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Sustainable Smart City and its Promising Urban Value: An Overview

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Abstract. Development from conventional urban city to the smart city requires a level of sustainable development. Smart city involves multiple fields of human capacity in knowledge of artificial intelligence, information and communication technology and management in form of environment sensing, innovation, education, culture, deep and machine learning, networking, information processing and digital technology, and city governance in order to enhance performance in resource management, improve well-being and economic development in the aspect of individuals standard of living which impacts on transportation, water supply, waste disposal, healthcare, etc. This paper highlights actions that can combine sustainability and innovation to result to a sustainable smart city and measures put into play in order to achieve a smart city which claims to be sustainable.

Keywords: Urban, City, Wastes, Technology, Sustainable

1. Introduction

In search of a better standard of living, rural to urban migration has increase in the years passed and will keep increasing. This has a great impact on pollution, energy demand, employment, etc. The increasing rate of urbanization from a global aspect sets up new challenges for the urban planners and policy makers [1]. Studies by [2] highlighted that climate change, ecosystem destruction, increased rate of natural disasters and many more are environmental and socioeconomic crises faced by most part of the world due to increased urbanization. This brings into play more methods to combat the negative effects of increased urbanization. Development from conventional urban city to the smart city to address the negative impact of urbanization requires a level of technological development and innovation which involves ICT, this provides new ways to solve urban problems [3]. Studies by [4] reveals that the quality of living among members of a city, economy, easy to access a means to transport individual and commodity, traffic management, the environmental state, and interaction with government, can be step up as information and communication technology plays a vital role in achieving that. Understanding what smart cities are were derived from [5] as a result of multi-dimensional approach of human capacity in knowledge of artificial intelligence, information and communication technology and management in form of environment sensing, innovation, education, culture, deep and machine learning, networking, information processing and digital technology, and city governance in other to enhance

performance in resource management, improve well-being and economic development in the aspect of individuals standard of living which impacts on transportation, water supply, waste disposal, healthcare, etc. In the study of smart cities and its makeup, [6] highlighted that smart cities integrates Internet of Things which includes sensors as one of the means to generate big data where the big data are analysed through artificial intelligence. These functions work together and are linked to each other as shown in the figure1. This sensor is used to collect data. Data from numerous neighbourhoods can now be obtained in order to better understand the urban fabric, this digital concept which are linked to artificial intelligence (AI) and machine learning which is an element of AI, making collection of near real-time data possible. This allows planners in the urban region and policy makers also, to make better decisions as the digital concept gives a deeper understanding of the city's evolution, adaptation and response to various conditions.

Research on sustainability has taken turns in providing different understanding on what sustainability is and that it means for a city to be referred to as a sustainable city. This study acknowledges the understanding of sustainable cities by [7] , these are cities characterized by its conformance in accomplishing UN's 11th sustainability development goal (sustainable cities and community) which envelops some other sustainability development goals on reduction of poverty and hunger, improved health and well-being, provision quality education which is inclusive, solving issues of gender inequality, provision of clean water and environment, provision of energy which is affordable and clean, increased production with respect to consumption, reduction of action that affect the climate condition negatively, provision of peace and justice, and partnership for the goals. Possibility to develop a smart city that doesn't having the functions of sustainability is certain. Sustainable smart city is the application of technology to a sustainable city as explained by [8] although outlined that smart city is a factor of transition from sustainable city. This paper outlines that a sustainable smart city can be due to management and innovation to sustain sustainability in a smart city. This leads to the creation of a sustainable smart city. This paper looks forward to studies the makeup of a smart city which consist of the concept and features in a city to achieve smartness, and the measures put into play in order to ensure sustainability of a smart city, although [9] portrayed points to show the difference between sustainable cities and smart cities. This paper highlights actions that can combine sustainability and smartness to result to a sustainable smart city building on the discoursed theory and concept of various authors.

2. Concept of a Smart City and Enabler
The smart city also referred to as a digital city: [9]. It is a city with increased application of digital technology in addressing human needs and economic growth, information city:[10] clams that information and communication technology(ICT) is the bases of a smart city and affect the other sectors of urban development to smart city, intelligent city: [11] believes smart city is a function of intelligence involving artificial intelligence and sensors, etc., innovative city, knowledge-based city:[3] sees human capacity development as the basic function for smart city development and sustenance referring a smart city as a knowledge-based ecosystem, ubiquitous city: [1] says smart city as a global phenomenon, or wired city involves multiple fields according to [8].

From the brake down of authors point of view of what a smart city is, better understanding of a smart city has been derived. Over the years' researchers have worked on different sectors of a smart city. [5] enumerated how universities manages the knowledge management governance issues in 20 smart city projects to conclude that university is responsible for knowledge based ecosystems such as the smart city project. Smart city technology as outlined

by [20] consists of internet of things, sensors in city infrastructures, building and other service units such as the metro bus stop, etc., resource management technologies such as renewable energy devices etc., means to store big data received from the environment means provided by internet of things (IOT), visualization technology for individuals, etc. These technologies are put into consideration while planning a smart city.
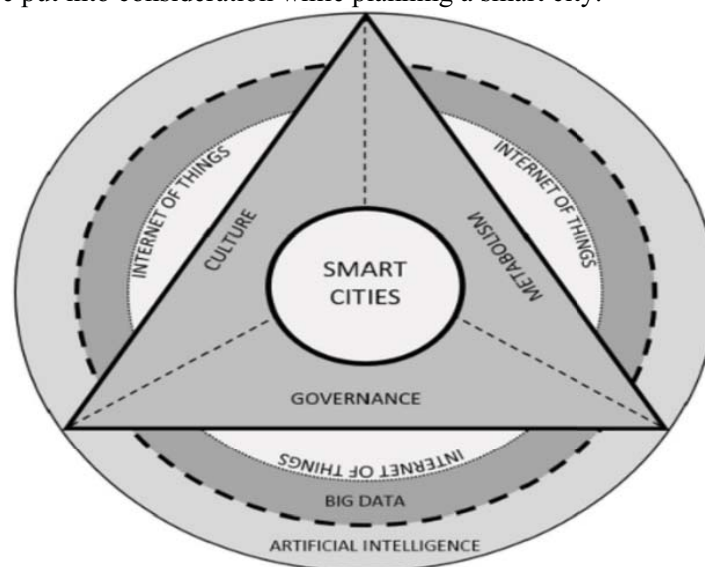

Figure 1: AI and Big data integration in smart cities to ensure liveability [6]

City planning is experiencing major changes now when new expectation and demand are made on sustainability in cities and resource efficiency. City planning therefore no longer only involves designing areas, building buildings, infrastructure and services, but also takes into consideration new perspectives, such as digitalisation, integration, quality of life, needs of citizens, new technologies, and equality. New ways for city planning are needed to plan and build a smart city district that integrates ICT in infrastructures and utilizes it in novel ways to control and manage the smart city functions [12].[3] highlighted six smart city development enablers which includes

- Smart city governance.
- Urban pro-activeness.
- Service innovation.
- Urban openness.
- Partnership development.
- Integration of infrastructure.

Studies by [8] explains that a city can be sustainable if the conditions of productivity does not deteriorate over time hence striking a balance between environmental protection and development of urban area with the mind set of equality in income, employment, shelter, basic service, social infrastructure and transportation in the urban area. [8] in figure 2 outlined the difference between sustainable framework and smart city framework illustrated in the graph below.
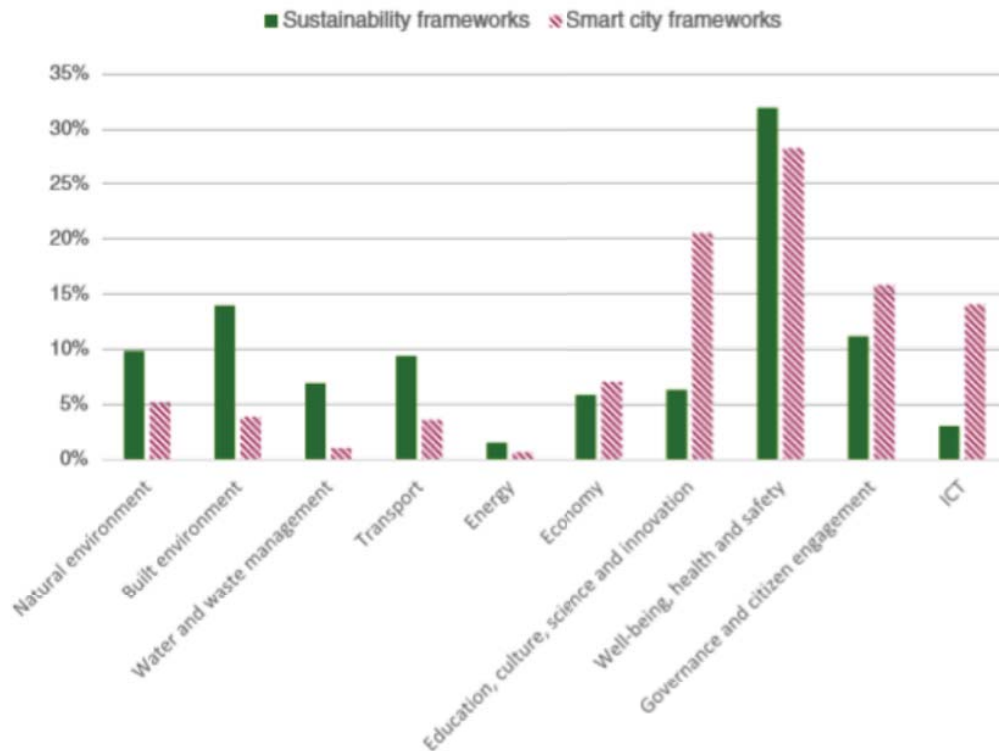
Figure 2: Difference between sustainable cites and smart cities under different sectors [8]

This study by [8] shows the difference between sustainable cites and smart cities, moreover the sustainable smart city brings together the attributes of both the smart and the sustainable city i.e., having sustainable development with the help of technology. It was also attested that sustainable development occurs when the cities production conditions are properly maintained with good standing and growth. This development comes with the protection of the environment, improves equality, and creates employment, provision of social infrastructure and basic services. It is of great importance according to [4] for a smart city to be able to sustain the above implication of development as discussed by [8] with the help of technology. [3] studied that the physical infrastructure, innovation ecosystem and quality of life of a smart city are determined six factors, also affirmed by [1] as Giffinger's six implementation domain as illustrated in figure 3 for a sustainable smart city which includes: smart environment, smart mobility, smart people, smart economy, smart governance, and smart living .
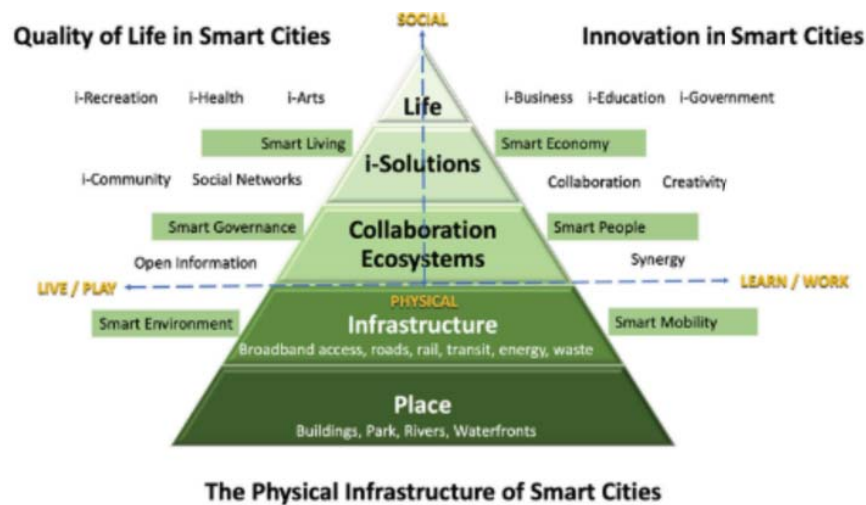
Figure 3: Giffinger's smart city [3]

3. Smart keys and progression

3.1. Smart environment

This involves the use of technology to impact positively on waste disposal [13], food growth (i.e. in terms of plant growth monitoring, pest control and soil condition, bio-science and microbiology practitioners can also develop special treatment for reduction of the use of toxic substance such as toxic pesticides and toxic fertilizers.), pollution control (this involves the use of sensors to detect and prevent wildfires, improve prediction, and simulation of pollution in the city). To measure the coherence of the zero carbon objectives projected for 2050, [14] proposed a zero means of reversing model greenhouse gas emissions, housing quality (Increased security via connected cameras and smart refrigerators can learn how home dwellers behaved and increased comfort at home to reduce food waste). Facility management and smart electricity grid (This includes intelligent energy supply in which the architecture enables the deployment of renewable energy efficiency system).

3.2. Smart mobility

This was made to make mobility more favourable therefore managing traffic, tracking vehicle, smart metros etc. It involves the deploying sensors in specific infrastructures such as roads, rail, airports, seaports, bridges and subways, etc. These sensors offer valuable information on fluidity, reducing accidents, improving public transportation and facilitating parking [3].

3.3. Smart people

The skills and competences of the individual or group can be defined as human capital. Universities and other higher education present in a smart city develops human capacity, this leads to citizens adaptation of technology and security [15].

3.4. Smart economy

Innovative business for the smart city based on smart environment, mobility and people. Investigations on how metropolitan cities set up patterns of its business model to become a smart city [16].

3.5. Smart Governance

Smart governance requires innovative ICT infrastructure, planning process, sustainable governance, and collaboration utilization to achieve these goals [17]. Investigations was carried out carried out

3.6. Smart living

In a smart city the smart living is a makeup of Smart Environment, smart mobility, smart people, smart economy, and smart governance. Smart living must include improved education, health, security, empower citizen participation and social services. Smart structures, water management, mobility, security and energy grid are also physical makeup of smart living [18, 21]. The aspect of health is one of the basic necessity in a smart city due to this, medical practitioners, health researchers has come in collaboration with urban city planners and urban city policy makers, with the objective to identify and decode parameters which has impact in public health and urban liveability [19]. At the point when a city can be called smart, it must have fulfilled certain criteria and attained a point of technical development. The quest for sustainable smart city is a reality by combing the futures of a sustainable city with that of a smart city. This involves the use of modern technology and ICT to sustain equity between environmental protection and productivity. The studies from literature presented by [1] draw this paper to a conclusion that sustainable smart cities are attainable and must not be separated. The table below highlights the area of sustainability as set up by UN which is handed by the uses of technology put in to use in a city.

Table1: Giffinger's implementation domain and the SDGs covered

Giffinger's six implementation domain studies by [1]	Addressed sustainable development goals set up by UN [16]
Smart environment	Provision of clean water and environment (SDG6, 14, and 15), provision of energy which is affordable and clean(SDG7), sustainable cities and communities(SDG11).
Smart mobility	Industry, innovation and infrastructure(SDG9)
Smart people	Provision quality education which is inclusive (SDG4), solving issues of gender inequality (SDG5)
Smart economy	reduction of poverty and hunger (SDG1&2), decent work and economic growth(SDG8)
Smart government	Increased production with respect to consumption (SDG12), reduction of action that affect the climate condition negatively (SDG13), peace, justice and strong institutions (SDG16), partnerships for the goals (SDG17).
Smart living	Provision for good health standing and which includes well-being of citizens(SDG3),

The six implementation domain by Giffinger can bridge the caps between sustainable and smart cities to address UN's sustainable goals as high by [20].

Conclusion

This paper have identifies actions that combine sustainability and innovation on sustainable smart city and measures to achieve a smart city which claims to be sustainable. Concept factor to foster sustenance of smart city from management and innovation was clearly identified. This falls in the hands of knowledge through human capacity development to improve the body for smart city governance. Innovation begins from improved productivity, maintenance of the smart city to its driven mechanism.

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