

A RETROSPECTIVE ANALYSIS: ICT FOR IMPROVED MUNICIPAL SERVICE DELIVERY AMIDST COVID 19

Juliet Joseph¹✉

jjoseph@uj.ac.za

Robyn Williams¹

*¹Department of Politics and International Relations
Centre for African Diplomacy and Leadership (CADL)
University of Johannesburg
Auckland Park, South Africa, PO Box 524, 2006*

✉Corresponding author

Abstract

South African municipal service delivery has been an area of highly debated concern, with many citizens lacking access to basic service delivery, such as water and electricity. Fast forward to the Covid-19 Pandemic, bombarding itself into every state, home and workplace and concerns over municipal service delivery has amplified. Much like Covid-19, the fourth industrial revolution too erupted into every facet of public and private life but more optimistically, so as it promises to fast track economic development, ease mundane daily tasks and improve services and systems. This article explores municipal service delivery in South Africa and its intersection with emerging technologies, further providing prospects for future application. The article relies on a qualitative approach, reviewing primary and secondary literature, such as statistics, reports and journal articles to explore how advanced and emerging technologies have been applied at a local level to improve municipal service delivery, further attempting to understand future prospects. From the findings of the study, it is evident, that protest action against municipal service delivery has escalated in the last few years, signifying possible worsening service delivery and little adaptation of new methods and technologies. However, there have been some attempts to improve service delivery, utilising emerging technologies, but much more can be done as illustrated in other states, at a local and national level.

Keywords: Fourth Industrial Revolution, municipal service delivery, local government, emerging technologies, Covid-19.

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1. Introduction

Globally, the coronavirus (Covid 19) pandemic has led to unprecedented concern about governance in nations. On 11 March, 2020, the World Health Organisation (WHO) declared the disease a global pandemic [1]. The Covid 19 pandemic continues to be a security threat, and therefore the WHO has provided global intelligence on the pandemic and has taken the lead to find a global solution to this issue.

The outbreak of coronavirus (Covid 19) disease was reported by the Wuhan Municipal Health Commission, China, in Wuhan, Hubei Province. Coronavirus is an infectious disease that affects the respiratory system of the body. Coronavirus disease (COVID -19) is an infectious disease, caused by a newly discovered coronavirus [1]. Coronavirus disease 2019 (COVID -19), is a severe acute respiratory syndrome virus [2], a non-traditional security threat, whose impact continues to haunt states, such as the Southern African Development Community (SADC) and has impacted governance and service delivery in the region. In early March 2020, South Africa reported its first Covid 19 case.

Since the end of apartheid, South Africa's local government legislative frameworks and structures have adopted democratic reform, instituting three types of municipalities, namely metropolitan municipalities, local municipalities and districts municipalities. These municipalities are responsible for the provision of essential goods and services and the development of local areas, as local government remains the first point of contact between citizens and government [3]. Notably,

local government is largely responsible for providing basic services and advancing development within their respective communities.

Section 24 and 27 of the Bill of Rights grants a specific right to access sufficient water and Section 27 highlights that everyone has the right to have access to sufficient water and further affirms that the state must take the necessary step to ensure that people have access to water. As a result, South Africa's local government has come under pressure due to the impact of globalisation, increasing threats to human security, such as social and economic challenges during the emerging Covid 19 pandemic.

In parallel with these reforms, there has been an increased focus on greater innovation and the use of technology to further develop systems for improved service delivery. The magnitude of the importance of 4IR was spotlighted when President Cyril Ramaphosa announced the Presidential Commission on the Fourth Industrial Revolution (PC4IR), emphasising the country's willingness to transition to a more industrialised state. Despite the commission's formation, implementation remains a major challenge, associated with local government service delivery and administration [4–6]. Further to this, an example includes the ATM pharmacy projects, implemented in 2018, focusing on easing the process of medical prescription procurement in rural areas. The Pharmacy Dispensing Unit (PDU) requires individuals to scan their Identity Document (ID) and enter their pin. Once complete, the technology connects the customer with a pharmacist, depicted on the screen, then engage. Once the prescription is confirmed, the innovative system collects the medication and dispenses it [7].

Furthermore, the City of Johannesburg has also started making use of mobile applications to report potholes. The Pothole Patrol App was launched in October 2021, where users report potholes using a GPS location and adding an image. The app also allows users to follow up on the status of their report [8].

Given this, Landsberg [9] suggests the execution and implementation of policy outcomes are the major hurdle, facing institutions in Southern Africa. This can also be seen to apply to the need for greater incorporation of ICT in municipal strategy at all levels to better involve citizens in decision-making on local issues and ensure effective service delivery by local government [10]. Given the advances in service delivery by municipal government, there remains the need for the effective and efficient implementation of technological advances, related to the 4IR strategy that will impact on better municipal service delivery outcomes.

The current municipal governance architecture and frameworks alone does not address these challenges and threats as demonstrated by the increasing challenges in South Africa in accessing these basic needs [11]. This is due to the fact that prior to the Covid 19 pandemic, municipalities and their service delivery strategy were more traditionally oriented and focused predominantly on face-to-face or on-site services, without an integrated hybrid model with integrated technologies for improved local government.

Visser and Tinomurinzi [10] suggest that governance can be improved through the use of information and communication technology (ICT) for improved municipal service delivery in South Africa that goes beyond traditional structures or inadequacies and puts citizens first by demonstrating relevance, impact, social significance and innovation for better services. This is echoed by Bhatnagar [12] who states that governance can be improved through the use of ICT as it increases efficiency, accountability, transparency and reduces corruption.

However, as will be shown, South African municipalities have adopted several approaches to achieve more effective and efficient service delivery through ICT. However, these methods have been very limited due to a lack of implementation connected to the lack of political will, municipal resistance to change, commitment and collaboration between municipal structures and within local government. Factors, such as the associated financial costs, insufficient funds available for new technologies, willingness to implement technologies in a timely manner, stronger collective coordination, and adequate human and logistical capacity, have prevented municipalities from achieving their service delivery goals and further amplified during the Covid-19 pandemic.

For this reason and several others, South Africa is a unique case study for analysing local government and ICT strategy for improved service delivery.

Research objective: To examine how emerging and advanced technologies, driven by 4IR, have been integrated into municipal service delivery in the South African context and to offer possible strategies to improve service delivery at the municipal level.

2. Materials and Methods

The study adopted a qualitative stance, taking a desktop approach as researchers explored an array of primary and secondary literature, which include national statistics, government reports, journal articles, interview documents.

A literature review was conducted initially to collect, search and evaluate definitions, theories, policies, viewpoints, principles, methods and other research findings, as well as collected statistics from municipal institutions. The study examined the technological advances of municipal governance and administration.

There were many different sources reviewed, including documentaries, reports, press releases, manuscripts, articles, the Internet, strategic and operational frameworks of municipal services, strategic plans, protocols, and municipal audit reports, related to municipal governance.

3. Result

3. 1. The Fourth Industrial Revolution and its ramifications on the globe

4IR continues to take the world by storm, creeping into every facet of public and private life. It can be understood as the convergence of physical, biological and digital spheres, propagating ‘technology-driven change’ [13]. The force of 4IR is far greater than any previous industrial revolution and virtually inevitable. The speed, scale, and system impact distinguish 4IR from the third industrial revolution [1]. The advent of 4IR is creating a new, virtual world that increasingly relies on advanced technologies, such as artificial intelligence (AI), the Internet of Things (IoT) and Big Data.

Schwab [14] emphasises that technology will impact economic systems, society and development. In an interview with the Mail and Guardian [15], Nicholas Davis described 4IR as another stage of human development, affecting work and its execution, skill acquisition and development. While there are legitimate concerns about the accessibility, adaptation and implementation of 4IR in developing countries, Schwab (10) sees the recent industrial revolution as potentially providing an opportunity for states to leapfrog development stages, increase income levels and improve living standards. However, it should be noted, that individuals and states that have benefited from a digitised society often have the financial means to afford to improve daily efficiency and overall quality of life. Simple services, such as online shopping and internet banking, have improved everyday tasks. In the long run, the adoption of 4IR will be cost-effective and increase efficiency and flexibility.

Technologies relevant to 4IR include AI, also known as Machine Learning (ML), Big Data and the IoT. AI remains the most pervasive, complex, and influential technology as it comes in various forms and consists of a range of functions, such as self-driving cars, robotics, drones, and voice and facial recognition. It can help find solutions in a human-like manner and also can generalise, reason, learn and recognise the significance of previous mistakes [16]. Moreover, with its advancements, AI is capable of analysing data and drawing near-perfect conclusions. It is also worth mentioning, that there are strong AI and weak AI [17]. The former is able to think and behave like a human and learn from their experiences. The latter can only do what it was programmed to do and cannot think independently or operate beyond its original scope.

Big Data consists of volume, velocity, and variety and enables organisations to quickly capture, shop, interpret, manipulate, and manage large amounts of data to produce relevant insights [18]. The expansive amount of information exceeds previously manageable aggregates [19]. Furthermore, these large amounts of information that researchers can access enable the identification of patterns and predicting future events.

Information and Communication Technologies (ICT), also commonly referred to as Information Technology (IT), is a grouping of telecommunications and communications with computer

software and middleware. It has storage and audiovisual systems that allow users to access, shop, transmit, and manipulate information [20].

IoT welcomes a newer, more sophisticated form of connectivity where different objects can communicate with each other. It can be understood as an extension of the internet that allows digital and physical domains to be included [21]. With the IoT, information is instantly accessible, and systems can be controlled remotely. Examples of IoT implementation include logistics, a smart water supply, and smart parking lots. Applied in different systems, the IoT has many different meanings - but that depends on its use and implementation.

One important transformative technology responsible for the continuous evolution of communication is natural language processing (NLP). Verspoor and Cohen [22] describe NLP as the distortion of unstructured streams of input data (texts) by integrated components systems. Different components are responsible for different aspects of the learning process. Aspects include adding structure and analysing relationships and components. Some examples of what NLP is capable of are extraction, summarisation, and language translation. This can be done through speech recognition, natural language interpretation, and the generation of interpretable text [23].

The subfields of NLP include Natural Language Understanding (NLU) and Natural Language Generation (NLG). NLU is a process of extracting information to understand the purpose of a sentence [24]. NLG then follows by generating responses. Latent Dirichlet Allocation (LDA) is a useful technology that is becoming more prevalent in government agencies. It is a form of topic modelling that pulls patterns from a sea of unstructured data. Users can then identify patterns and draw conclusions [25].

[1] The third industrial revolution is also known as the Digital Revolution that occurred in the second half of the 1900s, coinciding with the emergence of the internet, the spread of digitisation and automation, and nuclear energy discovery [26].

3. 2. The notion of governance

Historically, governance was first used to refer to business relationships. In other words, governance was not once understood in terms of government and legal authority. The term governance can be defined by The Economist as “the act, manner, office, or power of government [27].” Scholar Soderbaum [28] states that governing means “by whom, for whom, and for the purpose of whom?” At the international level the concept of governing aims at ensuring justice and the welfare of the people.

The traditional notion of governance emanated from domestic politics and involved the idea of a government. Given this, national governance involves the participation of non-governmental organisations (NGOs) and actors who exercise their authority and legitimacy. Hence the notion of governance has become synonymous with the idea of governments. On the African continent, governance has been associated with localisation, decolonisation and human rights [27].

Notably, it is important to note that governance entails more than governments; it can be defined as focusing less on socio-political and political-economic processes. Hence the term governance encompasses systems of rule, sustainability, power and legitimacy. One of the challenges identified, facing the notion of governance, is the fine line between elite governance and governance for the citizens. Suggesting that the notion of government should serve ordinary men and women within the state in a non-discriminatory manner. As elitist governance, which remains an important topic in a post-colonial context, is weak and lacks legitimacy. Given this, Soderbaum [28] distinguishes three types of governance: neoliberal regional governance, sovereignty pride governance, and regional shadow governance.

Good governance can be said to be state-centric and linked to national interests. For this to happen governance concepts need to be broadened beyond formal public governance to include multi-stakeholder engagement, formal and informal, and public-private partnerships [28]. In short, governance is constructed by specific interest groups for specific purposes. On this point, governments are social constructs that include major metropolitan areas or districts that are politically contested. States are political and encompass social projects, created by human actors to protect and change existing structures. Social, political and economic actors thus exercise governance within states. Hence, governance takes place at national, sub-regional and international levels and

encompasses spheres of power at the state level; it includes both formal and informal public private partnerships [28].

James Rosenau defines governance in terms of government activities, common flows, goals implemented, and policies pursued [27]. The World Bank defines governance as the use of power and resources within a state by political regimes, the authority of economic and social resources, and the ability to implement policies. The United Nations Development Programme (UNDP) [29] defines governance as the exercise of political, social, economic and administrative authority, through which groups express their needs, civil liberties and duties. The Organisation for Economic Development and Cooperation (OECD) defines the concept of governance as political authority, the exercise of control over resources for social and economic development, the building of infrastructures and relationships between power holders and citizens, and the integration of governance into institutional processes of society [30].

Governance is thus the process of building relationships between the state and its citizens. Scholar Soderbaum [28] notes that governing means “by whom, for whom, and for the purpose of whom?” At the international level, political economy is based on structure, history, power, and change. The concept of governing is to ensure justice and the welfare of the people. Evidence suggests that since the Cold War, state welfare has fallen by half and has become a contentious issue and state autonomy has been eroded by the involvement of actors, such as non-governmental organisations that have gained authority and resources through technology [27].

3. 3. South Africa’s municipal governance structures

In South Africa, city councils came into being as part of the reform of local government. In order for cities to become metropolises, city councils were created during reforms in the 1990s and are administered as semi-autonomous units under the provincial government. Large metropolitan municipalities grew out of a collection of smaller jurisdictions that existed prior to 1994. This shift from apartheid policy to robust policy led to an effort to provide municipalities with equal access to resources. After the apartheid policy with its segregation and unequal distribution of access to basic services for communities, 8 large municipalities were created through local government reform. The aim of these councils is to meet the needs of local communities, bridge the gap between parliament and grassroots needs, and address issues, such as local economic development of infrastructure and provision of basic services to the general population [31].

The constitution provides for three categories of local government structures, namely municipalities. Currently, there are 278 local governments. Within the three categories of municipalities, there are eight large urban municipalities (Category A), 44 district municipalities (Category C), and 226 local municipalities (Category B). Each municipality has a specific mandate, set out by the Constitution, the Local Government: Municipal Structures Act, 1998 (Act 117 of 1998) [32], bearing in mind that Category A municipalities can only be established in metropolitan areas. In addition, each municipality has a unified municipal budget, a common system for grading land and charging for services, and a unified employers’ organisation.

South Africa has eight metropolitan municipalities, namely: Buffalo City (East London); Cape Town (City of Cape Town); Ekurhuleni Municipality (East Rand); City of eThekweni (Durban) City of Johannesburg; Mangaung Municipality; (Bloemfontein); Nelson Mandela Municipality (Port Elizabeth) and the City of Tshwane (Pretoria). Municipal governments can devolve powers and functions. However, all original municipal, legislative, and executive powers are vested in the Metropolitan Council (**Fig. 1**).

Metropolitan areas have different types of executive systems: the mayoral executive system, where executive powers are vested in the mayor, or the collective executive committee system, where these powers are vested in the executive committee [31]. The non-metropolitan areas consist of district councils and municipal councils. District councils are primarily responsible for capacity building and district-wide planning. The Local Government: Municipal Structures Act 1998 [32] provides for municipal committees, whose functions include: developing, executing, monitoring, and evaluating the operations and functions of municipal councils and their services to communities.

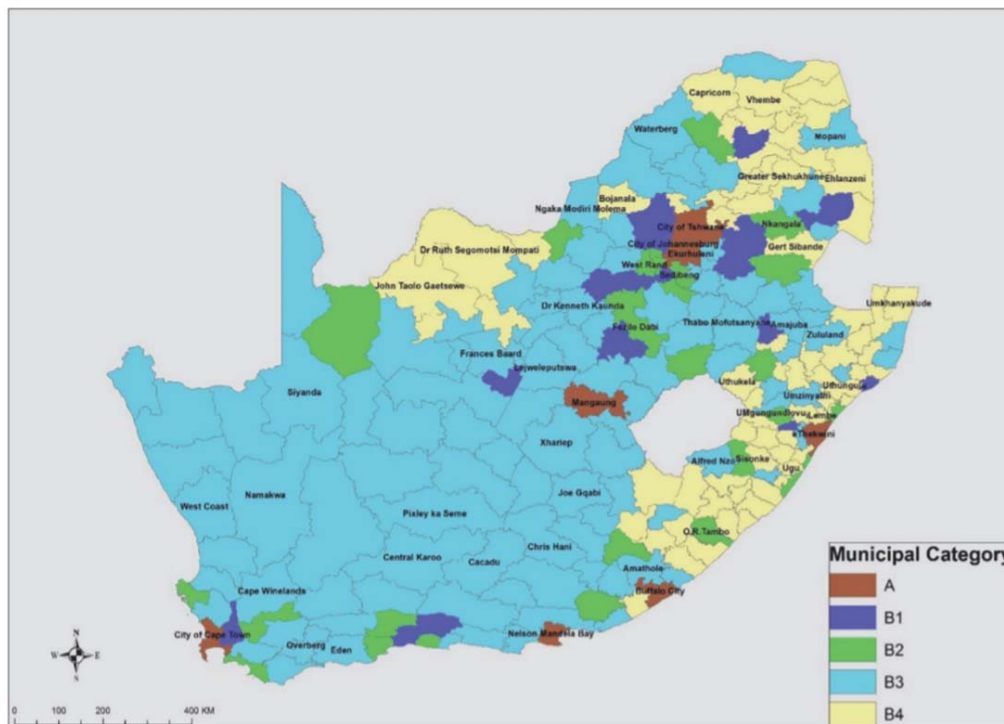


Fig. 1. Distribution of Category A and B municipalities, 2016 .StatsSA [4]

De Visser [33] points out that weak leadership, poor operations and lack of strategic decision-making lead to dysfunctional municipal structures. It is worth noting, that there have been many positive changes in the post-1994 period, such as the restructuring of local government, which has had a positive impact on the profile of local authorities, and the introduction of new leadership, which is remarkable compared to the apartheid local government years. Prior to 2000, the structure of municipalities was largely administrative and not policy oriented. In the post-2000 period, municipalities form a compromise of a large council and a strong executive, largely centred on a mayor. The council is chaired by a separately elected speaker and the administration is led by a municipal director who works closely with municipal boards [32].

The aim is for municipalities to implement by-laws, network with community stakeholders, and work together to achieve set objectives. Women undoubtedly have an important role to play, as community participation in municipal plans is a cornerstone of their existence and decision-making is integral to their role. Most importantly, new trends are emerging in how best to implement this mandate.

The municipalities are responsible for the following: Electricity supply, sewage and solid waste disposal, municipal health services, municipal roads, street commerce, parks and recreation, local tourism, water and domestic use, stormwater systems, fire services, land use decisions, municipal public transportation, slaughterhouses and fresh food markets, and libraries and other facilities.

Metropolitan areas are defined as large urban cities and towns, smaller cities and towns, while district councils cover larger geographical areas of low population than local councils. The Structures Act (117 of 1998) contains provisions for the design and conduct of elections, including the requirement that half of the candidates on political party lists must be women [32]. In addition, the Act provides for the formation of community committees to advise the municipality on local matters. It also allows for women's participation and equal representation on community committees to influence the council's decision-making processes [34].

3. 4. A review of South Africa's municipal governance and service delivery challenges

In South Africa, governance is primarily a redistribution of power, authority and structures, aimed at redressing injustice and inequality in the existing order. It can be said, that neoliberal governance works well for advanced liberal societies, but social conditions make it difficult to

apply the technologies of governmentality to positively affect different parts of the world, such as a developing world like South Africa [35].

Naz [36] and Kaliannan et al [37] indicate that ICT improves the delivery of municipal services in developing countries. Hence, ICT has been shown to transform public sector reform, to support the delivery of better community services when implemented efficiently and effectively [38].

Notwithstanding the existence of the digital divide, which many claim prevents the effective use of technology. Mimbi and Bankole [39] in their study of ICT efficiency in public services in 53 African countries point out that African countries like South Africa still need to improve on the efficient use of ICT to create public value. According to their study, “After more than a decade of ICT use in Africa, the most efficient group (18 countries) used ICT 39 percent of the time to create public value” [39] (Fig. 2).

Cluster 1 Countries	Efficiency Score	Cluster 2 Countries	Efficiency Score	Cluster 3 Countries	Efficiency Score
Mauritius	0.0338	Congo	0.1194	Côte d'Ivoire	0.1057
Seychelles*	0.0268	Equatorial Guinea	0.1193	Malawi	0.3292
Algeria	0.0340	Zambia	0.2104	Ethiopia	0.5113
Libya	0.0342	Ghana	0.1606	Gambia*	0.0639
Tunisia	0.0393	Sao Tome and Principe	0.0760	DR Congo **	0.6880
Botswana**	0.0746	Kenya	0.1639	Liberia	0.3669
Egypt	0.0359	Angola	0.1208	Guinea-Bissau	0.1927
Gabon	0.0553	Swaziland*	0.0685	Mali	0.2931
South Africa	0.0474	Tanzania	0.2785	Mozambique	0.3371
Cape Verde	0.0546	Nigeria	0.1636	Sierra Leone	0.6104
Morocco	0.0407	Cameroon	0.1086	Guinea	0.5901
Namibia	0.0657	Madagascar	0.3065	Burkina Faso	0.2794
Mean Score	0.0452	Zimbabwe	0.1105	Burundi	0.4788
Total Countries	12	Mauritania	0.1310	Chad	0.3324
Cluster 1		Comoros	0.1008	Eritrea	0.6854
Minimum	0.0268	Lesotho	0.1265	Central African Rep	0.5136
Maximum	0.0746	Togo	0.1299	Niger	0.4542
Cluster 2		Rwanda**	0.5999	Somalia	0.2662
Minimum	0.0685	Uganda	0.2931	Mean Score	0.3944
Maximum	0.5999	Benin	0.1581	Total Countries	18
Cluster 3		Mean Score	0.1773		
Minimum	0.0639	Total Countries	23		
Maximum	0.6880				

Fig. 2. Data Envelopment Analysis (DEA) Results for ICT Public Value Creation (2005-2014):
* represents the countries with the lowest efficiency score and ** represents the countries with the highest efficiency score [39]

Fig. 2 illustrates: first, ICT creates public value. Second, based on the level of human development, directly related to service delivery, cluster three is the best performing among the clusters, followed by cluster two. The results suggest that there was low use of ICTs to create public value, especially in the countries in the first cluster, South Africa falls into this cluster. In view of these findings, a greater commitment to the use of ICT is needed in South Africa to improve public service.

Moreover, better service delivery can be achieved even more effectively through appropriate democratic combinations that promote the involvement of civil society in decision-making and the creation of public-private partnerships. Against this backdrop, neoliberal governance is the dominant force in the South African government and should also be promoted from outside the state to achieve greater legitimacy as it risks continued radical participation of civil society in South Africa, such as through social discontent and municipal protests [40]. Notably, ICT bridges this gap

by ensuring open communication, engagement, participation, and inclusion in decision-making for good governance. ICT can also help address key challenges, facing local governments, such as improving leadership and governance by creating greater transparency and accountability, addressing historical shortcomings, related to structural, strategic and operational reforms by operationalising workflows that address current gaps in the system,

The situation of governance in South Africa is more complex than portrayed as there are formal, informal, public and private sectors, suggesting multiple stakeholders are involved in the process. Further to this, ICT and new innovations in governance are an evolving phenomenon that can drive reforms for a better future for the region. This can only be achieved if current challenges are addressed, such as overcoming the digital divide and a greater commitment by the municipalities to overcome service delivery deficiencies. The role of municipalities and their use of ICT in South African governance therefore remains a contentious issue that has become even more important since the outbreak of the Covid 19 pandemic. ICT and innovative technologies can certainly play a role in the urgency of municipal service delivery reforms, needed to incorporate ICT and innovation more effectively into current administrative structures and systems. This is even more true for how local governments promote participatory democracy, advance democracy, and address threats to human security, ultimately impacting socio-economic development, improving access to services for citizens (**Fig. 3**).

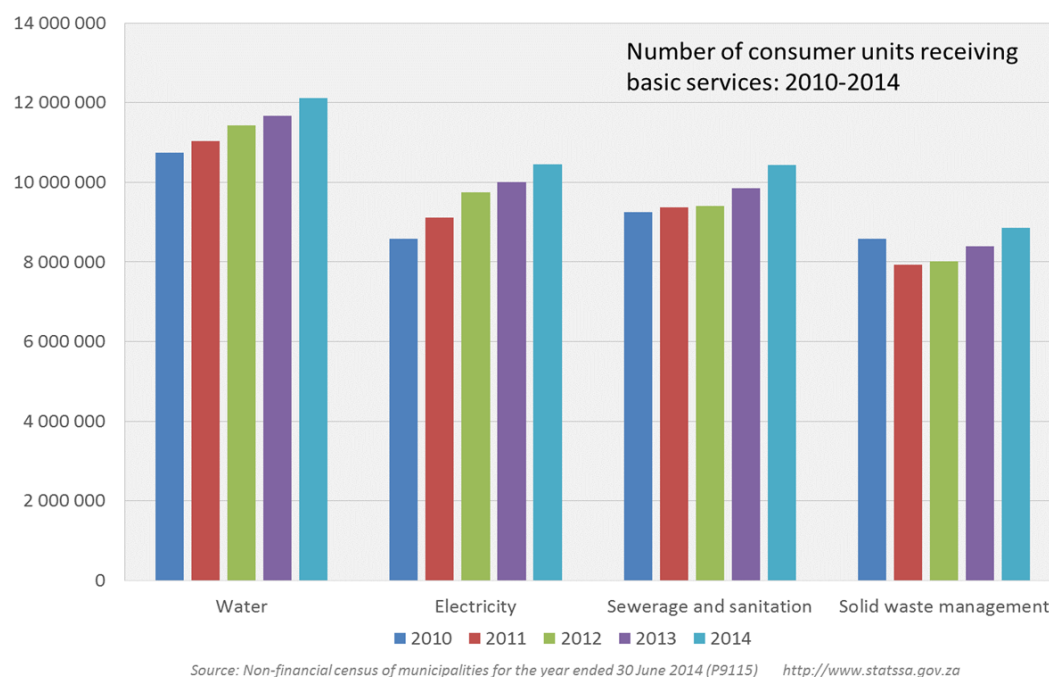


Fig. 3. Number of consumer units, receiving basic service in South Africa's municipalities [41]

Although many citizens of South Africa lack access to water and sanitation, electricity and adequate infrastructure, there is a need to rethink the current strategy and operations amidst changing global developments due to the global pandemic and advancing technological innovations. Further to this StatsSA [4] suggest that South African municipal governance service delivery challenges can be seen to be connected to the backlog of basic services that predominantly service some communities, overlooking others, increased migration to major metropolitan areas, leading to increased demand for services using current structures or systems, neglecting the maintenance of these systems in place. As a result, Municipal IQ [5] notes that protests against municipal services are related to lack of water and sanitation, power outages and lack of infrastructures, such as housing and roads in the three municipalities with the most protests against municipal services in 2019, namely Gauteng, Kwazulu Natal and Western Cape (**Fig. 4–6**).

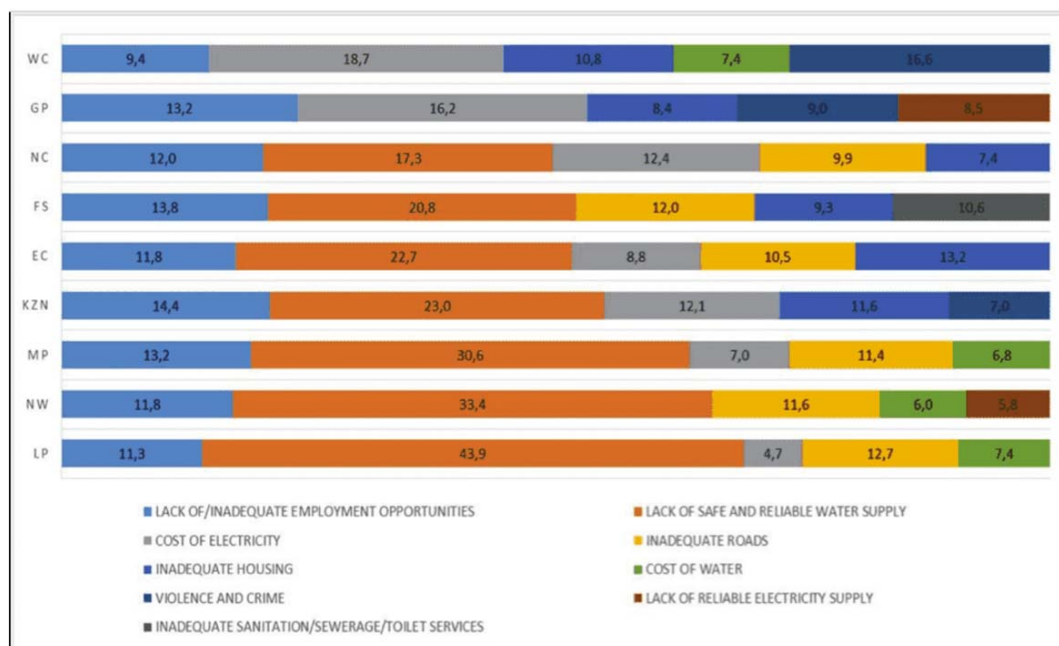


Fig. 4. Five leading challenges, facing municipalities presently as perceived by households by province, as percentage of all main challenges, Statistics South Africa 2016 [42]

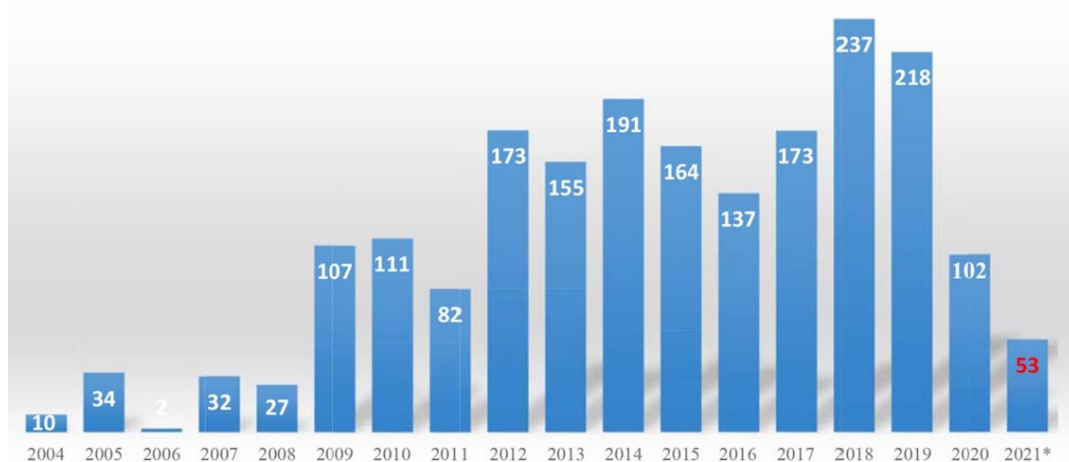


Fig. 5. Major service delivery protests from 2004 to 2020. Municipal IQ [5]

Protests against municipal service delivery, of which there have been hundreds in South Africa alone in recent years, are primarily related to inadequate access to water, sanitation and refuse [43]. These failures in service delivery disproportionately affect poorer communities and households [44].

Furthermore, Mahlasela [45] points out that there is a mismatch between the perception of the service provider and the needs of the client. This can be attributed to the lack of greater involvement of councillors and communities in local decision making [46], as studies have shown that increased active public engagement and participation of local communities in service delivery decision making and policy making is likely to improve municipal outcomes for these communities [47]. Notably, technology has been shown to have a progressive impact on governance by improving service delivery outcomes [48].

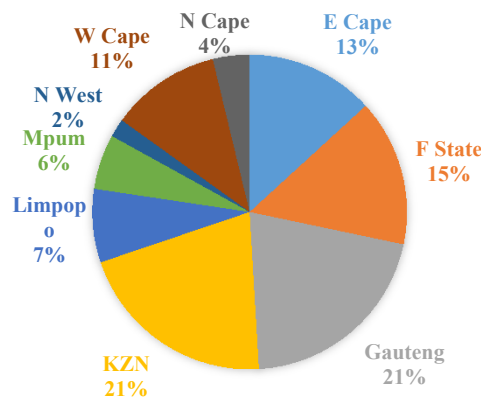


Fig. 6. Municipal service delivery protests in the provinces in 2020.
Municipal IQ [5]

In South Africa, the number of communal protests has escalated. Recent evidence suggests that these protests are becoming increasingly violent. There was a steep increase in protests between 2007 and 2009. The average number of protests against service delivery increased from 8.73 to 19.18 per month, and the percentage of violent protests increased from 41.66 % in 2007 to 54.08 % in 2010 (Naidoo, 2011). Between 1 August 2020 and 31 January 2021 alone, there were 909 service delivery protests in South Africa, with most occurring in July 2020 (an average of eight protests per day) (defencweb.co.za; 2021). These figures declined in 2020, which was due to the Covid 19 pandemic and strict curfews and police operations to curb social dissent. In addition, there was a resurgence of protests against service delivery in the dawn of local elections from August 2021 to 1 November 2021, in the midst of the Covid 19 pandemic [31].

Furthermore, “not only do people consider local government more corrupt than any other government institution, but their approval of performance and trust in political institutions is inversely related to the distance between them and that institution” [49]. This is related to the most pressing challenge, which is inadequate delivery of municipal services as a result of weak local government.

Abdou [50] suggests that the extensive strategic and innovative use of information technology helps in creating good governance in crisis management and uncertain times as was the case with the Covid 19 pandemic, to make progress in managing the pandemic by using the elements of good governance to contain and eliminate this pandemic. In 2000, Okot-Uma [51], supported by Ciborra and Navarre [52] and Meso et al [53], posit that public participation is a prerequisite for good governance as public participation can be seen as a form of empowerment and an essential component of democratic governance [54].

Prior et al. (1995) and Corrigan (1997) (cited in Lowndes and Sullivan [55] point out that empowering the citizen as a customer has been seen as a means of disciplining aloof and self-interested politicians and professionals in local government. This can be seen to be linked to better communication between different stakeholders in decision making at all levels of local government as ICT aims, to narrow this gap in poor service delivery processes [5]. Therefore, ICT can be expected to bridge the communication and consultation gap between communities and local authorities to achieve greater accountability and transparency.

In line with Karim [2] who asserts that information technology is a means of increasing productivity that leads to improved service delivery and has a positive impact on governance. Similarly, Visser and Twinomurinzi [9] are of the view that the principles of good governance require that ICT should be aligned with the service delivery strategy of “Batho Pele”, which means that people must come first to improve service delivery. These scholars also suggest that the nine principles should guide public servants: Consultation with citizens, setting service standards, improving access to information, ensuring courtesy, providing information, openness and transparency, less corruption, better service delivery, greater government responsiveness and value for money [9].

Thus, the benefits of ICT are greater transparency, less corruption, better delivery of government services and better responsiveness of government.

Consequently, local government is the structure of government that should be closest to the mass of the population and attend to the immediate needs of the people. Indeed, disadvantaged communities remain the most affected by poor service delivery and access to basic services, such as water, sanitation and refuse collection [56]. This is because poor communities, illiterate people, women, marginalised groups and people living in remote areas are often the most dependent on public services for household survival [57].

ICT can empower the poor, make state institutions work better for the poor, and break down social barriers [58]. Akinsola et al [59] further highlight how the poor can feel empowered by ICTs as ICTs enable better communication, access to information and interaction of citizens with government agencies and other stakeholders, which also leads to greater accountability of government. The poor are thus empowered through their engagement and consultation because they feel that they are receiving a service and not just a nuisance.

The lack of access to basic services has led to social discontent in the communities who have expressed their discontent through vandalism, burning tyres and destruction of buildings. In addition, there have also been cases of them attacking local councilors and even protesting in front of the councilors' houses [59].

Given this, the growing gap between the rich and the poor is related to limited access to resources and resource scarcity between the rich and the poor [46]. This is exacerbated by the Covid 19 pandemic and its impact on the South African economy as well as the growing inequality between the rich and the poor. Furthermore, it is alleged, that the decision-making processes of local governments are predominantly made by local political elites who pursue their own interests [60]. Communities complain that local councils are only present before elections and are absent in the delivery of basic services to the people they are supposed to serve [61].

The reform of local government after the end of the apartheid regime attempted to address the needs of communities. However, South Africa's fractured society, with a mass disadvantaged population and a small privileged middle class, has made it difficult to change the targeting, and services for black South Africans remain poor [62]. Consequently, the digital divide that comes with many positive advances also brings with it the challenge of the digital divide between the haves and have-nots.

According to Landsberg [9], execution and implementation of policy outcomes are the major hurdle, facing institutions in Southern Africa. This can also be seen to apply to the need for greater incorporation of ICT in municipal strategy at all levels to better involve citizens in decision-making on local issues and ensure effective service delivery by local government [10]. This challenge continues to affect the outcomes of local government service delivery. The goal of ICT is to bridge the communication gap, which requires greater accountability and transparency on the part of policy makers, as well as the political will to integrate technology into all levels of local government to achieve greater public participation for good governance in local decision making [63].

Notably, basic service delivery is an important issue that requires greater engagement of municipal structures and voluntary collective engagement of citizens to participate in addressing the challenges of municipal service delivery. In short, what is missing in South African municipalities is the institutionalisation of democratic governance and the achievement of sustainable human security, development, and peace. This should start with leaders who believe in development and are aware of where their leadership is taking the state.

3. 5. Emerging technologies used by municipal structures providing basic services

Concerns about developing countries have been voiced on numerous occasions, but many world leaders and 4IR pioneers, such as Klaus Schwab, are optimistic about the future for low-income states. Over time, the positive impact will be seen in communities, cities, and states as technologies improve efficiency and productivity – especially in communications and transportation. Supply chains in these sectors will increase and operate more effectively, further reducing operating costs over the long term. In a snowball effect, international import and export costs will

gradually fall, possibly disappearing altogether, and new markets will emerge. After hundreds of years of political economy where global capital was controlled and owned by a small elite, we may finally see an opening for developing countries and individuals to participate and contribute significantly to emerging markets. This could be the case at the community level, where the concerns of a highly industrialised society have been voiced repeatedly. Currently, most citizens work in low-skilled and low-income occupations, with the informal sector, accounting for roughly the largest share. The informal sector was hit hardest during Covid-19, when the South African government imposed strict lockdown regulations that brought employment and informal income to a halt in many households [64]. However, the integration of new and sophisticated technologies into communities is fatal, leading to both high skill learning and employment opportunities, as well as further improved basic service delivery.

3. 6. A respective analysis of technologies used for service delivery

All over the world, technology has become an integral aspect of public service delivery in various sectors. In India, the state-of-the-art system ID enables the government to ensure fiscal compliance and provides more details about citizens for public service delivery. The system helps to ensure the successful delivery of benefits, grants and subsidies. The system is also linked to the GST network, which is linked to citizens' bank accounts, so that accounts can be frozen if taxes are evaded [65]. In the Philippines, the Department of Education has partnered with technological innovators to develop the CheckMySchool application. The application is a technological crowdsourcing tool that monitors the quality of education, especially educational programs and infrastructure. In addition, any school-related issues can be reported through the application [66].

In South Africa, there is a plethora of technologies at the municipal level that can be used to improve service delivery. Chatbot and language translation applications are simple features that can be added to government websites. South Africa consists of 11 official languages, and English is used as the primary medium of exchange on all government websites and in official government offices, such as the Department of Home Affairs (DHA) [67]. However, DHA does not offer translation capabilities, making it difficult to obtain and provide services to individuals who do not use English as their first or second language. This small but far-reaching addition to the website could improve obtaining identification documents, VISA applications, birth, death and marriage certificates.

South Africa, however, is quite progressive when it comes to the use of social media. This is not surprising as we have seen this trend worldwide where governments are using platforms, such as Twitter and Facebook to engage with their citizens. The City of Johannesburg uses Twitter to keep its citizens informed about power and water outages, public events, government vacancies and public appointments. In addition, social media has allowed for direct contact between citizens and city councilors. Citizens post complaints or requests in Facebook community groups and city councilors respond, escalate, and work to resolve requests more quickly. However, the use of social media can be taken a step further.

By using AI-driven technology like NLU, councils and governments in general can use social media to understand public perceptions. NLU is a "set of analytics" that extract meaning from unstructured data sets – such information includes emotions, entities, and relationships [24]. Users of NLU can learn the purpose behind a tweet or Facebook post. In addition, LDA allows us to better understand public opinion. This technology has already been used by the UK government and could also contribute to the South African municipal context. For municipal service providers to fully understand citizens' needs, frustrations, and most pressing concerns, a collection of tweets or Facebook posts can be analysed. From this, it is possible to determine which services need to be provided and at what level.

In 2008, it was reported, that approximately 5 million citizens in South Africa did not have access to water, and 15 million citizens did not have access to basic sanitation. In 2018, it was reported that 89 % of citizens have access to water [68]. It was also reported, that access to sanitation improved by 20 % from 2002 to 2018, from 61.6 % to 83 %. However, these statistics show that 11 % of the population lacks access to clean water and 17 % lacks access to basic sanitation.

One possible solution to the lack of access and quality of water is a smart water supply. Tuser [69] describes smart water as a process that integrates new technologies to support water supply through data analysis, data collection, and automation. The process can detect leaks, increase water and energy efficiency, and improve overall water quality. In addition, advanced water technology can contribute to more informed decision making. While everyone can benefit from integrating smart water technology into water systems, it will be critical for the most marginalised communities that currently lack access to clean water and basic sanitation.

The authors acknowledge that the study has two major limitations, firstly, there is little evidence of 4IR technologies being integrated into municipal service delivery. And secondly, the advent of Covid-19 may have slowed down integration, as many ongoing projects were halted, people begun to work from home, there was a significant period of uncertainty of the way forward and adapting to living and working amidst Covid-19. However, this provides a platform for future research as some sense of normality sets in around the world and projects continue. Now, we witness more integration of 4IR, in a plethora of ways and multiple scenarios.

5. Conclusion

South Africa has taken legislative and structural measures to promote emerging technologies in municipal structures to improve service delivery. Although municipal statistics show that municipalities have provided access to basic services to the vast majority of South African citizens, greater attention needs to be paid to the extent to which interruptions hamper access to basic services due to power outages, water and sanitation problems. In addition, interruptions to the service delivery have been amplified during the Covid-19 pandemic as individuals were forced to work from home, slowing down productivity in government departments, a sharp incline in Covid-19 cases and hospitalisation rates, straining healthcare services. Sections 24 and 27 of the Basic Law grant a specific right to access to sufficient water, emphasising that everyone has the right to access sufficient water and that the state must take the necessary steps to ensure that people have access to basic services. Despite this, many people who cannot afford to pay for these basic services remain vulnerable in their access to these very basic needs. The rural dispersion of individuals and densely populated townships make access to basic services difficult, with age hold systems and processes. The South African government must begin not only considering but also implementing how to bridge the gap between service delivery and the most marginalised groups of society - an area where emerging technologies can provide life-changing solutions. The study highlighted that ICT is the most commonly implemented technology, positively impacting community service delivery when used with the intention and commitment to make greater strides in delivering improved services. It further acknowledges that Covid-19 made a dire situation worse, possibly slowing down processes of technological implementation. However, if implemented, 4IR presents a glimmer of hope for South African service delivery, where much can be explored and adapted.

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