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Concept Paper for Transforming Juba Into A Smart City Through "SMART" Approaches

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Abstract

Traditional cities always strive to become modern and smart cities. The concept of a Smart City revolves around leveraging technology and data-driven and integrated solutions to enhance various aspects of urban life, including key modernization elements such as infrastructure (both road and broadband connectivity), affordable modern housing, business facilities, transportation (public transport and parking spaces etc), waste management and environmental protection and sustainability, governance, and citizen engagement. Among others.

By considering factors such as ICT infrastructure, transportation efficiency, energy, and green initiatives, as well as e-government services, innovation hubs and or bio-networks, and quality of life of city inhabitants among others, and implementing development initiatives that enhance them, traditional cities are able to become smarter, more efficient, and more resilient and hence, transform into modern smart cities.

Keywords: smart city, resilience, sustainability, technology, infrastructure, population, connectivity and integrated solutions.

INTRODUCTION

As Juba City's population continues to grow, there is an increasing need for innovative solutions to address the challenges faced by the management of the city and keep it clean, green, safe, and smart. The concept of "smart cities" incorporates the integration of technology, data, and sustainable practices to enhance the living conditions of urban people, improve resource management, and promote economic growth e.g. connected traffic signals, connected city buses, connected security cameras, environment sensors, connected street lights, street WiFi, connected fire-fighters, connected state offices, etc. This proposal outlines a clear and measurable approach to developing Juba as a smart city by leveraging technology and other techniques to create effective, resilient, efficient, inclusive, and sustainable urban management and development. The concept seeks to address key urban challenges such as waste management, public safety, transportation, and energy management, as well as community and stakeholder engagement.

WHAT ARE THE ISSUES?

The rapid growth of Juba city population has led to a range of challenges, including overcrowding in city centers, traffic congestion on main roads, air, noise, and water pollution, crimes, inadequate public services, and social inequality. The Juba City Council (JCC) struggles to provide essential services and infrastructure to meet the demands of this growing population. Additionally, traditional approaches to urban development often lack coordination and fail to consider the long-term sustainability of initiatives

or projects and resources. The absence of integrated solutions, limited resources, and expertise hinders JCC from reaching its full potential, leaving the city's inhabitants vulnerable to socioeconomic and ecological challenges.

POPULATION GROWTH TREND IN JUBA CITY

Juba city population has been consistently growing over time since the country's independence in 2011. The population of Juba was estimated at 479,000 in 2024. It increased by 4.36% from 2023. It was 459,000 in 2023 with an increase of 4.32% and 440,000 in 2022 with an increase of 4.51% from 2021 (UN, 2023). The average population growth in Juba city is estimated at 4.5% for the last 14 years since South Sudan's independence in 2011.

Juba - Historical Population Data		
Year	**Population**	**Growth Rate**
2025	500,000	4.38%
2024	479,000	4.36%
2023	459,000	4.32%
2022	440,000	4.51%
2021	421,000	4.47%
2020	403,000	4.40%
2019	386,000	4.61%
2018	369,000	4.83%
2017	352,000	4.76%
2016	336,000	4.67%
2015	321,000	4.56%
2014	307,000	4.78%
2013	293,000	5.02%
2012	279,000	4.49%
2011	267,000	4.71%

Given the fact that South Sudan is one of Africa's fast-growing countries, these population growth trends indicate a potential for rapid growth in the years to come once the country's political crises subside and the economy improves to become attractive to foreign investors and migrant workers seeking investment opportunities and greener pastures.

The National Bureau of Statistics also projected a consistent increase in population in the Central Equatoria State (CES), one of the 10 States hosting the national Capital of South Sudan since 2015 to 2020. The population growth ratio between male and female is almost equal with female less than male by a small margin over the years.

Table 64: Central Equatoria State population projections, 2015-2020

Year	Male	Female	Total	t	r
2015	762,422	700,182	1,462,604	0	
2016	790,388	727,242	1,517,630	1	0.0369
2017	819,395	755,316	1,574,711	2	0.0369
2018	848,971	783,928	1,632,899	3	0.0367
2019	878,254	812,252	1,690,506	4	0.0362
2020	908,513	841,507	1,750,020	5	0.0359
Average growth rate, 2015-2020					0.0365

Source: NBS. 2015. Population Projections of South Sudan 2015 – 2020

Table 69: Central Equatoria State population projection, 2019

Age group	Male	Female	Total
0-4	173,073	168,838	341,910
5-9	140,964	137,193	278,157
10-14	86,924	82,024	168,948
15-19	86,958	79,856	166,814
20-24	71,091	64,071	135,162
25-29	68,022	61,554	129,576
30-34	54,809	51,610	106,418
35-39	53,983	49,589	103,572
40-44	40,712	35,636	76,349
45-49	32,835	27,750	60,584
50-54	24,239	19,769	44,009
55-59	17,152	13,623	30,776
60-64	11,464	9,628	21,092
65-69	6,866	4,822	11,688
70-74	5,114	3,757	8,872
75-79	2,514	1,690	4,204
80-84	1,136	649	1,784
85-89	315	152	467
90-94	82	40	122
95+	2	1	3
Total	878,254	812,253	1,690,507

Table 70: Central Equatoria State population projection, 2020

Age group	Male	Female	Total
0-4	176,869	172,537	349,406
5-9	148,844	144,859	293,703
10-14	91,941	87,432	179,373
15-19	85,597	78,832	164,429
20-24	78,920	71,569	150,490
25-29	60,592	53,911	114,503
30-34	64,086	60,788	124,874
35-39	48,894	43,734	92,628
40-44	49,108	45,092	94,200
45-49	29,888	24,007	53,895
50-54	28,124	24,070	52,194
55-59	16,122	12,362	28,484
60-64	13,239	11,135	24,374
65-69	6,765	4,703	11,468
70-74	5,552	4,061	9,612
75-79	2,358	1,516	3,873
80-84	1,236	744	1,981
85-89	294	117	411
90-94	82	37	119
95+	2	1	3
Total	908,513	841,508	1,750,021

Source: NBS. 2015. Population Projections of South Sudan 2015 – 2020

Looking at the NBS Population projection of CES between 2019 and 2020, the large population group is between the ages of 0-34 with the age group 0-9 leading. This means there is a highly increasing birth rate and the population is young. The high birth rates shall continue to increase even further in the years to come. As a young city, consumption and crime rates are as well high and expected to increase even more in the years to come, this means appropriate measures need to be put in place to manage the growing population in Juba in terms of increasing road infrastructure development, waste management mechanisms, crime control mechanisms, socioeconomic overheads for jobs creation and human capital development, ICT infrastructure (broadband) for efficient connectivity, research and innovation for creation of integrated solutions that can offer effective management and governance as well as economic boost among others.

THE SMART AFRICA AGENDA

The Smart Africa Manifesto was adopted by the African heads of state in 2013, providing a vision for achieving socio-economic development through ICT. The Manifesto outlined five key principles including ICT as the center of the national socio-economic development agenda, improving access to ICT, especially broadband, improving accountability, efficiency, and openness through ICT, putting the private sector first and to leverage ICT to promote sustainable development. The Smart Africa Manifesto is being implemented through the Smart Africa Alliance, established in 2016. Within Smart Africa, Rwanda is leading the smart cities theme (UNHABITAT, n.d).

BENCHMARKS AND LESSONS TO LEARN FROM GROWING SMART CITIES IN AFRICA AND THE EAST AFRICAN REGION

Ranking bodies such as the IESE Cities in Motion Index, the IMD Smart City Index, and the Smart Cities Index are being platforms used to measure how smart cities are performing globally. The IESE Cities in Motion Index is a research platform that applies a combination of objective and subjective indicators to evaluate performance of cities. The evaluation is carried out with basis on four key drivers including sustainable ecosystems, innovative activities, equitability, and connected territory while the IMD Smart City Index ranking system based it evaluation of smart cities on various factors including Digital infrastructure, transportation, energy and environment, e-Government, economy and innovation, quality of life, sustainability and resilience; and the Smart Cities Index measures how well cities perform in areas such as traffic management, environmental sustainability, and public transportation e.g. segregated cycling infrastructure and the share of people walking or cycling etc. (Victor Oluwole, 2024). Most countries and ranking Agencies have the following factors in common for ranking smart-cities (as analyzed by Victor):

1. **Technology and Digital Infrastructure:** This includes the availability and quality of high-speed internet access, mobile connectivity, digital platforms, and smart devices across the city.
2. **Sustainability and Resilience of governance and economy:** Assessment of initiatives promoting sustainability, climate resilience, disaster preparedness, water conservation, green infrastructure, and efforts to mitigate environmental impact.
3. **E-Governance and services:** Evaluation of digital services provided by the government, transparency, accessibility of public information, online citizen engagement platforms, and efficiency in delivering public services.
4. **Transportation systems** Indicators such as public transit efficiency, use of smart transportation systems (like real-time traffic monitoring or smart parking), integration of sustainable mobility options, and reduction of congestion and pollution.
5. **Energy and Environmental protection:** Factors like renewable energy adoption, energy efficiency measures in buildings and infrastructure, waste management practices, air quality monitoring, and green spaces.
6. **Economic performance and Innovation:** Metrics related to innovation ecosystems, support for startups and businesses, investment in research and development, digital entrepreneurship, and collaboration between the public and private sectors.
7. **Quality of Life and human capital (development):** Consideration of factors impacting residents' well-being, such as healthcare services, education quality, affordable housing, safety and security measures, cultural amenities, and overall livability.

Indeed, the above are critical elements to measure the progress of a traditional city and its transformation into a smart city. Countries in the third world and especially South Sudan should consider its status with regards to these key factors as Juba seeks to follow the path to transform itself into a smart city. Below are some of the top smart cities in Africa according to the Smart City Index of 2024:

#	Country	City	Rank	Global Position
1	Egypt	Cairo	C	114th
2	Algerie	Algiers	C	124th
3	Morocco	Rabat	C	126th
4	South Africa	Cape Town	D	129th
5	Kenya	Nairobi	C	131st
6	Nigeria	Abuja	D	135th
7	Nigeria	Lagos	D	136th
8	Tunisie	Tunis	D	137th
9	Ghana	Accra	D	138th
10	Egypt	Sana'a	D	141st

Source: (Donald Masimbi, 2024)

We can also learn or refer to the progressive cities in the East African region. Two that stand-out amongst the 7-member states are Kigali, Rwanda, and Nairobi, Kenya.

Kigali, Rwanda

"The Government of Rwanda has set an ambitious vision "to transform the country from an agrarian economy into a knowledge-based economy by 2020". This transformation agenda has been taking place in the context of two of the most important trends of the 21st century thus, rapid urbanization and the increased application of digital technologies in all sectors of society (UNHABITAT, n.d). Rwanda's Vision City transformation agenda focuses on the technological advancements seen in other smart cities across Africa and the world. Its emphasis has been the demand for improved housing for the masses aiming at establishing 4,500 homes in Kigali, accommodating approximately 25,000 people. The Rwandan Smart

City Masterplan provides a framework that guides the country's cities and towns in their efforts to incorporate ICTs to provide a higher quality of life to their citizen, businesses and visitors.

According to Vision 2020, 35% of the population in Rwanda is projected to live in urban areas by 2020, meaning that large numbers of people will move to towns and cities, putting pressure on local governments to effectively manage urban cities/towns to guarantee quality of living and sustainability. Rwanda planned to reach 95% internet penetration by the end of 2017, opening up new opportunities to develop the digital economy, jobs creation, and bridging digital skills gaps among the population. It initiated changes to urban planning and management processes and introduced innovative ways to deliver services to citizens. "The Masterplan was developed in 2017, based on extensive discussions, meetings, and workshops with a variety of urban and ICT stakeholders in Rwanda, including ministries, regulatory bodies, local authorities, academia, civil society, and the private sector. The development was aligned with the Smart Africa Alliance Smart Sustainable Cities Blueprint for Africa" (UNHABITAT, n.d)

The Kigali City Masterplan of 2013, for example, which was derived from the national Master Plan, accounts for a growth from 1.31 million inhabitants to 3.7 million inhabitants by 2032. The Masterplan covered four (4) pillars including coordination, densification, and conviviality: ".."

Pillar 1: COORDINATION; to ensure multi-level institutional coordination, good governance, and effective planning i.e. data-based institutional coordination through a cross-agency financial and project management platform, promotion of planning tools and participatory planning processes through GIS-based urban management platforms, dynamic data-supported master planning, digital citizen engagement tools, and the creation of innovation teams in ministries and local authorities

Pillar 2: DENSIFICATION; to ensure land is used efficiently for sustainable urban development i.e. proposing concrete initiatives related to strategic investment phasing, such as the cross-agency financial and project management platform, and informed decision-making to support the development of efficiently serviced urban neighborhoods with initiatives such as digitally monitored and managed utility networks, and data-led 'door-to-door' mobility solutions.

Pillar 3: CONVIVIALITY; to promote quality of life, mitigation of disaster risks, social inclusion, and cultural preservation i.e. identifying concrete initiatives for conviviality such as digital service points for rural settlements, smart urban agriculture initiatives, sensor-based environmental data, smart and green building labs to promote sustainable living and working and the development of smart, sustainable and shared neighborhood pilot projects.

Pillar 4: ECONOMIC GROWTH; to connect urban development to green growth and market-responsiveness to release the potential of innovation, public-private partnerships, local revenue development, and efficient financial management i.e. promoting concrete initiatives such as a national fund to encourage challenge-based innovation, local digital business platforms, collaborative urban innovation acceleration labs and personalized e-finance platforms for all life-time services.

A number of initiatives are created under these pillars such as smart electricity meters, Kigali Innovation City, smart electricity meters, water and electricity online payments systems, Rwanda Infrastructure geoportal, Huzza energy resource planning system, Brembo e-government portal, Kigali Land and construction one-stop shop, Kigali smart bus project, Kigali pollution mapping, 4G-LTE rollout, digital revenue collection, One laptop per child program etc to transform Rwandan cities and towns into smart-cities or towns. The deployment of Inmarsat's LoRaWAN network has provided the critical infrastructure for Kigali to begin its transformation into a smart city including helping Rwanda's national grid, WASAC (Rwanda Water and Sanitation Corporation, etc. which has yielded a number of practical applications for

comprehensive monitoring of power grid infrastructure and power stations for capacity and security, water leak monitoring and environmental monitoring, with sensors being deployed in buildings to shape a picture of air quality across the city. Smart streetlights are being deployed in order to make the illumination of Kigali's streets more responsive to its citizens' needs.

Nairobi, Kenya

The Government of Kenya (GoK) launched a ten-year Information Communication Technology (ICT) Digital Masterplan 2022-2032 with the aim to align with global technological advancement trends and enhance Kenya's digital economy. The digital master plan identifies four key pillars i.e. digital infrastructure (laying 100,000 kilometers of fiber optic cable, installing twenty-five thousand hotspots in key business centers at public places, developing the government cloud, accelerating the development of the Konza Technopolis/smart city development, building out the regional ICT infrastructure, and developing a sustainable power plan to support the infrastructure); digital services and data management (digitization and automation of government records, the integration and increased interoperability of government services, the review and automation of all critical government services, the development of government security, intelligence and surveillance systems, and the digitization and automation of county processes in all of Kenya's forty-seven counties), digital skills (promoting investments in digital skills capacity and public workforce development), and driving digital innovation for entrepreneurship (nurturing national physical addressing system, and the development of the Kenya software industry) Nairobi Smart-city transformation.

The Nairobi City Authorities initiated a master plan named "The Nairobi Integrated Urban Development Master Plan (NIUPLAN)" which is a major milestone for Nairobi City County (NCC) and the country at large in terms of initiating moves to enhance or transform the traditional city of Nairobi into smart-city. This particular city is not only the capital city of Kenya but also an important commercial and industrial hub for the East and Central African Region. The plan provides an integrated framework based on a comprehensive and holistic view of urban development developed through an inclusive and participatory process. The development vision contained in the plan "Nairobi 2030: An Iconic and Globally-attractive City Aimed at Regional Integration and Sustainability" is anchored on four pillars: i) Economy, ii) Environment, iii) Governance, and iv) Social Culture capturing the views and aspirations of the city residents, and is as a result of numerous grassroots meetings and consultations held in each of the nine sub-counties of the City. NIUPLAN has also been subjected to a Strategic Environmental Assessment (SEA) process to identify environmental, social, and economic impacts of the plan and elicit related

concerns from a broad spectrum of stakeholders thus able to formulate the necessary social and environmental safeguards into the master plan (NCC, Dec. 2014).

Nairobi is the capital city of Kenya and one of the most important economic centers in East and Central Africa. "It accounts for 50% of formal employment in Kenya and generates over 50% of the country's gross domestic product (GDP)" (NCC, Dec. 2014). Nairobi city has a Population of over 3.1 million. It faces similar problems other EAC countries including South Sudan face such as traffic congestion, expansion of slum areas, insecurity, poor urban governance, and environment deterioration amongst others. According to the Kenya Population and Housing Census, the total population of Kenya in 2009 was approximately 38,610,000, and that of Nairobi City was approximately 3,138,000. The average population density, excluding Nairobi National Park, is 5,429 per km2 (NCC, Dec. 2014). Among the wage employment in 2012 and high economic performing sectors are; the community, social, and personal services sector accounting for 52.1%, the agriculture and forestry sector (24.1%) and wholesale and retail trade, restaurants, and hotels sector (7.2%). Commercial and service businesses are more concentrated in the central business district (CBD) while manufacturing businesses are located more in Makadara Division. Informal employments are distributed throughout the city. The Priority programs of Nairobi city Master Plan for implementation starting in 2018 include; urban development program, urban transport development program, urban infrastructure development program, environment improvement program, and urban development management strengthening program. While other long-term initiatives include those indicated in the table below;

List of High Priority Projects

Program	Project Title	Possible Fund Source
Urban Development Program		
CBD Development Program	Railway City Development	ODA (Loan, Technical Cooperation)
Sub-centre Development Program (priority area)	Dandora Sub-centre Development	ODA (Technical Cooperation)
	Eastlands Urban Renewal Project	ODA (Technical Cooperation)
Urban Transport Development Program		
Road Network Development Program	Flyover in CBD for Railway City	ODA (Grant Aid / Loan)
	Widening of Enterprise Road	ODA (Grant Aid)
	Construction of Northern Part of Circumferential Road C-2	ODA (Grant Aid)
Public Transport Development Program	Development of New Bus and *Matatu* Terminal in Railway City	ODA (Grant Aid)
	Vitalisation of Commuter Train Operation	ODA (Technical Cooperation)
	Feasibility Study on Nairobi Loop Line	ODA (Technical Cooperation)
ITS Development Program	Formulation of ITS City Master Plan	ODA (Technical Cooperation)
Infrastructure Development Program		
Water supply	Master Plan of Distribution Network in Nairobi	ODA (Technical Cooperation)
Power	Amendment for Technical Criteria of Overhead Line	ODA (Technical Cooperation)
Telecommunications	Fiber Optic Trunk Communication Network in Nairobi City	ODA (Loan)
Environment Improvement Program		
Stormwater drainage and sewerage	Capacity Development for Stormwater Drainage System in Nairobi City	ODA (Technical Cooperation)
	Capacity Development for Sewerage System in Nairobi City	ODA (Technical Cooperation)
Solid waste management	Development of New Landfill Site	ODA (Loan)
City-wide Air Quality Management Program	City-wide Air Quality Management Program	ODA (Technical Cooperation)
Urban Development Management Strengthening Program		
Urban Development Management Strengthening Program	Urban Development Management Strengthening	ODA (Technical Cooperation)

Source: JICA Study Team (JST)

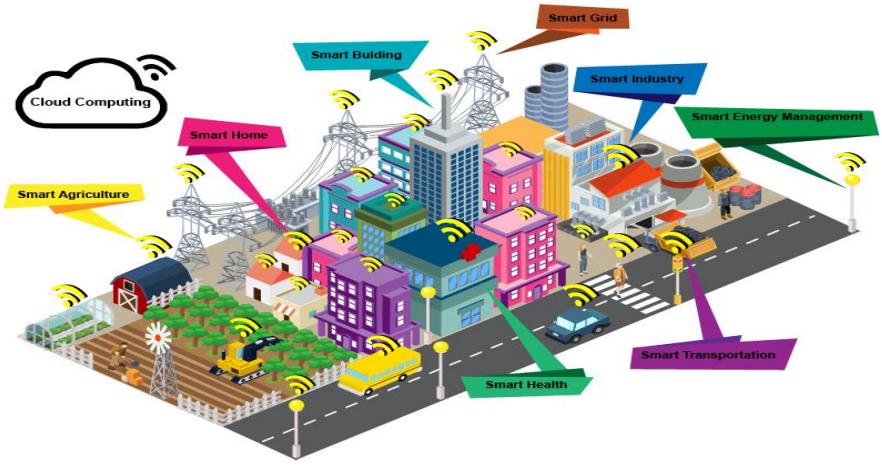
The Konza Techno City, Kenya.

Kenya is making significant strides towards establishing a smart city with the development of Silicon Savannah Konza Techno City, a technology hub modeled after Silicon Valley. Located 60 kilometers from Nairobi, this ambitious project aims to integrate smart gadgets and sensors embedded in roads and structures. This infrastructure has been a model for Nairobi Smart City program, its initiatives on optimized traffic management, improved communication services, and enhanced citizen engagement within the proposed satellite city will inform Kenya's Capital (Nairobi) transformation into a smart city.

WHY THIS APPROACH?

Juba City is facing enormous challenges in terms of mitigation mechanisms for improving and sustaining sanitation, controlling crimes, improving communication infrastructure and services i.e. road network and ICT infrastructure, stakeholders engagement, and other socioeconomic overhead enhancement that can improve the living conditions and well-being of the people in the city. This plan of action (approach) shall ensure that there are progressively doable activities that are SMART. It intends to turn the programming at the JCC into a project-based one that is result result-oriented. It will rally partners and stakeholders including the community/population in the city to share thoughts and resources to support the common good for the people to live well in the city. It further aims to gradually turn Juba into a "Smart City" in the near future.

Sample fundamental "Smart City" elements:



Development is progressive and requires workable initiatives and technologies for efficiency and cost-effectiveness in delivering development programs or projects, as well as common understanding, sacrifice, institutional and personal will/support, and discipline to realize it. Its journey must, somehow, be started and continued through realistic programs and initiatives. This concept can help start the journey toward turning Juba into a "Smart City".

WHAT TO CONSIDER? (STRATEGIC PILLARS):

1. **Connectivity** (Roads, Energy, and ICT infrastructure)
2. **Socioeconomic Investments** (Social and Business infrastructures), SME support instruments. Examples: recreation centers, sports centers, schools, markets, PHCCs, malls, mini-markets, guest houses etc
3. **Public Sanitation** (pollution control e.g. S-Waste, E-Waste, noise etc)
4. **Ecological Development** (Green city & Beautification)
5. **Safety and Public Order** (public protection and crime control)
6. **Capacity enhancement and Partnerships** (skills, tools, materials, equipment, collaborations etc)
7. **Research and Development** (smart technologies and innovative techniques for service delivery and investment)

STRATEGIC GOALS:

1. **Enhance Urban Quality of Life through connectivity;** Create a livable and sustainable urban environment that improves the overall quality of life of the people in Juba city through enhancing road networks, ICT infrastructure thus Internet/fiber to the facility/home (ITTF or FTTH), power grids thus "electricity to the home" (ETTH) and clean water lines to the homes thus, "water to the home" (WTTH).
2. **Promote Sustainable Resource Management;** Implement integrated systems that efficiently use resources, reduce waste, and minimize the ecological or protect the environment in Juba city.
3. **Foster Economic Growth and Innovation;** Stimulate local economic development through business infrastructure developments, social mechanisms and spaces, technology-driven business solutions, and job creation in emerging sectors thus stimulating the private sector, particularly SMEs.
4. **Encourage Partnership and Stakeholder Engagement;** Involve line institutions and residents in the planning and decision-making process to ensure that Juba city development meets the common needs and preferences of the people or public at large.
5. **Strengthen Urban Resilience;** Build capacity to weather and recover from the challenges facing the city development, including climate change, population growth, and economic fluxes.
6. **Promote peace and coexistence;** Improve the security sector and supporting mechanisms that improve people's self-discipline and keep law and order

STRATEGIC TASKS:

1. **Develop Smart Connectivity Systems (SCS);** Improve city road networks, ETTH (i.e. Promote the adoption of renewable energy sources and energy-efficient technologies in public and private sectors, smart grid technologies, renewable energy, energy-efficient building practices and retrofitting programs for existing structures.), ITTF, WTTH, Improve Real-time Traffic Management Solutions/Systems (RTMS) to reduce congestion and improve City Transportation Mechanisms (CT-

M) e.g. public transport, parking, pedestrian markings along highways, etc. for residents.

2. **Establish Advanced Pollution Management Solutions (PMS);** Introduce smart waste bins and recycling programs that enhance solid and electronic waste collection and promote sustainable practices. Limit noises and use of individual generators in public centers and vicinity by adopting Centralized Single Power Supply (CSPS) in city centers as well as regulate club noises in the city; Introduce smart bins equipped with sensors to monitor waste levels and optimize collection routes; Develop recycling and composting programs supported by technology for efficient waste sorting; and increase educational campaigns to raise awareness about waste control and recycling practices etc.
3. **Enhance Public Safety and Emergency Response Mechanisms;** Utilize smart surveillance and communication technologies to improve public safety and streamline and enhance emergency response efforts to hazards; and develop community safety tech applications that provide real-time alerts and resources for residents. Thus; ensure police stations/units, fire fighters' placements, alarm systems and mechanisms (tools and personnel), civic awareness/outreach on public responsibility on safety mechanisms;
4. **Create Digital Platforms for Citizen Engagement;** Create and launch digital (online) platforms, town hall conferences, etc that facilitate government-citizen interaction and feedback, encourage participation in urban planning, and foster transparency in governance and accountability.
5. **Establish and improve Economic Boosters;** Invest in business-boosting infrastructure including city centers/malls, business support technologies, industries, and policies/regulations that create a conducive business space that maintains and attracts existing and emerging entrepreneurs in the marketplace.
6. **Maintain peace and security;** Establish community dialogue mechanisms and promote peaceful coexistence amongst communities and between communities and security sector or the government; install smart security surveillance cameras with real-time monitoring capabilities in high-traffic areas; stablish a smart emergency response system that integrates communication between citizens and frontline security responders; engage gang groups in a 3-fold approach i.e. "constructive", "disciplined crack-down" and "punishable crack-down" engagements starting with "constructive approach" such as opening opportunities for them to denounce crime and engage in productive activities e.g. space to promote art, entrepreneurship, associations, etc. the second approach which is "disciplined crack-down" involves capturing criminals and assess magnitude of crime then put them in citizen discipline zone such as state government farms, animal husbandry plants, workshops such as metal works, garages, carpentry etc. they shall work for the state government to generate revenues as well as make them disciplined and constructive citizen after serving their term. The third approach which is "punishable crack-down" is to capture criminals with high crimes to be in strict prison shells and punished by courts of law.
7. **Conduct Institutional and Community Capacity building and Research;** Provide educational programs to equip officials and residents with the knowledge and necessary skills to engage with smart city initiatives actively; increase number of schools and skilled teachers, increase health facilities and skilled health practitioners, equip schools and public health centers with tools and skills and create space for research on innovative development approaches and productivity discoveries (technologies) for sustainable development.
8. **Monitor and Evaluate for Transparency and Accountability;** Establish a hybrid framework for tracking progress and assessing the effectiveness or impacts of implemented smart city solutions or p-

rojects for development process transparency and accountability.

STRATEGIC DEMOGRAPHIC TARGET GROUPS:

Juba City Residents:

- **Groups:** Individuals and families living within Juba city council's jurisdiction, including diverse age groups, socio-economic backgrounds, and cultural identities.
- **Aims:** To improve the quality of life, access to efficient public services, sustainable living environments, and community engagement opportunities.

Local Businesses:

- **Groups:** Small to medium-sized enterprises (SMEs) and local entrepreneurs operating within urban areas.
- **Aims:** Support for economic growth, access to technological resources, and opportunities to participate in smart city initiatives that enhance business operations and improve productivity and the economy.

Community Organizations and NGOs:

- **Groups:** Non-profit organizations and community groups focused on urban development, social equity, effective governance, and sustainability.
- **Aims:** Establish partnership and collaboration opportunities, funding for community-driven projects, and platforms for citizen engagement in decision-making processes.

Local Government and Policy Makers:

- **Groups:** JCC officials, city planners, and local government agencies involved in city infrastructure development and governance.
- **Aims:** Ensure data-driven insights for policy formulation, capacity-building, innovative solutions for challenges facing Juba city, and engagement with residents for effective service delivery.

Students and Educational Institutions:

- **Groups:** Students, educators, and academic institutions involved in research and innovation related to urban development.
- **Aims:** Opportunities for experiential learning, collaboration on research projects, and access to resources for developing smart city solutions.

Vulnerable Populations:

- **Groups:** Marginalized groups, including low-income households, the elderly, and individuals with disabilities (PWDs) living in Juba city blocks including crime perpetrators.
- **Aims:** ensure accessible services, inclusive urban planning, and targeted initiatives that address the specific challenges facing PWDs as well as crime perpetrators in Juba city.

Research, Health and Faith Institutions:

- **Groups:** Health practitioners and patients, clergy, and followers, and Researchers.
- **Aims:** increase and improve health centers and provisions for health practitioners, schools, and teaching materials, Research support to enhance innovation and guarantee progressive development in the future supported by healthy, skilled labor and production as well as service delivery innovations.

WHAT ARE THE PROSPECTS?

1. **Improved Quality of Living;** Residents of Juba city experience enhanced living conditions through better access to services, improved public transportation (roads and organized means), and increased

green spaces.

2. **Sustainable Resource Management;** Reduction in power and labor consumption, low waste generation, leading to more efficient use of resources and a lower environmental impact.
3. **Economic Restoration and Growth;** Increased job opportunities, economic opportunities, and development through the promotion of technology-driven productivity and support for local businesses.
4. **Enhanced Public Safety;** Reduction in crime rates and improved emergency response time due to the implementation of smart surveillance and communication technologies.
5. **Greater Community and Stakeholders' Engagement;** Increased participation of residents and stakeholders/partners in urban planning and decision-making processes to foster a sense of ownership, support, and community pride.
6. **Enhanced Digital Literacy;** Community training and workshops lead to improved digital skills among residents, enabling them to engage with smart city technologies effectively.
7. **Data-Driven Decision Making;** The local government or JCC and its policymakers utilize data collected from smart technologies to inform effective decision-making on Juba city planning and service delivery, resulting in more effective governance, resource allocation on positively impactful development areas.
8. **Increased Resilience;** JCC Blocks/Payams are better equipped to handle challenges such as climate change, natural disasters, and economic fluctuations, leading to a more resilient community and sustainable development initiatives.
9. **Healthier City Environments;** Improved air, land and water quality through smart environmental monitoring and sustainable practices, contributing to the overall health and well-being of residents of Juba.
10. **Stronger Societal and Community Networks with Government and Partners;** Formation of partnerships among local government, non-governmental organizations, businesses, and residents, fostering collaboration and collective action towards common goals leading to progressive development.

HOW TO ENSURE EFFECTIVE PERFORMANCE OF THE APPRAOCH? (M & E)

To ensure the success of the "Juba smart city initiative", a comprehensive monitoring and evaluation framework will be developed. Key performance indicators (KPIs) will be established to assess progress in areas such as transportation efficiency, energy consumption, waste reduction, public safety incidents, crime reduction, innovations, productivity, improvements in the economy (State GDP or per capita incomes), community engagement, and level of partnerships and support, etc. Regular data collection and analysis will inform decision-making and adjustments to strategic approaches/techniques as needed. Regular/periodic reports shall be produced to ascertain process and resource utilization accountability through the established accounting principles in the public accountability legislation and the reform mechanisms of the R-NDS and other government accountability procedures.

WHAT SHALL BE THE SOURCES OF FUNDS TO FINANCE THIS SMART APPROACH?

Funding for the "Juba Smart City Transformation Initiative" will be sought from a variety of sources, including the following proposal:

1. **Government Grants;** state and federal funding allocations or transfers for city development and su-

stainability projects.

2. **Local Revenues;** revenue collections from business tax, PIT, and fees from local government property leases, including JCC investment incomes
3. **International Organizations;** collaborations with organizations such as the United Nations, World Bank, and development agencies for technical and financial support.
4. **Corporate Partnerships;** engaging technology companies, energy firms, and local businesses to provide funding and resources through corporate social responsibility (CSR) initiatives.
5. **Public-Private Partnerships (PPPs);** establishing joint ventures between public agencies and private companies to share investment and operational responsibilities.
6. **Community Fundraising;** involving residents and local organizations in fundraising efforts to support specific project components.

CAN IT BE FEASIBLE? AND WHEN CAN RESULTS BE EXPERIENCED BY THE CITY POPULATION?

This smart approach is feasible if paid attention by the State government of Central Equatoria State (CES) and local authorities (JCC) leadership. Implementers can phase it into small bits/projects that can be implemented within a limited or defined period of time. Finances shall not be an issue if there is deliberate intention geared towards achieving it. Below is a suggestion that can be considered depending on the commitments of the authorities and political will.

Phase	Duration	Tasks
Phase 1	Months 1-3	Community engagement and baseline surveys
Phase 2	Months 4-6	Development of Operations frameworks; Rollout implementation of smart CTM, ETTH, WTTH, and other initiatives.
Phase 3	Months 7-9	Launch of citizen engagement platforms and ongoing monitoring.
Phase 4	Months 9-18	Rollout implementation of ITTF (Internet to the facility)
Phase 5	Months 19-21	Complete initiatives (projects)
Phase 6	Months 21-24	Post-implementation Monitoring and Evaluation, Reporting, and Impact Assessment.

CONCLUSION

This idea of integrating smart approaches using technology for the Comprehensive Transformation and Development of Juba into a “Smart City” presents an intelligent opportunity to develop and change the living conditions of the people residing in Juba city. The approach prioritizes SMART techniques to develop initiatives that ensure sustainability, community engagement, partnerships, and innovative solutions to address the challenges faced by JCC or the city residents of Juba. By harnessing the power of smart approaches and technology as well as stakeholders’ engagements including community inclusivity in planning and implementation, we can create an environment that not only enhances the quality of life for residents but also fosters economic growth and resilience in the face of dynamic circumstances our

country face at moment. Boosting socioeconomic infrastructure, and engaging everybody in the development path and processes, we guarantee ownership and sustainability.

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