDBs and the private sector financiers. In relation to the DBSA and its role in Smart City development, a holistic approach would ensure inclusion, sustainability, and an integrated plan that links technology to our development position.

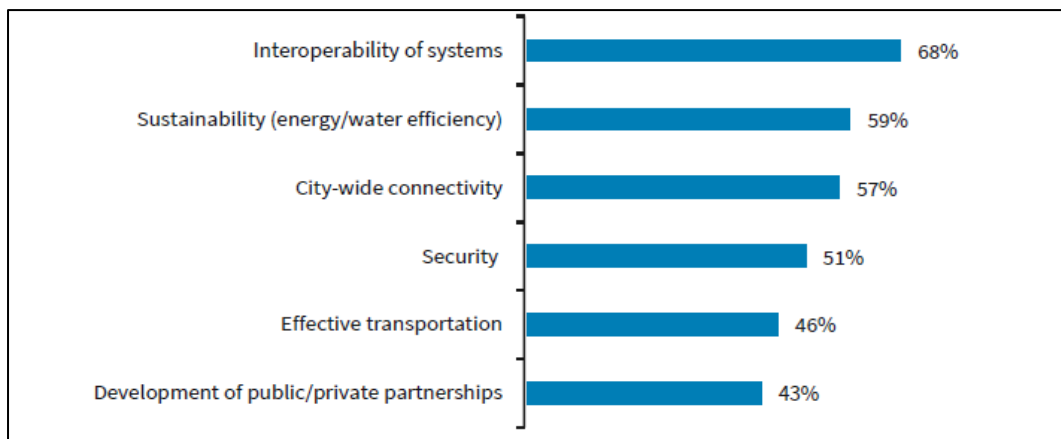
### **3.2 Smart City Concept**

There is no commonly acceptable definition of a Smart City. The understanding varies from a city that harnesses its strengths (people, resources, space) and mitigates its risks (resource limits, Green House Gas (GHG) emissions, overcrowding) to a city that is built on technology access and services. It is also a city that drives an integrated system that relies on linkages, shared use-value and provides a holistic service to all who live in it. There are four key challenges to the achievement of a Smart City (Barclays 2020):

- Lack of a standardised definition
- Geography
  - Choice between retrofit vs build from scratch
  - Public sector funding and demographics play a large role
- Cyber security and data privacy concerns – regulation is crucial
- Technology takes longer to integrate in the public sector
  - Lack of interoperability is a major concern

Each city or country must determine their own definition that is driven by their context and their ability to do new builds or need for retrofitted projects. If the demographic is more urban and younger, there is a greater demand for technologically driven services, but the concern is whether the public sector could afford the widespread changes that are needed to connect services through technology. Interoperability is an important factor for most countries and cities (Barclays 2020).

**Figure 3: Factors Crucial for Smart City Development**



Source: Barclays (2020)

In the narrow definition, the term “smart” is often replaced by “intelligent” or “digital”, which limits the definition of a city to those qualities (Albino *et al.*, 2015:4). By including social development and lived experiences of cities the conventional limitation of ‘Smart Cities’ is broadened beyond technology (Backhouse, 2015; Pieterse, 2019; Valencia *et al.*, 2019). In the 1990s, when the term was coined, it was the height of the dot.com and technological revolution, hence the link to technology. Modernity was defined by the extent of reliance on technology as a solution. The University of Ottawa criticised this definition and referred to a Smart City that has a strong governance-oriented approach with a focus on social capital and relations in urban development.

The term “smart” has also been used to describe a city that is agile, responsive to feedback and is an instrumented, interconnected and intelligent city (Albino *et al.*, 2015). This links data (instrumented) to communication of information (interconnected) and to the inclusion of complex analytics, modelling, optimization and visualisation services to make better operational decisions. Integrated transport systems such as the MyCity in Cape Town and the Rea Vaya in Johannesburg are Bus Rapid Transit (BRT) systems that aim to create connected Smart Cities through transport

infrastructure. In urban planning, smart refers to a government that can make strategic decisions such as integrated transport systems, smart meters or intelligent water systems that lend themselves to technological monitoring and evaluation.

Governments and their institutions have important roles to play in the development and financing of Smart Cities (Phushela, 2020) particularly in providing access to quantitative and qualitative data that could inform the development of smart solutions. There are two questions that government financiers could ask regarding financing Smart Cities, namely:

- What combination of existing and new approaches exist to fund/finance Smart Cities?
- What does the new partnership model look like as one embarks upon a Smart Cities program? In other words, how can different levels of government, industry, and other non-governmental entities work together to create Smart Cities—and will old procurement models need to be updated to new realities? (Hamilton and Zhu, 2017).

DFIs have been instrumental in preparing cities for the 4IR and the use of technology for automated services for citizens. Each DFI or category of DFIs (multilateral, regional or national) has a mandate it needs to implement. The French Development Agency (AFD), the German Development Agency (KfW) and the Japan International Cooperation Agency (JICA) have included the development of smart urban spaces as part of their mandates.

Smart solutions require partnerships that straddle the public and private sectors, national and local government and the citizens. Successful strategies have been developed to solve for 'hard' and 'soft' domains (see Table 1) of the Smart City (Slavova and Okwechime, 2016). These solutions could involve infrastructure decoupling that entails changing the functionality of existing infrastructure to meet the new needs of a growing and changing urban population or become more people focused in their solutions. Smart Cities do not necessarily need to be new constructions but could be a 'refit' programme to existing infrastructure.

**Table 1: Smart Cities and African Urban Challenges**

	<b>Urban challenge</b>	<b>“Smart city” elements</b>
“Hard” domains	Inadequate physical infrastructure	Natural resources and energy: <ul style="list-style-type: none"> <li>• smart grids</li> <li>• public lighting</li> <li>• green, renewable energy</li> <li>• waste management</li> <li>• water management</li> <li>• food and agriculture</li> </ul>
	Urban density and congestion	Transport and mobility: <ul style="list-style-type: none"> <li>• city logistics</li> <li>• information mobility</li> <li>• people mobility</li> </ul>
	Urban slums and informal settlements	Buildings: <ul style="list-style-type: none"> <li>• facility management</li> <li>• building services</li> <li>• housing quality</li> </ul>
“Soft” domains	Low quality, unsustainable and segregated social services	Living: <ul style="list-style-type: none"> <li>• entertainment</li> <li>• hospitality</li> <li>• pollution control</li> <li>• public safety</li> <li>• healthcare</li> <li>• welfare and social inclusion</li> <li>• culture</li> <li>• public spaces management</li> </ul>
	Environmental vulnerability and climate change risk	Government: <ul style="list-style-type: none"> <li>• e-government</li> <li>• e-democracy</li> <li>• procurement</li> <li>• transparency</li> </ul>
	Unemployment and informal urban economy	Economy and people: <ul style="list-style-type: none"> <li>• innovation and entrepreneurship</li> <li>• cultural heritage management</li> <li>• digital education</li> <li>• human capital management</li> <li>• SMMEs</li> </ul>

Source: Adapted from Slavova & Owechime (2016)

The United for Smart Sustainable Cities initiative (U4SSC) has developed Key Performance Indicators (KPIs) to advance the following focus areas within cities:

- Achieving the Sustainable Development Goals (SDGs);
- Becoming a Smarter City; and
- Becoming a more sustainable city.

The U4SSC KPIs for Smart Sustainable Cities are sorted into three key dimensions:

- Economy,

- Environment, and
- Society and Culture.

Each dimension further encompasses different sub-dimensions including:

- Information and Communication Technologies (ICTs)
- Productivity
- Infrastructure
- Environment
- Energy
- Education, Health and Culture
- Safety, Housing and Social Inclusion

The U4SCC initiative has developed an index that measures cities according to 91 KPIs. The index has been operational since 2016 and has more than 50 countries reporting on these KPIs.

Much research has been undertaken on Smart Cities and the characteristics of Smart Cities. The definition provided by the U4SCC initiative and the ITU has been adopted by global experts while the World Economic Forum (WEF) has also launched a collaboration project called the G20 Global Smart Cities Alliance with the tasks to:

- Establish universal norms and guidelines for implementation of Smart City technology
- Advance how technology is used in public places and promote core principles including transparency, privacy and security
- Elevate global technology governance and Smart City technologies for the first time on the main G20 Agenda under Japan's presidency of the G20 (Russo, 2019).

As information and technology gain importance in development programmes, it becomes evident that technology and its governance has to be regulated ethically in a rights-based framework. The following section will explore global Smart Cities as well as look at the Smart City project in Moscow with the U4SCC initiative.

### **3.3 Global Smart Cities**

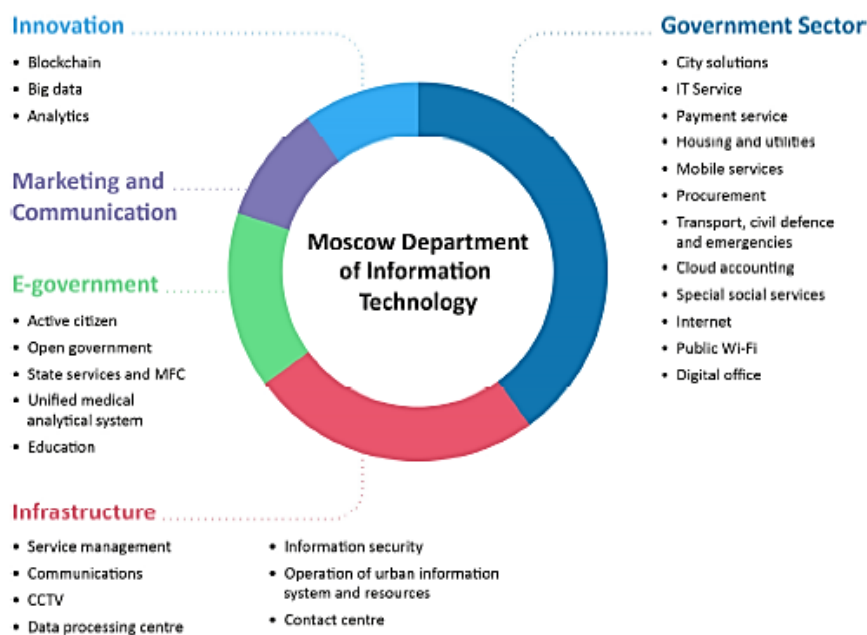
The study on the City of Moscow (Smiciklas and Imran, 2018) outlines the experience of the Russian capital through these KPIs. To understand Moscow's programme, the following definition provides the framework for the city's smart programme where they have centred around ICT.



A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects. (ibid., 2018, p.1).

This definition highlights the role of ICT in facilitating human development rather than for technology purposes only. The Department of Information Technology (DIT) in Moscow is the leading government department that coordinates all work on the Smart City initiative.

**Figure 4: Structure of the Moscow Department of Information Technology**



Source: Smiciklas and Imran, 2018

Figure 4 provides an overview of the DIT that focuses on infrastructure, e-government, marketing and community, innovation and the broader government sector. The DIT is tasked with creating the Smart Moscow 2030 vision (Smiciklas and Imran, 2018), which uses digital technologies to:

- Make citizens happier, healthier and more education, and to boost their well-being;
- Make the city safer, green, more environmentally-friendly, comfortable for life, sustainable and joyful;

- Create a favorable environment for the business, entrepreneurship and scientific communities that would facilitate well-being, innovations and the transformation of the city into a live laboratory for growth and development;
- Unite people in order to enhance living standards and city governance efficiency;
- Facilitate the consolidation of society;
- Ensure an active life for elderly residents.

Moscow is one of many cities that have embarked on a Smart City programme as is evidenced in the IESE Cities in Motion Index 2020 (CIMI). According to the CIMI, the top 10 Smart Cities in the world, which are in order of ranking from 1 to 10: London, New York City, Paris, Tokyo, Reykjavik, Copenhagen, Berlin, Amsterdam, Singapore and Hong Kong (IESE, 2020). The CIMI (2020) uses 9 dimensions to rank the cities, namely:

- human capital;
- social cohesion;
- the economy;
- governance (that merges “governance” with “public management”);
- the environment;
- mobility and transportation;
- urban planning;
- international outreach; and
- technology.

In these roles of Smart Cities, technology and the 4IR feature significantly. Technology is the driver of all the other attributes of Smart Cities. Hamilton *et al* (2019:17) report that, “[a]s they work to close the infrastructure gap, city governments in developing economies must strongly consider smart infrastructure solutions, which use advanced technologies to deliver works and services to citizens”.

**Table 2: The Top Five African Smart Cities According to IESE Index**

<b>City</b>	<b>Regional position 2018</b>	<b>Global position 2016</b>	<b>Global position 2017</b>	<b>Global position 2018</b>
Casablanca, Morocco	1	153	152	155
Tunis, Tunisia	2	156	157	157
Cape Town, South Africa	3	146	151	158
Nairobi, Kenya	4	163	162	162
Cairo, Egypt	5	165	163	165

Source: IESE, 2019

Ultimately, cities will need to determine which strategy they adopt to ensure that they improve their value offering to their citizens.

### **3.4 International DFIs in Smart City projects**

#### **3.4.1 Japan International Cooperation Agency (JICA)**

Internationally, JICA has been instrumental in the development of the Association of South-East Asian Nations (ASEAN) Smart City Network. The development of the Smart City of the Bang Sue area in Thailand was led by JICA in collaboration with the Government of Thailand. Seven gateway components supported this development vision: Business, Urban Lifestyle, Education, International Culture, Traditional Culture, Rest and Recreation and Innovation (JICA, 2020). The Bang Sue programme's foundation was a transport plan that would make Bang Sue a Transit Oriented Development (TOD) area. The Bang Sue project has also adopted an integrated approach to Smart City development, incorporating smart mobility (transport); smart energy; smart environment (including water and sanitation); smart technologies and services; and the open data platform.

In 2014, JICA and the Nikken Sekkei Research Institute conducted a Survey on Environmentally Friendly Urban Development in South Africa. The three pilot metropolitan areas included in the survey were Johannesburg, Cape Town and eThekweni. The study explored the Integrated Development Plans and city plans for each of the cities. The City of Johannesburg's 2040 Growth and Development Plan (GDP) identified the Smart City concept as a theme to guide the city's development.

The 2040 GDP described Johannesburg as a “World Class African City of the Future” – a vibrant, equitable African city, strengthened through its diversity; a city that provides real quality of life; a city that provides sustainability for all its citizens; a resilient and adaptive society” (JICA, 2014:2-4). The CoJ Smart City concept was based on TOD.

In their attempt to create a TOD node, Johannesburg introduced the Bus Rapid Transit System and the Gautrain network. These projects will be further developed to more effectively link the communities where people live to the areas where they work. The JICA survey shows that the City of Johannesburg will need to improve its water and waste water management, solid waste management, transport, human settlements, ICT, electricity, and energy and environmental planning.

JICA’s role in Smart City development has been as a Technical Advisor and knowledge sharing partner. Their research has underpinned the programme in South Africa and in Thailand, among other places. The Japanese modality for cooperation is often in the financing of pre-feasibility and feasibility work such as the research they did on the Sustainable Urban Development project. They prefer the “softer” side of partnerships where relationships are built over time and expertise and knowledge are shared.

### **3.4.2 German Development Agencies (KfW and GIZ)**

In 2017, an Indo-German technical agreement was signed for an “Implementation Agreement in Sustainable Urban Development and Smart Cities in India”. The objective of the programme, which ran from 2018 – 2020 was to develop and apply concepts of sustainable urban development about the provision of urban basic services and housing in selected cities and Smart Cities in India. The agreement covered integrated planning, provision of affordable housing and basic services including water, wastewater and solid waste management and mobility. This programme is aligned to the Smart Cities Mission spearheaded by the Government of India.

The GIZ, in collaboration with India’s Ministry of Housing and Urban Affairs, has partnered to develop India’s Climate Smart Cities initiative, which will support the Government of India in the planning and implementation of smart and climate-friendly

measures for infrastructure and area-based development, as well as the measuring and monitoring of their GHG emissions (GIZ, 2017).

The project started with three Indian Smart Cities of Bhubaneswar, Coimbatore, Kochi and their respective state governments of Odisha, Tamil Nadu and Kerala and hopes to reach the 100 Smart Cities identified in the Smart Cities Mission project.

### **3.4.3 French Development Agency (AFD)**

AFD developed an online Smart City Guide to assist local governments and other cities' stakeholders in meeting the challenge of digital transition. One of their success stories is in India with The Cities Investments to Innovate, Integrate and Sustain (CITIIS) that was co-developed by AFD. The programme has four focus areas, namely:

- Sustainable mobility including e-vehicles, green fuel, non-motorised mobility, ICT solutions related to mobility and multimodal facilities.
- Public open spaces – including blue and green corridors, activation and vibrant place-making of public spaces and improving quality of heritage sites.
- Urban e-governance and ICT – urban services improvement including smart metering systems, Geographic Information Systems (GIS) based asset management, municipal administration including online voting, bill payment and participatory budgeting, and promotion of entrepreneurship through partnerships for the development of incubators and to boost the local economy.
- Social and organisational innovation in low income settlements encompassing in-situ upgrade of the existing housing stock, creation or rehabilitation of social and economic facilities, improved access to primary services (waste, water, public transport and energy) and improvement of public spaces (lighting)

The CITIIS project dovetails with India's Smart Cities Mission to develop 100 Indian cities with the AFD in the process of supporting this initiative. The Government of India has defined the programme (Government of India) as follows:

In the imagination of any city dweller in India, the picture of a Smart City contains a wish list of infrastructure and services that describes his or her level of aspiration. To provide for the aspirations and needs of the citizens, urban planners ideally aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development-institutional, physical, social and economic infrastructure. This can be a long-term goal and

cities can work towards developing such comprehensive infrastructure incrementally, adding on layers of “smartness” (Government of India).

In 2019, the AFD introduced the African Smart Towns Network (ASToN) initiative for African cities to bring together 12 African cities that aim to address a specific digital transition priority. For example, mobility, tax collection, security, civic participation. The programmes are supported with grant funding, guidance by international experts as well as peer-to-peer learning. Among the 12 selected cities, only Maputo is in Southern Africa. The AFD has recently collaborated with the City of Johannesburg (CoJ) by funding the Inner City Economic and Investment Masterplan that was completed in 2019. In the Cities of Cape Town and eThekweni, they are mostly collaborating with water and sanitation departments to assist them in developing their infrastructure programme and identifying innovative funding options, but not focusing on Smart Cities development.

#### **3.4.4 European Investment Bank (EIB) and the European Commission (EC)**

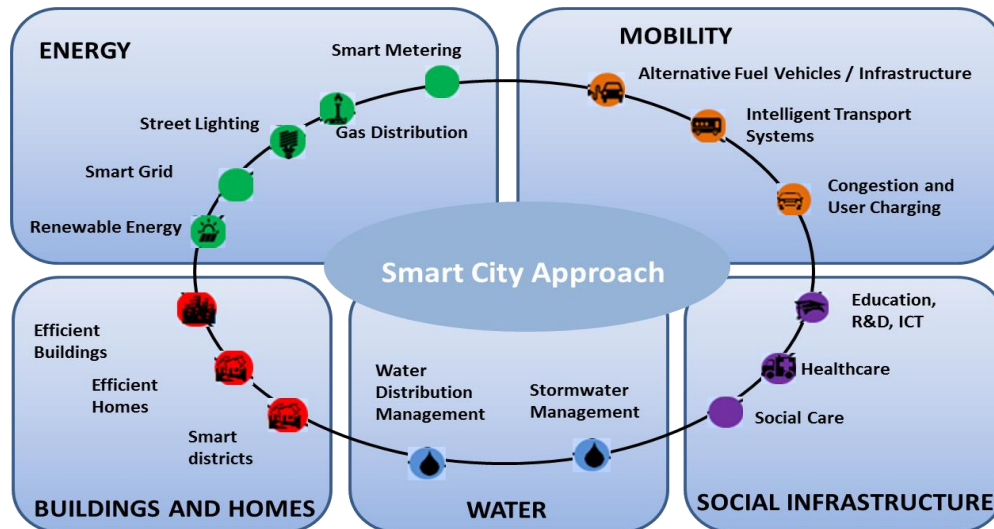
The European Investment Bank (EIB) and European Commission see their role as providers of financial solutions for Smart City development, but in conjunction with an integrated planning framework. The EIB focuses on a multisector sustainable development strategy that uses cities’ comparative advantage. They also consult all stakeholders and citizens, adopt a comprehensive approach in the making of investment decisions, use new technologies, skills and innovation and foster a pro-innovation environment. Figure 5 below shows the linkages between the five sectors of the EIB Smart City Approach.

The EIB’s investment products include:

- Investment loan – direct loan to a region/city for a single smart urban investment project
- Direct framework loan – loan to a region/city for a smart urban investment programme
- Intermediate framework loan – Dedicated multi-beneficiary loans to a financial intermediary targeting smart urban investments
- Equity investment – smart urban infrastructure investment fund such as Ginkgo (a closed-end risk capital investment vehicle)

- Investment platforms (European Fund of Strategic Investments (EFSI) – public and private financing for investment in a portfolio of smart projects

**Figure 5: EIB Smart Cities Approach – project examples**



Source: EIB Smart Cities Factsheet

In July 2012, the European Commission (EC) launched the Smart Cities and Communities (SCC) European Innovation Partnership. It proposes to pool resources to support the demonstration of energy, transport and ICT in urban areas, concentrating them on a small number of demonstration projects (Owusu, 2016).

These development partners have each identified specific areas through which they engage in smart city development. The highlighted areas are technical assistance (JICA), capacity building (KfW and GIZ), financing (EIB and the AFD). The role that these DFIs have played could create a coordinated role for DFIs like the DBSA who are seeking constructive and sustainable entry-points to support the development of Smart Cities.

### 3.5 South African Smart Cities

The National Development Plan (NDP) identified South Africa as a developmental state that should ensure the economic and social well-being of the country and its people. The developmental state would ensure safe and affordable transport and sufficient energy for industrial growth. CoGTA has since finalized a National Smart City Framework that would guide the development of Smart Cities in South Africa.

The purpose of the Smart City Framework is to guide decision-making and provide all role players with a structured approach to identifying, planning, and implementing Smart City initiatives that are appropriate to the local context (CoGTA, 2021). The novel feature of this framework in comparison to existing literature on Smart Cities is that of a clearly delineated division of labour between the various spheres of government. The framework defines the role of government as provision of the following:

- (i) *Supportive Political Environment*
- (ii) *High-Level Infrastructure*
- (iii) *National Priorities and Standards*
- (iv) *Legislation and Regulation*
- (v) *Procurement Processes*
- (vi) *Targeted Funding*

The main risks from the framework are that (i) it does not designate government as the leader; (ii) municipalities lack the requisite capability to implement the framework; (iii) connectivity is one of the biggest challenges in the country.

In relation to urban development, CoGTA introduced the IUDF transformative vision to:

- Ensure people have access to social and economic services, opportunities and choices;
- Harness urban dynamism for inclusive, sustainable economic growth and development;
- Enhance the capacity of the state and its citizens to work together to achieve social integration; and
- Forge new spatial forms in settlement, transport, social and economic areas.

Currently, there is no single definition of what a South African Smart City should be. The lack of a definition gives rise to metropolitan cities defining their own path to achieving “smartness”. The City of Cape Town focused on the development of a Digital City Strategy to drive the use of technology to make the provincial government responsive to citizens’ needs and to ensure that all residents have free access to basic information and communication technologies.



The NDP, the IUDF and the DDM provide frameworks for collaboration and synthesis between national and local development plans for cities. These frameworks are aspirational rather than directly addressing the technological and infrastructure needs of the cities. Apartheid has created geographical and economic differences that technology and access to improved services could address but the NDP, the IUDF and the DDM do not quite provide the holistic frameworks that would address those differences.

The DDM model builds on the idea that local government should be capacitated to play a development role in the economy and the broader local society. This idea is built on the idea that local government is at the coal face of providing services to communities. If the assumption is that the DDM will develop districts and cities to provide those services, there is still a lacuna in services at the smaller city level.

The objectives of the District Development Model (CoGTA, 2020b) are to:

- Coordinate a government response to challenges of poverty, unemployment and inequality particularly amongst women, youth and people living with disabilities.
- Ensure inclusivity by gender budgeting based on the needs and aspirations of our people and communities at a local level.
- Narrow the distance between people and government by strengthening the coordination role and capacities at the District and City levels.
- Foster a practical intergovernmental relations mechanism to plan, budget and implement jointly in order to provide a coherent government for the people in the Republic; (solve silos, duplication and fragmentation) maximise impact and align plans and resources at our disposal through the development of “One District, One Plan and One Budget”.
- Build government capacity to provide support to municipalities.
- Strengthen monitoring and evaluation at district and local levels.
- Implement a balanced approach towards development between urban and rural areas.
- Exercise oversight over budgets and projects in an accountable and transparent manner.

Defined this way, the DDM model does not go far enough in ensuring that an all-inclusive people-focused approach is implemented. The focus in the DDM model is focused on strengthening local government's internal operations rather than providing services that consider the interaction with citizens.

The DBSA has engaged municipalities around the role of infrastructure and Smart Cities and it is therefore ideally placed to guide municipalities beyond the provision of a loan and towards sustainability issues (Boya, 2020). The DBSA's Memorandum of Understanding (MoU) with the City of Johannesburg is an example of this partnership that initially centred on a funding discussion but expanded to include the establishment of a Programme Management Office (PMO) to coordinate major programmes under the Smart City umbrella (Boya, 2020).

Naidoo (2020) expressed the same sentiment about the role of the DBSA being appropriate to working with municipalities, therefore the Bank should focus on supporting this level of government directly in addition to CoGTA having completed the National Smart City Framework they undertook to formulate independently of consultants.

The eThekweni Municipality's Smart City initiatives include energy, transport, ICT and learning in their approach to developing a Smart City. Through technology and the Smart Community Initiative, the Metro has connected customers via a smartphone application to local government. Customers use technology to report faults, receive revenue balances and municipal alerts as part of a campaign to bring local government closer to its citizens and to improve its services to those communities (Edge, 2015). The eThekweni Transport Authority (ETA) has sought smart solutions for the transport sector in the municipality. Using a GIS based tool that collates information on road accidents, traffic signal faults, schools and street lighting, the municipality is able to generate information and strategies on streamlining transport services (Aucamp *et al*, 2016). The energy utility in the metro, eThekweni Electricity, has applied a smart grid concept to the management of electricity resources, which has improved service delivery, electricity management and communication with users (Hunsley *et al*, 2014).

In a comparative study of the Cities of Cape Town and Johannesburg, Fataar (2020:30) dates the former city's evolution of the concept to its 2002 Integrated Development Plan (IDP) and the latter to its 2013 IDP. Cape Town focused on the

development of technological hubs and real-time public transport information. He reports that the 2017 IDP defines the Smart City as “the use of data and IT to improve the governance” as illustrated by the Intelligent Operations Centre (ibid, p.30).

#### **4. The City of Johannesburg**

The City of Johannesburg’s Smart City Strategy: Implementation and Roadmap 2019-2021 (CoJ, 2019) is built on six pillars:

- *Smart Citizen and Citizen Centricity* – which is to ensure that citizens are at the centre of all initiatives to develop the city into a compelling investment destination, and a place to live, work, and play in;
- *Connectivity and Universal Access* – which is about ensuring that the city is fully connected via broadband and other communication infrastructure, and that internet access throughout the city is made available to eliminate the digital divide;
- *Digital/Smart Economy* – is about stimulating and extracting the economic benefits of a digital economy. Its focus is on citizens learning new skills and adopting new ways of living, working, engaging and operating businesses. It is about talent being developed to meet the future market demands and attracting investment into the sector;
- *Smart Governance and Institution* – which is about building open, democratic, and people centred governance, as well as an institution geared to provide services in the most convenient and efficient manner, aided by technology and efficient business processes;
- *Smart Services* – is about understanding our citizens’ needs and providing a 24/7 basket of services that are efficient and responsive; and
- *Green and Sustainable Built Environment* – which is about taking advantage of advances in technology, and encouraging innovation to facilitate more efficient, convenient and sustainable access to services, and the protection of the environment.

These six pillars have focused on ways the CoJ aims to use technology to improve its service offerings to citizens and to provide climate-friendly alternatives for development projects.

According to the IESE (2018:55), Johannesburg is characterized as a vulnerable city, meaning that it is growing at a slower pace. The Smart City revolution in Johannesburg began in 2010 through an ICT strategy in NASREC (Broadband network). One of the issues that this revolution aimed at addressing was how technology will equalise access to services. To do that, people need to remain at the centre of the conversation. The City of Johannesburg partnered with the private sector to foster innovation.

The Council for Scientific and Industrial Research (CSIR) was involved in the initial framing of the City of Johannesburg's Smart City project in relation to integrated transport systems (Mokgukulushi *et al*, 2018) and is engaged in an ongoing relationship with the city working on developing a green economy to promote sustainability in green transport solutions (CSIR, 2020). Currently, the relationship is less direct as the CSIR through its Next Generation Enterprises and Institutions is creating "Smart Places", a concept which goes beyond smart cities to smart rural areas, smart secondary cities and entire smart provinces. The CSIR has identified the ICT and infrastructure needs of "Smart Places" and what infrastructure should be brought in to support Special Economic Zones and hubs for Small, Micro and Medium Enterprises (SMMEs). DFIs could provide infrastructure such as transport and new road development within the smart places.

The DBSA has a relationship with the City of Johannesburg and the Smart City Initiative Office that dates to 2018 when the two institutions held a Roundtable at the DBSA to define the Smart City concept. More recently, the a cross-divisional team uses the DBSA's convening power to collaborate with different stakeholders in the Smart City initiatives. The World Bank is a partner to CoGTA and the DBSA through the Redeemable Advisory Services (RAS) Smart City project. The DBSA works with four metropolitan municipalities, namely, the cities of Johannesburg, Cape Town, Ekurhuleni and eThekweni. The DBSA's objectives in this programme are to provide integrated smart cities' solutions and to establish a Smart City in Lanseria. The project has also been extended to work with 39 intermediate cities.

Finally, the DBSA assists municipalities with strategies for maturity assessments for each pilot project to identify a pipeline of bankable projects for:

- Funding;

- Implementation;
- Monitoring and evaluation; and
- The socialisation of the Smart City concept across sectors.

## 5. Key Lessons

The literature has provided an overview of global Smart City programmes that highlight the role of technology. Backhouse (2015) identifies three different academic discourses on Smart City development. The first is based on infrastructure-based services; the second on business-led urban development; and, finally, social inclusion, learning and development. Based on the findings in this research paper, the DBSA and other DFIs continue contributing to infrastructure-based services. This sector could be supported by ICT innovation and technology development to produce sustainable infrastructure that is informed and supported by technology. The provision of basic services such as energy, water and sanitation and transport could be run on technology-driven infrastructure that boosts interoperability. The TOD model from Ban Sue could inform transport integration within South Africa.

The GIZ programme in India has provided strategic and technical assistance support to the Government of India and it has reaped dividends in its programme with the Smart Mission in India. The GIZ programme has been participatory where government has worked with communities to lower the GHG emissions in local communities. Foster (2020:25) refers to this as a bottom-up Smart City where public participation is improved, and inclusive development drives the programme. The metropolitan municipalities of eThekweni and the City of Johannesburg have introduced smartphone applications to narrow the gap between themselves as service providers and their consumers. Social inclusion is a role that DFIs have left to local government and social networks. This role has however become more important with the SDGs and the need to create inclusive sustainable development.

This research paper has shown that the DBSA is aligned to the role of the DFIs in Smart City development. It is a financier, implementer, facilitator and integrator of Smart Cities, which role is particularly evident in the three pilot cities of Johannesburg, Tshwane and Ethekwini. The DBSA's Smart City team performs these roles. One suggestion would be to create an overarching Smart City framework through which all

our urban development takes place and follows a programmatic role, as we have done in the climate or Just Transition work.

An additional role that the DBSA recently played was in the creation of the Development Laboratories (D-Labs). These are spaces the Bank has created in collaboration with partners in local government, the private sector and the community to provide social, economic, health, and sports facilities, as is the case with the Jabulani D-Lab. The model proposed by the D-Lab is to provide enabling technology that will assist the community in accessing services and for local government to provide services in collaboration with the communities. This iterative and collaborative model could lead to a prototype for a Smart City that is built on access to basic services, technology as an enabling tool, a social space where people can gather to learn from each other and engage socially, and a space for business development. In fact, the D-Labs fulfil the requirements for Smart Cities, namely, social inclusion, business development and urban development. The D-Labs drive the infrastructure, business and social inclusion required for the construction of Smart Cities.

The SA Cities Network recently produced their *Smart Cities Paper Series: Smart Governance in South African Cities* (SACN, 2020) mapping the current discussion on Smart Cities in South Africa. Think-tanks like the SACN develop a broader agenda that goes beyond technology. In his contribution, Foster (2020) refers to the draft National e-Strategy or *Digital Society SA* that highlights the role that ICT could play to facilitate economic and social inclusion that highlights the “smart delivery” of services but does not provide a window for citizen participation in governance. In many cases, the Smart City is seen as one that provides services and enables easier payment systems and record-keeping. It is clear, however, that community involvement is integral to the success of a Smart City. In this regard, the DBSA’s Infrastructure Delivery Division (IDD) has introduced Community Liaison Officers who engage with the communities prior to and during the implementation of municipal infrastructure projects. This has led to a higher success and acceptance rates of the projects.

The final area of business-led urban development points to the DBSA’s ability to crowd-in private sector finance once it has de-risked municipal projects. Once the infrastructure is in place, especially ICT infrastructure, cities will attract business-led development. It will be interesting to see the impact COVID-19 has on urban development as businesses realise that brick and mortar infrastructure is not a

necessary requirement as staff could work remotely. This does require a strong ICT industry and service in our urban areas.

Finally, the role the DBSA plays in policy discussions should be formalised through characterising the bank as a “policy bank”. Many national, regional and international DFIs are defined as policy banks as they implement the policies of their governments. The DBSA has not comfortably taken on this identity, rather it defines itself as an infrastructure bank. Historically, however, the DBSA had a strong policy and advocacy role to play in the past especially in relation to the debate on the role of the developmental state.

The DBSA has a relationship with all the stakeholders in the Smart City environment. It plays a key role in infrastructure development and the provision of ICT for development and governance purposes. This research has shown that there are a few more opportunities that the DBSA could explore that go beyond financing.

## **6. Conclusion**

Research for this paper has highlighted several areas where DFIs, especially the DBSA, could play a role in Smart City development. The infrastructure-based services in the transport, water and sanitation, energy and ICT fall within the DBSA mandate. As Boya (June 2020) stated, the mandate of the DFI should drive its role in the Smart City initiative. The DBSA should play to its strengths. It is one of the few institutions that offers an end-to-end value chain of services to municipalities. The DBSA could replicate the JICA model where technical assistance and capacity building forms the backbone of its support to municipalities, provide finance as per the AFD model and provide planning assistance as the KFW and GIZ have done with their partners. Another model that the DBSA has in its offerings is the D-Lab model that incorporates community inclusion, business-led development and urban development.

The DDM programme and the D-Lab model should be used to scale up a general development model that the DBSA could pilot. In addition to these, a Smart City framework should be developed for the DBSA’s urban development programmes that will provide a high-level strategy for those programmes. This will ensure that the approach remains strategic and similar for all our Smart City clients. The DBSA has a history of capacity building and training within municipalities under the Development

Fund and the *Siyenza Manje* programmes and the Vulindlela Academy. This experience should be leveraged in the formation of the framework.



## **Additional sources**

### **Interviews**

Lawrence Boya, Director, Smart City Office, City of Johannesburg

Lucas Gumbi, Business Development and R&D Manager, Centre for Scientific and Industrial Research (CSIR)

Stacey-Leigh Joseph, Former Executive Manager, SA Cities Network (SACN)

Kevin Reddy, Executive Manager: Municipal Governance, Department of Cooperative Governance and Traditional Affairs (COGTA)

Tshepo Ntsimane, Head RSA Municipalities and Bankable Cities, Coverage Division, Development Bank of Southern Africa

Tsakani Manyike, Senior Deal Originator, RSA Municipalities and Bankable Cities Coverage Division, Development Bank of Southern Africa

### **Questionnaire**

1. What is your definition of a smart city?
2. What is your role in smart city projects in your context?
3. What role should DFIs play in smart city projects?
4. Do you have a relationship with the DBSA in relation to smart city development? Please describe it?

### **Email correspondence**

JICA

AFD

KFW

EIB

Monique Griffith, City of Johannesburg Smart City Office

### **Questionnaire:**

1. Have you worked on smart city development projects in the past?
2. Please provide some examples of those projects.
3. Please identify your role in those projects.
4. Have you worked on African smart city projects? Please provide examples.
5. What do you see as the role for DFIs in smart city development?

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