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The purpose of the *Kuveza neKuumba - Zimbabwe Ezekiel Guti University Journal of Design, Innovative Thinking and Practice is* to provide a forum for design and innovative solutions to daily challenges in communities.

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Are Efforts by Urban Local Authorities in Embracing Smart Technologies for Urban Development and Governance in Africa Yielding Results? Case Studies of Cape Town, Cairo, Lagos and Harare

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Abstract

There is evidence and consensus that African urban local authorities have to capitalise on the dawn of smart technologies to match cities and towns of the developed world. The adoption of technological advances in finance and administration has improved local authorities' revenue collection. This article assesses the success of efforts by urban local authorities in embracing smart technologies in urban development and governance in selected African cities. African cities are faced with service delivery and urban development challenges owing largely to the lack of smart technologies in urban infrastructure planning and maintenance. The article examines the struggles of cities, municipalities and towns in embracing smart technologies in dealing with urban development and administration in Africa.

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The adoption of e-administration, geographical information systems and other technologies for the surveillance of urban infrastructure enhance transparency and efficiency in service delivery in urban areas. It highlights how ICTs have continued to influence urban development in the rapidly urbanising cities of Cape Town (South Africa), Cairo (Egypt), Lagos (Nigeria) and Harare (Zimbabwe).

Keywords: cities, service delivery, e-administration, infrastructure.

INTRODUCTION

African cities are facing challenges in dealing with their rapidly growing populations. Cities are growing at a faster rate than they can provide for their people. The cities face various challenges, including economic collapse, poor governance, social decay, mobility and environmental challenges. Technology is seen to make work easier (Brynjolfsson and McFee, 2014; Raja and Nagasubramani, 2018). There are various ways of improving technology in people's lives. Advancements in technology have taken centre stage in various fields, including communications, and have also been adopted in urban development (Naveed *et al.*, 2018). These developments in technology have made it easier to gather and disseminate information, thus improving communication (Tumbo *et al.*, 2018).

Technology is used to reduce human carbon footprint (Hayder, 2017). This is done through the use of solar systems (Shahsavari and Akbari, 2018). There is a link between climate resilience and economic resilience that has prompted people to focus on the environment and urban development to ensure economic growth (Evenhuis, 2020). Residential areas are being modified to meet the standards of the people by retrofitting solar systems, boreholes and green buildings on old properties and designing new housing with those modifications in place.

Urban development has adopted the use of smart technology to improve service delivery (Albreiki *et al.*, 2019). This is seen through the use of artificial intelligence (AI) and autonomous vehicles used in Singapore (Tan and Taehagh, 2021) to make it

more liveable. Washington DC street lighting is upgraded to include monitoring and control systems, Wi-Fi and sensors, with the LED lights used energy-efficient (Nirosha *et al.*, 2017; Patarroyo *et al.*, 2019). Developed nations can afford to further develop their technology whilst developing countries are lagging behind, creating a gap between the countries (Ngwa *et al.*, 2020).

Smart systems are viewed as intelligent technological systems that are self-sufficient and have advanced functionality (Smys, 2020). These can sense, analyse and manage any given situation. They can work simultaneously and communicate with each other, yielding highly reliable and predictive results. They assess a situation and provide the most optimal route to follow with technically calculated variables (Alter, 2020).

Smart technology in urban development and governance is vital as it promotes the development of smart cities, resulting in the success of the National Agenda 2030, fitting in with Sustainable Development Goal (SDG) 11 (Angelidou *et al.*, 2018). The characteristics of smart cities include interconnectedness, intelligence and autonomy (Cui *et al.*, 2018). These highlight smart systems, showing that they ought to be integrated and self-governing. However, these smart systems have challenges of their own that include integration vulnerability, and centralisation vulnerability as servers are usually located in one area and then information is disseminated elsewhere. This compromises individual privacy, increases automation and inconsistent adoption, creating gaps and lag times between different municipalities or countries (Silva *et al.*, 2018; Pathak and Pandey, 2021).

Technology is changing at an alarming speed. This has led to a change in industries, commerce and also urban development and governance. The technology industry growth has opened up a variety of avenues in the world and their interconnectedness (Bailey and Osei-Bryson, 2018). Technology has made it easier to communicate and to spread information and also store it in

various forms and anywhere. This information has proved to be essential in running businesses and urban development (Chen and Milanovic, 2019). This is particularly vital as urban development is one of the fields that require real-time and predictive data to create functional and operational products.

Most urban development has adopted the use of Geographical Information Systems (GIS) to map zone, visualise and predict urban plans and compare data. GIS was introduced in the 1960s and has been used as a vital data source (Malleson, 2019). This is particularly helpful in the bid for the New Urban Agenda 2030 of creating smart cities using geospatial data (Moomen *et al.*, 2019). Spatial planners can compare master plan designs with what is on the ground with cadastral maps, overlays and Google Earth software. The adoption of planning support systems (PSS) has provided geospatial tools in communication (Pettit *et al.*, 2018), analysis and information handling. However, there exists a mismatch between the supply and demand, the information needed and the users.

CONCEPTUAL FRAMEWORK

URBANISATION CHALLENGES

Urbanisation is a result of an increase in population in the city due to rural-urban migration and the government expanding urban areas (Dijkstra *et al.*, 2020). Rapidly urbanising cities are facing challenges due to their incapacitation. This stems from the large and growing population that places pressure on the available services and resources of the city. A growth in population means that there is need for housing institutions to cater for the citizens. This is difficult to deliver, especially in developing countries, where the state of the economy does not allow for good quality free or low-income housing. Most people end up renting and, in turn, increase pressure on the available resources and services. Overcrowding results in bursting sewer pipes and the spread of diseases (Bodo, 2019; Singh *et al.*, 2020).

A growing urban population requires employment for independence from the government and donor assistance. With jobs, people pull themselves out of poverty. If people are incapacitated and do not have enough resources to go digital, then the hopes of achieving a smart city vanish without the technological means to access information and services (Gore, 2017; Ranchod, 2020).

INFORMATION COMMUNICATION TECHNOLOGY (ICT)

This refers to technology that is centred on information access through telecommunication. The focus is on communication technology, the internet, mobile phones and wireless networks (Franca *et al.*, 2020; Porru *et al.*, 2020). ICT has become key for the sharing of information to do with service delivery and feedback in urban areas.

SMART CITY

Smart city refers to an urban settlement where citizens and the government work through the use of technology (Kirimtat *et al.*, 2020). It is the transformation of how local governments work and how they interact with the citizens. The local authorities adopt technologically aided means of communication to better disseminate information (Caragliu and Del, 2019).

The smart city has various components that enable it to be called 'smart' and these include smart citizens who use technology for communication and everything else, mobile network/ Wi-Fi access and open data that is accessible to all. This includes smart health, where transactions are done online, smart government, smart farming, a smart grid with clean energy sources, smart buildings, smart manufacturing and smart transportation (Silva *et al.*, 2018; Singh *et al.*, 2021) (Figure 1). The 'smart' is representing reduced carbon footprints and environmental exploitation and industrial emissions. It is a digital city that provides services and passes information through digital and technological means (Rathore *et al.*, 2021).

Figure 1: *Smart City Components* (Facilitator, 2021)

LITERATURE REVIEW

Economic challenges faced by cities include poverty, where the citizens live in deprivation and are prone to urban insecurities (Oluwatayo and Ojo, 2018). Access to employment is limited and urban poverty is perpetuated by an increase in competition for resources. The infrastructure in place cannot cater for the networks required for the high functioning of a city (Ibragimova *et al.*, 2021). A lack of diversification and an unbalanced geographical development also pose challenges to the city. Lack of diversification means no innovation, thus no new ways of accessing employment and generation of income. Unbalanced geographic development results in overcrowding in a certain area due to infrastructure jnavailability (Xiong *et al.*, 2021).

Mobility is another challenge faced by cities that includes transportation shortages, congestion and pollution (Gebresselassie and Sanchez, 2018). Growing cities have difficulties in accessing affordable public transportation, as characterised by long bus queues. Taking the case of Zimbabwe, this has an avenue for th *mushikashika* (Chigwenya and Dube, 2018; Chikengezha and Thebe, 2021). These are private cars that illegally transporting people between the Harare CBD and residential area. This has created a serious

situation where operators of these vehicles are in a rat race with the municipal police (Mutambanengwe and Dambudzo, 2021) as the former try to avoid arrest. Many accidents have occurred and these vehicles do not have passenger insurance, hence putting passengers are at great risk (Maringira and Gukurume, 2020). These vehicles have invaded the City of Harare in large numbers and have worsened the congestion crisis in the CBD..

The influx of these *mushikashikas* is caused by the shortage of public transport, and the societal construct that vehicle ownership translates to wealth (Londoño-Vélez and Ávila-Mahecha, 2018; Lucas and Wilson, 2019). This has seen an increase in vehicle ownership in African cities. This negatively impacts the environment of the urban areas as people are not willing to adopt cycling as a means of mobility.

Pollution is dangerous as it releases chloroflorocarbons (CFCs) and greenhouse gases that are eroding the ozone layer and causing climate change (Adedeji *et al.*, 2020). This is one of the main reasons most companies have tried to go paperless (Wilts and Berg, 2018; Nopilda and Setiawan, 2019). Most cities are facing water shortages that has seen many boreholes sunk and wells dug to supplement council water (Mapunda *et al.*, 2018). The rate of development in cities is also another environmental challenge because development is at a high rate and there are very little or no regulations to govern urban growth (Boamah *et al.*, 2018). At times, regulations are acknowledged after development completion.

Urbanisation challenges can also be classified as people challenges. The dimension is significant as people drive development, directly or indirectly. They migrate to cities and put up structures and settle in different areas, driving development. Other services come to complement the residential growth. The people dimension includes inequalities such as education inequalities (Reay, 2018), where some people are unable to access education. This may be due to geographic

differences (Öhler *et al.*, 2019) and poverty where some residents cannot afford school fees. Cultural differences also provide challenges to city development (Ayed *et al.*, 2017). For instance, some cultures do not allow women to go to work, which reduces the household's income. Gender inequalities also pose challenges. This is because some men may not allow their wives to have smartphones to pay bills and to communicate with local governments, yet, most women have the information of what they need and the services they want to pay for.

Access to employment is also another people dimension affecting urban development (Wei and Ewing, 2018). This is because people who cannot access employment do not have funds to acquire stands and may, therefore,end up illegally settling on land reserved for other uses. Urban poverty also means that citizens do not have access to technology required for the city to go 'smart'.

Other challenges are related to the quality of life of citizens. This includes access to decent housing that is seen as a luxury in most rapidly growing cities because of the government's inability to provide housing to its people (Karadimitriou *et al.*, 2021). This leads to the development of illegal illegal settlements. Access to employment also affects the quality of living and other basic rights to security and protection against violence within a settlement (King *et al.*, 2017). Leisure facilities access also affects the quality of life because everyone needs free time to refresh and rest. Access to information affects living quality through the spread and access of data (Nevado-Peña *et al.*, 2019).

Governance challenges are interwoven in the cities' structure. These challenges are centred on institutional instability where institutions do not have enough capacity to develop, monitor and guide urban development (Repette *et al.*, 2021). This capacity can either be human, financial or technological, hence limiting the capabilities of the city. Excessive centralisation

creates an abyss between the government and the governed, creating communication gaps where decision-makers are unable to pass on adequate information to the citizens (Dadashpoor and Yousefi, 2018). Institutional coordination is vital; a lack will lead to difficulties for different departments to formulate complementary solutions. Lack of participation, awareness, infrastructure deficit, technology and access to information creates poor governance (Oleribe *et al.*, 2019).

NEW URBAN AGENDA 2030

The Agenda 2030 was established to propel the development of cities to be world-class and match cities in developed countries (Valencia *et al.*, 2019). The initiative is centred on the use of technology to further develop cities. This was also a way of correcting challenges of congestion, pollution and overcrowding in the cities. Some initiatives used towards Agenda 2030 include densification of residential areas, creating mixed-use areas and using technology to advance urban development, to manage and monitor urban infrastructure with the use of geospatial data (Alves, 2020). Geospatial data takes centre stage in urban development for individuals and companies to access geographical data online and openly (Scott and Rajabifard, 2017). There is need to educate people on the use of technology devices and to formulate new innovative ideas to propel development further.

In South Africa, Cape Town localised the New Urban Agenda framework through the Integrated Urban Development Framework launched in 2018 andand the UN Sustainable Development Goals (SDGs). However, central government did not actively support this endeavour. The smart city concept has evoked the need to use of clean energy to achieve the development of cities. In this case, companies such as Eskom have developed systems to provide clean and safe energy through solar development.

Zimbabwe has also embarked on the noble idea, though it is facing some challenges. It was established that there be an encouragement in the development of alternative energy uses to help create a smart city. However, taxes and duties made it

expensive such that a battery bought US$75 is sold for almost US$350 because of these taxes, put in place to protect local businesses. This has not helped because the solar development sector is developing slower than the demand for the equipment.

RESEARCH METHODOLOGY

The data used in this study were from mainly secondary data sources such as documents, including reports and plans. Thematic analysis was employed to discern the different smart technology tools used in different parts of the world.

RESULTS

The urban population is growing at a high rate, leading to the estimation that about 70% of the world's population will be in cities by 2050 (Ritchie and Roser, 2018). This growth in the urban population compounds the urban challenges, which include pollution, congestion, poor sanitation and shortage of potable water, housing and poverty (Dos Santos *et al.*, 2017). This makes urban areas difficult to manage and service.

CAIRO

Cairo has embraced smart technology in various aspects. It has initiated and integrated a smart CCTV system design to access information from around the city and to help in crime prevention (Hassanein, 2017). These require sharing of information timely enough to allow quick response to utility outages or traffic congestion. These systems are being adopted from South Korea as it is one of the leading countries in smart technology (Elsayed, 2021).

The New Cairo Capital is a smart city proposed to change and embrace smart technology (Hassanein, 2017). The proposed area is about 700km^2 of high and medium residential areas, with about 200km^2 as natural preservation areas (Figure 2). The city embraces the old one and is connected with it through public transit links. The city is also concerned with education, quality of life and economic opportunities, especially for the younger generation whilst conscious of environmental sustainability.

Figure 2: *Master Plan of the New Capital Cairo. Source* (SOM News, 2015)

CAPE TOWN

Cape Town is one of the leading cities in smart technology. This has drawn many people to the city, therefore, creating a platform for innovation and competitiveness among the residents (Pinfold, 2018). An influx of technical people encourages the development and spread of digital 'smart' tech (Killian and Kabanda, 2017). Bills are paid online, conserving the environment and reducing the travel frequency of people between their homes and service provider accounting halls.

The city of Cape Town initiated its first ever smart city strategy in the year 2000 (Mhangara *et al.*, 2017). This was in a bid to aid in the accomplishment of city goals such as employment creation, economic growth of the city, high-quality service provision and to improve citizen engagement in urban development and governance. It centred on finding ways in which technology is used to meet the city's objectives and to encourage citizen participation. The Unicity initiative integrated seven municipalities in the Cape Town region to allow inclusivity and integration(Hart, 2021).

However, the city has faced challenges (Boyle, 2020) in adopting these initiatives and the smart city concept. This is because of the ambiguity that surrounds the digital city and smart technology. Therefore, it created a theoretical framework that is difficult to undertake practically. It lacks implementation techniques and remain hypothetical and superficial (Lim *et al.*, 2019).

LAGOS

Nigeria is one of the countries facing an infrastructure gap due to underinvestment and poor innovation strategies and performance (Orji *et al.*, 2019). In Lagos, the public service delivery and implementation strategies failed due to the methods and techniques used. The government is also failing to adequately provide services to the people and has also failed to properly manage public infrastructure (Ahmad, 2017). This is worsened by the growing urban population resulting from the rural-to-urban migration. There is an increase in governmental challenges of service delivery in education, health care, safety programmes, social welfare and an efficient business environment. The Internet of Things (IoT) is not yet widely used in the public sector as most government services are not online yet (Kunle *et al.*, 2017).

The Lagos smart city project was initiated in June 2016 (Adejuwon, 2018) as a conceptual way of improving service delivery and governance. The project was aimed at creating a link between human and social capital with ICT infrastructure to enable the flow of useable information to the residents. This was also to address the gap in public service delivery and to drive sustainable urban development to improve the quality of life of citizens (Olokesusi and Aiyegbajeje, 2017).

HARARE

The prepaid Zimbabwe Electricity Supply Authority (ZESA) system has worked to a greater extent as most residents buy electricity tokens before using the power (Dumbura and Özkoç, 2021). The use of prepaid meters has encouraged people to pay for their electricity, hence people are paying for the energy that they are using, unlike what was happening before, where one

would use the electricity and be billed later. This reduces unpaid bills and ensures that households or companies use only electricity that they paid for. It also helped in the revenue collection of unpaid bills. However, a some residents have bypassed the the system of buying tokens; therefore no revenue for that electricity is collected. Prepayment also has helped in reducing the energy consumption of citizens, since some are are now using LP gas and firewood for heating and cooking, saving the nation's electricity (Macheka and Chikoto, 2021). The use of gas has been a great substitute for electricity. There has also been the use of other energy sources such as solar power, which is a clean source of energy. The use of solar energy is used in Homelink, Westlea, Harare, and has provided lighting during intermittent power cuts. These are clean energy sources that protect the environment and reduce pressure on the resource.

The Harare City Council has faced many challenges in delivering potable water to its residents. The chemicals required for water purification are expensive (Tundu *et al.*, 2018). The city needs all the revenue it can get. However, it is difficult to obtain because of non-revenue water which is between 40% and 60% in amount lost (Nhongo *et al.*, 2018). This is attributed to burst water pipes, illegal connections and political exemptions. The need to adopt prepaid water meters is long overdue, as the idea has not taken flight since 2016 (Maramura, 2018). The prepaid water meter will help in revenue collection and reduce non-revenue water.

Urban local authorities have attempted to embrace smart technologies in their daily operations with 15 million mobile connections and a 98% connectivity rate (Mupfiga and Tafadzwa, 2017). This is through the establishment of bill payment applications, such as the one for the City of Harare. The council has developed an application that allows people to pay their bills online (Mapfumo and Mutereko, 2020). The application was also designed to enable citizens to report issues and to request or advise on garbage collection. The application needs to be downloaded first on Google Playstore, eliminating those residents who do not have smartphones.

DISCUSSION

There is widespread use of smart technology in urban development and governance. This is one of the main causes of modernisation in developing countries and the adoption of new tools and innovations. The development of ICTs has made the smart city concept a possibility as they provide the means to achieve sustainable city development.

African countries, like Zimbabwe, South Africa, Egypt and Nigeria, have adopted the use of electronic payments and mobile payment of rates and utility bills. Zimbabwe has adopted the use of Ecocash and Telecash as payment methods for rates and utilities (Mupfiga and Tafadzwa, 2017). This has reduced the need for people to commute to and from the accounting offices that are usually located in the CBD, thereby reducing the hustle of paying ratesb and also reducing the need to travel. The city can get more payments via mobile and online means and has, therefore, aided in the revenue of the city (Simatele, 2021). The sending of messages and advertisements on easier ways of paying bills has also acted as an enabler with people using those avenues stated by different service providers and the City of Harare.

The City of Harare has moved away from the sending of hard copy bills, as a way of ensuring environmental sustainability. However, the sending of electronic bills has not taken root because one needs to send an email requesting their bill and/or statement. Some people tend to pay a fixed amount that may or may not be significant enough to aid the city in service delivery because they will not have updated arrears to the city council (Mhike, 2019; Zvobgo, 2021). The city is moving towards smart technology but does not have enough resources and also the citizens do not all have access to the technology required for the smooth flow of information. Therefore, service delivery is still facing deficits in terms of supply and demand.

The city lacks monitoring mechanisms for rate payments (Maramura and Shava, 2021). This is because technological innovation and adoption in developing countries are still in their infancy as it has not fully developed to meet all the requirements.

The adoption of smart technology is a way of addressing urban challenges faced by developing countries. Most developing countries lack diversification in the economic sector with most tending to lean towards primary industries such as farming, forestry and mining (Mayuzimi, 2020). This sets a limit on the country's reach because the economy is not driven further by the chosen sector. There is also an unbalanced geographical scenario where urban areas have most of the population and the potential for development and rural areas are left with very few people and little to no development. The developed centres cannot provide enough money to develop these areas. There is also an excess weight of the informal sector. It is vital to have an informal sector that caters for the uneducated and unskilled. However, this situation has overtaken the formal sector that does not have enough money to function well with almost all sectors of commerce informal. This limits employment creation and income generation that is beneficial to the whole.

Zimbabwe needs to learn from Lagos and adopt a situation whereby a link between human and social capital is encouraged. The connection provides a pathway for infrastructure development, with social needs expressed to inform urban development. There is also need to abolish the development for the 'greater good' without consulting the people,who will eventually use the developed area.

CONCLUSION AND RECOMMENDATIONS

Technology is ingratiated in most activities. Its advancements have led to the improvement of work and its mechanisation. Technology has also been adopted in the urban planning field to plan creation, mapping and monitoring development through the use of GIS and other systems. Smart technology has had an impact on most developed countries with enough financial capacity to implement and further develop plans. However, developing countries have found it difficult time implementing smart tech ideas. This is because of a lack of financial, human and political capacity. That is why cities, like Harare and Lagos, have formulated plans that tend to be superficial and theoretical.

The New Urban Agenda 2030 has been adopted the world over and there is need to work to successfully get results. The embracing of technology in all aspects, working with the IoT to stay connected and sharing information is critical. This begins with accepting that the world is interconnected and so information[-sharing should be free and easily accessible through open data sources and urban labs.

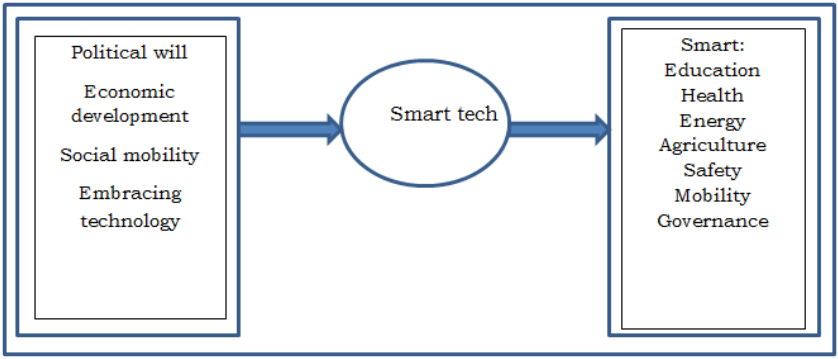

Figure 3: *Smart Tech Framework (*Adapted from Kumar *et al.*, 2020).

There is a need to foster political persuasion for the idea of smart tech to take root and be a priority (Figure 3). Equity wealth distribution and economic development are key to ensuring access and ability to purchase technological gadgets that aid in accessing the internet and performing tasks. Social mobility is also vital to succeed in the development of smart cities that use technology in almost all aspects of urban development (Mapfumo and Mutereko, 2020). There is need for a platform where people can move out of poverty and further develop their housing and move to other residential areas.

All this work leads to the attainment of smart cities that have all aspects required for further development and improvements. The results are smart agriculture, smart energy, smart manufacturing, smart health care, smart living, smart education, smart safety, smart mobility and smart governance.

REFERENCES

Adedeji, A.R. *et al.* (2020). Sustainable Energy Towards Air Pollution and Climate Change Mitigation. *Journal of Environmental Management*, *260*, 109978.

Adejuwon, K.D. (2018). Internet of Things and Smart City Development: Is Nigeria Leveraging On Emerging Technologies to Improve Efficiency in Public Service Delivery? *Journal of Public Administration, Finance and Law*, *13*, 7-20.

Ahmad, M.T. (2017). The Role of Water Vendors In Water Service Delivery in Developing Countries: A Case of Dala Local Government, Kano, Nigeria. *Applied Water Science*, *7*(3), 1191-1201.

Albreiki, S., Ameen, A. and Bhaumik, A. (2019). Impact of Internal Government Efficiency and Service Delivery Infrastructure on the Smart Government Effectiveness in UAE. *International Journal on Emerging Technologies*, *10*(1), 12-19.

Alves, T. (2020). November). The Policy and Practice of Apartment Provision: A Test Case for Australia's New Urban Agenda. *IOP Conference Series: Earth and Environmental Science*, 588(5), 052048). IOP Publishing.

Angelidou, M. *et al.* (2018). Enhancing Sustainable Urban Development through Smart City Applications. *Journal of Science and Technology Policy Management*, 9 (2) 146-169. https://doi.org/10.1108/JSTPM-05-2017-0016.

Ayed, H., Vanderose, B. and Habra, N. (2017 May). Agile Cultural Challenges in Europe and Asia: Insights From Practitioners. 2017 IEEE/ACM 39th International Conference on Software Engineering: Software Engineering in Practice Track (ICSE-SEIP), 153-162). IEEE.

Bailey, A. and Osei-Bryson, K.M. (2018). Contextual Reflections on Innovations in an Interconnected World: Theoretical Lenses snd Practical Considerations in ICT4D. *Information Technology for Development*, 24(3):423-428, DOI: 10.1080/02681102.2018.1499202

Boamah, K.B., Du, J., Boamah, A.J. and Appiah, K. (2018). A Study on the Causal Effect of Urban Population Growth and International Trade on Environmental Pollution: Evidence from China. *Environmental Science and Pollution Research*, *25*(6), 5862-5874.

Bodo, T. (2019). Rapid Urbanisation: Theories, Causes, Consequences and Coping Strategies. *Annals of Geographical Studies*, *2*(3), 32-45.

Boyle, L. (2020). *The Way Forward for the City of Cape Town and What it Means to be 'Smart' in Africa*. (RERU Smart City Series: Part 4. Cape Town: Urban Real Estate Research Unit.

Brynjolfsson, E. and McAfee, A. (2014). *The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton & Company.

Caragliu, A. and Del Bo, C.F. (2019). Smart Innovative Cities: The Impact of Smart City Policies on Urban Innovation. *Technological Forecasting and Social Change*, *142*, 373-383.

Chen, Y. and Milanovic, J. (2019). Reliability Analysis of Interconnected Electrical Power and ICT Systems using Hybrid Object-oriented Modelling Approach. Available online: https://www.cired-repository.org/server/api/core/bitstreams/e863fd78-b1d8-4cc8-b05c-2e9ea01520b1/content#:~:text=In%20this%20paper%2C%20a%20hybrid,energy%20loss%20of%20the%20system.

Chigwenya, A. and Dube, D. (2018). Informality and the Right to the City Centre: Contestations for Space in the City of Harare. *Education, Science & Production* (1), 2018-01.

Chikengezha, T. and Thebe, V. (2021), August). Living on the Periphery and Challenges of Mobility: A Tale of Transport-Induced Social Exclusion in Southlea Park, Harare, Zimbabwe. *Urban Forum*, 33(2), 1-13.

Cui, L. *et al.* (2018). Security and Privacy in Smart Cities: Challenges and Opportunities. *IEEE Access*, *6*, 46134-46145.

Dadashpoor, H. and Yousefi, Z. (2018). Centralization or Decentralization? A Review of the Effects of Information and Communication Technology on Urban Spatial Structure. *Cities*, *78*, 194-205.

Dijkstra, L. *et al.* (2020). Applying the Degree of Urbanisation to the Globe: A New Harmonised Definition Reveals A Different Picture of Global Urbanisation. *Journal of Urban Economics*, 125, https://doi.org/10.1016/j.jue.2020.103312.

Dos Santos, S. *et al.* (2017). Urban Growth and Water Access in Sub-Saharan Africa: Progress, Challenges and Emerging Research Directions. *Science of the Total Environment*, *607*, 497-508.

Dumbura, A. and Özkoç, E.E. (2021). Examining Technology Acceptance in Least-Developed Countries: The Case of ZESA. *Multidisciplinary Digital Publishing Institute Proceedings, 74*(1), 3-16.

Elsayed, M. (2021). The South Korean Contribution to the Economic Development of the Middle EastAvailable online: https://kantakji.com/files/Vol_107YUDwT.pdf.

Evenhuis, E. (2020). New Directions In Researching Regional Economic Resilience and Adaptation. In: *Handbook on Regional Economic Resilience*. London: Edward Elgar Publishing.

Facilitator, C. (2021). Smart City- Elements, Features, Technology and Govt. Approach. Available online: https://constrofacilitator.com/smart-city-elements-features-technology-and-govt-approach/

França, R.P. *et al.* (2020). Improvement of the Transmission of Information for ICT Techniques Through CBEDE Methodology. In: *Utilizing Educational Data Mining Techniques for Improved Learning: Emerging Research and Opportunities*, 13-34). IGI Global.

Gebresselassie, M. and Sanchez, T.W. (2018). "Smart" Tools for Socially Sustainable Transport: A Review of Mobility Apps. *Urban Science*, *2*(2), 45.

Gore, C. (2017). Late Industrialisation, Urbanisation and the Middle-Income Trap: An Analytical Approach and the Case of Vietnam. *Cambridge Journal of Regions, Economy and Society*, *10*(1), 35-57.

Hart, G. (2021). Public Libraries Stepping into the Gap? A Study of School Learners' Use of Libraries in a Disadvantaged Community in Cape Town. IASL Annual Conference Proceedings. Available online: https://repository.uwc.ac.za/bitstream/handle/10566/6701/Public_Libraries_Stepping_into_the_Gap_A_Study_of_%20%281%29.pdf?sequence=1&isAllowed=y.

Hassanein, H. (2017). Smart Technical Street Furniture Design: Case Study of 'New Cairo Administrative Capital'. Available online: https://press.ierek.com/index.php /ARChive/article/view/124.

Hayder, G. (2017). Impact of Green Campus Initiatives on the Carbon Footprint of the University Campus: Awareness of Students. *Journal of Energy and Environment*, *10*(1), 45-67.

Ibragimova, A., Wang, Y. and Ivanov, M. (2021). Infrastructure Development in Africa's Regions: Investment Trends and Challenges. *E3S Web of Conferences*, *295*01029). EDP Sciences.

Karadimitriou, N., Maloutas, T. and Arapoglou, V.P. (2021). Multiple Deprivation and Urban Development in Athens, Greece: Spatial Trends and the Role of Access to Housing. *Land, 10*(3), 290.

Killian, D. and Kabanda, S. (2017). Mobile Payments in South Africa: Middle-income Earners' Perspective. Association for Information Systems AIS Electronic Library (AISeL) PACIS 2017 Proceedings.

King, R. *et al.* (2017). Confronting the Urban Housing Crisis in the Global South: Adequate, Secure and Affordable Housing. World Resources Institute Working Paper.

Kirimtat, A. *et al.* (2020). Future Trends and Current State of Smart City Concepts: A Survey. *IEEE Access*, *8*, 86448-86467.

Kumar, H. *et al.* (2020). Moving Towards Smart Cities: Solutions that Lead to the Smart City Transformation Framework. *Technological Forecasting and Social Change*, *153*, 119281.

Kunle, O.J., Olubunmi, O.A. and Sani, S. (2017, November). Internet of Things Prospect in Nigeria: Challenges and Solutions. 2017 IEEE 3rd International Conference on Electro-Technology for National Development (NIGERCON), 736-745). IEEE.

Lim, Y., Edelenbos, J. and Gianoli, A. (2019). Identifying the Results of Smart City Development: Findings from Systematic Literature Review. *Cities*, *95*, 102397.

Londoño-Vélez, J. and Ávila-Mahecha, J. (2018, November). Can Wealth Taxation Work in Developing Countries? Quasi-Experimental Evidence from Colombia. Annual Congress of the IIPF. Available online: https://www.iipf.org/papers /WealthTaxation_LondonoVelez_JMP.pdf.

Lucas, A.M. and Wilson, N.L. (2019). Schooling, Wealth, Risky Sexual Behaviour, and HIV/AIDS in Sub-Saharan Africa. *The Journal of Development Studies*, *55*(10), 2177-2192.

Macheka, M.T. and Chikoto, D. (2021). Water, Energy, Health and Sanitation Challenges in Masvingo's Low-Income Urban Communities in the Context of SDGs in Zimbabwe. *Sustainable Development Goals for Society,1* 235-246. Springer, Cham.

Malleson, N. (2019). Building Temporal Dynamism into Applied GIS Research. *Applied Spatial Analysis and Policy*, *12*(1), 1-3.

Mapfumo, L. and Mutereko, S. (2020). E-participation as a Mechanism of Stakeholder Engagement in the City of Harare.*Reflections on African Cities in Transition* (169-182). Springer, Cham.

Mapunda, D.W., Chen, S.S. and Yu, C. (2018). The Role of Informal Small-scale Water Supply System in Resolving Drinking Water Shortages in Peri-Urban Dar Es Salaam, Tanzania. *Applied Geography*, *92*, 112-122.

Maramura, T.C. and Shava, E. (2021). Ethics and Accountability in Municipal Supply Chain Management in Zimbabwe. *Int. J. Management Practice*, *14*(5), 621.

Maramura, T.C. (2018). The Efficacy of Prepaid Water Meters for Potable Water Service Provision in the Harare City Council, Zimbabwe. Doctoral dissertation, North-West University.

Maringira, G. and Gukurume, S. (2020). Youth Patronage: Violence, Intimidation and Political Mobilisation in Zimbabwe. African Peacebuilding Network APN Working Papers, 28.

Mayuzumi, Y. (2020). Is There a Future for Agriculture in World Leading Tourism Resort Islands of Developing Countries? Case Study about Survey of Consciousness about Career Choice of Young Generation in Bali, Indonesia. *Asia-Pacific Journal of Regional Science*, *4*(1), 91-110.

Mhangara, P. *et al.* (2017). Transforming the City of Cape Town from an Apartheid City to an Inclusive Smart City. In: Vinod Kumar T.M. (eds.) *Smart Economy in Smart Cities*, 951-983. Singapore: Springer, Singapore.

Mhike, N. (2019). Exploring Factors Affecting Revenue Collection from SMEs by City of Harare Council: A Case of Zone 4. Doctoral dissertation, Chinhoyi University of Technology.

Moomen, A.W. *et al.* (2019). Inadequate Adaptation of Geospatial Information for Sustainable Mining Towards Agenda 2030 Sustainable Development Goals. *Journal of Cleaner Production*, *238*, 117954.

Mupfiga, P. and Tafadzwa, P. (2017). The Rise of Mobile Technology in the Financial Sector in Zimbabwe. *Journal of Systems Integration*, *8*(3), 19-26.

Mutambanengwe, B.K. and Dambudzo, I.I. (2021). Employment Creation and Extreme Poverty Eradication through Open and Distance eLearning and Technical-Vocational Education and Training in Zimbabwe. *International Journal of Distance Education and E-Learning*, *6*(2), 1-14.

Naveed, K., Watanabe, C. and Neittaanmäki, P. (2018). The transformative Direction of Innovation toward an IoT-based Society - Increasing dependency on Uncaptured GDP in Global ICT firms. *Technology in Society*, *53*, 23-46.

Nevado-Peña, D., López-Ruiz, V.R. and Alfaro-Navarro, J.L. (2019). Improving Quality of Life Perception with ICT Use and Technological Capacity in Europe. *Technological Forecasting and Social Change*, *148*, 119734.

Ngwa, W., Olver, I. and Schmeler, K.M. (2020). The Use of Health-related Technology Reduces the Gap Between Developed and Undeveloped Regions around the Globe. *American Society of Clinical Oncology Educational Book*, *40*, 227-236.

Nhongo, K., Hoko, Z. and Kugara, J. (2018). Investigating Disinfectant By-products in Harare Potable Water Supply, Zimbabwe. *Journal of Water, Sanitation and Hygiene for Development*, *8*(3), 415-428.

Nirosha, K. *et al.* (2017). Automatic Street Lights On/Off Application Using IoT. *Int. J. Mech. Eng. Technol*, *8*, 38-47.

Nopilda, L. and Setiawan, A.A. (2019). Building the Environmental Care Culture in the Articles Society Trend. Proceedings of the Padang International Conference on Educational Management and Administration (PICEMA 2018). https://doi.org/10.2991/picema-18.2019.28.

Öhler, H. *et al.* (2019). Putting Your Money Where Your Mouth Is: Geographic Targeting of World Bank Projects to the Bottom 40 Percent. *Plos One*, *14*(6), e0218671.

Oleribe, O.O. *et al.*. (2019). Identifying Key Challenges Facing Healthcare Systems in Africa and Potential Solutions. *International Journal of General Medicine*, *12*, 395.

Olokesusi, F. and Aiyegbajeje, F.O. (2017). E-democracy for Smart City Lagos. Kumar, T. V. (Ed.). (2017). *E-democracy for Smart Cities*, Singapore: Springer Singapore. Oluwatayo, I.B. and Ojo, A.O. (2018). Walking through a Tightrope: The Challenge of Economic Growth and Poverty in Africa. *The Journal of Developing Areas*, *52*(1), 59-69.

Orji, I.J. *et al.* (2019). Evaluating Challenges to Implementing Eco-Innovation for Freight Logistics Sustainability in Nigeria. *Transportation Research Part A: Policy and Practice*, *129*, 288-305.

Patarroyo, D.J.R., Garzón, I.F.C. and Forero, C.A.L. (2019). Revision of Smart Street Lighting LED. *Ingeniería Solidaria*, *15*(2), 1-28.

Pathak, S. and Pandey, M. (2021).January. Smart Cities: Review of Characteristics, Composition, Challenges and Technologies. 2021 6th International Conference on Inventive Computation Technologies (ICICT), 871-876), IEEE.

Pettit, C. *et al.* (2018). Planning Support Systems for Smart Cities. *City, Culture and Society*, *12*, 13-24.

Pinfold, L (2018) Coupling Innovative Technology, Space Management and BIM Processes with Smart City Management: Congested Construction Sites in Urban Centres in Cape, Town South Africa. In Gorse, C. and Neilson, C.J. (eds). Proceeding of the 34th Annual ARCOM Conference, 3-5 September 2018, Belfast, UK, Association of Researchers in Construction Management, 727-735.

Porru, S *et al.* (2020. Smart Mobility and Public Transport: Opportunities and Challenges in Rural and Urban Areas. *Journal of Traffic and Transportation Engineering (English edition)*, *7*(1), 88-97.

Raja, R. and Nagasubramani, P.C. (2018). Impact of Modern Technology In Education. *Journal of Applied and Advanced Research*, *3*(1), 33-35.

Ranchod, R. (2020. The Data-Technology Nexus in South African Secondary Cities: The Challenges to Smart Governance. *Urban Studies*, *57*(16), 3281-3298.

Rathore, M.M. *et al.* (2018). Exploiting IoT and Big Data Analytics: Defining Smart Digital City Using Real-Time Urban Data. *Sustainable Cities and Society*, *40*, 600-610.

Reay, D. (2018). Miseducation: Inequality, Education and the Working Classes. *International Studies in Sociology of Education*, *27*(4), 453-456.

Ritchie, H. and Roser, M. (2018). Urbanization. *Our world is in data*. https://ourworldindata.org/urbanization.

Scott, G. and Rajabifard, A. (2017). Sustainable Development and Geospatial Information: A Strategic Framework for Integrating a Global Policy Agenda into National Geospatial Capabilities. *Geo-Spatial Information Science*, *20*(2), 59-76.

Shahsavari, A. and Akbari, M. (2018). The Potential of Solar Energy in Developing Countries for Reducing Energy-related Emissions. *Renewable and Sustainable Energy Reviews*, *90*, 275-291.

Silva, B.N., Khan, M. and Han, K. (2018). Towards Sustainable Smart Cities: A Review of Trends, Architectures, Components, and Open Challenges in Smart Cities. *Sustainable Cities and Society*, *38*, 697-713.

Silva, B.N. *et al.* (2018). Urban Planning and Smart City Decision Management Empowered by Real-time Data Processing Using Big Data Analytics. *Sensors*, *18*(9), 2994.

Simatele, M. (2021). E-payment Instruments and Welfare: The case of Zimbabwe. *TD: The Journal for Transdisciplinary Research in Southern Africa*, *17*(1), 1-11.

Singh, T., Solanki, A. and Sharma, S.K. (2021). Role of Smart Buildings in Smart City — Components, Technology, Indicators, Challenges, Future Research Opportunities. In: Solanki,A, Kumar, A and Nayya, A. (Eds.). *Digital Cities Roadmap: IoT-Based Architecture and Sustainable Buildings*, (pp. 449-476). London: Wiley and Sons.

Smys, S. (2020. A Survey on Internet of Things (IoT)-based Smart Systems. *Journal of ISMAC*, *2*(04), 181-189.

SOM News (2015). Skidmore, Ownings and Perrill Leading City Planning for New Egyptian Capital City. Press Release. https://www.som.com/news/.

Tan, S.Y. and Taeihagh, A. (2021). Adaptive Governance of Autonomous Vehicles: Accelerating the Adoption of Disruptive Technologies in Singapore. *Government Information Quarterly*, *38*(2), p.101546.

Tumbo, S.D. *et al.* (2018). Exploring Information-Seeking Behaviour Of Farmers In Information Related To Climate Change Adaptation through ICT (CHAI). *International Review of Research in Open and Distributed Learning*, *19*(3), 23-36.

Tundu, C., Tumbare, M.J. and Kileshye Onema, J.M. (2018). Sedimentation and its Impacts/Effects on River System and Reservoir Water Quality: Case Study of Mazowe Catchment, Zimbabwe. *Proceedings of the International Association of Hydrological Sciences*, *377*, 57-66.

Valencia, S.C. *et al.* (2019). Adapting the Sustainable Development Goals and the New Urban Agenda to The City Level: Initial Reflections from a Comparative Research Project. *International Journal of Urban Sustainable Development*, *11*(1), 4-23.

Wei, Y. D., & Ewing, R. (2018). Urban Expansion, Sprawl and Inequality. *Landscape And Urban Planning*, 177, 259-265.

Wilts, H. and Berg, H. (2018). The Digital Circular Economy: Can The Digital Transformation Pave The Way For Resource-Efficient Materials Cycles? Available online: https://epub.wupperinst.org/frontdoor/deliver/index/docId/6978/file/6978_Wilts.pdf

Wu, H., Zhou, X.G. and Hou, D.Y. (2019). Preface–ISPRS and GEO workshop on Geospatially-enabled SDGs Monitoring for the 2030 Agenda. *The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences*, *42*, 1.

Xiong, G. *et al.* (2021). Unbalanced Development Characteristics and Driving Mechanisms Of Regional Urban Spatial Form: A Case Study of Jiangsu Province, China. *Sustainability*, *13*(6), 3121.

Zvobgo, L. (2021). Consumer Ability and Willingness to Pay More for Continuous Municipal Water Supply in Chitungwiza. *Sustainable Water Resources Management*, *7*(2), 1-15.