AFRICA WITHIN GLOBAL SMART CITIES: What do we know and how to proceed?

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Abstract:

Increasing globalization, unprecedented urbanisation, environmental consciousness and technology development has redirected global cities' focus towards strategic and smart solutions to solve issues changing city dynamics through a smart city agenda, African cities included. The smart city agenda has been globally debated via varying perspectives but most of the concept's ideology has been limited to the diffusion of technology; excluding social, human, economic, environmental capital and city networks that determine city progress and smartness. Also, despite Africa's incessant dysfunctional land and housing systems, inadequate basic services and infrastructure and poor environmental performances; less research exist in the continent to understand this concept, its application and the continent's position amongst world smart cities. This paper investigates the concept of smart cities within the spectrum of these identified gaps. The research begins by providing an array of relevant literature on smart city. It then assesses global smart cities with specific attention on the position of African cities amongst these cities. The research methodology included a quantitative data analysis based on an ordered probit regression model to examine the relationship between a city's characteristics and its smartness. The study revealed that for a city, especially African cities to achieve a high level of smartness and prosperity, the city needs to have a long term and global vision beyond the domain of ICT. The study concludes by critically re-examining development policy agendas and integrating elements of a smart city into a particular city's vision, policy makers in Africa will discover requisite information on attaining smart, sustainable and integrated development in their cities.

Keywords: smart cities; sustainable development; Africa; network centrality; world city network

Introduction

In recent decades, the smart city concept has become more popular in major scientific journals, local and international policies. However, understanding the concept requires recognition of current city dynamics, major developments that form the basis for the concept and the prime roles cities play in present and future developments. To begin with, global urban population has surpassed practically all other demographic indicators, especially in the late 20th century with a statistic of 29 percent of world's population in 1950 and 55 percent in 2018 (World Bank, 2018). This proportion is expected to increase to 68 percent owing to a report by the United Nations Department of Economic and Social Affair (2018) that by 2050, global urban population and built up area will experience exponential growth with emphasis laid on cities in developing economies like India, China and Nigeria. Currently in Europe, urban growth is as high as 75 percent, a figure expected to rise to 80 percent by 2020. Regions like Asia, Latin America and Africa have equally been experiencing a high level of urbanization due to growth of megacities (over 20 million people in each region) (United Nations, 2008; United Nations Department of Economic and Social Affairs (UN DESA), 2011, 2018). This city population growth has reflected in the quantity of world resources e.g. land, water, energy etc. consumed by urban residents. Report by Kennedy et al. (2011) reveals that global urban population consume about 75 percent of earth's resources and with the rate of growth in these cities, the resource consumption rate might be further strained. While resource consumption in cities contributes to cities' economic performance and relevance, their social and environmental performances have been poor (70 percent of carbon emissions coming majorly from energy consumption in buildings and transportation) due to increasing global problems that have been created locally within these cities but has no local effects (Perlman and Sheehan, 2007; Intergovernmental Panel on Climate Change, 2013). Pressure on available infrastructure for sustainable service delivery has equally increased in the past decades with rising urban inequality within and across global cities.

Speaking of resource consumption, Congress for the New Urbanism (2001) and Bettencourt et al. (2007) opines from the perspective of urban metabolism that cities are complex living organisms that regularly consume materials, water and energy and eject wastes in and out of the city. Increase in the development of Information Communication Technology (ICT) has likewise influenced lifestyles within and across cities, particularly in areas of recreation, accommodation, work, societal interconnectivity and arrangement (UN DESA, 2011). To this end, services have become more accessible with recent development in

ICT. Companies have been able to augment their product deliverables and business models with the new tool. However, from an environmental perspective, this development has been double-edged. On one hand is the increase in communication and decline in the number of entertainment materials and books disseminated. On the flip side of the coin, societal consumption has increased due to increased level of productivity, causing more inexpensive products to be manufactured (as is the case in many Asian countries). Similarly, IATA (2014) cited that worldwide travel has increased as a result of technological development.

Responses to these city challenges that have been birth by the recent developments have been met with approaches geared towards anthropocentricity for good city management. Such approaches recognize that people within cities are the most significant entity, and thus their needs should be responded to through solutions that are sustainable (Turcu, 2013; Berardi, 2013a; 2013b). These approaches have been implemented to certain extent across cities but with lapses. More recently, cities globally have begun delving into more efficient approaches that interconnect social capital, human capital and infrastructure to address public issues. These approaches are referred to as "smart city models", and they are expected to have long-term positive impacts on the global economy while creating smart growth within cities. While several cities have embraced this new approach for city progress through their strategic policies, African cities included, scholarly investigations reveal that these approaches of creating smarter, prosperous and sustainable cities have majorly been streamlined to the diffusion of technologies (for instance, e-municipality, e-commerce, public transportation app, intelligent bus stops, etc.) - raising concerns from scholars on what it takes to achieve a smart city (Coe, Paquet, and Roy, 2000; Chen, 2010; Bakıcı et al., 2012; Barrionuevo et al., 2012; Belissent and Giron 2013; Nam and Pardo 2011). Also, a substantial amount of existing literature around the concept of smart city is limited to terminologies like 'digital city', 'intelligent city', 'hybrid city' etc. to indicate the smartness of a city, but it is vital to understand that city smartness is beyond technology application. The use of the term has equally proliferated in different sectors with no exclusive definition acknowledged universally (Hemment and Townsend 2013). This has triggered huge problem and confusion in urban policy regarding the specific policies to establish that will make cities smart.

The idea is gaining traction in Africa, the least urbanized region (43 percent urban population in 2015) although now the second-fastest urbanizing region in the world (behind Asia and projected by population experts to be on top by 2020. African cities have begun implementing the smart city initiative with projects like Eko Atlantic Lagos, Hope City Ghana, Vision City, Rwanda etc. but while major African cities have embraced the concept

and have begun strategizing for smart growth through their policies and developmental projects for better city management, not much has been researched in the continent on this. In fact, only two percent reviewed smart city papers exist in Africa (Cocchia, 2014). Also, with the current level of development in Africa, there is still a gap in knowledge to be filled to understand the changing position of African cities with respect to smartness globally since a substantial number of African policy makers have begun incorporating smart cities into their urbanization strategies.

Thus, this paper seeks to explicate what a smart city is and its key dimensions, the position of African cities amongst global smart cities and the prime factors for attaining smartness in the continent. The structure of the paper is as follows: first, an array of relevant literature on smart city is provided, specifically highlighting the different definitions, dimensions and perspectives from different authors; next, it uses a quantitative data analysis based on an ordered probit regression model to examine the relationship between a city's social and economic capital, city networks, environmental and infrastructural based services and its smartness. Then, it assesses in detail global smart cities vis-à-vis the location of the smartest cities, their characteristics and best practices. Later, the position of African cities amongst these global smart cities and the factors important for attaining smartness in the region are also assessed. Finally, it closes with discussion of major findings of the study.

Literature Review

A substantial number of smart city literature exist but none of them has given an exclusive meaning of what a smart city is (O'Grady and O'Hare, 2012; Cocchia 2014). In the past, the concept has been substituted with several analogies: digital city, intelligent city, knowledge city, sustainable city, ubiquitous city, virtual city, eco-city, resilient city, humane city, learning city, hybrid city and information city (Torregrosa and Martín, 2017). The concept was initially coined in the nineties and the focus was on the role ICT can play in modern infrastructure within cities. At early stage of birthing the concept, the California Institute for Smart Communities was one of the institutional bodies to direct attention to the application of ICT to achieve smartness in cities (Alawadhi et al., 2012). However, the implementation of ICT in this regard was criticised by the Centre of Governance at the University of Ottawa; being that the smart city idea was too technical in its orientation. Arguments in literature reveal that the concept should follow an institutional approach that

emphasises the role of urban development and social capital. Overtime, the smart city concept has been viewed from several contexts.

Nam and Pardo (2011), Washburn et al. (2010), Klein and Kaefer (2008), Ghaffarian Hoseini et al. (2013), Hancke et al. (2013) and Liu and Peng (2013) all attempted to dissect and investigate the concept along three categories: technology, people and community. According to their various studies, from the angle of technology, a smart city is a city with an excessive amount of ICT applied to its various service and infrastructural components. Studies (Ghaffarian Hoseini et al., 2013 and Hancke et al., 2013) cite examples of smart cities to include smart homes and smart buildings that are embedded and furnished with mobile terminals, connected sensors, actuators and devices. The study by Liu and Peng (2013) explored system miniaturization, intelligent wireless technology, comprehensive perception and information processing, code resolution services, information distribution, network planning and development and wireless sensor network node technology that create an extension of a smart city on a city scale. Harrison et al. (2010) defined the smart city as an intelligent and interconnected city which has the competence to collect and link real life data through the use of meters, personal devices, sensors and appliances. Based on this study, the smart city has the capacity to integrate data into computing platforms that permits the transmission and communication of such data to different urban services; and include multifaceted analytics, optimization, modelling and visualization services that helps in making functional decisions. Multinational corporations including IBM, Siemens AG and Cisco Systems and scholars like Cugurullo (2013), Kitchin (2014) and Vanolo (2014) view technology as the key component that defines smart cities. However, Adam Greenfield (2013) in his research titled *'Against the Smart City'* criticises this view. Greenfield citing cities like Masdar City, UAE, Songdo, Korea and PlanIT Valley, Portugal, argued that solely viewing and designing smart cities from technological ideology shuns the real knowledge on how cities function and creates empty spaces that neglects the value of complexity, unforeseen circumstances, and the mix uses of city spaces. Greenfield's research laid emphasis that viewing smart cities from the perspective of technology alone excludes the 'people' factor in a city in its entirety.

Based on the fact that earlier smart city ideas excluded 'people as an important driver of smart cities, recent analogies like 'creative city' emerges. The creative city recognizes that for a city to be smart, education, knowledge and learning all have central roles to play (Thuzar, 2011). Florida (2002, 2005) writes that a smart city encourages an atmosphere

appropriate for developing creativity. Alawadhi et al. (2012) opine that smart cities should have both intellectual and social capital as that encourages connection with people and relationship formation. Winters (2011) supports this notion of smart cities by submitting that when a city is endowed with social capital, smartness increases because people are given the opportunity to benefit from such available resources. As such, the availability of economic, education, culture, arts, social, business and commercial enterprises are paramount for attaining smartness in a city. Winters (2011) further explicates that a smart city is a city with advanced education, better educated people, skilled and trained labour force. With this definition, the more educated and skilled people are in a city, the smarter the citizens and the city itself. This can be related to a similar analogy of smart city: 'knowledge city'. With available social and human capital, people are exposed to several opportunities to exploit their potentials and creativity (Partridge, 2004). As a confirmation, Glaeser and Berry (2006) in their study revealed that most rapid growth in cities occur in urban areas with a high percentage of educated and skilled workforce. Consequently, being smart or having a high level of urban development is strongly dependent on the level of skill, creativity, network, connection and competitiveness of a city (Dirks et al., 2010).

Amongst the three categories of smart city explained by Nam and Pardo (2011) is the community perspective. This angle of smart cities is of the ideology that citizens and institutions should work in corporation with one another; government should create and induce citizen engagement within cities to reduce traffic congestion, reduce school overcrowding, improve the open spaces, reduce cost of public facility, conserve historical places and reduce air pollution. Thus, promoting and participating in smart growth (Eger, 2009; Berardi, 2013a, 2013b).

The smart city concept has equally been viewed in the urban planning field. From this perspective, the concept is used to denote strategic programs, solutions and policies established at all levels of government and public institutions targeted at achieving sustainable development, increased well-being as well as improved quality of life for citizens and economic growth (Ballas, 2013; Centre for Globalization and Strategy, 2014,2015,2016).

Currently in Africa, only 2 percent of smart city reviewed papers exist as previously mentioned (Cocchia, 2014). Amongst this 2%, Soyinka et al. (2016) using a mixed method of data collection and analysis with multi-stage sampling techniques of 460 households in six communities of Eti-Osa and Ikeja local government areas of Lagos metropolis found that sustainable development can only be achieved in the city via smart infrastructure approaches. The authors submit that the smart infrastructure approaches need to be applied such that

strategic interventions are made in the environment, residents' wellbeing, use of buildings, facilities and services in Lagos metropolis. In South Africa, Du Plessis and Marnewick (2017) investigated small business challenges (*lack of government support, corruption, Workforce issues, lack of entrepreneurial support, regulatory compliance and infrastructural issues*) and linked smart city services (*Educational tools and training material, Small-business support portal, eGovernment and open data policies, City-wide Wi-Fi, Smart meters, grid and lighting, Smart security, transport and traffic management*) that could help ameliorate these challenges experienced by small business owners. The research finds that educational tools and training materials are the most valued smart city services that could help address challenges small business entrepreneurs encounter. The research concludes that smart solutions and systems need to be developed to decrease the effects of those challenges. By so doing, cities will be equipped to provide unswerving value to businesses, help the entrepreneurs save time and cost, thus increasing wealth and success in the city.

Recently, a school of thought in world city literature deviated from the conventional style of addressing smart cities. This school of thought is referred to as the network theory. The network theory views smart cities as multi-dimensional territorial systems to exploit problem solving capacities (Komninos, 2002, 2006). Existing literature in this school of thought emphasises that the success and prosperity of a city is highly dependent on its virtual position within global networks, in which urban areas are linked via several globalized flows. These flows include inter-city capital movements, information, knowledge, ideas and people (Sassen 1991; Knox and Taylor 1995; Alderson and Beckfield 2004; Coe et al. 2004; Derudder et al. 2010; Wall and van der Knaap 2011). These flows also indicate the level of a city's international outreach (Centre for Globalization and Strategy, 2014, 2015, 2016). Wall and Stravropoulos (2016) and a host of other economic geographers along this thought have found that components (measures) of a network (indegree and inward distance emanating from foreign direct investment (FDI) of cities have significant influence on cities' prosperity and smartness. FDI serves as prime international network within which urban areas can progress competitively.

In conclusion of the literature review, the smart city concept is viewed from different dimensions not restricted to the application of technologies. This is probably why a universal meaning of the concept has not emerged. Also, the term has often times been used in different context in which ICT play critical and different roles such as in energy grids, buildings, waste management, water management, logistics, transportation and mobility etc. and in other

context where ICT is not very critical: culture, education, social inclusion, policy innovations and government (Neirotti et al, 2014).

Research Methodology

Data for the research is based on key smart city dimensions: Technology, environment, mobility, government, economy, people and living. Indicators representing each of these dimensions were sourced from Euromonitor Passport, World bank and Financial Times Market Data according to annual data reports in these databases. Data from the Financial Times database is on greenfield Foreign Direct Investment (FDI) (*investments that involve new projects and induce employment generation and have tremendous impact on city development)* (Grimwade, 2000). This FDI represents the level of international outreach of a city and its network connections (Centre for Globalization and Strategy (2014, 2015, 2016). The samples feature 126 global cities from a time period of 2005 to 2013. The cities were selected based on their population size, economic, cultural and political importance to the country to which they belong. These cities were grouped into four classes: less smart, moderately smart, smart and very smart. The city smartness is ranked from low (1) to high (4), based on a ranking technique: Pena's Distance technique (DP2), adopted by Centre for Globalization and Strategy (2014, 2015, 2016). This ranking methodology uses a function of distances. Adopting this technique helps correct any problem of heterogeneity that might occur in measurement units (Perez-Luque et al., 2015). Indicators representing the key smart city dimensions included in the analysis include: number of broadband Internet subscribers per 100 inhabitants (FIS) (*government and technology*); CO2 emissions (*Environment & Urban Planning*); means of transportation (*transportation and mobility*); total GDP and unemployment rate (*economic*); proportion of population with higher educational attainment (HEP) (*people*) and Gini coefficient (GIN) (*living*).

Based on arguments in the network theory literature in previous section, network measures (indegree, outdegree, inward distance and betweenness) which are indication of a city's level of international outreach and connectivity were included in the analysis. These measures were derived from the greenfield foreign direct investment to and fro each of the 126 cities featured in the analysis. *Indegree* represents the relative number of inward investments received by each of the 126 cities, denoting the 'prestige' of a city; *outdegree* indicates the relative number of outward investments originating from the 126 cities to other cities. This shows the 'power' a city has over others. Inward distance denotes the

international scope of a city. It basically measures the overall geographic distance of all the FDI between the 126 featured cities. *Betweenness* indicates the strategic position a city occupies or the 'brokerage' it has within a network of the 126 smart cities. Openness is also included in the analysis as an indicator of the degree of openness of a city to other cities that aids engagement between cities. In order to examine the indicators that affect the smartness of a city, an ordered probit regression model is employed. This model is adopted based on the categorical nature of the dependent variable.

$$\text{Smartness} = \text{technology}_{it} + \text{mobility}_{it} + \text{government}_{it} + \text{economic}_{it} + \text{environment}_{it} + \text{people}_{it} + \text{living}_{it} + \text{network}_{it} + \varepsilon_{it}$$

Where:

Smartness_{it} = ranking of smartness for city i in year t,

Technology_{it} = vector of the technology characteristics

Mobility_{it} = vector of the mobility and transportation characteristics

Government_{it} = vector of the governmental characteristics

Economic_{it} = vector of the economic characteristics

Environment_{it} = vector of the environmental characteristics

People_{it} = vector of the people characteristics

Living_{it} = vector of the living characteristics

Network_{it} = vector of the network measures or characteristics, and

ε_{it} = the residual error.

Findings and Discussion

Table1. City smartness, smart city characteristics, ordered probit regression and marginal effects

	Overall	Less Smart	Moderately smart	Smart	Very Smart
Outdegree	0.00203**	-0.000489**	-0.000176*	0.000434*	0.000230**
	(0.00103)	(0.000248)	(9.24e-05)	(0.000222)	(0.000117)
Indegree	-0.00453***	0.00109***	0.000393***	-0.000972***	-0.000515***
	(0.00116)	(0.000276)	(0.000118)	(0.000251)	(0.000139)
	2.90e-05	-7.02e-06	-2.52e-06	6.23e-06	3.30e-06

Betweenness					
	(3.47e-05)	(8.39e-06)	(3.02e-06)	(7.44e-06)	(3.96e-06)
Inward Distance	3.04e-05*	-7.35e-06*	-2.64e-06*	6.52e-06*	3.46e-06*
	(1.71e-05)	(4.13e-06)	(1.50e-06)	(3.66e-06)	(1.96e-06)
GDP	4.47e-06***	-1.08e-06***	-3.87e-07***	9.59e-07***	5.08e-07***
	(7.25e-07)	(1.76e-07)	(7.83e-08)	(1.58e-07)	(8.97e-08)
Unemployment Rate	-0.0175**	0.00423**	0.00152**	-0.00376**	-0.00199**
	(0.00708)	(0.00171)	(0.000633)	(0.00150)	(0.000830)
Population by Educational Attainment	0.000229***	-5.52e-05***	-1.98e-05***	4.90e-05***	2.60e-05***
	(5.59e-05)	(1.37e-05)	(5.24e-06)	(1.22e-05)	(6.43e-06)
Gini Index	-0.0352***	0.00851***	0.00305***	-0.00755***	-0.00400***
	(0.00548)	(0.00135)	(0.000555)	(0.00116)	(0.000693)
CO2 emissions	-2.03e-07***	4.95e-08***	1.76e-08***	-4.39e-08***	-2.33e-08***
	(7.26e-08)	(1.78e-08)	(6.83e-09)	(1.59e-08)	(8.49e-09)
means of transportation	0.0864	-0.0209	-0.00748	0.0185	0.00982
	(0.0915)	(0.0221)	(0.00791)	(0.0195)	(0.0105)
Openness	-1.19e-05	2.87e-06	1.03e-06	-2.55e-06	-1.35e-06
	(8.87e-06)	(2.15e-06)	(7.70e-07)	(1.90e-06)	(1.01e-06)
number of broadband internet subscribers	2.54e-09*	-6.15e-10*	-2.21e-10*	5.46e-10*	2.89e-10*
	(1.38e-09)	(3.35e-10)	(1.22e-10)	(2.97e-10)	(1.58e-10)
Observations	933	933	933	933	933
Pseudo R-squared	0.1229				
Year Dummies	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author, 2018. Data Source: Euromonitor Passport, World bank and Financial Times Market.

The table 1 above presents the result from the ordered probit regression with marginal effects of each of the variables for the four categories of smartness. To begin with, the model analysed from a wholistic perspective as discussed in previous sections: indicators representing each dimension of a smart city were analysed. The result suggests that the ability of a city to have higher outward foreign direct investment (outdegree) has a positive relationship and significant influence on higher levels of smartness. Likewise, cities with wider international scope (inward distance) tend to become smarter. Surprisingly, the ability

of a city to attract foreign direct investment (indegree) and the strategic position a city occupies in its network do not a make a city attain higher levels of smartness. This might likely be a result of errors in data computation from data source or bias in the categorization of the cities.

Moving away from the city network, the result also presents that a city's economic strength or power and its inhabitants' income(GDP), proportion of population with secondary and higher education attainment and number of broadband internet subscribers all have positive relationship and significant influence on a city's higher levels of smartness. As expected, number of unemployed people (unemployment rate) reduces the chances of a city becoming smarter. Similarly, the higher the social inequality in a city (Gini index), the lower its level of smartness, irrespective of its performance in other areas of development. Also, the result reveals that a city with weak sustainable urban planning policies which is expected to checkmate human activities especially air pollution (CO2 emissions) in the environment cannot attain higher level of smartness. Unexpectedly, the degree of openness of a city to other cities as an indicator of level of openness for economic engagement including other forms of interconnectivity and public transportation options for smart cities do not make a city smarter. This might also be a result of bias in the smartness categorization.

From the findings presented in table 1, it can be inferred from the result that the signs of coefficients of the variables in the two higher categories of smartness appear quite similar but very different from those of the two lesser groups. It is also worth noting that the variables all have different magnitude of effects, particularly the network measures which appear very different from the city specific variables.

Location of global smart cities (2005 – 2013)

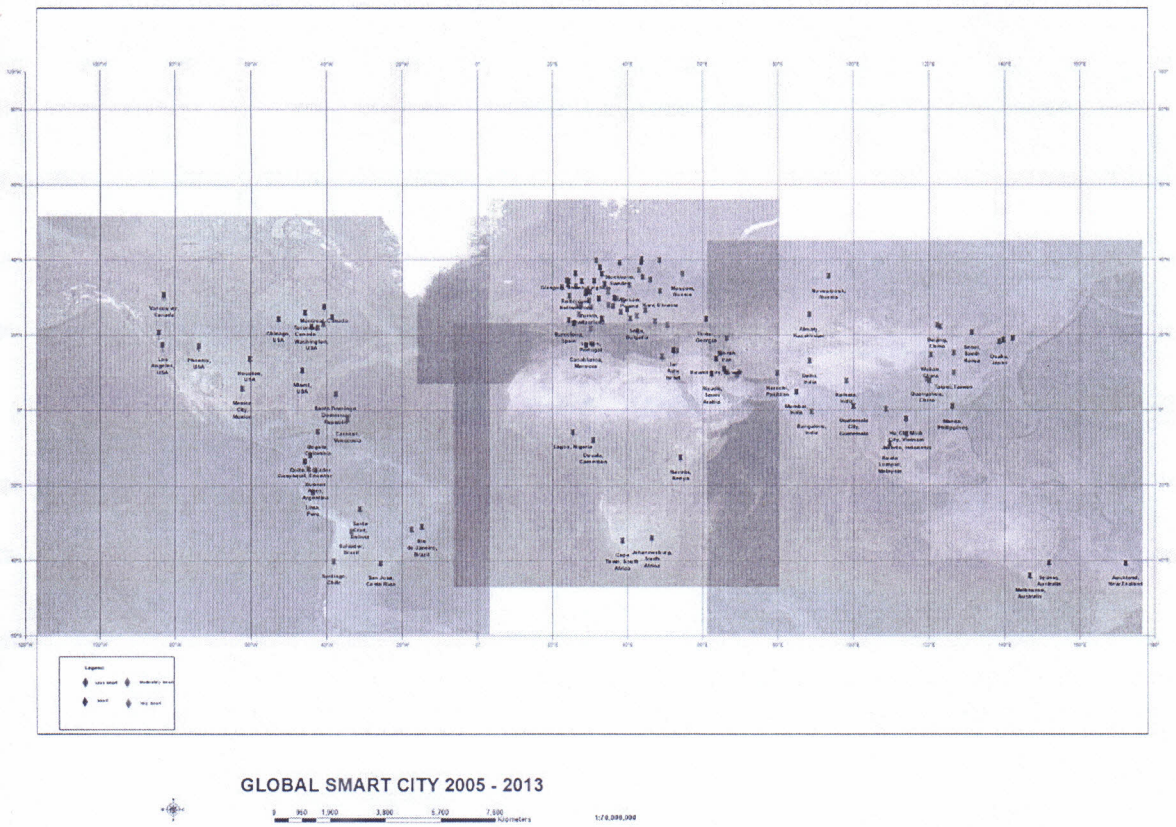

Figure 1. Geographic location of global smart cities (2005 – 2013)
Created using the ArcGIS software. Data source: Centre for Globalization and Strategy
Source: Author, 2018

The global smart cities analysed were limited between the years 2005 and 2013 mainly due to data availability. As previously mentioned, the cities are categorized into four smartness groups: less smart, moderately smart, smart and very smart. Examining the two extreme cases: less smart cities and very smart cities critically: many of the less smart cities are spread across 5 continents, with 16 of them in Europe, 8 in Asia, 4 in Africa, 4 in North America and 2 in South America. The cities within the 'very smart' group are spread across 4 continents: 3 in Africa, 4 in South America, 4 in Asia and 1 in Europe. Connecting these two categories to the empirical result above, the data available for each variable in the 'very smart' group shows that cities in these groups attained this smartness level because of their ability for outward foreign direct investment and connection with other global cities. These cities also have wider international scope compared with their counterparts. Each of these cities in this category has a very strong economic power over other cities. Their level of smartness also reflects in the proportion of population with higher education and number of broadband subscriptions in the cities. On the other hand, the less smart cities have had lower performance in the level of social inequality, unemployment rate and CO2 emissions. Even

with the diffusion of technology to enhance city management, when cities constantly import without increasing their protectionism policy or ensuring goods imported are eco-friendly, their smartness index is usually affected. Cities suffering from inequality tend to have issues with coexistence amongst the groups residing in it due to differences in their income, culture, age and profession. African cities being the main focus of this research, the position of the cities amongst the global cities is explained in next section.

Position of African Cities within Global Smart Cities

Figure 2 below reveals that in the featured time period (2005 – 2013), African cities (Doula, Cameroon and Nairobi, Kenya) occupied sub-top position amongst the 'less smart' cities, except Lagos, Nigeria and Tunis, Tunisia which occupy lower positions. Considering the 'very smart' cities (figure 3 below), only three African cities fall within this category (Cairo, Egypt, Cape Town and Johannesburg, South Africa). The position of these three cities are 6^{th}, 9^{th} and 10^{th} amongst the 13 'very smart' cities within the period analysed. The figures 2 and 3 below show analysis for the 'less and very smart' cities because the data set did not feature any African city in the 'moderately' and 'smart' groups, except Casablanca, Morocco which falls in the moderately smart group in the analysis period. Also, a specific interest is on the two extreme cases of smartness groups, simply to understand why a particular city falls within a particular smartness group and to compare the two groups for policy purposes.

Generally, many of the African cities featured have had poor performance in the smart city indicators analysed except Cairo, Cape Town and Johannesburg that have had outstanding performance in the analysis period in terms of the amount of the CO2 emitted between this period of analysis; outward investment and connection with other cities; number of unemployed population, gross domestic product, internet subscribers. However, despite three African cities being featured in the highest smartness group, level of social inequality is still quite high and even in the less smart cities.

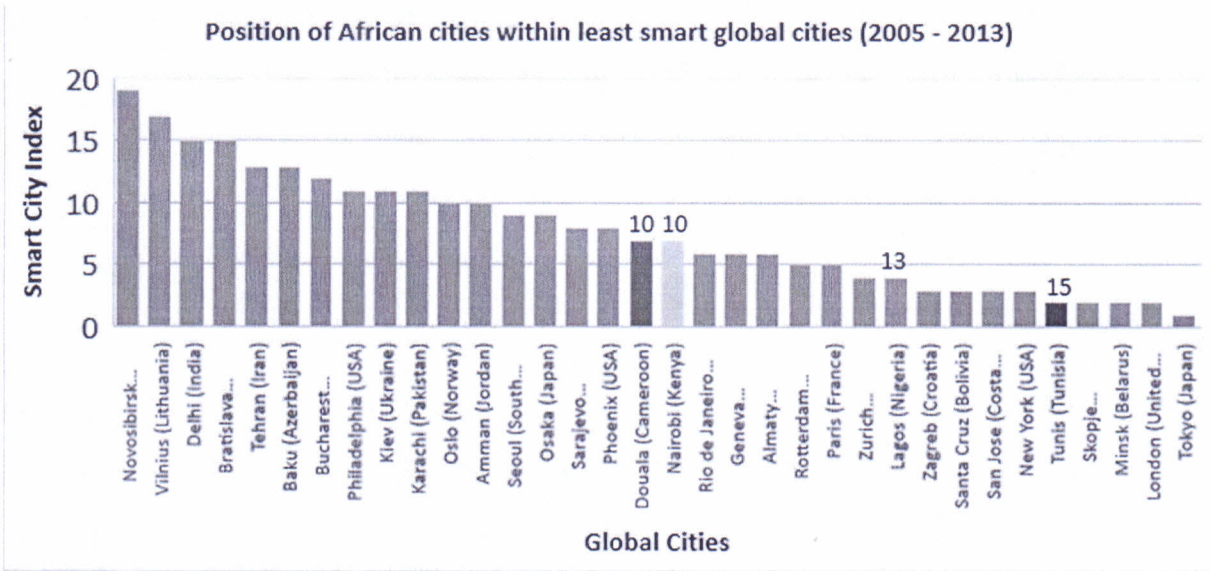

Figure 1: Position of African Cities within least smart cities
Source: Author, 2018
Data Source: Centre for Globalization and Strategy

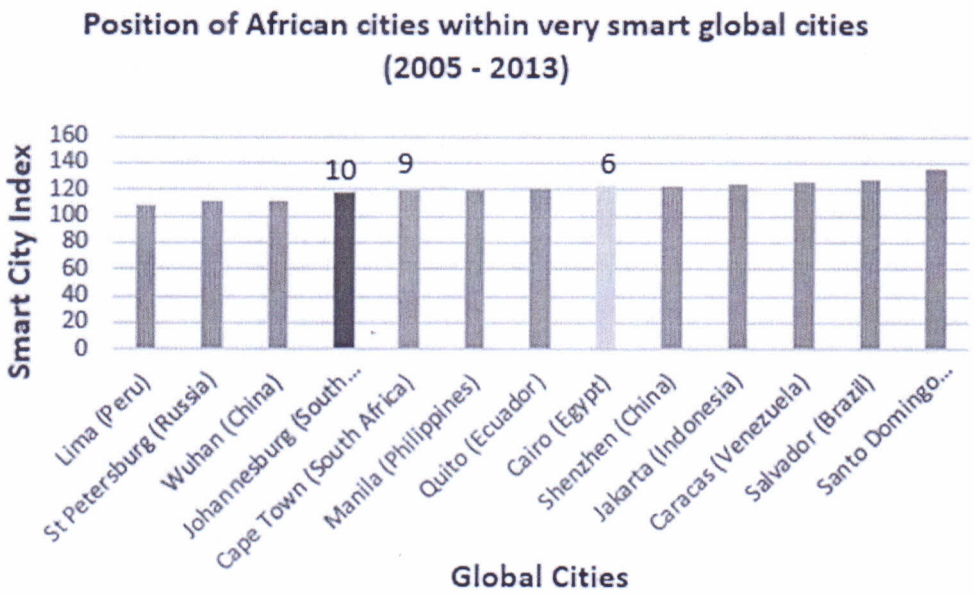

Figure 2: Position of African cities within very smart global cities (2005 - 2013
Source: Author, 2018
Data Source: Centre for Globalization and Strategy

Important smart city indicators to develop in African cities

The result from the ordered probit model has shown the important indicators that determine the level of smartness a particular city can attain. Having weighted the magnitude of coefficient of the variables, it is observed that outdegree, inward distance, gross domestic product, population with higher education attainment and number of broadband internet

subscriptions are critical smart city indicators to develop in cities particularly African cities that have mostly been featured in the 'less smart' category. As one of the targets in the Kyoto Protocol, global new urban agenda and the 2030 agenda for sustainable development, African cities have to strive to keep the amount of CO2 emissions emanating from the burning of fossil fuels and the manufacture of cement low. Achieving this will come via strong sustainable and anti-pollution policies and plans, increase in support for green and smart building and alternative energy and policies that help counter the effects of climate change. This will essentially increase long-term sustainability of the cities.

Since level of unemployment is synonymous to the level of security and safety in a city, then to transition from the less smart category, African governments need to increase employment rate within their cities. The higher the number of people in the labour force, the less time there is for engaging in crime. With more opportunities made available for people in Africa, particularly the youths, the higher the quality of life of the population. More proportion of population in the labour force means more contribution to the gross domestic product which will increase the economic strength of African cities. As more employment opportunities are made available in African cities, the social cohesion amongst people tend to strengthen as well. while it is important for African cities to increase their ability to attract foreign direct investment with other global cities, it is equally essential to enforce policies that control these types of activities.

Although many African cities are fast growing economies, especially the African cities featured in this research, the cities can only attain higher level of smartness when there are more people with secondary and higher education, which is a measure of the human development index of a city. While Cape town and Johannesburg are two of the top smart cities in Africa, these cities and other African cities need to strive to increase educational opportunities within them. With more smart people in the cities, the competitive advantage of cities increases because there will be more smart people in the labour force to solve complex problems in the industries. Having more educated people also increase attractiveness of the cities for more investment and international engagement and partnerships. All of these tend to have spill over effect on the smartness and prosperity index of a city in Africa.

Conclusion and Future Research

First and foremost, the goal of this research was to challenge existing studies on smart cities which have majorly argued that technology is the major driver for a smart city. The research extended knowledge beyond the technological diffusion myth for smart cities by holistically analysing smart cities through the combination of variables of a network emanating from world city literature with traditional city specific characteristics. The results clearly show that beyond technology application, other pertinent components of a city are essential for the smartness and progress of the city. This is clearly evident in the magnitude of influence of the network characteristics of a city and the city's specific characteristics. Africa being of particular interest was analysed to understand the changing position of its cities amongst global smart cities and findings show that African cities fall within two categories of smartness groups (less smart and very smart), occupying different positions (sub-top and lower positions) in each category. With respect to this, it is recommended that African governments revisit their individual city visions and development plans for re-integration and inclusion purposes in their urbanization strategies. They should emphasize on infrastructure and citizen needs that will not just reduce congestions, create spaces for recreational uses, enhance service delivery but also increase citizen's quality of life. As results have shown, the smartness of a city is not limited to a city's characteristics alone but the virtual position of such city in its network (local, regional and global network) is equally important for its progress. Thus, policy agenda of African policy makers need to be formulated such that cities are viewed as part of a network and every agenda made has a way of influencing the city's position in the network. While all these indicators have been analysed, further research should evaluate if the smartness of a city increases or reduces inequality or if it increases the attractiveness of such a smart city for more economic engagement.

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