Smart city agendas of African cities

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Abstract

Increasing numbers of people live in cities, making cities an important focus for development. Cities have common problems associated with many people living together comfortably: food supply, water and power, waste management, transportation, accommodation and keeping order. These problems are now being faced on previously unimagined scales. One understanding of Smart Cities is that new technologies, like new information and communication technologies, present opportunities to manage these problems more effectively.

Africa is home to some of the oldest and largest cities in the world and several African cities are important centres of learning, political power and international trade. Research shows that the approaches cities take to becoming a Smart City relates to factors like economic development, geographic location and population. So it is likely that African cities approach smart city agendas in ways that reflect these contextual issues.

This paper investigates how African cities understand the idea of a Smart City by examining what smart city agendas are being pursued in five cities on the continent and how these agendas are informed by local realities. The paper identifies competing discourses of social inclusion and development that benefit all city residents and smart-looking cities that benefit business and the elite.

Keywords

Development; Information systems; Smart City; Intelligent City; Smart city agendas; Africa

1 Introduction

A key component of development is the rapid growth of cities and the increasing urbanisation of populations. Cities have always had certain common problems associated with many people living together comfortably: the supply of food, water and power, waste management, transportation, accommodation and keeping order (Freund, 2007). The idea of a Smart City has emerged as part of initiatives to improve city living. For example, information and communications technologies (ICTs) have the potential to contribute to the management and coordination of cities, to their economic success, and to improving the quality of life of city residents.

Research done into understandings and applications of smart city concepts has been based in Europe and in emerging economies of the Far East. Little has been done to understand how this concept is playing out on the African continent, although many African cities are pursuing smart city agendas. Smart City application domains that are pursued by cities depend on factors such as the economic development, geographical location, and population density in the city (Neirotti et al., 2014) and so we might expect African cities to pursue agendas that reflect these factors and that these might be quite different from more researched contexts.

As part of a larger funded project that investigates information systems for Smart Cities in Africa, this paper explores African understandings of smart city concepts as a prelude to designing more in-depth investigations.

2 Key concepts

This section introduces key concepts in the analysis presented in this paper.

2.1 Smartness

The term *smart* is full of interesting ambiguities.

Smart is most commonly used to connote an appearance that is polished, fashionable or indicative of wealth. According to the Oxford English Dictionary (OED, n.d.), smart is an adjective that can mean "clean, tidy and well dressed" when applied to a person, "attractively neat and stylish" when applied

to clothing, "bright and fresh in appearance" when applied to an object or "fashionable and upmarket" when applied to a place. This element of appearance infuses smart city discourses and smart city agendas include projects to clean city streets and buildings, beautification projects that introduce or improve parks and attractive public spaces, as well as gentrification projects that seek to replace slums or informal housing with buildings that are more upmarket.

On the other hand, the term smart can also indicate "quick-witted intelligence" when applied to a person, "programmed so as to be capable of some independent action" when applied to a device, and quick or brisk when applied to a manner of movement. These understandings of the term are also reflected in the smart cities discourses. There is a sense that Smart Cities apply human intelligence to the problems of city living to achieve better end results. To live in a manner that does not worsen natural resource constraints is one aspect of being clever about city living. The use of smart devices and information systems that can act independently to serve the interests of people in cities is a dominant theme in smart city agendas and plans. Likewise the idea of being able to move quickly around the city is reflected in the concerns for effective transportation.

There are also negative connotations of the word smart. The verb "to smart" means to "feel a sharp, stinging pain" or to "feel upset and annoyed" and the noun smart is defined as "a sharp stinging pain". These connotations of the word are generally not acknowledged in the smart city discourses, but do in fact reflect the feelings expressed by residents in response to smart city initiatives, as we shall see in the subsequent discussion.

2.2 Smart cities

There are many different ways of defining and understanding the idea of a Smart City, complicated by overlapping terms such as the knowledge city (Yitcanlar et al., 2008), ubiquitous city (Leem and Kim, 2012), the digital city (Shin and Kim, 2012) and the intelligent city (Komninos, 2008) all of which have slightly different emphases.

Smart cities have been defined in terms of their performance: "a city well-performing in a forward-looking way in various characteristics, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens" (Giffinger et al., 2007), or in terms of the needs and preferences of their residents: "people want to live in Smart Cities, with a higher quality of work, study, life and social relations; capable of supporting the expectation of a better future, individually and collectively; compatible with the planets finite resources and people's human right" (Toppeta, 2010).

Hollands (2008) has identified three different discourses in the definitions and criteria that are selected to describe Smart Cities and has argued that these discourses present different ways of understanding the term "Smart City" and reveal different assumptions about cities and their inhabitants. This paper uses Hollands' categorisation to frame the analysis of the discourses observed in African cities.

First there is a discourse focused on *infrastructure-based services*, particularly using information and communication technologies. An example of this discourse is the "use of smart computing technologies to make the critical infrastructure components and services of a city (e.g., city administration, education, healthcare, public safety, real estate, transportation, and utilities) more intelligent, interconnected, and efficient" (Washburn et al., 2010). Information and communication technologies play some role in most smart city definitions (Caragliu, Del Bo, and Nijkamp, 2011; Chourabi et al., 2012; Giffinger et al., 2007; Velosa and Tratz-Ryan, 2013) with some focusing narrowly on the technologies such as sensors and networks, without considering the use to which such infrastructure may be put (Roche and Rajabifard, 2012).

The second discourse concerns *business-led urban development*. Here the focus is on creating conditions conducive to business by providing infrastructure and attracting appropriately skilled workers to the cities. An example of this discourse is the definition of a Smart City as "a vibrant economy where businesses want to locate and expand" (City of Edmonton cited in Hollands, 2008, p308). This discourse assumes the goal of economic growth and sees cities as competing for capital investment and skills in the pursuit of that growth (Caragliu, Del Bo, and Nijkamp, 2011). Of interest

to those concerned with economic performance is the fostering of innovation within cities and the needs and preferences of elite knowledge workers (Frenkel et. al, 2013; Yigitcanlar et al., 2008). This discourse recognises the need for education and research and development, as well as for a culturally diverse population to facilitate creativity. However, the needs of those who are not knowledge workers are secondary; it is only important that social harmony is maintained (Yigitcanlar et al., 2008) so as to not impede economic and business goals.

A third discourse is of *social inclusion, learning and development* towards better meeting community needs, for example: "smart communities where business, government and residents use new technology to transform life and work" (Komninos, 2002, p188). This discourse sees smart city agendas as being set and driven collaboratively, and focuses on the services that are needed to ensure quality of life (Hollands, 2008). This discourse is concerned with all the people in the urban environment and how they can take advantage of the benefits of smart living (Caragliu et al., 2011; Odendaal, 2003) and overcome problems of the various digital divides (Partridge, 2004).

2.3 Digitally connected living and informated living

In analysing the smart city agendas it is useful to distinguish between digitally connected living and informated living.

Zuboff (1988) introduced us to the idea that information technologies can be used to *informate* as well as automate processes. As these technologies perform automated activities, they simultaneously generate information about those activities. It is this ability to generate information that sets information technologies apart from machines that simply automate. Writing in the context of information technologies applied to work in organisations, she says:

> *"... when the technology also informates the processes to which it is applied, it increases the explicit information content of tasks and sets into motion a series of dynamics that will ultimately reconfigure the nature of work..." (Zuboff, 1988)*

Part of the power of applying information systems to life in a city is that these systems can informate. For example, records collected as people swipe a card to gain access to public transport, become a resource that can reveal detailed patterns of use that will inform transport planning in the future. In the context of Smart Cities, *informated living* can be conceptualised as the state where information systems facilitate both the use of information to support decisions and actions in people's daily lives and the generation of information as a consequence of those decisions and actions that can be used to reconfigure the way people live over time.

Digitally connected living, on the other hand, is possible when people have access to the necessary applications, devices and network infrastructure, as well as the necessary skills to access and make use of information resources. Being digitally connected may mean owning a smart phone and having free wi-fi in the street where one lives, as well as having the appropriate applications to connect to information services. Or it may mean having access to a computer in a public library that is physically connected to a network and loaded with appropriate software. Knowing how to use the software would be a necessary part of digitally connected living, as would having the time and transport to get to the library.

It is obvious that digitally connected living is a prerequisite for informated living. This is an important point in the African context. Smart City agendas in the overdeveloped world tend to start from the assumption that residents are digitally connected, while in African cities this may not be the case.

3 About this research

To begin to understand what the concept of a Smart City might mean in African cities, this paper considers the following research questions:

1) What are African cities planning to do, if anything, as part of their smart city agendas?
2) From these agendas, what can we deduce about how African cities understand the concept of a Smart City? (That is, what discourses prevail?)

To gain a preliminary understanding of these questions, the plans of five African cities were examined. The choice of cities was made as follows: Firstly, the twenty African cities with the largest populations were identified. Secondly, cities in countries with very low (less than $1500) gross domestic product per capita were eliminated from this list. Finally we identified five prominent cities for which information, as described below, was available.

For this preliminary review, desktop research was conducted which will inform future, more in-depth studies. Information about the cities and their smart city agendas was collected from the cities' web sites, from academic databases for publications (books and journal articles) that made specific reference to the cities, and from press reports to gain a richer picture of each context. We searched using the name of the city together with the terms "Smart City", "Development Plan" and "City Plan".

Documents were examined for content relating to general city development plans as well as content specifically identified as smart city agendas. The underlying assumptions that were revealed about understandings of Smart Cities were analysed in terms of the discourses identified by Hollands (2008) and the different meanings of the word *smart* identified above.

4 Smart City agendas of the five cities

4.1 Cairo – building on the splendors of the past

Cairo's Vision 2050 (El-hefnawi, 2010) envisages a city that is "global, green and connected". The city sees itself as the gateway to Africa, the custodians of a global cultural heritage and a regional and global focal point. The green agenda focuses on recreating the architectural splendor of the past, eliminating slums and creating open, green and pedestrian areas. This aligns with the vision of connectedness which is described as being socially, physically and electronically connected. The plan suggests two broad areas of work: the first to "raise living standards to the international level" and the second to increase the competitiveness of the city. These two broad areas of work are underpinned by improvements in education and healthcare.

The first part of the plan focuses on improving administration, housing, environment, transportation, water and sanitation. The plan does not expand on what "international" living standards are, but it deals in some depth with the matter of unsafe housing, including buildings that are structurally unsound or present a health hazard. There is significant overcrowding in the city centre and about 50000 dwellings are deemed unsafe. The plan cites the Giza development (www.newgiza.com), a housing, shopping and entertainment complex being developed near the ancient pyramids of Giza, as an example of the kind of development that the city will undertake to eliminate unsafe dwellings. The Vision 2050 plan includes impressive diagrams and architectural drawings explaining how congestion can be dealt with by improving roads in the city.

The second set of priority areas are focused on increasing competitiveness and include improvements in the areas of culture and media, trade and industry, tourism, finance, telecommunications and ICT. The plan goes into some detail on proposals for increasing tourism and attracting business investments and plans to establish additional educational and health facilities. All these proposals are illustrated with architect's impressions of large and modern facilities, reinforcing the importance of buildings and transport infrastructure.

4.2 Nairobi – a collaborative process towards local priorities

The Nairobi City County (NCC) is in the process of developing the Nairobi Integrated Urban Development Master Plan (NIUPLAN) for 2014 to 2030 (Nairobi, n.d.) with assistance from the Japan International Cooperation Agency (JICA). Activities and progress on the master plan are available on a web site (http://citymasterplan.nairobi.go.ke) and documents related to the process are available for download. The plan is intended to provide "a guiding framework to manage urban development" and to integrate planning across sectors. It addresses six themes: transportation; governance and institutions; environment; land use and human settlements; population, social systems and urban economy; and infrastructure. A "master plan" is being developed for each theme.

The draft master plan for the telecommunications sector (Sakagami, 2013) sets out the developments needed in telecommunications to support Kenya's development into a "middle-income country".

Much of the plan is concerned with enabling digitally connected living; improving digital literacy and infrastructure, including expanded broadband capacity. Opportunities are identified for improving administrative efficiencies and for better e-government services. The plan identifies nine important projects and proposes that five be tackled as priorities. Three of these are concerned with establishing and improving ICT infrastructure, one develops an infrastructure sharing policy and the fifth is a disaster information gathering and disseminating system.

In contrast to the NIUPLAN, another report on Nairobi, developed as part of the IBM Smarter Cities Challenge (IBM, 2012), claims that "new technologies and approaches are required to modernise the city's systems and to make it a better place to live, work and do business" and suggests technology solutions for dealing with traffic congestion, power supply, emergency response and central record keeping. The IBM Smarter Cities Challenge is a "philanthropic initiative" that offers cities access to expert consultants to assist them in addressing "critical challenges" (IBM, n.d.).

4.3 Lagos – a self-service city with grand plans

Lagos has been described as a "self-service city" (Gandy, 2006) where the residents have largely given up any expectation of services being provided by city management. Instead, residents have developed entrepreneurial networks to provide everything from water to technology hubs. Gandy challenges the rationalist and pragmatist discourses of city planning, pointing out that, "*planning* denotes the possibility of influencing or directing different sets of developments" and that it is at odds with the "combination of fatalism, religiosity and profound insecurity [that] infuses everyday life" in Lagos (Gandy, 2006, p.387).

There is, however, an emerging breed of city technocrats who are keen to tackle the city's problems, as well as growing activism among residents, fuelled by the ease of communication and access to information via mobile technologies (Gandy, 2006). These two groups are seeking local solutions to the problems facing Lagos and are defining the needs and services for the city. However no formal plans emanating from the city's government could be located.

There are initiatives aimed at creating technology-enabled modern living and working spaces. Lagos State Government is collaborating with the private sector to build Eko Atlantic city on the outskirts of Lagos, a massive futuristic living and business complex intended to become the "financial centre of Nigeria" and described in glossy marketing materials as "one of the wonders of the 21st century" (http://www.ekoatlantic.com). Lagos also participated in the IBM Smarter Cities Challenge from which emerged recommendations to use technology solutions to better manage traffic and co-ordinate emergency services in the city (IBM, 2013).

4.4 Johannesburg – modest goals, starting with connectedness

The City of Johannesburg's Integrated Development Plan explicitly acknowledges the need to pursue a smart city agenda and cites an academic definition (from Caragliu et al, 2011) that blends discourses of technology, economic development and social participation:

> "A city can be defined as 'smart' when investments in human and social capital, and traditional (transport) and modern (ICT) communication infrastructure, fuel sustainable economic development and a high quality of life, co-exists with the management of natural resources, through participatory action and engagement". (City of Johannesburg, date, p117)

The plan identifies and prioritises five smart city projects. Firstly, the city is seeking to improve the use of ICT throughout its operations, through improving the skills of staff and automating city management processes. Then the city is collaborating with the Gauteng provincial government to develop a local technology hub that will improve access to broadband connectivity across the city and it is providing access to the Internet from public libraries. The city also plans to roll out smart metering for electricity, with a view to improving service and managing demand, while another project will establish an integrated operations centre for public safety.

Without explicitly stating it that way, projects such as providing broadband and Internet access in public libraries recognise the need to facilitate digitally connected living for residents. Projects such

as the use of smart meters and an integrated public safety centre have the potential to move towards informated services; although the initial intentions are modest, but realistic, recognising the complexity of such projects.

4.5 Cape Town – strong on service

The City of Cape Town's Integrated Development Plan (IDP) (Cape Town, 2012) makes no explicit reference to a Smart City although the five focus areas that it is structured into: the Opportunity City (economic development and mobility), the Safe City (crime prevention and management), the Caring City (housing and healthcare), the Inclusive City (service management and community facilities) and the Well-Run City (transparency and administrative efficiency) all speak to common dimensions in Smart City definitions. The plan proposes the use of an intelligent transport information system to improve mobility as well as an "integrated spatially enabled response management system" to informate aspects of crime prevention and management. Cape Town has a City Development Information Resource Centre that collects and consolidates information about the city and there are plans to disseminate information via a web site.

Despite there being no explicit mention of Smart Cities in the IDP, Cape Town is not ignoring the idea. A presentation titled "Smart City Strategy: Public Private Partnership Conference" discusses a smart city strategy for Cape Town and the city has a partnership with the Massachusetts Institute of Technology's "SENSEable City Lab" (http://senseable.mit.edu) which has developed concepts for a range of smart applications for resident services. The City is installing computers in libraries for public use, rolling out broadband infrastructure to municipal facilities to improve service delivery, and is in the midst of a large-scale rollout of SAP enterprise software.

In this mix of activities, some focus on facilitating digitally connected living, in the installation of computers in libraries, while others aim at informating city services, including transport and crime prevention. It is evident, however, that all the plans are underpinned by a strong focus on service provision.

5   Understandings of Smart Cities

Hollands (2008) makes the point that the "definitional impreciseness" of Smart Cities masks a range of assumptions about cities, their functions and the roles of people within them. The kinds of plans being put in place by these five cities reflect different dominant discourses which reveal these assumptions.

5.1 Smart technologies for infrastructure-based services

For the five African cities reviewed, the idea that a Smart City is about using smart technologies for infrastructure-based services is not a dominant discourse. It is present in the plans of Cape Town to build an intelligent transport information system and an integrated response management system, as well as in their collaboration with MIT to develop smart services. It is also there in Nairobi's plan to develop a disaster information system, and Johannesburg is working towards such systems with the rollout of smart meters for electricity.

This understanding of Smart Cities, where *smart* refers to the properties of technologies, emerges most strongly in the proposals, like those produced by IBM, for cities to implement intelligent systems for traffic management (moving smartly), power management and emergency response. When there is a lack of leadership in defining a Smart City for the local context, international technology and construction providers step in to present their own technological definition, often at odds with the needs and preferences of the poorer sectors of society (Tarbush, 2012; Watson, 2014).

5.2 Business-led urban development

Some cities are pursuing massive building development projects to create safe locations for business and luxurious lifestyles. Eko Atlantic City outside Lagos and the "New Cities" around Cairo support a conception of Smart Cities as exclusive places for business and wealthy individuals. These initiatives are allowed to flourish in some cities, often with government support, but are less concerned with

local needs and preferences and more likely to serve the interests of the elite (Tarbush, 2012; Watson, 2014). Here *smart* is about appearance and rapid movement.

In Cairo the New Cities are intended to address inner-city overcrowding, but few residents have moved to them from the inner city. This is in contrast to growing numbers of informal settlements around the outskirts of the city where some two thirds of Cairo residents now live (Sims, 2010). Despite consultations (El-hefnawi, 2010), plans to replace "unsafe housing" in Cairo are not all welcomed by the intended recipients (Björklund, 2009; Charbel, 2009, Viney 2013). The plans are being challenged by a neighbourhood advocacy group who describe them as "gentrification" and "beautification". The inclusion of dwellings with no tenure documents in the definition of unsafe housing is seen as an underhand move to sell off land to developers at the expense of current occupants.

Hollands (2008) notes that where cities espouse smart city discourses of economic growth or entrepreneurship, cities "can become not only more economically polarized, but also socially, culturally and spatially divided by the growing contrast between incoming knowledge and creative workers, and the unskilled and IT illiterate sections of the local poorer population". Such approaches are criticised for supporting development in two directions – with formal, planned cities for the middle class and wealthy and unregulated informal development for the poor (Sims, 2010).

5.3 Social inclusion and meeting community needs

Three cities – Cape Town, Johannesburg and Nairobi – plan to increase digital connectedness among residents by measures such as providing broadband, access to public computers, or training in digital literacy. Such projects assert the importance of participation, particularly by the poorest residents who do not have the means to secure such participation on their own. This reflects a concern with inclusion and that a Smart City is for all people who live in it.

These cities also interpret a Smart City as one that works towards providing better services. Johannesburg and Nairobi aim to improve the functioning of the city administration. More ambitiously, Cape Town's smart city strategy is "not only focused on transforming the way that local government works and delivers its services, but transforming the way that the entire society operates" (Cape Town, 2003, p.10). Service projects identified appear to relate closely to local concerns. For example regular flooding in Nairobi is to be addressed by a disaster management system and escalating crime in Cape Town by an integrated response system. Here *smart* has less to do with appearance and more to do with human intelligence.

Concerns with inclusion are also reflected in consultative approaches to arriving at city plans. The Nairobi City County (NCC) has taken a highly consultative approach to developing the NIUPLAN and the NCC web site includes records of meetings with stakeholders as well as submissions from residents of drawings of the city they envisage. Cairo's plan details the consultative process, including a survey of city residents that asked them to prioritise needs.

Where residents feel that their needs are not being addressed, they take action (Singerman, 2009). In Lagos entrepreneurial residents develop their own city services (Gandy, 2006) while in Cairo visions of the upgraded "ring road" as a sleek high-speed highway (El-hefnawi, 2010), have been thwarted as communities have worked to "break into" the ring road by building illegal stairs and exit off-ramps (Hazem, 2014). So despite Cairo's efforts to consult residents, Smart Cities that focus on business-led development appear to fuel resistance from smarting residents who work to create their own understanding of what their cities might be.

6 Conclusions

Hollands' three smart city discourses are present in African cities, but to different degrees and emanating from different stakeholders. On the one hand being smart means seeking social inclusion and development that benefits all residents of the city and residents contribute their own "smarts" to the process. This discourse comes through in Cape Town's emphasis on service, Nairobi's inclusive process and in Cairo resident's own attempts to shape city development. On the other hand, smart is about improving appearances and creating cities that benefit business and the elite, with a view to

economic competitiveness. In this discourse, only knowledge workers are smart enough to be included (and perhaps those that serve them, to keep things looking smart). This discourse is most obvious in Lagos and Cairo where they are closely associated with large construction companies, although the benefits for economic competitiveness are mentioned by city governments in all five cities. City residents appear not to embrace this discourse, but are more inclined to challenge it.

Where there are efforts to locally define what it means to be smart, smart city agendas focus on putting in place the ICT infrastructure required to facilitate digitally connected living, followed by a focus on service provision. The provision of ICT infrastructure is seen as necessary to deliver services and to create equity of access for residents. The services that are identified as priorities relate to local conditions: disaster management in Nairobi, power and public safety in Johannesburg, transport and crime in Cape Town. Smart technologies that facilitate informated living are some distance off with only technology companies suggesting that they are immediately applicable.

This review has examined the smart city agendas of only five cities, while there are a great number of cities in Africa pursuing smart city agendas, and it has been conducted only with readily available published material. Future empirical studies will need to confirm these impressions; to tease out how the different discourses are linked to different stakeholders and to unpack the local nuances of smart city agendas and the development of those agendas, including the extent to which smart city agendas in Africa do respond to local needs, who drives these agendas and how, and who benefits from them.

7   Acknowledgements

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