



## THE IMPACT OF ICT TO SMART CITIES FROM COMMUNITIES' DAILY ACTIVITIES MIND-SET

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### ABSTRACT

*Being smart in the context of setting goals means be specific, measurable, achievable, realistic and timely as well, the city to be smart need to set goals which are specific that can be measurable and achieved in a certain period and this goals are accurate. Being in smart city with successful integration of information communication technology means people are able to live and work within the city using its resource by improving operation efficiency, sharing information within the public and provide a better quality of government service and its community well-being. Smart cities enrich social stability and economic prosperity by encouraging its community to invest and use its resources for better living. This research surveyed the community of Rwanda specifically to smart Kigali city which also referred as capital city with the initiative of modernizing citizenship through use of ICT for better service delivery and providing free broadband Wi-Fi internet access in public places that include commercial buildings, bus stations, airport, public transport and cab. Well, as the community are the user of the services, their mind-set need to be taken into accounting during goals set, the more their use services*

*the higher quality of life achieved. This paper will contribute to the future researchers and provide the impact of ICT to smart city toward its smartness this will facilitate the technology suppliers to support smart city initiatives to their respectively cities*

**Key words:** ICT (Information Communication Technology), Smart city, integrity, privacy, good servicing.

### 1. INTRODUCTION

According to Saraju p.Mohanty smart city is a place where traditional networks and services are made more flexible, efficient, and sustainable with the use of information, digital and telecommunication technologies to improve the city operations for the benefit of its inhabitants[1]smart city could be used to represent efforts that in many ways describe a vision of a city[2] to achieve all this some aspect need to be taken into account smart transport, smart infrastructure, smart health care, smart energy and smart technology. ICT play major role in transforming traditional cities to smart cities where it promote development across many dimensions like making governments more efficiency and their decision-making more transparent, ICT enable organization to be more productive and enable

communities with access to services this will improve significantly the quality of life[3].The United Nations estimates that between 2015 and 2025 the world population will increase by 32%, it means from 7.2 – 9.7 billion inhabitants, while the urban population will increase by 63%, from 3.9 – 6.3 billion inhabitants, The current estimations suggest that until 2030, over 60% of the world population will live in cities, and the significant growth will be in African, Asia and Latin America[4][5]. The urban development and its associated problems have been intensively discussed in the last years at many international and national conferences due to research shows that cities occupy only 2% of the planet's surface, they accommodate about 50% of the world population, consumes 70% of the total generated energy, and are responsible for 80% of the greenhouse effect [6]. According to the Rwanda National institute of statistics, the Rwandan population is expected to grow from 10.5 million in 2012 to 16.3 million in 2032. A near doubling in percentage terms from 16.5% in 2012 to 30% in 2032. The Kigali city masterplan of 2013, accounts for a growth from 1,3million inhabitants to 3.7 million inhabitants in 2032[7].Rwanda has the potential to champion the development of smart cities in Africa, due to its stable and innovative leadership, the fast digital transformation and the innovation capacity of its youth. Digital technology support the functioning of urban fundamentals such as planning, basic services, governance and housing in the smart city.

## 2. METHODOLOGY

Different cities confirmed that the implementation of smart-city elements ad solutions are high on their agenda, due to the fact that they expect great amount of benefits when they become smart included sustainability, efficiency, better participation of citizens in the work of local governments and increase of quality of life in general

[8].Since Kigali city is still not primarily oriented towards implementing smart-city methods and elements among Rwanda cities, we have decided to examine opinions of Rwandan citizens on their standpoints regarding implementation of Kigali as smart-city elements into Rwanda Country. We have also compared the responses of citizens who responded to the questionnaire on the crucial elements of smart-cities.

Google Forms was created and used while conducting this research as one way of gathering information from a random sample of respondents in the questionnaire, and the numbers of respondents in the qualitative research wasn't limited with the highest number of respondents. Data was collected in the period of one month from 2<sup>nd</sup> August to 28<sup>th</sup> August 2021, the participant need to have access to the internet as the questionnaire was provided to a certain number of participants using social media. Even though this questionnaire can be used as an example of larger scale project for local self-government when implementing the elements of a smart city but the value of the questionnaire is limited because the knowledge that we give depends on the of respondents and their ability to answer the questions asked.

Kinyarwanda language was used as the questionnaire was conducted for Rwandan citizens only and the participants were introduced with the purpose and the objectives of the questionnaire before answering the questions. The reasoning behind using the web questionnaire in Google Forms is the following: the provision to potential participants was conducted without expenses, it offered anonymity and the authors concluded it was optimal for a certain number of respondents [9]. A Couple of ten (10) questions was set where the first three (3) were related to defining the participants by several categories authors viewed as important (Gender, age and the location of the

participants), the fourth (4) question asked the participants how they get access to technology devices like laptop, smartphone, etc.. It like do you own one those device or you have access from public place? And how often they use that technology in daily activity. The next question provide participants with the ability to select from multiple answers, the fifth (5) question was like which of the following element of the smart city are already provided in Kigali city? Some of those elements are Digital infrastructure, e-services, quality of life, energy, economy and smart citizens' participation. The following two questions was designed in way which participants will allow to propose their own answer or chose some of the given proposal, the six questions was like how do ICT impact your daily activity when you are in your city (Kigali city), some of the proposed answer: ICT reduce costs, reduce resource consumption, ICT improve contact between citizens and city stakeholders, ICT enhance quality of urban services and it promote performance and interactivity of urban services.

Question number seven was like which of the following elements of the Smart-city are already provided in the Kigali city?" The areas in which cities need indicators to measure their smart city performance are: energy, greenhouse gas emissions, traffic and transport, digital infrastructure and E-services, resource management, citizens' participation, competitiveness, economy, environment, quality of life etc. The answers have been categorized into the five (5) basic categories which the smart-city consist of: Smart governance, Smart living, Smart mobility, Smart environment and Smart people. Some answers belong into the two (2) categories [15].

| Smart governance                                      | Smart living          | Smart mobility              | Smart environment        | Smart people                    | Uncategorized/ false                               |
|---|-----------------------|-----------------------------|--------------------------|---------------------------------|--|
| Citizen-government interconnection                    | Smart security system | Smart parking               | Energy-efficient facades | Smart education and health care | Shared drives with a personal vehicle (carpooling) |
| Automated collection of data regarding citizen habits |                       | Smart traffic lights        | Smart waste disposal     |                                 | Quality of life reduction                          |
|   |                       | Smart public transportation | Smart energy savings     |                                 | Usage of non-renewable energy sources              |
|   |                       |                             |                          |                                 | Free Wi-fi in bars                                 |
|   |                       |                             |                          |                                 | Smart benches                                      |

Figure 1: Answer in category

The selection of indicators for the evaluation framework was based on an inventory of the needs of cities and citizens, the CITY keys working definitions and the structure of the evaluation framework, and the categorization made by S. Kondepudi and R. Kondepudi [10]. Additionally, some of the answers were not elements of a smart-city (not grouped in any of the above-mentioned categories).

The set of questions from eight (8) to ten (10) asked participants the following: "Question number 8: "Which of the following smart-city elements you think your city needs the most? Q9. Does the introduction of smart-city elements increase the quality of your lives"; "Question 10: Are you familiar with any barriers to the initiatives your government to facilitate smart-city elements? The eleventh (final) question was open-ended, and participants were asked whether they think the city they live in is "smart". Participants were asked to write and explain their answer on the above question. Different Software will be used for data analysis.

### 3. DATA & RESULT ANALYSIS

A total number of 582 was respondents the questionnaire given and 31.5% are from 18 to 30 years old; 29.1% are from 31 to 45 years of age; 30.6% are from 46 to 55 years of age and a total of 8.8 % are from 51 plus years of age and below 18 years of age of the respondents, out of 582 which is equal to 100%, a total of 62.2% were male and 37.8% of the participant were female. A total number of 71% of the

respondents reported that they live in Kigali city, 15% was live near Kigali city and 14% live far from Kigali city.

The research done by ITU World Telecommunication/ICT indicator database from 2000 – 2010 shows that ICT penetration was like 78.0/100 inhabitants with mobile-cellular telephone subscriptions, 29.7per 100 inhabitants with internet user, 17.2% with fixed-telephone lines 12.6% active mobile-broadband subscriptions and 7.6 fixed(wired)-broadband subscriptions [16].

And research has shown that in 2019, the number of mobile cellular subscriptions per 100 inhabitants in Rwanda are 76.49 per 100

Out of the 582 respondents reported that 95% own their devices (own laptop, smart phone, Desktop and iPad) and a total of 5% need to lent or go for cyber-café to access the internet and among this participants 71% live in Kigali.

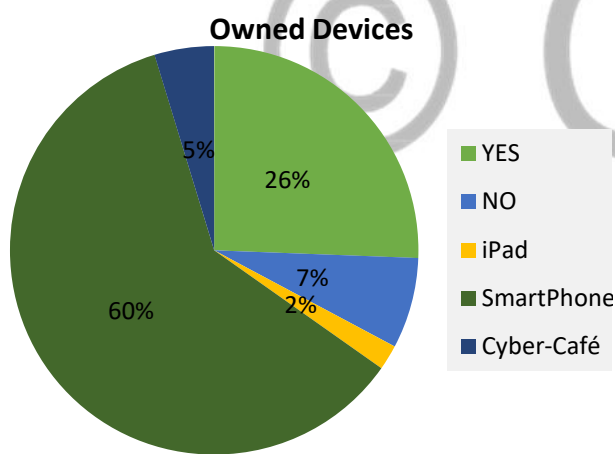


Figure 2: Devices owned

The research we conducted has shown that the ICT impact daily the lives of citizen where ICT reduce cost(88%), ICT reduce resource consumption (71%), ICT improve contact between citizens and city stakeholder (82%), ICT for enhancing quality of urban services (86%) and for Promoting performance and interactivity of urban services (62.25%). Question 5 which of the following element of

the smart city are already provided in Kigali city most of the participant said that e-services are used more for both government and private business where Irembo website for almost government services. And e-market, e-commerce e-banking and other online services are available, Digital infrastructure are available in different part of Kigali but not much as needed. Most respondent reported that their still need smart education and healthcare and better citizen and government interconnection. Referring to the figure below is clear understand how people see the element of smart city increase the quality of their lives

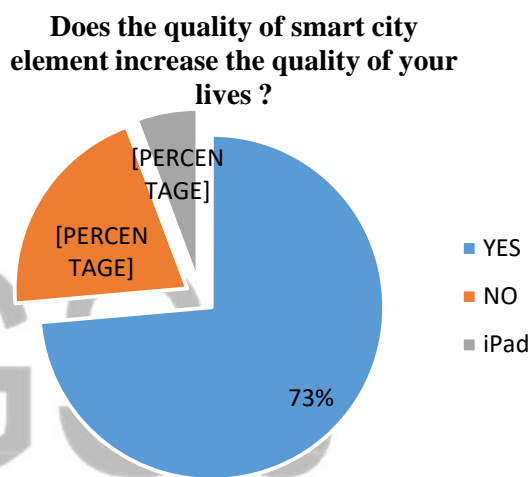


Figure 3: question number 8

Question number eight “Which of the following smart-city elements you think your city needs the most? “Represents the opinions of respondents on the smart-city elements needed in their city. The most respondents concluded they primarily need: smart education and Healthcare, better citizen-government interconnection, and quality of life improvement, roughly around 80%. The result suggests that the local self-governments need to educate citizens considerably on the topic because citizens are eager to learn new skills in the smart-city introduced to them.

Question tenth (10): “Are you familiar with any barriers to the initiatives your government

to facilitate smart-city elements?" is perhaps the most important question for our research. The answers indicate that only 29.3% of all the respondents actually knew that there is a barriers to Rwanda government to turn Kigali into smart-city implementation projects. Such a low percentage may indicate one or more of the following:

a) The lack of connectivity of different neighbourhoods, combined with the low density, limits possibilities of creating alternative means of transport, hampering the development of proper multimodal public transport networks where public transport can be combined with alternatives such as biking or walking. From the perspective of capacity development, many transport companies have limited skills in how to run a profitable business with proper bookkeeping and financial recording.

b) Climate change has reported as an increased frequency and intensity of extreme natural events, including floods and droughts. Rwanda needs to invest in adaptation and mitigation projects to address these issues. Urban growth and changing of urban patterns may expand these threats, calling for essential coordination and higher preparedness levels to prevent or manage emergency events such as floods and landslides.

c) Rwanda has solid infrastructure compared to countries on a similar stage of economic development, with a substantial government and donor investment. An estimated 7.6% of the infrastructure is developed with the support of international aids. Despite this, investment is required in primary infrastructure, mainly in energy and transport but also in water supply, sanitation and watershed management.

The (final) question: "Do you think the city you live in is "smart" and explain why? Was included as an open-ended question. Respondents could freely write and explain their answer. Out of the 582 participants, 245 answered that their city is not "smart" (negative); 220 answered that their city is

"smart" (positive); 82 respondents answered answers such as "partly, somewhat, better than the rest, it has potential" (categorized as partly yes); and 35 respondents did not provide any identifiable answer (Unidentified). The results indicate that 42.09% of the respondents' state that their city is not "smart" and needs

#### 4. CONCLUSION

The idea behind this paper was to explore the impact of ICT to smart cities from communities' daily activities mind-set from the Kigali community and use the results of this research questionnaire for the future researchers and also to technology suppliers to support smart city initiatives to their respectively cities.

All the questions (except Question 10) were posed as closed-ended. Close-ended questions require respondents to choose from a set of provided response options. There are also possibilities to use open-ended questions, which we did not use in this questionnaire, (except the last question), since the usage of mixed questions is not suitable for this kind of random sample. Furthermore, Oudejans and Christian (2010) found respondents more likely to respond to narrative open-ended questions when they were interested in the topic of the questionnaire. [11] Also, there are some positive aspects when using the closed-ended questions; answering closed-ended questions is easier as well. Respondents do not have to formulate an answer in their own words. Instead, they only have to check the response option that applies to their answer, making the answering process much easier and less demanding, resulting in better response rates to closed-ended questions [12].

Regarding to the answer given by the respondents, it can be concluded that the ICT is used (impacting) Kigali community at good average as most of the services they need are done through internet technology from e-services, e-market and other online services.

But there was a problem of technology awareness where some of the citizen are not aware of technology due to the rapid wave of technology in the entire country, we highly recommend adoption of national-level strategy for better citizen inclusion in training more people as much as possible about ICT technology.

There are, however, a few examples of smart-city technologies elements. For examples, Kigali city has implemented free broadband Wi-Fi internet access in public places that include commercial buildings, bus stations, airport, public transport and cab, E-governance system, and some other small projects towards becoming a smart-city [13]. In Kigali city, cars that uses electric energy has been introduced, this will keep Kigali city smart and green [14].

The significance of this research is to demonstrate the impact of ICT to Kigali smart city in the community mind set to words their daily activity.

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