

# Smart leadership for smart cities

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## **Abstract**

This paper examines the issue of smart leadership for smart cities and the challenges they are facing. Particular emphasis is given to Africa (Rwanda and Ethiopia) which undergoing impressive urban growth at the rate of 3.5% annually that makes Africa the fastest urbanizing place in the world. However, the development of infrastructure and industries has not kept pace with the growth in urban population. Then how should Africa leaders be prepared and deal with the booming urbanization process? Smart Leadership for Smart Cities: a solution to the booming urbanization process in the continent. Indeed, as indicated in African Smart Cities Strategies for Agenda 2063, smart leaders- smarter citizens-smarter cities can alleviate African urban challenges. Indeed, only a little research discusses political leadership and commitment/political rationalities while the literature of technology innovation/technical rationalities is abundant. Recognizing the fact that Smart cities will not succeed without developing smart leadership, Rwanda under Paul Kagame and Ethiopia under Abiy Ahmed- have launched Smart Kigali initiative and “Beautifying Sheger” project respectively with the aims to develop the entire urban eco-system and realize smarter and sustainable neighborhoods and cities in their respective capital cities. The study employed a secondary method of data collection and analysis in combination with observation. Thus, the study concludes that political leadership is indispensable and leaders in both countries are undertaking impressive measures in transforming their country while building alliances and partnerships with various stakeholders. However, such initiatives are challenged by factors like trust and transparency, debt burden, public participation, and poor existing infrastructure. African leaders and their policymakers can learn a lot from the experiences of the two countries and their leadership style and moreover it provides a valuable contribution to the much-untouched areas of smart leadership for smart cities.

**Keywords:** political rationality; urbanization; smart citizenry; sheger beautification and kigali initiative.

## **I. Introduction**

### ***1.1 Background of the study***

Africa, already home to the world’s youngest and fastest-growing population, is undergoing impressive urban growth at the rate of 3.5% annually that makes Africa the fastest urbanizing place in the world [1]. Though, Africa remains mostly rural, with 43% of its population living in urban areas [2], the share of Africans living in urban areas is projected to grow from 36 percent in 2010 to 50 percent by 2030 [3]. While urbanization can be a boost to national economies, it can also present many infrastructure and humanitarian challenges since cities, megacities, generate new kinds of problems. Here it is important to notice the fact that the development of infrastructure and industries in Africa has not kept pace with the growth in urban population indicating the policy challenges that the continent facing in ensuring sustainable and inclusive urban growth. According to a study conducted by the Economist Intelligence Unit (The Global Liveability Index 2018), 7 of the world's 10 least livable cities are located in sub-Saharan Africa [4].

Historically, urbanization has strongly correlated with economic development [13]. However, this correlation is weaker in developing countries, especially in Africa. In Africa, unlike in the West where urbanization took place following the rhythm of industrial growth which made cities better prepared to welcome the incoming flows of people, ‘urbanization is characterize by at least three elements: first, it is not a consequence of industrialization,

but runs parallel to it; second, it occurs regardless of the creation of infrastructures, which on the contrary remain rather lacking; and third, technological innovation in the urban areas does not follow a gradual pattern as occurred in the Western world, but proceeds by jumps' [5]. Consequently, African cities and their inhabitants do face numerous challenges [6]. This trend will get worse as African enter 2030 where predications indicates that more than one billion Africans will be city-dwellers, while at least six cities will be inhabited by more than ten million citizens. Hence, as a consequence of rapid urban in Africa, what one can commonly observe is: the emergence of slums, difficulty in waste management, scarcity of resources, air pollution, human health concerns, traffic congestions, and inadequate, deteriorating and aging infrastructures are among the more basic technical, physical, and material problems. Therefore, there is an imperative that African cities are resilient, able to accommodate and manage the population influx. The cities will need to adequately sustain economic development and sustained service delivery through improved income and employment opportunities.

Indeed, cities are where problems and solutions meet since they are centers of commerce and innovation—and the gateways to the global economy. The aforementioned challenges creates urgency to get our cities “right” because the national, regional and global response to our most pressing challenges—from climate change to rising inequality—will likely succeed or fail in cities. [7]. But with this challenge relaying on the traditional normative approaches to deal with urban revolution in Africa will neither work as heuristic instruments nor produce the insights needed to advance urban development. This calls for the urgency of how the urban revolution in Africa shall be handled which indeed depends on how well it is understood by its political leaders. Thus, the fundamental question here is how should Africa leaders be prepared and deals with the booming urbanization process? Smart Leadership for Smart Cities: a solution to the booming urbanization process in the continent. Smart leadership is ‘the kind of leadership that is able to deal with the complexities of the ecosystem and the culture, in addition to being able to synchronize inputs and outputs in the smart city space to produce socio-economic benefits for all’[8]. Indeed, the complexity of the ecosystem within a smart city as well as the complexity and demands of the challenges of urban management in Africa definitely require leaders committed to the structural and social transformation of urban contexts and the transformation of cities into true engines for the development of the continent. Within this perspective, it would be useful to adopt specific policies for cities, with special focuses on areas of scientific and technological development, the training of human capital and social innovation [9].

Currently, there is a continental push for smart cities amongst African leadership and policymakers to incorporate smart cities into their urbanization strategies given rapid urbanization and population growth. At the national level, countries such as Rwanda, Nigeria, Ghana, and Ethiopia have launched smart cities efforts. The African Smart Cities Strategies for Agenda 2063 elaborates how cities shape the future of a continent and demonstrates that smart leaders- smarter citizens-smarter cities can alleviate African urban challenges. In the agenda, Smart Cities, encompassing the four major pillars of comprehensive development – institutional, physical, social and economic infrastructure, are presented by policymakers as the solution to the rapid urbanization growth in the

continent [10]. Moreover, since 2013 the continent is organizing Transform Africa Summit as a platform for various leaders from the public sector, private sector, international organizations, academia and civil society to devise ways to propel Africa's digital transformation including boosting Africa's Digital Economy" [11]. Here, it is important to quote the Rwandan President his excellence Paul Kagame's impressive speech made at the conference, held back 2017, 'African leaders need to work together to put technology in hands of citizens in order to build inclusive and sustainable places to live, as the continent looks set to emerge as one of the planet's great centers of growth, innovation and opportunity in the generations ahead'. Further, the president asserted that future smart city development depends on good leadership and political commitment. This idea is rightly observed in the following quotes H.E. President Paul Kagame goes in the Smart Africa summit "we have to think ahead. It is up to us to plan adequately for urban expansion by anticipating the higher standard of public services, housing, livability, and economic opportunity that our citizens expect and deserve. [...] technology is not a panacea, and it does not run on auto-pilot. To get the cities we want, we must always keep the people we serve at the center of our efforts. Technology alone cannot do that for us [Ibid]. This justifies the fact that smart cities initiatives are driven not only by technical rationalities but also political rationalities in understanding how smarter and sustainable neighborhoods and cities are being developed right now. However, only a few studies in the academic literature on smart city initiatives address issues related to leadership, managerial and organizational factors. Recognizing the fact that Smart cities will not succeed without developing smart leadership, this study examines the issue of smart leadership for smart cities and the challenges they are facing in the African continent taking Ethiopia and Rwanda as a case study. .

### ***1.2 Objectives of the study***

Although shiny new technology can connect us and deliver data, cities won't become smarter without smart leadership and in effect, the prospects of smart cities are greatly diminished. says Jose A. LugoSantiago [8].

This study has two objectives:

1. Examine the role of African leadership in the development of smart city initiatives and their implementation
2. Analyze the challenges that African leaderships are facing in the process and development of smart city initiatives while taking Ethiopia and Rwanda as a case study.

### ***1.3 Study approach***

The approach of this particular study was dominantly based on a literature review of secondary data drawn from existing relevant smart city related concepts, implementations, frameworks and case studies. This study assesses the role of African leadership and the challenges they are facing in the development of smart city initiatives and implementations to fill the gaps of academic literature since only a few studies in the academic literature on smart city initiatives address issues related to leadership.

The theoretical and practical discourses of smart cities were critically examined. Worldwide analysis of smart city was conducted to clarify and better understand the

concept, definition, dimension and indicators of smart city. In reference to this, important analysis was made on African Smart Cities Strategies for Agenda 2063 to understand the concept and implementation of smart city in African context. An assessment was carried out on governance, leadership and smart city implementations and challenges in the African context while experience from Ethiopia's Addis Ababa and Rwanda's Kigali taken into account to demonstrate the need for smart city/why smart Africa.

## **2. Review of smart city concepts, operationalization and approach**

### ***2.1 Concept and application of smart city***

Globally, the concept of smart city is getting more and more relevant for both academics and policy makers. Despite this, there is still confusion about what a smart city is, as several similar terms are often used interchangeably and the term is also used in ways that are not always consistent. According to Barzilai-Nahon, K., there is neither a single template of framing a smart city, nor a one-size-fits-all definition of it [12].

Historically, the concept smart city was used in the 1990s in connection with the significance of new ICT with regard to modern infrastructures within cities. The California Institute for Smart Communities was among the first to focus on how communities could become smart and how a city could be designed to implement information technologies. Some years later, the Center of Governance at the University of Ottawa started criticizing the idea of smart cities as being too technically oriented and argued that should have a strong governance-oriented approach which emphasizes the role of social capital and relations in urban development [14]. It is, therefore, the concept emerged as making a city “smart” as a strategy to mitigate the problems generated by the urban population growth and rapid urbanization. Since then the term smart city has been a subject of debate among research and academic, corporates and governance sectors. In this regard, an assessment of various literatures in the area reveals that the concept is used all over the world with different nomenclatures, context and meanings. In effect, many definitions of smart cities exist. The following are worth mentioning: A city that “monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens” [15]. A city “connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city” [16]. A city “combining ICT and Web 2.0 technology with other organizational, design and planning efforts to dematerialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and livability” [17]. A city that use of Smart Computing technologies to make the critical infrastructure components and services of a city—which include city administration, education, healthcare, public safety, real estate, transportation, and utilities—more intelligent, interconnected, and efficient” [18].

To summarize, the definition of smart cities could be categorized into three major categories and areas of reflection:



A top-down approach refers to a process that is fostered or led by actors of an organizational upper level in a hierarchical structure and that is progressively diffused and implemented by involving actors of lower levels. Such an approach is likely to be based on a central authority and control. The process management is orchestrated by an actor with authority and risks not to take into account the plurality of all involved stakeholders [21]. In contrast to a top-down perspective, a “bottom-up” approach means being intentional about systematically incorporating citizen voice throughout a smart cities project lifecycle. This is needed to help move urban residents from passive consumers to engaged consumers. And this trend will continue to rise as urban dwellers are demanding more flexible, personalized services. Additionally, building an infrastructure to continuously manage and measure what matters most to advance the economic and social well-being of a city can’t happen in a vacuum; it requires broad-based community engagement [22].

Addressing the topic of people and communities as part of smart cities is critical, and traditionally has been neglected on the expense of understanding more technological and policy aspects of smart cities which is more of technocratic, disempowering, anti-democratic. Indeed, projects of smart cities have an impact on the quality of life of citizens and aim to foster more informed, educated, and participatory citizens. Additionally, smart cities initiatives allow members of the city to participate in the governance and management of the city and become active users. If they are key players they may have the opportunity to engage with the initiative to the extent that they can influence the effort to be a success or a failure. Thus, whether a city takes on a top down, bottom-up, or platform approach when investing in smart technologies, a truly smart city involves much more than an infrastructure upgrade. Done correctly, smart cities have the potential to transform the character and livability of a city, rejuvenate its economy and heritage, enhance its resilience and sustainability, and even tighten the social compact with the government and among citizens [23]. *It is, therefore, a combination of approach that is based on top-down (government-citizen), bottom –up (citizen to government) and side to side (citizen-to-citizen) engagement is paramount important for the successful design and implementation of smart cities.*

### ***2.3 Concept and implementation of smart city in the African context***

As revealed in the discussion under the concept of smart city, the term has many dimension and used in different contexts. This entails that a contextual understanding of a smart city is important so as to provide not only a meaningful definition for the term but also a ground for comparison among African cities. In the literature, ICT infrastructure is a key component of smart solutions for cities. However, limitations of ICT in many parts of Africa mean it should not be central to the definition of a smart city in this context. This is due to a lack of digital literacy and to poor internet connectivity in many African cities.

Consequently, a contextual understanding of smart city in Africa is fundamental i.e. based on the idea that Africa has seen rapid urbanization over recent decades, this trend is expected to continue, and the challenges and opportunities associated with rapid urbanization. On the one hand, African urban expansion presented huge challenges like a rise in informal housing, poverty, and social inequality for African political leaders, urban

and national policy makers since urbanization in the continent is largely due to massive rural to urban migration. This indicates that the links between urbanization, industrialization, social transformation and economic development must be tackled together. This means that the cities will need to not only deliver new infrastructure but also manage existing infrastructure related to water, sanitation, energy, transportation, information and communications [24]. On the other hand, this rapid growth rate provides an excellent reason for African leaders and policymakers to incorporate smart city planning to their strategies. Thus, the concept and implementation of smart city in African context must be based on the socioeconomic realities of the continent and focus on the many challenges specific to the African cities to the end provide their citizens with equal economic opportunities while transitioning to a low carbon economy, using limited resources efficiently, and managing rapid urban and population growth as well as manage the impacts of a youthful population.

The notion and implementation of smart cities that puts more emphasis on the environment, people, the economy, and mobility will be more useful in the African context. Focusing on these areas make cities in Africa centers of growth and job creation and future proofed for climate, environment and natural resource challenges, so that they are inclusive and resilient, and have growing economies. It is, therefore, current and future trends of smart cities in Africa shall aims to help cities achieve inclusive economic growth, manage demographic change, and address environmental risks. Indicators in these areas could be used for targeted effort by urban managers. They can also be used to make comparisons between African cities.

In Africa currently there is a continent-wide push for smart cities. For instance, the heads of state and governments of the AU adopted Agenda 2063 in 2015 with the goal to ensure Sustainable infrastructure that is infrastructure that is socially, economically and environmentally sustainable...Sustainable infrastructure is inclusive and respects human rights. Such infrastructure meets the needs of the poor by increasing infrastructure access, supporting general poverty reduction, and reducing vulnerability to climate change risks...It positively impacts GDP per capita and job outcomes [25]. The African Union has also made smart city adoption one of the tenets of its 2063 development plan. As the 2016-2025 decade is promising to be the decade of the continent's development through technology, smart cities are presented by African leaders and policymakers as the solution to the rapid urbanization growth [26]. Further, since 2013 'Transform Africa Summit' culminating into the adoption of the Smart Africa Manifesto, which seeks to enable member states to "become more competitive, agile, open and innovative smart economies with the most favorable business climates. Smart Africa is overseeing several flagship projects, including smart and innovation cities, across the African continent. African countries want to turn their poor, overcrowded urban centers into "smart cities" [11].

At the national level, member states integrated Agenda 2063 into their domestic plans and in effect several smart city efforts and initiatives are progressing throughout Africa. Countries such as Nigeria, Rwanda, Ghana, and Ethiopia have already launched smart cities initiatives. Rwanda is a pioneer in the field, and is currently modernizing its capital, Kigali,

and launching other initiatives to modernize and simplify public services by the use of an e-governance platform. Nigeria's Smart City Initiative aims to increase ICT innovations and link them with physical infrastructure. Ethiopia is piloting an impressive smart parking project using Chinese technology. Ghana is working with IBM in order to assess ways of using technology to implement economic and social reform. Smart cities can aid the rapid urbanization of African countries and improve the quality of life of the new city dwellers, solving some of the biggest challenges of the urban environment, such as high-cost, low-quality, and inaccessible services. However, in order for the continent to reap the benefits, planners and policymakers must keep the big picture in mind when promoting smart cities, emphasizing well-implemented infrastructure and citizen needs [27].

### **3. Smart leadership for smart cities: Case from Ethiopia's Addis Ababa and Rwanda's Kigali smart city initiatives**

#### ***3.1 Introduction***

Smart Cities are taking center stage in securing an adaptable, inclusive, productive, sustainable, and resilient future for humanity, where government plays the key role in leading the projects and contributing funds. Governments are eager to explore different ways to integrate digital technology, knowledge, and assets. In this regard, smart leadership, which is the result of the development of skills in three key areas: servant leadership; the balance between innovation and sustainability; and strategic thinking and foresight is important it help manage complexity [28], [9]. Hence, smart cities will not succeed without developing smart leadership; builds alliances and partnerships.

Globally, there are three Smart city leadership models: first, Dedicated Office driving the smart city vision as a case Singapore where comprehensive approach from the national government; second Distributing responsibility across departments as a case New York where decentralizing leadership drives smart city initiatives and projects; the third leadership model involves forming partnerships with private organizations to drive smart city solutions, the South Korean capital- from citizen-oriented to citizen-led services- worth mentioned [23]. It is, therefore, a mix of the above model works in the African context and when a mix of the above model drives the implementation of the smart city strategy, the entire ecosystem can rally around the identified objectives, closely integrating know-how with planning and execution, and adapting to the ever-changing technological landscape.

Acute urbanization combined with years of infrastructure neglect creates challenges on path to smart city projects in Africa. However, African leaders and their policy makers have recently expressed political commitment to see urbanization as an opportunity to achieve the SDGs and the goals of Agenda 2063. To this end, several Africa countries have started transformational projects and initiatives called smart city initiatives to better serve their citizens and to improve quality of life in their respective territories. These smart city initiatives and projects are primarily designed/guided by the political leadership while allowing the involvement of multiple stakeholders. Indeed, solutions to complex economic, social and technological challenges in smart cities require leadership that promotes and enables collaborative approaches to knowledge creation; knowledge sharing and knowledge dissemination across a whole smart city partnership is an important local attribute.

### ***3.2 Smart leadership and smart city, Ethiopia's Addis Ababa smart city initiatives and projects***

Ethiopia is the oldest independent country with a unique history and cultural heritage and second most populous, with a population of 90 million in the African continent [29]. The country has a vision of becoming a middle-income country by 2025. Ethiopia in the last two decades has made tremendous socio-economic progress, achieving remarkable economic growth with a 10.3% growth rate in GDP driven by major state led investments (top-down approach) in economic and social infrastructure. Consequently, Ethiopia has roughly halved the poverty rate and Ethiopians now have greater access to education, healthcare and other basic social services [Ibid]. The poverty rate has already decreased from 39% in 2004/5 to 26% in 2012/13, and there has been a 53% increase in its absolute Human Development Index (HDI) since 2000 [30]. Parallel to this, Ethiopia has also experienced/experiencing a rapid urbanization process since the implementation of economic development and privatization policy to stimulate national economic growth. Currently, Ethiopia's urban population consists of 21.2% of total population (2019) with a rate of urbanization at 4.63% annual rate of change [31]. However, as it is observed in numerous developing countries, the intensified constraints, following the fast urbanization processes in the country, are unplanned and uncontrolled that resulting in scattered urban growth, loss of farmland, and environmental degradation [32].

Ethiopia's capital Addis Ababa, has a huge diplomatic presence and is home to both the headquarters of the African Union and the United Nations Economic Commission for Africa, is a city that grew chaotically over the last 100 years without planning. However, since its establishment in 1886, Addis Ababa has undergone many changes in terms of its size and demographics, its finance and economic structure, its physical and spatial organization where the state has a very significant role in the urban economy unlike many other urban centers where the poor are being marginalized. Hence, the comprehensive approach by the national government implementing strategic planning (SDPRP, PASDEP, GTP) across the country - especially into roads, rail, and housing - is setting Addis Ababa on an impressive development path [9], [33].

The Addis Ababa Structure Plan is prepared to guide the development of the city for the coming ten years (2013-2023) cognizant of the fact that the city needs to achieve economic, social, cultural and environmental objectives stipulated by Articles 89-92 of the FDRE Constitution, and the right of the residents to "improved living standards and to sustainable development" by indicating major "development activities ... to enhance the capacity of citizens for development and to meet their basic needs" (FDRE constitution art 43(1) and (4)) [34], [35].

#### ***3.2.1 Smart city initiatives/projects in Addis Ababa***

Under Comprehensive approach from the national government, Addis Ababa city has carried/carrying out a number of smart city initiatives and projects in which the role played by the political leadership is indispensable. The Prime minister has launched smart city campaign which focuses on building people-centered partnerships for bringing transformative change to Addis and later on to replicate the results across cities in the country. Ethiopia is dominantly pursuing top-down approach in implementing smart city

projects. However, encouraging attempt is currently underway in implementing smart city initiatives under a public-private partnership (PPP) model and combination of both approach (top-down, bottom-up) while involving both local and international ICT firms (including CIROC, Alibaba, Eagle Hills, SYSTRA SA, Twitter, GTZ) sovereign states (china and some other neighboring countries), private investment groups, researchers and academicians.

### **3.2.1.1 Sheger beautification**

The “Beautifying Sheger” is a three-year initiative, currently under construction, of the Prime Minister of the Federal Democratic Republic of Ethiopia, H.E. Abiy Ahmed Ali aiming to change the face of Addis Ababa while creating thousands of jobs for the youth (up to 4000 jobs). The project will run along the rivers of Addis Ababa, developing green spaces at a cost of 29 billion Birr starting from Entoto to Akaki alongside of the 56Km (the Chinese government is supporting the development of 12kms) river streams until they reach Akaki waste water treatment plant, which currently are garbage areas. At the heart, the project carried three fundamental aims: first, to elevate the city to a site of urban tourism leveraging on rehabilitation of the aforementioned water bodies; secondly, enhance the well-being of city dwellers by putting river flooding in check and creating public spaces, parks, bicycle paths and walkways along the river banks and third, to enable the aspiration of a green economy by expanding green spaces and creating related services economies [36].The project designed and constructed by China’s Urban Construction Design and Research Institute China Urban Construction Design and Research Institute while contextualize the needs of the city. In the efforts to involve various stakeholders, the Prime Minister has hosted a fundraising dinner at a cost of 5 million birr per plate—or \$175,000 to mobilize resource for the implementation of the project where foreign and domestic companies, embassies, sovereign government, people of dignitaries attended.



Source: <https://www.fanabc.com>

### **3.2.1.2 The La-Gare housing village modern project**

The La-Gare housing Village modern project in Addis Ababa will cover 36 hectares of land. It will be jointly owned by the Ethiopian government and the Abu Dhabi-based construction company – Eagle Hills; renovative and redevelopment projects; the integrated village of housing in La-Gare is an exceptional housing project which will not disintegrate residents of the project, and have also a neighborhood-oriented, affordable cost/s and above all generate 25,000 jobs for the city dwellers. The housing project of La-Gare includes

modern residential apartments, commercial housing units, recreational areas, sports fields, international-standard hotels, cinemas, bureaus and modern parking spaces [37].



Source: <https://www.afro105fm.com/>

### 3.2.1.3 Building smart economy

Ethiopia's Digitization Drive Attracts Global two Tech Giants i.e. Alibaba groups (aims building a digital economy and comprehensive digital hub e-WTP) and Twitter (aims at provide smart logistics for small and micro enterprises).

a.



b.



Source : ( a) <http://addisstandard.com/> ( b) <https://www.forbes.com/>

### 3.2.1.4 Sustainable transport –smart mobility

Rapid dynamism of urbanization in Ethiopia made the government focus on fast and cost-effective transportation systems that suit the city.

#### *Smart parking' system*

Africa has unveiled it's first-ever 'smart parking' system' in the Ethiopian capital of Addis Ababa in an effort to reduce urban congestion and parking problems in the city. The system uses modern Chinese technology to park vehicles inside a steel structured building using an automated lift.

#### *City to expand bus depots*

A depot that accommodates 850 buses; fuel station, dry cleaning and generator room, water reservoir with pump house, water recycling plant and wastewater treatment plant. The

detailed design of the project has already been completed by SYSTRA SA, a French consulting company with 27 years of experience [39].

### ***Addis light railway***

Ethiopia's light rail transit-oriented development initiative is a big step towards addressing the challenges rising from urbanization in the region and ensuring prosperous, equitable, and sustainable cities. This light railway project is designed and constructed according to Chinese standards. To ensure the quality of the project, the Ethiopian government and the Ethiopia Railway Corporation have hired the European international company, CIROC.



Source: (a) <http://www.smartcitiesworldforums.com/> (b) <http://africansmartcities.info/ethiopia/>

### ***3.2.1.5 Climate resilient smart environment***

#### ***Repi Land-Fill Power Project***

Ethiopia's Repi Land-Fill Power Project is Africa's first factory turning trash into energy, clean water and bricks. Reppie burns 1400 tons of waste a day to generate 50MW (expectation, actually now 25MW) of electricity to power 25% of Addis Ababa homes- provide electricity to over 3million people-while creating hundreds of jobs [38].

#### ***Nationwide Green Initiatives***

Ethiopia for the last two decades has been promoting green economy, designed by the then prime minster Meles Zenawi. Currently, under prime minster Abiy Ahmed's leadership with high citizen engagement has planted 350m seeds in a single day to reverse deforestation and increase the nation's forest by 4b trees smashing the previous world record set by India in 2017-66m trees. Expanding Green areas/squares/Parks and planting more trees help combat climate change and offset urban pressures on the ecosystem and regenerate the city's water resources, helping stabilize the city's water supply during times of drought and overconsumption.



Source: <https://gggi.org/gggi-joined-ethiopia-green-legacy->

### **3.2.1.6 Smart living: Integrated Housing Development Program (IHDP)**

Since 2005 Ethiopia has implemented IHDP and promised to clear the inner-city slums and poor neighborhoods by building “up to 50, 000 houses per year working with Germany’s official development agency ‘German Technical Cooperation’ (GTZ). The national government and the city administration currently more interested in slum upgrading, rather than demolition and reconstruction which is more effective and less disruptive way of promoting urban development. For instance, the ‘five-year goals’ for the period between 2004 and 2008, mainly targeting Addis Ababa, aimed at a reduction of slum dwellings by 50%, planned to build 150,000-200’000 housing units, create 60,000 jobs, give the basis for 2000 micro and small enterprises (MSEs), reorganize the existing training procedures for the domestic construction sector, broadly introduce the developed low-cost building technologies [40]. Further, in 2019 the Addis Ababa city government officially launched the construction of 20,504 condos as part of its urban housing development program involving the building of 500,000 condos in the metropolis which unlike the past, will not uproot residents and send them to the outskirts of the city [40].



Source: <http://www.geeskaafrika.com/>

### **3.2.1.7 Smart governance: Gender participation and empowerment**

Currently, Ethiopia sees 50 per cent women ministers (cabinet) assume key positions.



Source: <http://addisstandard.com/>

### ***3.3 Smart leadership and smart city, Rwanda’s Kigali smart city initiatives and projects***

Rwanda is small and landlocked country located in Central and East Africa and has a population of about 12.5 million people (2018). The Government of Rwanda is aiming to become a middle-income country by 2020, following the disruption caused to development by the 1994 genocide against the Tutsi, in which 800,000 people were killed [43]. Rwanda has managed to show the highest annual economic growth rate of 8.2 per cent in the last 3 years. The country has identified ICT as a key driver for economic growth. Rwanda now aspires to reach Middle Income Country (MIC) and High-Income Country (HIC) status by 2035 and 2050, respectively [Ibid]. The observed economic growth in the last decades has successfully reduced poverty by 19.8%; extreme poverty has reduced by 23.7% during 2001 and 2015 though the majority of the population still lives in extreme poverty. Consequently, life expectancy, literacy, primary school enrollment and spending on healthcare have all improved [44].

The Government launched its SMART Rwanda Vision Statement, which is moving the nation towards a “knowledge-based society” as part of the wider Smart Africa Manifesto, in 2013. Rwanda is one of the pioneers of smart city engineering in Africa. Modernizing Kigali is part of a wider effort by the Rwanda government to increase and simplify access to public services. Since 2014, the Rwandan government launched the Smart Rwanda Master Plan which seeks to drive Rwanda toward a knowledge-based economy by the year 2020 by using ICT services that improve productivity and efficiency. To support the Smart Kigali initiative, which is currently being implemented involves collaboration with local and international ICT firms, including Inmarsat, Nokia, Ericsson, and Intel as technology partners, to implement smart city solutions under a public-private partnership (PPP) model. As said by Jean Philbert Nsengimana, Minister of Youth and ICT: “It is our vision as a country to position Rwanda as a Technology Hub, by using ICT innovation to provide a better quality of life to our citizens and visitors. Rwanda is a pioneer in deploying Smart City Solution in Africa. Through this project, we will not only improve people’s day to day lives with improved services and security, but we do anticipate long-term positive socio-economic benefits for the people in Rwanda and we also plan to share our experience with many other countries in Africa” [45].

Indeed, Rwanda is steadily moving towards its vision of becoming an information-rich and knowledge-based economy and society and an ICT hub in the region. Vision City, a

housing project under construction on a hill overlooking Kigali, is expected to have free wifi in the town square, solar-powered street lamps, a 36-meter antenna, powered by the sun to beam 4G LTE to residents, and motion sensors that trigger the electricity when one walks into one of these homes. The ambitious aim is to institute such changes to the rest of Kigali and most of the country within the next 20 years. In addition, a special economic zone to the east of the capital will be home to Kigali Innovation City. This will be a hub for tech incubators, universities, and companies both local and international. Firms based here will enjoy preferential income tax rates, tax holidays, and waived customs duties.

### ***3.3.1 Kigali smart city initiatives and projects***

Rwanda’s smart cities initiative aims turning Kigali into Africa's smart cities hub while leveraging technology solutions to improve efficiency in cities’ service delivery. This has seen Rwanda roll out various developments including: WI-FI in public areas and public transport vehicles as well as cashless payment systems in different public and private services.



Source: <https://www.edie.net>

### ***The future vision city, Rwanda***

It is a housing project under construction on a hill overlooking Kigali, is expected to have free wifi (a city-wide deployment of LoRaWAN (or Low Power Wide Area Network) in the town square to ease the internet of things (IOT) thereby provide smart urban solution. This includes air quality sensors; smart farming initiatives; and a ‘smart’ bus equipped with satellite internet that will provide connectivity for remote communities.



Source: <https://africaresearchonline.wordpress.com/>

***Climate Resilient Smart Environment: - Rwanda is leading on green growth***

Rwanda’s mission to maintain a clean and healthy environment has been going since 2008 when it banned the use of non-biodegradable plastic bags and packaging materials. Apart from banning plastics materials, the mission includes forest cover, restoration, the green fund; green politics. These efforts, along with the plastic-bag ban, earned the nation a Future Policy Award from World Future in 2011. The City of Kigali is among 16 finalists -Wellbeing City Award that recognizes cities that place the wellbeing of their citizens at the center of urban design, planning, and policies.



Source: <http://www.therwandan.com/kigali-features-among-top-50-smart-city-governments-in-the-world/>

Rwanda has awarded the Green Fund Honored at COP24 in Poland as Winner of UN Climate Action Award.



Source:<http://www.ipsnews.net/>

***Smart governance: Reducing inequality***

Rwanda has done/is doing great job when it comes to women empowerment and participation. Currently, 64% of the Rwandan Parliament is female and has been ranked the highest country in the world with the most women in parliament as of January 2017.



Source: <https://www.rwanda-podium.org/index.php/actualites/politique>

### ***Smart mobility-transport and ICT***

As part of the broad Smart Kigali initiative, more than 400 buses have been connected to 4G Internet connection, which will allow passengers on board have full access to free super-fast internet. The initiative comes after the City of Kigali in partnership with the Ministry of Youth and ICT and other stakeholders last year launched the Internet Bus Project, which will see all buses not only within Kigali, but also across the country offer internet to passengers.



Source: <https://yitug.wordpress.com/>

### ***Kigali center for international events***

Kigali Ranked 2nd Most Popular Destination in Africa for International Events next to Cape Town.



Source: <https://kenyanwallstreet.com/>

### ***Smart cities initiatives collaboration***

Kigali and Barcelona have signed a memorandum of understanding to jointly advance smart city initiatives. The new MoU will support the Smart Rwanda Master Plan which will seek to drive Rwanda toward a knowledge-based economy by the year 2020 by using ICT services.



Source: <https://smartmycity.com>

### **4. Key challenges of smart city implementation and their solutions**

Lacks clarity in smart cities, undeveloped local governance system, poor urban planning and design practices, poor participation & the challenge of inclusion, mindset problem, lack of resources to finance urban infrastructure and undeveloped information technology system are among the numerous challenges.

#### ***The Smart City Mission lacks clarity in its conceptualization and contextualization***

There is a lack of clarity in understanding the end (Smart City) and the means to reach the end (ICT). The focus seems to be on technology implementation, without an overall framework to understand the need and impact of the same. For instance, Kigali started providing buses with free Wi-Fi and cashless payment service, but the buses have had connectivity issues related to the Korea-built technology's inability to adapt to local conditions. In addition, there has been criticism around the lack of inclusivity of certain smart cities projects. Kigali's Smart city project-vision city- creates a tech-enabled neighborhood with solar powered street lamps and frees Wi-Fi in the town square. Though Rwanda made important gains in education, health, and rural development, critics figure out that the project ignored the socioeconomic realities of a city where 80 percent of its population lives in slums with monthly earnings below \$240 (Vision City Homes cost \$160,000) [47]. Hence, smart city has to be understood and contextualize as a place of strong investment in human and social capital and in effect, political leaders, planners and policymakers must keep the big picture in mind when promoting smart cities, emphasizing well-implemented infrastructure and citizen needs. To this end, cities must start to employ people that have the specific skills that are required to understand a project or development from a technological, legal and regulatory perspective.

### ***Lack of operational and capital cost related to the implementation of smart city initiatives***

Funding/Financing is key constraint for African cities [48]. African cities dominantly engaged in informal business activities which coupled with narrow tax base, rampant corruption and capacity related problems made them handicapped in financing smart city projects. This discrepancy led them to heavily rely on transfer from the central government and foreign debt. Consequently, debt burden is a common phenomenon in the content. Hence, funding strategy for Smart Cities must involve collective intelligence allowing active public-private partnership while leverage resources from private and public sectors as well as foreign capital targeting investments that have higher rate of return.

### ***Poor urban planning and design practices***

It is true that African cities are suffered from poor urban planning and design practices [48]. This is very challenging for the continent which currently undergoing unprecedented pace of urbanization. As well known, urbanization in Africa is largely the result of massive urban-rural migration. The first waves of migration to the city are unplanned. But it is necessary to introduce as soon as possible urban planning on a massive scale in Africa. The first response to that is to improve urban planning, to plan for city growth, which urges the need to have a pro-active approach, of national governments developing national urban policies to cope with the challenging future of African cities.

### ***The challenge of inclusion and undeveloped information technology system***

Lack of the use of participatory and transparent approach in capturing a local community's needs and local solutions has resulting in loss of trust from the public. The public sector is crucial for tailoring smart initiatives to be more inclusive and transversal. A core challenge for smart city initiatives is the issue of inclusiveness and participation. Community need for basic service delivery and appropriate smart technology to facilitate such basic service delivery. Who benefits from new technology, especially when digital equipment, such as mobile phones and internet connections, are unequally distributed amongst African urban populations? Although mobile penetration is high on the continent, the cost of mobile communication and data is still exclusionary in many places. In 2016, internet penetration in Africa is about 28.6% which is far behind the world average of 49.5%. Further, the cost of broadband data is also particularly high in many African countries. The processing and sharing of data is also crucial to the smart city project. However, cities are failing to bridge the 'digital divide, i.e. the social and economic inequalities which come about as a result of who has access to communication technology, and how they use it and rarely manage to create inclusive dynamics that involve residents, public and private actors in a shared ecosystem of innovation [49].

### ***Mindset problem***

The mindset of city leaders, administrations, citizens and the private companies is key Success factors for smart city development [50]. For instance, in Rwanda "awareness and literacy – so many people are not aware while others are not digitally literate- found a big challenge to implement E-Certificates to Ease Services Delivery. Jules Ntabwoba, who works with the Irembo, Rwanda's online government services portal, says, "people in the cities can be an obstacle in the form of 'resistance to change' i.e. some people fear

technology because they fear they will be replaced and we have faced issues where some institutions would not accept these e-certificates”[51]. Hence, continuous engagement with local people and institution plays pivotal role in realizing the objectives of smart city projects.

## 5. Conclusion

*Currently, there is urbanization boom in the African continent. African leaders and policy makers have to recognize the critical role that well-managed urbanization will play a critical role in realizing their ambitious national and global development goals and achieve sustainable development goals (SDGs). In this regard, Smart cities can aid the rapid urbanization of African countries and improve the quality of life of the new city dwellers, solving some of the biggest challenges of the urban environment, such as high-cost, low-quality, and inaccessible services. However, in order for the continent to reap the benefits, planners and policymakers must keep the big picture in mind when promoting smart cities, emphasizing well-implemented infrastructure and citizen needs. Obviously, developing a truly smart city is urges putting people at the heart of any city which requires a venture demanding immense scale, complexity, and commitment. This is clearly recognized among African political leaders and policy makers in their commitment to realize the values and principled ensured in ‘Agenda 63 and Smart Africa summit’. Rwanda’s Kigali and Ethiopia’s Addis Ababa have showed good progress in implementing smart city initiatives and projects. However, lacks clarity in smart cities, undeveloped local governance system, poor urban planning and design practices, poor participation & the challenge of inclusion, mindset problem, lack of resources to finance urban infrastructure and undeveloped information technology system are among the numerous challenges that they are facing in smart city design and implementation.*

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