
From "Developing" to "Smart" a scalable integration of the change in city's dimensions.

Auteur : Ngoie Kazadi, Drusilla

Promoteur(s) : Clement, Jessica

Faculté : HEC-Ecole de gestion de l'Université de Liège

Diplôme : Master en sciences de gestion

Année académique : 2020-2021

URI/URL : <http://hdl.handle.net/2268.2/11652>

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**FROM “DEVELOPING” TO “SMART”:
A SCALABLE INTEGRATION OF THE CHANGE
IN CITY’S DIMENSIONS.**

Jury :
Promoter :
Jessica CLEMENT
Reader(s) :
Giovanni ESPOSITO
Alexis HAKIZUMUKAMA

Dissertation by
Drusilla NGOIE KAZADI
For a Master in Management sciences,
option enterprise management

Academic year 2020/2021

Forewords

The digital transformation has impacted our daily lifestyle and consumption in an unpredicted way. Today, we are no longer using the Internet, but we are in the Internet. No one can deny the fact that Information and Communications technology (ICT) is urging us to adapt and accept a new mode of goods and services consumption. And that forced adaptation may become wider in several years. Cities will be offered to us as a service, using ICT in all the existing dimensions. If we thought that our developed society has reached the peak on the developmental curve, smart cities have proved us wrong. The exponential increase of new technologies seems to be infinite.

The most disruptive and unpredictable phenomenon for me is the fact that developing countries could leapfrog the developed world, turning the tables in the traditional developmental progress. With a challenging context, it is intriguing to analyse how the developing countries manage to permutate from a traditional city to a smart city, knowing that we, in developed countries, will be impacted on an economic point of view.

1. Introduction

Since a couple of years, smart cities have been a subject in developed countries' debates. From one side, society is evolving through decades facing worldwide urbanization (Alawadhi et al., 2012) and on the other, technology seems to have taken a wide turn: it is progressing at the speed of light. Since those evolutions, intelligent cities development was a logical continuation in the question of technology-based society development.

Yet, the question has overpassed borders since developing countries are implementing or aim to implement smart cities projects during following years. Giving birth to several reviews on the subject. Most of which surrounding the importance of the context to reach a positive and sustainable implementation of smart cities due to challenges faced by those countries. Challenges faced by developing countries can be radically different from those battled by developed countries. That gap is due to socioeconomic challenges.

Tan et al. (2020) explain that two cities within the same country may face different levels of common challenges. Dawning the necessity to understand cities' current context when discussing smart cities development. Joshi et al. (2016) determine 5 factors to reach this comprehension: social, management, economy, legal, technology and sustainability. Tal et al. seem to back this statement when quoting drivers for smart cities development in developing countries. Mboup and Oyelaran (2019) underline the social factor taking as a scope of research, health and show an example of the disparities that exist in Nigeria: 43% in urban areas to 16% in rural areas benefited from immunization. Not only are the city-scale challenges, yet country-scale challenges may also exist.

Although developing countries can benefit from smart cities, say Mboup and Oyelaran (2019), we understand that it is crucial to understand the structure before thinking about smart cities development. Rana and al. demonstrate that existing barriers must be broken to reach their development.

1.1. Urbanization

Bhattacharya et al. state that urbanization will affect current challenges, pressing the need to develop smart cities. They conclude that different factors must be taken into account, together, in order to obtain a sustainable society. Which is the common goal for all smart cities.

For two decades, the phenomenon of urbanization is faced globally: inhabitants in rural areas tend to move in urban areas.

Since, cities have become a main subject in the global development debate of the United Nations (UN, 2017): “Make cities and human settlements inclusive, safe, resilient and sustainable” is the 11th goal, out of 17, of the UN’s sustainable development plan (2017).

In fact, they are the common component to face today’s challenges concerning several scopes: economy, energy, environment, science, technology and education. Climate pollution or energy excess consumption, e.g., in the environment field.

Reported by the UN (2017), hurried urbanization causes pressure on the management of those current global challenges:

- More than half of today’s population will live in cities by 2030. 70% will live in urban areas by 2050.
- Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health.
- 60% to 80% of energy consumption and 75% of carbon emissions are produced by the world’s cities.
- Developing world is where urban expansion will occur most, representing 95%.
- Eastern and South-Eastern Asia are home to most of the 828 million slum dwellers globally.
- In the next 30 years, 90% of urban growth is forecasted to happen in developing countries.

Much of this urbanization will unfold in Africa and Asia, bringing huge social, economic and environmental transformations.

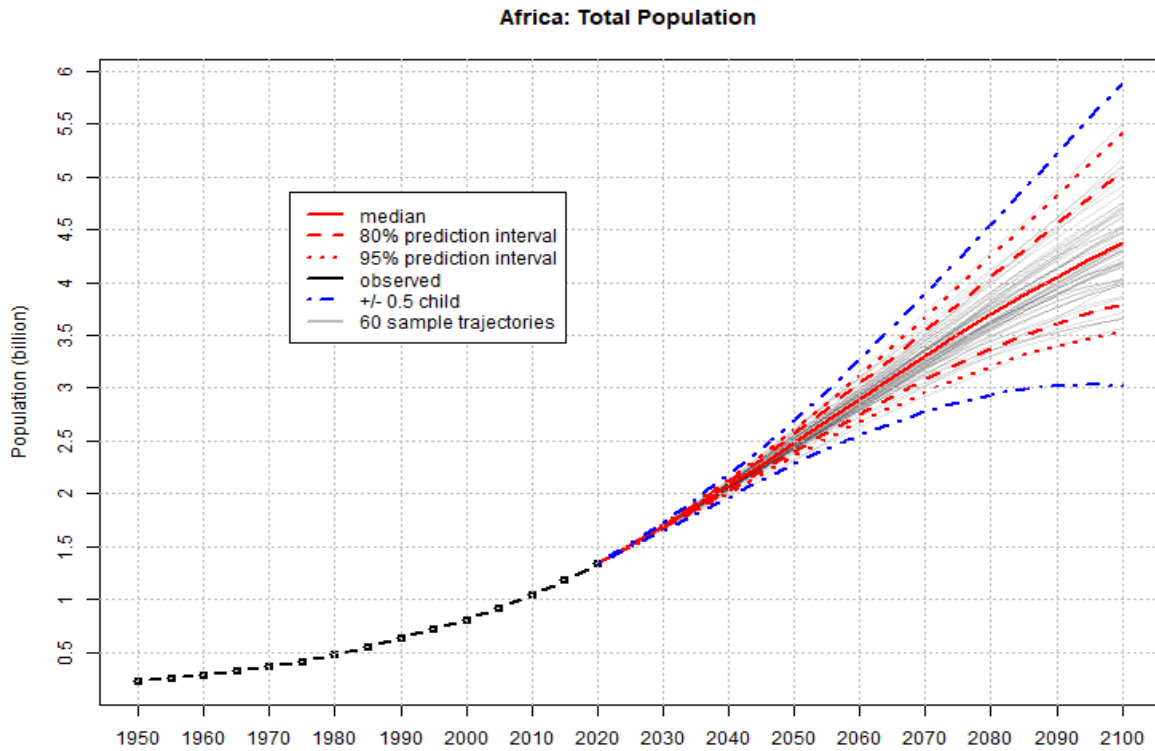


Figure 1. United Nations, World Population Prospects (2019).

1.2. Digital transformation

Digital transformation is another global phenomenon faced today. Defined by Blavier (2021) as the fusion of the physical world with the virtual world enabled by the cloud, internet of things (IoT), data and empowerment through new technologies and digital skills.¹

For several years now, digital technologies have been used as a solution to confront today's challenges. They are drivers for progress and improvement for societies through citizen participation. Nonetheless, they can be the source of turmoil in environment, democracy or inequalities locally, since digitalisation depends on the local context and needs (Carter et al., 2020).

Digital skills arise in this "tech storm" and disrupt the traditional relationships and pyramidal organization of the society (Blavier, 2021). ICT being a must for smart city development, it

¹ BLAVIER, A. (2021, FEBRUARY 25TH). MODULE 4 CLOUD & API, DATA & AI [POWERPOINT]. https://lola.hec.uliege.be/pluginfile.php/12124/mod_resource/content/7/2020-2021%20HEC%20DB%20M4%20Cloud%20%20API%20Students.pdf

requires digital literacy skills for people to be able to adapt fully to the digital transformation in their local environment (Eshet, 2004).

Carte et al., (2020) supports the importance of digital literacy, defining it as an important factor that can facilitate digital transformation acceptance in African countries. Besides, it is a matter of a successful smart city implementation. Compared to developed countries, the digital ecosystem is still under construction in developing countries. African cities must consider its digital development challenges to keep up with the digital transformation. Indeed, without its inhabitants, a smart city can not progress.

1.3. Management of smart city project

There is no framework applied as a common basis for smart cities in developing countries (Barro et al., 2018). A lot of studies propose a structure to analyse the change in some countries and countries publish their own reports based on their own management baselines.

Besides, they affirm that African developing countries should give consideration to what has been done so far in developed countries and adapt it to their context to plan their sustainable development through ITC and digital tools.

According to Pichault and Nizet (2013), it is crucial to understand the contextual situation where the change is occurring.

Considering smart city implementation as a change, a move from traditional city to a connected environment, and based on the political approach in the change explanation process, Pichault and Nizet (2013) also explain that every stakeholder's interest that are affected by the change process has to be considered: involve all stakeholders from the very start and ensure that a common goal is pursued by everyone in order to achieve a successful change management. Thus, all stakeholders within the smart city ecosystem must be involved in this digital change (Kar and Chatterjee, 2015).

1.4. Research question

From all these observations, one could understand that smart cities initiatives could be solutions to developing countries' challenges. Their challenging context, the digital divide, and the importance of involving citizens in the change and transformation process require a structured management approach. They are the fuel for a successful smart city project. Their implication in the change process is imperative. If developing countries understand, investing in digital

education can push them to achieve this sustainable, resilient, and desired city and leapfrog the other cities and countries on the developmental curve.

Thus, this thesis aims to analyse the current situation in developing countries, specifically from Africa, the continent with most developing countries (UNCATD, 2019) and smart cities projects' perspectives and evolution within those countries. The citizens being at the centre of attention, I will focus on the "Smart people" dimension to answer this research question: **How are developing cities or countries transitioning from traditional to smart to become sustainable and resilient? In other words, what modes are used in the digital transition? Which change management process approach is undertaken?**

2. Methodology

This section describes the methodology and method employed for information collection and analysis. The different examples used to illustrate the statements concern African developing countries. This choice is based on the fact that most developing countries are located in that area.

Secondary sources are used in order to conduct the research, retrieved from on-line databases. English and French language information were searched. Although the context is limited to developing countries, documentation about developed countries documentation were used for some aspects.

First, the smart city concept is defined from different positions. A general contextual analysis of developing countries is presented with examples of creative initiatives undertaken in some developing countries from Africa.

“Smart people” dimension will then be analysed in the case of Senegal. The aim is to identify the different action planned in the digital transformation to involve stakeholders and reach digital maturity to overcome digital challenges, in the sector of education.

3. Smart city concept

3.1. Definitions

Monzón (2015), declared there's no specific definition for smart city concept. A wide number of definitions can be found but two main aspects seem to prevail: ICT and needed infrastructure.

The European commission emphasizes the capital role of digital ICT by defining smart city as a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business.

The Smart City Institute of Liege University's (SCI) definition includes the 6 fields of action: a "smart city" is a multi-stakeholders' ecosystem (composed with local governments, citizens' associations, multinational and local businesses, universities, international institutions...) engaged in a sustainability strategy/transition (mobility, environment, economy, people, governance & living), using technologies (ICT mainly) as enabler in order to become more sustainable (economic prosperity, social well-being & conservation of our natural resources).

Among that multi-stakeholders' ecosystem, Mboup et al. emphasises a people-centric orientation: "a smart city is viewed as a sustainable, inclusive, resilient, and prosperous city that promotes a people-centric approach based on three core components (smart city Foundation, smart ICT and smart institutions and laws) and seven dimensions (Infrastructure Development, Environmental Sustainability, Social Development, Social Inclusion, Disasters Exposure, Resilience, and Peace and Security)".

But for Carter and al. (2020), there is not just one model or one approach for smart city development. "Becoming" a smart city can be driven by any of the actors in the city ecosystem. The network's thesis is that becoming a smart city will involve an effort by the local urban authority to build a coalition of actors across all sectors, who can improve the quality of life of the city's citizens, by improving the digital capacity of the local authority, its ecosystem, and the territory it works within. This definition will be used for this dissertation.

3.2. The 4 pillars and roles

Government, academia, and industry were the main areas that shaped the smart city concept. Each, having a distinct standpoint and roles in smart city implementation. Government has a focus on urban development and sustainability management. Knowledge creation and information development is of importance for academia's concern whereas industry stakeholders centre on businesses becoming digital (Agbali et al., 2019).

Besides those 3 main areas, the quadruple helix model concept (Fraunhofer, 2016) highlights the importance of society integration in every national innovation project system. The model's scheme thus integrates 4 main actors: academia, industry, government, and society. They are part of multi-layered, dynamic, bi-directional interactions, favouring synergies and conceding empowerment to the civil population through different techniques and approaches undertaken by the government mainly.

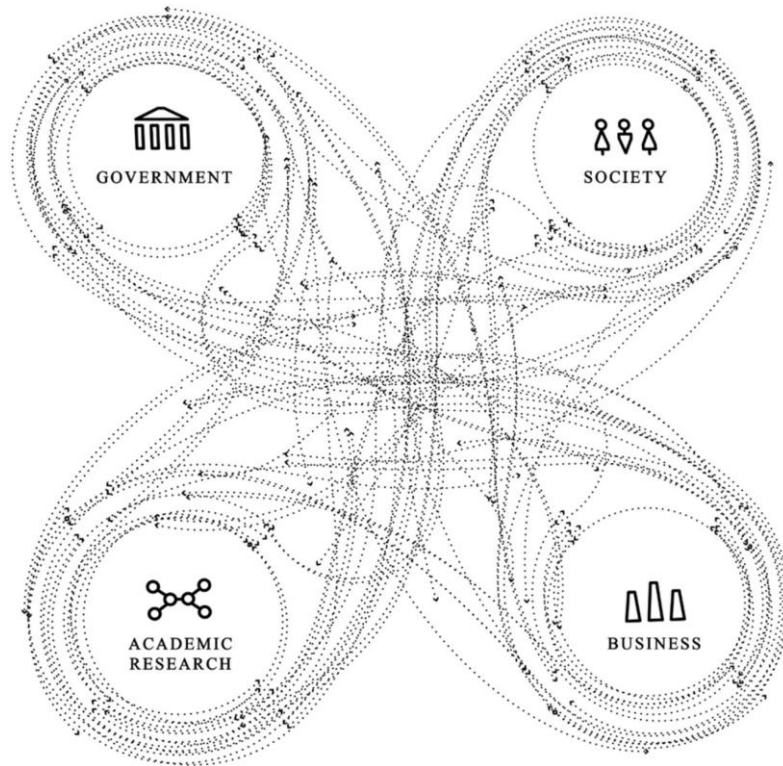


Figure 2. The Quadruple Helix Model adapted by Fraunhofer (2016).

3.3. Fields of action or dimensions

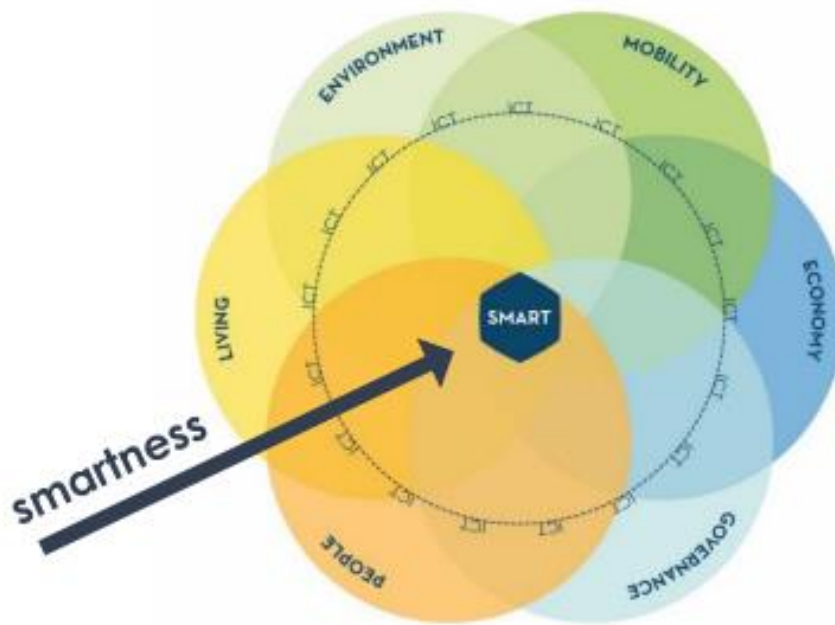


Figure 3. Monzón, smart city dimensions (2015).

3.3.1. Smart government

It is a governance system where synergies are stimulated between all stakeholders within the city ecosystem: governments, citizens, businesses and other organizations. The needs are addressed using new technologies and innovative methods. (Monzón, 2015).

Kampala city and e-government

To allow payments via mobile phones through mobile money platforms, point of sale terminals and banks to reduce cost of revenue collection and increase compliance, the city has applied a revenue collection system.

3.3.2. Smart economy

Sikora-Fernandez and Stawasz (2016) include smart ICT industries, businesses, and technological zones. With productivity and innovation, the economy adapts to the market environment and manages to stay competitive with new business models and resilient global model (Monzón, 2015).

Rwandan company Tap'n'Go and e-economy

The company has created a system to allow quicker boarding and real time supervising of data related to public transport: rechargeable cashless payment cards. They can be

used in public bus transport services, equipped with WI-FI connectivity. Tap'n'Go service may be available in taxis and shopping centres.

3.3.3. Smart living

Smart facilities and public spaces and services at the disposal of citizens in order to improve their accessibility, achieve a flexible use and serve effectively the city-dwellers (Monzón, 2015). Sikora-Fernandez and Stawasz (2016) state further the provision of a secure and friendly environment.

Lagos (Nigeria) and e-living

Charge-free dedicated lines of communication were provided to citizens to reach security and emergency agencies in the country. This initiative was put in place by the Lagos State Command and Control Centre.

3.3.4. Smart mobility

According to Monzón (2015) smart mobility offers a productive, clean, and equitable transport network. Users, planners and transport managers have access to information and data. Traditional transport modes and innovative communication means merge for a smart utilisation of present infrastructure (Sikora-Fernandez and Stawasz 2016).

Kampala (Uganda) and e-mobility

A traffic control centre project, covering 15 junctions in the city, which gives updates on traffic as well as the performance of the signals has been completed. This improved the communication between the Kampala Capital City Authority's offices, traffic signals and the control centre network.

3.3.5. Smart environment

The smart environment represents a place where the consumption of the city resources, air or water i.e., is maximized. Management policies follow a sustainable and resilient strategy (Sikora-Fernandez and Stawasz 2016).

Kenya and e-environment

The ACACIA project promotes the production and distribution of innovative, non-carbonised biomass briquettes to remove charcoal and firewood for clean cooking. This will also improve health in the country and decrease carbon emissions.

3.3.6. Smart people

Smart people are engaged in smart urban initiatives. Provided with technical support and creative solutions and innovative initiatives, citizens will be participative to improve their quality of life. Digital education is also a key tool (Monzón, 2015).

Bamako (Mali) and e-people

The Regional Development Agency of the District of Bamako and the private company FAMIB Group, specialized in software and operating systems, have decided to collaborate to create the Virtual University of Mali. Starting from January 2020, the objective was to train more than 10,000 young Malians and Africans each year.

4. Smart cities in developing countries

4.1. Developing countries context

As the UN reported (2017), in the coming 3 decades, 90% of urban growth is forecasted to happen in developing countries. Much of this urbanization will unfold in Africa and Asia, bringing huge social, economic and environmental transformations.

But certain developing countries still facing basic citizen needs challenges causing more difficulty to govern smart city implementation but at the same time, highlighting the opportunity to develop. Indeed, based on the definition of an intelligent city, most developing countries' challenges could be solved if the city successfully transitions into a smart urban area (Tan and Taihagh, 2020).

Bhattacharya et al. judge cities as the power source of economic growth (2018). But they face challenges stressed by the increasing urbanization rate. Those challenges need to be prudently analysed in order for economic growth, social development and population evolution to be aligned and evolving within the same perspective (Monzón, 2015). Waste management, scarcity of resources, air pollution, human health concerns, traffic congestion, electricity generation are only a portion of the obstacles generated by growing cities (Bawany, 2015). There are numerous challenges considered as obstacles for a sustainable and resilient development for developing countries (Dos Santos and Mota 2019).

Developing economies not only have to catch up with the developed countries. Some of them are still facing basic citizen's needs for years now and are very late on the competitive curve. But, although they are late compared to developed economies, they may leapfrog the competitive global market through implementation of smart cities. In fact, the rapid urbanisation and technology adoption made African countries seen as "the next big market"².

4.2. Global goal: the 2030 Agenda for Sustainable Development

All developing countries are Member States of the UN who presented (2015) its plan tackle today's biggest global challenges: poverty, hunger, disease, violence, equitable and universal access to high education, health care, e.g. To reach the 17 developmental goals, all countries and stakeholders ought to engage in collaborative partnerships. "Make cities and human

²Deloitte, *Africa is ready to leapfrog the competition through smart cities technology.* (2015)

settlements inclusive, safe, resilient and sustainable” one of the goals. By 2030, UN aim to reach it through several actions:

- Ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums.
- Provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
- Enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries
- Reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.
- Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.
- Provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.
- Support developing countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.



Figure 4. United Nations’ sustainable development goals, (2015).

4.2.1. Management at different scale

On national and subnational scales, constant reviews of progress should be carried out by all Member States. Those reviews must highlight participation of all stakeholders, citizens, societies, private sector and others.

At the regional level, peer-to-peer learning, sharing of best practices, discussions are advised to benefit from opportunities. Follow up and review are also tools that UN support.

4.2.2. Covid-19 effect

UN reported (2019) mixed results before the pandemic. Developing countries haven't been spared and the crisis may impact more than half of the 17 goals. Its impact is likely to carry on until the dateline of 2030. Therefore, developing countries must innovate in policies making to achieve the developmental goals (Barbier and Burgess, 2020).

4.3. Regional goal: Virtual University of Africa

Senegal is a member of the pan African intergovernmental organisation which goal is the permit the access to higher quality education through ICT.

4.4. Going smart: the advantages

For developing countries, drivers to go smart are numerous. Tan and Taeihagh (2020) analysed 8 significant drivers that boost developing countries to adopt smart city concepts in their territory and could suit UN goals:

- Financing capacity of the government.
- Building a strong regulatory environment that fosters the confidence and trust of citizens and investors.
- Technology and infrastructure readiness.
- Stability in economic development.
- Active citizen engagement and participation.
- Knowledge transfer and participation from the private sector and public.
- Creating a supportive ecosystem that promotes innovation and learning.

5. Smart people dimension: the case of Senegal

5.1. Digital in Senegal

In the economic and social development of Senegal, the digital is a main sector. Through digital goods and services offering, it is a stimulant for productivity and development. Private companies, SME and start-ups are the main components of the digital ecosystem. The digital transition mainly takes its start from ICT, considered as the fuel for the digital growth. Indeed, ICT infrastructures are the most developed and productive. The rate of ICT use is high for enterprises and the sector of education, thanks to several innovative initiatives in middle-school and academies. The digital transformation pressed education institutions to adapt quickly.³

5.2. Education as a key for digital skill

Citizens are the core of digital transformation. An appropriate education to achieve digital literacy is key to overcoming smart city issues. They are the ones who can resolve local challenges (Idelle and Mboup, 2019).

The middle-class population is particularly dominant in African countries: 62% of the population is under 25 years old. Willing to upgrade their living conditions and digitally literate, the transition into smart city can be successful if they are digitally ready.⁴ Supported by Idelle and Mboup (2019), 15-24 years old population are the drivers of change, today and tomorrow in African countries.

³ *Senegal digital strategy, 2016-2025*. Retrieved from: <https://www.sec.gouv.sn/sites/default/files/Strat%C3%A9gie%20S%C3%A9n%C3%A9gal%20Num%C3%A9rique%202016-2025.pdf>

⁴ Deloitte, *Africa is ready to leapfrog the competition through smart cities technology*. (2015)

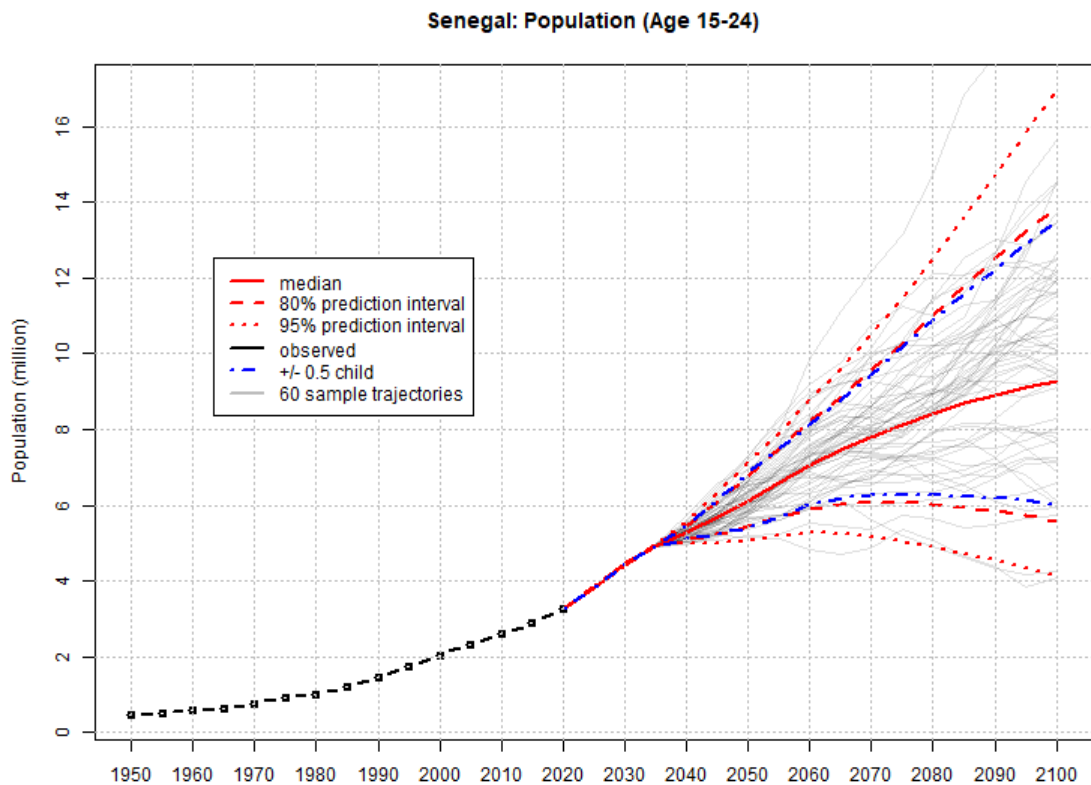


Figure 5. United Nations, World Population Prospects (2019).

5.3. Education challenges in Senegal

Major challenges were faced by the country: excluded children, increasing completion rates, enhancing teaching quality, improving education management, upgrading vocational training, promoting national languages and reducing illiteracy. But over the years, the country observed a growth in education access by young from 15 to 19 years old. Access to a better-quality education and system management were provided by the national education program.⁵

5.4. Innovative initiative: PDES action plan in higher education⁶

Deriving from a national vision, the Priority Programme Reform and The Development Plan for higher Education and Research, 2013-2017 (PDES)

⁵ United Nations, *Economic and Social Council, Geneva*. (2011)

⁶ African development fund, *Senegal virtual university support project, Senegal* (2013).

was launched by the Ministry of Higher Education and Research in Senegal: 3 universities were built. One of them being the Virtual University of Senegal (VUS) that provides face-to-face and distance classes, based on ICT. Thus, the VUS is a local university, in line with the vision of higher scaled perspectives: higher education for Senegal, Africa, and globally.

Through its implementation, synergies engaged stakeholders: ministries, the Chairperson of the VUS Steering Committee, higher education institutions already involved in e-learning, private higher education, ICT and development partners.

Outcomes of the plan are better inclusion of women in higher education, equitable access to education, creation of internships in the private sector, improvement of the know-how and skills that will fortify employability. The university is also a catalyst for innovation and digital development, helps building digital skills and therefore tackles the challenge of digital literacy.

5.5. Actions in the VUS plan to meet national and global expectations

Action level	Actions	Goals
Local	<ul style="list-style-type: none"> - Creation of the Virtual University of Senegal - Master programmes - Short-term certifying classes - Development of teaching modules and the training of trainers - Construction of digital open spaces (DOS) and the Office - Creation of a technological platform, the UVS headquarters and infrastructure - Community service activities 	<ul style="list-style-type: none"> - Higher education access - Favour digital economy development, access to resources and services - Equitable access for young graduates to higher education, information security - Fight discrimination

	<ul style="list-style-type: none"> - Provision of the internet connection - “One student, one computer” program - Division of the professional cooperation and insertion (support for funding of curriculum design, training of tutors, internships opportunities information, etc) 	<ul style="list-style-type: none"> - Equitable access to education - Digital literacy, improvement of know-how and employability
National	<ul style="list-style-type: none"> - Partnerships - Creation of a DOS - Set up of a datacenter 	<ul style="list-style-type: none"> - Exchange, training - National access to information
Regional	<ul style="list-style-type: none"> - Partnerships with Ivory Coast and Burkina-Faso - Creation of the NWE Regional Coordination - Partnerships 	<ul style="list-style-type: none"> - Exchange - Fight discrimination

Table 1. Actions launched within the UVS infrastructure. Source: UVS performance report, (2019).

Conclusion

Developing countries have high potential to join the most developed countries row. Although there is a lot that still needs to be done, the vision of a better Africa is becoming more and more real. African societies, governments, entrepreneurs, and other actor in the society ecosystem manage to collaborate and apply innovative idea to live in a sustainable environment.

The transition is handled in a cooperative approach: stakeholders are usually involved in projects through synergies. The governments support the 3 remaining actors: academia, industry, and society. They have all integrated the importance of citizens participation and the need to empower them in the digital transformation process.

Several cities or countries take advantages of their strengths to focus on one specific dimension and become key actor at the regional scale, first. Local sustainable projects are linked to higher-scaled sustainable perspectives. The vision is transferable vertically, in a top-down manner. The VUS is a project integrates in the VUA project who is also part of UN goal to improve education in developing countries when making cities resilient. Although the initiative comes from the top, the management is fully decentralised. Aligned on the same vision, regional then national and local actors are free to manage the change while considering their context.

From the Senegal case, despite the lack of digital literacy, local initiatives are tackling this challenge. The importance of education, an enabler to solve the digital divide challenge, is not neglected. Young populations, the main consumer in the economy, are provided with solutions and encouraged in skills development for a hopeful future.

Recommendations

One specific smart city definition should be considered from the very beginning of studies. The indenumerable number of definitions might be explained by the fact that contexts differ from one smart city to another.

Collecting secondary data concerning African countries is quite challenging. A lot of smart city projects are recent; thus, aftermath reports are lacking and an “before-after” analysis is difficult to conduct. In order to provide the analysis, primary data should be considered eventually.

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