Assessment Of Fourth Industrial Revolution (4 IR) Readiness In South African Municipalities

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Abstract
The study aims to investigate the significance of ICT strategies to improve service delivery. The study holistically explains the situation in South African municipalities through qualitative approach. The desktop analysis was considered, and information was compiled through literature review. The information was then analysed through conceptual and document analysis. The findings indicate that the municipal government in the country is falling behind because there is insufficient training centered on robotics, artificial intelligence (AI), and related fourth industrial revolution (4IR) aspects. Based on the findings, the article provides policy recommendations for improvement.

Key words: Capacity-building, local government, talent management, qualitative, service delivery.

Introduction

There are various challenges that municipalities face in adopting the Fourth Industrial Revolution (4IR) technologies. These may vary from inadequate staff capacity with technological expertise, inadequate infrastructure with lack of coordination of processes, lack of integration of technological systems, inadequate budget to invest in technological infrastructure, inadequate talent management to operate technological processes, weak leadership and poor governance with lack of strategy to implement technological platforms to offer smart services to community members. Erasmus (2021) draws attention to the fact that the country's progress toward the implementation of the 4IR and technological advancement is hampered by several factors, including inadequate infrastructure, financial constraints, poor governance, corruption, and capacity limitations. Vyas-Doorgapersad (2022) also emphasised that in the South African context, there is a 'lack of skills' that hamper the effective implementation of technological measures to improve delivery of smart services. Soga and Vyas-Doorgapersad (2022a) added that 'lack of skills' also underutilises the technological measures available in the municipalities; and 'lack of adequate skills' (Soga & Vyas-Doorgapersad 2022b) also leads to slow and delayed use of technological interventions available in the municipalities Erasmus (2021) suggested that to ensure efficient service delivery and raise community standards of living, the public and private sectors must work together for addressing these barriers and enable the implementation of 4IR technologies in municipalities (Erasmus 2021). This suggestion was supported by Shava and Vyas-Doorgapersad (2021; 2022) stating that technological platforms may assist municipalities to create better communication opportunities with community members. Through improved participation with citizens and stakeholders, municipalities may find strategies and resources to create digital opportunities to offer and receive smart services.

Utilising 4IR technology as a tool for service delivery is imperative for South African local government in this era of advanced technology. The 4IR is a process that is radically altering the manner people can communicate, operate and provide opinions for improved municipal services though digitalised platforms. It involves ongoing digital transformation, automation, and technology integration. So, to build capacity to use 4IR tools, ongoing training is needed (refer to Ayentimi & Burgess 2019). When it comes to delivering services in a way that is effective, efficient, and ultimately satisfying for communities, 4IR technologies can offer significant advantages. Furthermore, technologies have the potential to improve the way in which services are provided. 4IR encourages cost-cutting, paperless processes, administrative burden reduction, and remote access and support. By using technological platforms that are always available online, it can also increase community involvement. As a result, applying the 4IR can boost community involvement in public policymaking processes and decision-making meetings pertaining to the deployment of smart services. Municipalities must secure the support of stakeholders to guarantee that the implementation of 4IR in their jurisdictional areas is necessary.

The goal of the 4IR was to replace the traditional way of life with a more advanced and contemporary one. The technologies, including big data, blockchain, information and communication technology (ICT), artificial intelligence (AI), cyber security, and the Internet of Things (IoT), present an opportunity for both the public and private sectors for improved accountability, particularly in the field of public administration. 4IR presents a chance for South African municipalities to become smart cities. It gives municipalities support to demonstrate and deliver their services effectively and efficiently provide the services within their constituents. Therefore, municipalities need to undertake responsibility to ensure providing appropriate training to enhance skills, expertise and capacity of personnel to operate 4IR applications with advanced digital knowledge.

The lack of delivering of acceptable standards of services puts pressure on local government authorities in South Africa to come up with technological solutions to turn their municipalities into smart cities. ICTS, e-government, and tools and methods of the 4IR are the technological initiatives that are considered necessary to achieve the desired aim. It is therefore a necessity

to capacitate and educate community members and municipal staff about technology. This could improve everyone's ability to provide and receive smart services. It is imperative to accept that there are issues with the service users' and municipal employees' computer and 4IR literacy. The article henceforth considers that there are common challenges with capacity building that local government in South Africa is experiencing. Based on the findings and discussion, policy recommendations are offered for improvement.

The study concludes with suggestion that local government can accelerate service delivery by utilising a variety of 4IR interventions. Sahu et al. (2009) emphasised even more how e-government is tied to the electronic business operations of public administrative functions, which together aim to provide e-services to the populace or inhabitants in the context of municipalities. These activities also involve forming alliances with business entities to facilitate and maintain electronic transactions in every type of organisational setting. It is therefore some kind of stakeholder-inclusive public service delivery regime beneficial to all parties.

Conceptual Framework
In today's fast changing and quick pace environment, municipalities are required to have access to 4IR technologies and measures to offer smart services to community members. The quality of services provided to community members is positively impacted by smart city services. Most of the service users are residents or citizens, and they perceive as having undergone a significant transformation of lifestyle as their standards of living have improved (refer to Yeh 2017). According to Scholl and AlAwadhi (2015) through the adoption and use of ICTs, municipal governments can make significant progress in developing their smart web portals, where service users would then interface with their authorities and utilise administrative processes with ease. However, in furthering Scholl and AlAwadhi's (2015)'s argument, it is also evident that most municipalities at all levels - local, district and metropolitan—fail to provide efficient services. This claim is supported by the ongoing service delivery protests that municipalities deal with, where locals express their annoyance and displeasure with the subpar services provided in their jurisdictions. Local governments need to consider using technology-driven 4IR interventions in this situation to enhance service delivery.

Bhatnagar et. al. (2011) construed that establishing a more tangible, efficient, responsive, transparent, and effective public administration is the primary goal of 4IR electronic governance. It can be deduced that such an effective form of public administration is also imperative to create a culture of good, ethical and professional governance. According to Singh (2012), because this practice focuses on enhancing government processes and systems to establish and maintain a system that possesses all the qualities of good governance, including accountability, responsiveness, and people-centeredness, it can also be referred to as smart governance. Ncamphalala (2019) suggested that cities that adopt a smart city approach can improve urban living through embracing the benefits offered by 4IR based services. Key technologies will support this, including artificial intelligence (AI), distributed ledger technologies, which are increasingly promising for security, assurance, the pervasive form of connectivity, which together form an Internet of Things (IoT) enabled by fifth generation (5G).

The 4IR can be seen as an assortment of diverse value-chain accelerators, including AI, 5G, mobile broadband, 3D printing, cloud computing applications, automation, unmanned aerial vehicles (UAV), the IoT, genomics, biometrics, and block chains (Watson 2020). These have altered the way that organisations run their businesses, municipalities provide services to the local population, and society plans and executes its affairs. Artificial intelligence (AI) is defined by Ayinde and Kirkwood (2020) as any type of learning or intelligence that makes computers mimic actions by using language and form concepts and provide a variety of solutions intended to improve humanity. Since machines have drastically changed the way that complicated and delicate tasks are undertaken to support business, healthcare, social development, and research and development, it can be argued that AI is one of the 4IR's biggest game changers. Given how important data analytics and the role of data are to 4IR, block chain technology is another component of 4IR that is equally revolutionary. Sillaber and Waltl (2017) cited in Ayinde and Kirkwood (2020) stated that a distributed database, which is made possible by several computerised devices operating from a single central processor, allows block-chain technology to organise data into blocks that have cryptographic validation built in and can be used by individuals with crypto keys to manage files and records. According to this logic, technology enables states and towns in less developed regions to participate in the 4IR through data sharing, solve social issues, change people's lives, and increase the effectiveness of systems that are currently in use throughout the world. Just by investing in the end-user resources of these systems, cities can benefit from 4IR block chain technology (Ncamphalala 2024) in offering smart services (delivery of electricity, water, healthcare, education, billing, tender, to state a few). Moreover, value chain advancements fall under the category of contemporary advanced technologies, which Watson (2020) claims will have a significant and enormous impact on how humanity advances in addressing the many upheavals of famine and hunger, and in the case of South Africa the disasters like floods and droughts.

There are studies done in South African municipalities to justify these merits. Maseko (2018)'s study in the City of Johannesburg Metropolitan Municipality (CoJ) explores the use of advanced technological tools and applications by city authorities to deliver smart services. The technological terms used in the city documents are stated here. *Information management* is the process of managing and maintaining electronic services in governance (City of Johannesburg (CoJ) 2016). Furthermore, such a process includes a clear statement of the duties of service utilisers, and the critical responsibilities that are related to safeguarding data and information for the integrity of the system (Maseko 2018). *Information systems* is a phrase used to refer to the programmes which involve technological applications that are needed to administer information of data resources. These are thus focused on the creation, implementation, running, maintaining as well as timeously updating technological systems toward always attaining the goals of an organisation (Maseko 2018). *Information technology* encompasses all kinds of technologies that are needed to make possible for entities to smoothly run digital or technical programmes socially when related to support systems for these. These further incorporates the technological options needed to enable the systems that are needed for an effective strategy for managing information in organisation such as municipalities (Ncamphalala 2019:25). In the same vein,

the CoJ has various technological tools such as billing and procurement as part of the information technology systems of the entity (Maseko 2018).

Another study was conducted by Ncamphalala (2019) in the City of Ekurhuleni Metropolitan Municipality (CoE) where over and above, the city was seen as one of the most interconnected and digitally viable cities in South Africa as evidenced by the number of citizens that are accessing municipal commodities via smart solutions. Furthermore, Ncamphalala (2019) observed that ICT-based municipal service rendering has been part and parcel of the transformative agenda of the CoE. In the same vein, this strategic approach is discussed in the Growth and Development Strategy (GDS) 2025, the Integrated Development Plan (IDP), together with the Business Plan for the Implementation of Customer Care Centres as posited by Ncamphalala (2019). In addition, the CoE acknowledges that the transformation it needs is based on its ability to tap into the ICT sector towards making it's the manufacturing industrial hub that it thrives to become by 2055 (Ncamphalala 2019).

Despite the reservations and fears that may arise from the rapid technological investment in the 4IR, technological innovations are considered essential and the cornerstones of development (community, organisational, societal). According to Xing et al. (2018), these technologies have improved how committed people are to plan, carry out, and maintain these innovations. think that people will always be needed to organise implementation tasks and handle maintenance for newly introduced technologies. It is concluded that the world's entities are actively engaged in and benefiting from the 4IR above and beyond, particularly since it is riding a wave of massive globalisation. Therefore, to guarantee a significant and commensurate transformation in the provision of municipal services and to enhance the quality of life in their areas of jurisdiction, South African local government must allocate resources towards the effective implementation of 4IR.

To fully participate in 4IR activities, local government entities must also make sure that the new requirements are met, i.e., they must have the necessary technological and infrastructural resources, the necessary competencies, and a mentality that aligns with the vision of digitalised smart local governance in the provision of more intelligent, reasonably priced, durable, and customised public and municipal services (refer to Copping et al. 2018, in Ncamphalala 2019). It was stressed by Maseko and Vyas-Doorgapersad (2018) that with the changed technological environment of municipalities, whereby the manual tasks are replaced with digitalised processes, it is imperative that municipalities be equipped to offer service delivery through online platforms. The technological tools are getting advanced with time, it is therefore important that South African municipalities have appropriate skills and capacities to be e-ready to deliver smart services.

Methodology

The article adopted a qualitative approach to gather data. As a starting point, qualitative researchers highlight how reality is socially constructed, suggests Bauwens et. al. (2013). In qualitative research, the research design or strategy is determined by the decisions and actions of the researcher. Put simply, the chosen strategy is the focal point of the research project that the qualitative researcher develops, as suggested by de Vos et. al. (2002). The information was compiled through a comprehensive literature review that is a methodical approach to synthesising and compiling prior research (Snyder 2019). Additionally, Boswell and Cannon (2011) posit that the identification of the known and unknown aspects of a phenomenon under investigation is the primary goal of a literature review. Hart (cited in Grant & Osanloo 2014) stated that a literature review is important because it helps uncover and synthesise new viewpoints, find connections between theory and practice, justify the implications of an issue, understand the subject's structure, and connect theory and ideas to real situations with practical applications. Also to consider that the development of theory and the advancement of knowledge are made possible by a well-conducted and effective literature review, as emphasised by Snyder (2019). The information was analysed through conceptual analysis. Conceptual analysis is commonly understood as an explanation put forth to improve comprehension of the social reality or phenomenon under investigation. It includes the framework of beliefs, concepts, theories, presumptions, and expectations guiding the research (Maxwell 2005, in Auriacombe 2011:96). The data was also collected through document review and document analysis to assess information. When trustworthy documents are used, document review can yield trustworthy results; it is less vulnerable to participant biases, forgetfulness, and/or ignorance of certain topics; and it makes it simpler for third parties to verify results, which boosts confidence in the study's final findings (Bowen 2009). Additionally, researchers can quickly and inexpensively obtain accurate data through document analysis (Tight 2019).

Discussion and Findings

It is impossible to predict whether the 4IR will be successful in South Africa. This is because most developmental policies have not been put into practice in the past due to apartheid's historical experiences. Furthermore, there were many obstacles to overcome in the democratic transition. The effective implementation of sound policies by policymakers was impeded by various factors such as insufficient funding, insufficient human resources, inappropriate infrastructure, and a lack of investment in capacity-building. These factors raise concerns about the preparedness of municipalities for the 4IR. Nhede et. al. (2022) observe that the government of South Africa significantly relies on polices on technology and digitalisation. There is therefore a need for a comprehensive, detailed and descriptive 4IR Policy, and municipalities must be obligated to comply with the legislative framework of such policy.

Not all municipalities are financially viable, and community members are struggling with poverty and unemployment. In this situation, it is also not economical for community members to have smart gadgets to use smart services. It is also not expected from community members to leave their daily jobs and attend capacity-building workshops to understand 4IR interventions. This challenge is substantiated by the opinions of Sutherland (2020) who stressed the local economy is not a natural fit for the 4IR because it is primarily extractive, has a sizable informal sector, is plagued by the three evils of inequality, poverty, and unemployment. The study infers that even municipal personnel remain unequipped and cause skills-gap in technology in cases where municipalities are not financially viable.

It is important that funds can be raised and invested in smart systems because tasks that need a considerably long period of time can swiftly and affordably be replaced by a smart 4IR system to offer more efficient services, as suggested by Chou (2019). This is important as there is a digital divide within the country. Municipalities that are rich can afford to capacitate personnel and community members and have an adequate technological infrastructure to implement 4IR interventions. However, such digital divide also exists outside the context of individual countries, where 4IR may be more successful in developed countries as comparison to the developing countries due to the availability of human, financial and technological resources. Pollitzer (2019) argues that when it comes to making the huge injection of capital into *inter alia*, in research innovation towards creation of smooth and reliant cyber-physical systems that are inherently 'smart', 'safe', and 'secure'-developed countries are more than prepared for the 4IR than developing ones. This is an area of further discussion and may form part of future publications. Overall, governments across the world should take advantage of the opportunities that this era (4IR) presents to them in terms of how these can accelerate interventions to solve challenges (Thani 2020). In South Africa, these challenges could be the fighting of poverty, poor living standards in communities, high rates of unemployment, stunted community development and unsafe communities. In addition, Thani (2020), highlights the huge challenge of poor skills development that makes the government to tread with investments in technology carefully. Shava and Hofisi (2017) argue that the economy of the white-collar and blue-collar sectors are expected to contract during this time, and upskilling and skill development related to technology will become more difficult. Having to deal with unemployment and inequality amid this enormous technological revolution only makes the situation worse (Shava & Hofisi 2017) This further affirms how South Africa is lagging as far as embracing the 4IR is concerned, something that is not good news to the plight of poor citizens (Thani 2020) who struggle the most with ineffective and insufficient basic services. A reformed public service is premised on how much of the internet and other 4IR tools a government adopts and uses; and that is creating serious differences between those that adopt and those that do not (Farris et. al.2009). Therefore, all the three tiers of government (national, provincial and local) need to amend their traditional tasks and incorporate the new technological applications to offer smart services through smart governance.

Esposito and Kapoor (2022) noted that, in the 4IR era, with the advent of fresh ICTs like 3D printing, technopreneurs with innovative designs can now launch small businesses at a reduced start-up cost, all without the time constraints associated with the now obsolete old-fashioned prototyping approaches. The conventional entry obstacles are eliminated from the promotional mix of marketing. Also, growing trends in AI indicate the comings of huge economic interruptions in the immediate and coming future in the 4IR (Walther 2021). It was also stated by Xu et. al. (2018), that AI systems that logically answer composite problems create a genuine threat to numerous jobs and careers while they also give a ray of hope for sustainable community development. An article by McKinsey revealed that a majority of currently existing jobs and occupations are going to move to automation using emerging 4IR technologies thereby enabling cost-cutting by entities that invest in these tools and packages (Esposito & Kapoor 2022). For example, self-driving automobiles will replace pay services such as Uber while self-driving trucks will significantly transform the shipping sector and make it more efficient (Xu et al. 2018). Furthermore, cutting-edge ICTs will integrate many technical and technological modalities to revolutionise interactions between government and governed.

Robots have been used in some countries as a support to deliver services efficiently, especially in the fields of medical science, engineering, healthcare, and industrial sectors such as agriculture and mining, to state a few. One nation that has made investments in 4IR technologies and significantly changed the way public services are delivered is the state of Israel. One 4IR innovation company that has made investments in robots that can do almost any task in the field of AI and robotics is Boston Dynamics (Darlington 2020). Digitisation is revolutionising many other countries as well. A comparative analysis of best practices will be compiled in the upcoming publications, which will examine case studies of selected nations. Consequently, automated machines have a huge potential to advance living standards and the quality of lives across all spectrums of modern society, bet it in work situations, at home and other spheres (Yang et al. 2020). It is argued by Billari et. al. (2020:1060), that ICTs and the 4IR have an effect of being elitist while it drives its genuine transformative agenda. While ICTs may level the playing field in some instances, they also have an exclusionary impact especially between the haves and have-nots. The study infers that, in general, the 4IR opens doors that, with sufficient infrastructure investment, will benefit even the most isolated and impoverished rural communities in developing nations. Harvie (2019), postulated that, the improvements in ICTs and progress in the locomotion sector has been at the fore of globalisation of (free) markets and financial accumulation. In the same vein, the slackening of trade hurdles and the freeing of national economies managed to reduce distances between regions, countries and societies creating a well-knit community of global citizens (Shang & Shang 2019). Also, it is argued by Pereira et. al. (2017) that as a result, local government organisations are exposed to a wealth of knowledge, statistics, and opportunities that they can take advantage of. The globalisation of 4IR represents a promising formula for obtaining information and generating innovative ideas that have the potential to revolutionise societies (Pereira et al. 2017). The technological networks are not geographically restricted. The 4IR hence offers national and local government organisations a chance to create seamless collaborations and strengthen ties between the developed and developing worlds, which could result in a swift transfer of technologies from the latter to the former. Also to note that, economic networks and production are no longer limited by physical borders since big businesses can locate or sell their goods in practically every market on the planet. Similarly, cities continue to be significant in this sense as hubs for services and labour as well as growing as places for entertainment and recreation (Choi 2020) that may create more job opportunities and bring socio-economic development to municipalities.

Technology has become a requirement to run processes in almost all organisations globally, and its impact has different outcomes-either it is seen as a fear or an alternative to improve services. There is a fear that technology may lead to job losses as humans may not be required to do tasks that technology can perform through Robots, AI and internet. From a humanistic standpoint, Postelnicu and Calea (2019) noted that despite the proliferation of ICTs, automated machines may never acquire the natural ability to show empathy, ethics, emotions as well as professionalism that is naturally endowed with human capital. While supporters of this era regard it as a catalyst of socio-economic-politico development, Ayentimi and Burgess (2019)

acknowledge that it also comes with an equal measure of baggage in the context of it changing the geopolitical dynamics, the choice of customers and increasing consumerism is significantly changing how goods are produced, and how labour market's function. Some of the envisioned fears posed by the 4IR include the shortages of soft skills especially in various ICT fields (Markowitz 2019) that is a challenge faced by many municipalities in the country.

The 4IR has many advantages, but there are also several significant obstacles to overcome. Contrariwise, because of its potential to upend job markets, the digital revolution may lead to more inequality across the globe. The net dislodgment of employees by automated machines can change the differences between the return on labour or capital investments (Xu et al. 2018). Prisecaru (2017), notes that in the 4IR, the rarest and most treasured resource of the 4IR is not going to be the labour or capital the society is used to knowing, but the entrepreneurs and creators of novel ideas and systems. Thus, soon, talent and creativity are going to be the pinnacle of what is critical, not physical or ordinary labour. Additionally, Spencer (2018:8) advises that, the pool of talent that has innovative ideas or soft skills is going to become the scantest and most expensive supply. Bloomberg Global Business Forum of 2017 quoted Tim Cook (Chief Executive Office of Apple Inc.) referring to the need to monopolise the world talent as the goal that leaders must now seek to attain if they are to dominate global production and inventions (Xu et al. 2018). This will ensure that there is a high demand for technological and innovation-based talent and that organisations all over the world can benefit financially from hiring such talent.

Conclusion

Municipalities in South Africa face difficulties despite the availability of 4IR opportunities. These include the problems caused by free Wi-Fi being unavailable in certain areas, which are necessary for using different 4IR applications. The municipality's lack of computer literacy and 4IR expertise, which influences how the 4IR solutions are integrated into its service delivery programmes, is another obstacle preventing the full realisation of the benefits of the 4IR. The ability of community members to interact with the municipality's e-governance applications and that of municipal officials are the two aspects of this, making it a two-pronged approach. Additionally, there is the question of the independence of service providers, like internet or mobile network providers, whose cooperation and sincerity are essential to the success of smart city government solutions.

Municipalities need to invest in capacity-building initiatives equipping both internal customers (personnel) and external customers (community members). The budget needs to be allocated for talent management workshops. Technological infrastructure needs to be adequately integrated with all municipal services for easy access. Municipal websites need to be user friendly and simple to operate. There needs to be an IT customer service booth for community members to discuss IT related challenges. This booth can be established at either municipal office or preferable to various community centres that are geographically close to end users. Technology is the present and future, and this awareness needs to be accepted and obligated by municipal government and community members.

The article aims to contribute towards the disciplines of information technology, local government, and public management. The limitation is related to the fact that study is comprehensive hence could not incorporate interviews to gain insight from the municipal personnel. The information would have added value to understand the types of challenges municipalities face to implement 4IR initiatives effectively. Future studies may decide to select a few municipalities to gather primary data and with time may form part of longitudinal-comparative studies.

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