



COVID-19 and the attainment of Sustainable Development Goal 6 (clean water and sanitation) in South Africa

**Authors:**

Beauty Zindi¹ 
Elvin Shava² 

Affiliations:

¹Department of Public Administration, Faculty of Management and Commerce, University of Fort Hare, Bisho, South Africa

²School of Public Management, Governance and Public Policy, College of Business and Economics, University of Johannesburg, Johannesburg, South Africa

Corresponding author:

Beauty Zindi,
201105350@ufh.ac.za

Dates:

Received: 12 Jan. 2022
Accepted: 28 Apr. 2022
Published: 10 June 2022

How to cite this article:

Zindi, B. & Shava, E., 2022, 'COVID-19 and the attainment of Sustainable Development Goal 6 (clean water and sanitation) in South Africa', *Journal of Local Government Research and Innovation* 3(0), a58.
<https://doi.org/10.4102/jolgr.v3i0.58>

Copyright:

© 2022. The Authors.
Licensee: AOSIS. This work is licensed under the Creative Commons Attribution License.

Read online:

Scan this QR code with your smart phone or mobile device to read online.

Background: Sustainable Development Goal (SDG) 6 demands that countries globally provide clean water and sanitation to their citizens. The outbreak of the coronavirus disease (COVID-19) pandemic triggered various obstacles to the attainment of this goal, especially in developing states that struggle to render clean water and sanitation to their ever-growing populations.

Aim: The aim of the study is to analyse the effects of COVID-19 on the attainment of SDG 6 (clean water and sanitation) in South African municipalities.

Setting: Several South African municipalities.

Methods: The article utilised expansive documentary sources on the SDGs, United Nations and World Health documents, journal articles and textbooks on water service provision in South African municipalities for analysis. Qualitative thematic analysis based on documents was employed to examine the effects of the COVID-19 pandemic on the attainment of SDG 6 in South African municipalities.

Results: The study indicates that local municipalities struggled to provide clean water to informal settlements where water supply infrastructure is not even available. Results also revealed that some urban municipalities in Gauteng Province are grappling with the provision of clean water supply to their informal settlements, which poses a risk of an outbreak of COVID-19 and a delay in the attainment of SDG 6 in general.

Conclusion: The study concludes that the South African government needs to embrace a truly bottom-up approach as opposed to a trickle-down approach to water service provision. This is because local authorities have greater proximity and thus a better understanding of the social and economic challenges within their communities and can effectively implement strategies towards addressing these challenges of providing clean water to communities.

Keywords: Sustainable Development Goal 6; COVID-19 pandemic; local municipalities; African resilience; water; sanitation.

Introduction

In 2016, the United Nations adopted the Sustainable Development Goals (SDGs), which are aimed at ending poverty, eradicating inequality and injustice and fighting climate change within agreed timeframes. The predecessors to the SDGs were the Millennium Development Goals (MDGs), which in 1990 set 25-year global development targets for signatory states. One of the MDGs required the states to 'halve ... the proportion of people without sustainable access to safe drinking water and basic sanitation (SDG 6)'. One of the indicators used to track progress was the provision of an improved sanitation facility in households.

The attainment of SDGs has been threatened by the coronavirus disease (COVID-19) pandemic globally, which has severely affected the livelihoods of people in various unprecedented ways (Yanow & Good 2020). A World Health Organization (WHO) report shows that most countries are at an advanced stage in introducing vaccines to curb the rapid spread of COVID-19 through vaccination. Vaccine boosters were later introduced to strengthen the immune system against further vulnerability to COVID-19 (Worldometer 2021).

Available evidence on 11 January 2022 shows that South Africa is now at number 17 on the global list of states bearing the negative brunt of COVID-19 with 3 534 131 active cases, 92 649 deaths and 3 298 672 recoveries (Worldometers 2022). In line with the COVID-19 containment recommendations by the WHO (2020), South Africa adopted and has been implementing

several strategies, including a national lockdown, large-scale screening and testing, contact tracing, isolation of infected and exposed individuals, provision of specialist treatment and community awareness and capacity building through mass communication systems and education programmes.

Amidst extensive and deleterious clinical impacts of COVID-19, analysts have noted that the pandemic is also concomitant with serious social and economic challenges (Zhao et al. 2020). Indications are that the COVID-19 containment strategies in South Africa have exposed many people to lives of indigence (Ozili & Arun 2020). Amongst some of the key impacts of the pandemic has been that the national lockdown had people cut off their income-generating activities, which exacerbated household food insecurity and general poverty (McKibbin & Fernando 2020). For Staunton, Swanepoel and Labuschagine (2020), compliance with self-quarantine and general social distancing protocols as prescribed by the WHO was hindered by cramped living conditions in areas such as informal settlements.

Since the outbreak of COVID-19, many African countries have struggled to provide adequate water supply because of the increasing demand for good hygienic standards (Haddout, Priya, Hogueane & Ljubenkov, (2019). According to a study conducted by Nhemachena et al. (2020) on the effects of water scarcity in Africa, water scarcity is triggered by hydrological variations and rapid population growth, which all work against the attainment of SDGs. The shortage of water, as noted by Haddout et al. (2019), can constrain the social and economic development of a country. Owing to rapid population growth, South Africa has become a water-distressed country (Solomons 2013), which may deter the attainment of SDG 6, which demands clean sanitation services and access to clean water for all. The water insecurity challenges affecting South Africa can affect the socio-economic growth and achievements of SDG 6, as a clean water supply is required for citizens to ensure they maintain proper sanitation and hygiene as a corrective measure to the COVID-19 pandemic (Odendaal 2013). Given the pressure exerted on the water supply systems of many urban municipalities in South Africa, citizens in many informal settlements were exposed to the risk of contracting COVID-19, which, as a matter of urgency, required urgent measures to be taken (Maphela & Cloete 2020). Maphela and Cloete (2020) also submit that municipalities in South Africa should increase efficiency in managing water as a scarce resource by equating its supply to the demand as the population grows. To cope with water insecurity problems amidst the COVID-19 pandemic, as Donnenfeld, Crooke and Hedde (2018) suggest, the use of technologies to realign water supply and demand whilst maintaining water security for future generations became important. This view is based on the water insecurity challenges within the Western Cape province, in which the supply of water could not match the demand (Muller 2017). A WHO (2021) study shows that water scarcity triggers poor sanitation and waterborne diseases (cholera, diarrhoea, malaria), as witnessed in Tanzania and the Democratic Republic of Congo.

Bearing in mind the adverse effects of COVID-19 on clean water supply and sanitation in South African municipalities, this article seeks to achieve the following objectives:

- Explore the effects of COVID-19 on the attainment of SDG 6 (clean water and sanitation) in South Africa.
- Establish the resilient strategies adopted by South African municipalities to provide clean water and sanitation towards achieving SDG 6 during the pandemic.

The article utilised expansive documentary sources on the SDGs' water service provision in South African municipalities. Secondary data analysis largely involved the analysis of literature from the United Nations and World Health documents, journal articles and textbooks with recent statistics and relevant information regarding the provision of water in South African local government during the COVID-19 pandemic. The identified secondary data sources were read and subjected to data coding processes involving the identification of keywords, idea patterns and codes, which were then attached to the emerging themes. After coding all the secondary data sources, the codes with similar ideas were merged through the process of data reduction. The data reduction processes led to the emergence of the major themes and subthemes which inform the writing of this paper.

This article consists of eight sections; in the first introduction section, some theoretical and conceptual perspectives are addressed. The second section reviews the water and sanitation supply in sub-Saharan Africa and in South African municipalities during COVID-19. The third section focuses on resilience in water services provision in African countries during COVID-19, followed by a discussion in the fourth section on COVID-19 water supply measures and the attainment of SDG 6 in South African municipalities. The fifth section discusses the attainment of SDG 6 in South African municipalities, followed by challenges associated with accessing clean water and sanitation during COVID-19 in the sixth section. The seventh section discusses how challenges of clean water supply and sanitation in South African municipalities can be overcome, whilst the last section draws conclusions and offers recommendations and direction for further research.

Theoretical and conceptual perspectives

This article is drawn from the human rights-based approach (HRBA) that was developed by the United Nations in 2003. The HRBA is a theory that can be used in all developmental fields, meets the international human rights standards and is mainly concerned with promoting and safeguarding human rights (Gargarella, Pilar & Theunis 2006; Gauri 2011). In addition, this theory is used to examine responsibilities, inequalities and vulnerabilities and to address discriminatory practices and unequal distribution of power that inhibit and block human rights in particular (Fredman 2008). Under HRBA, plans, policies and programmes are attached to a

system of rights and they are consistent with the obligations established by international law (Englund & Francis 2004). The HRBA entails that the government must play a critical role in distributing water and sanitation amongst the less privileged citizens. Citizens have the fundamental right to have access to basic services such as water, refuse removal, health and housing facilities and education, as enshrined in the Constitution of the Republic of South Africa, 1996. The Universal Declaration of Human Rights (UDHR 1948) and other international human rights instruments such as the United Nations General Assembly and the Committee on Economic, Social and Cultural Rights emphasise and encourage developing countries to prioritise water projects to make them accessible to everyone (WHO 2020).

Access to sufficient water and decent sanitation is regarded as a basic human right which should be universally enjoyed by every citizen in South Africa. Section 27(1)(b) of the Constitution of the Republic of South Africa, 1996, guarantees everyone the right of access to sufficient water and requires the state to adopt reasonable legislative and other measures to progressively realise this right within its available resources. The Constitution implicitly recognises the right to sanitation via associated rights provided for in the Bill of Rights, including the rights to a healthy environment, health and dignity. Section 3 of the Water Services Act 108 of 1997 interprets Section 27 of the Constitution of the Republic of South Africa, 1996, by stipulating that everyone has the right of access to water and basic sanitation. Furthermore, the South African Human Rights Commission has undertaken extensive work in respect of the right to water and sanitation as part of its constitutional and statutory mandate. In 2014, the Commission launched a report entitled the *Right to Access Sufficient Water and Decent Sanitation in South Africa* based on the Commission's systematic and extensive work undertaken in fulfilment of its mandate on these rights since 2010. In 2016, the Human Rights Council (HRC) adopted a resolution where it expressed its concern at the negative impact that a lack of access to water and sanitation and hygiene has on health and mortality. The HRC has also recognised the challenges faced by women and girls in accessing water and sanitation, particularly during their menstrual cycle, and that the deprivation of this right reinforces widespread stigma associated with menstruation.

The HRBA assumes that the lack of resources does not attribute to the cause of poverty, but there are also other factors to be considered such as discrimination and political power in decision-making processes (Englund & Francis 2004). The HRBA also addresses the problems which are being faced by the underprivileged and marginalised communities and helps to achieve the goals of SDGs by 2030. The HRBA seeks to bring innovative ideas and knowledge on how to modify, design, implement and evaluate programmes, especially those that are spearheaded by the municipalities (United Nations 2015, 2018). The HRBA encourages different stakeholders such as the nongovernmental organisations, community-based organisations and governments to work cordially to deliver services to the people.

The HRBA aims to ensure the upliftment of human rights whilst promoting empowerment through various developmental projects (United Nations 2015) and advocate for actors to play various roles towards respecting, protecting and ensuring the rights of the underprivileged, weak and vulnerable people (Smiley 2016; United Nations 2018). The HRBA is viewed as a tool to reach the underprivileged and most vulnerable people. It allows the views of the people (rights-holders) to be considered in such communities through active engagement and participation, thereby providing a comprehensive understanding of the problems at hand and their causes and consequences (Gauri 2011; Gauri & Daniel 2008). This article adopted the HRBA because it ensures that water supply projects in South African municipalities are executed bearing in mind that water is a human right as enshrined in the HRBA. The HRBAs sometimes entail persuading states to ratify and then live up to international and regional human rights treaty commitments, thereby enhancing a variety of accountability-oriented institutions in governments and donors (e.g. human rights commissions, ombudsmen, agencies of administrative redress) and persuading citizens to think of themselves as rights-holders through civil society-based organisations.

Water and sanitation supply in sub-Saharan Africa

Approximately 238 million people in sub-Saharan Africa are residing in informal settlements characterised by shortage of water and social amenities to be able to practise hygiene (WHO 2020). Compliance with the COVID-19 guidelines that aim to prevent the rapid spread of the virus was thus difficult. This put millions of people in danger from the rapid spreading of the virus in sub-Saharan Africa. For example, in Malawi, the government embarked on providing water and sanitation to its people by building tanks and dams to have adequate water supplies to several communities (Yanow & Good 2020). The Malawian government built toilets for the poor who reside in the rural areas or outskirts of the main towns (Yanow & Good 2020). The Zimbabwean government also drilled some boreholes in highly populated suburbs of Chitungwiza, Dzivarasekwa, Budiro and Kambuzuma to prevent the rapid spread of the virus (Chigonda & Chazireni 2020). Ghana was also offering a free water initiative to its underprivileged citizens as a response measure to COVID-19, and the World Bank had funded the Democratic Republic of Congo in its Urban Water Supply Projects that provided water through tanker trucks (World Bank 2020).

Similarly, the Addis Ababa Water and Sewage Authority in Ethiopia, with support from the World Bank, replaced water pipes and drilled boreholes to provide water to cities (World Bank 2020). In Kenya, the Mombasa Water Company and Nairobi Water and Sanitation Company collaborated to provide tanked water to informal settlements in the quest to achieve clean sanitation in line with the SDG 6 during the pandemic (Olando 2020).

Although the intention of the SDG 6 is to halve the proportion of people without sustainable access to drinking water by

2020, several communities in most developing countries still lack access to safe drinking water (Sarah et al. 2020; Stiegler & Bouchard 2020). Melzer and Rust (2020) confirm that in Africa, about 40% of people are facing challenges in accessing safe drinking water. Many African countries are failing to meet the improved sanitation facility target. Inadequate provision of basic sanitation impedes the efforts to alleviate extreme poverty and diseases in many of Africa's underdeveloped communities, particularly in rural and informal urban settlements. Access to safe water and sanitation is crucial for human health, social dignity and productive livelihoods. Stiegler and Bouchard (2020) posit that Africa is experiencing a high child mortality rate, with more than 2000 children losing their lives from diarrhoeal diseases, which is mainly attributed to the shortage of clean water, poor sanitation and inadequate hygiene.

Evidence shows that many people lack access to handwashing facilities, which made it difficult to curtail the spread of the COVID-19 pandemic. For instance, the WHO (2020) reports that many people are facing challenges in accessing safe and reliable water services and approximately 3 billion people worldwide are unable to access basic handwashing facilities (soap and water) in their homes. The United Nations (2017) also reports that two out of five people worldwide do not have basic handwashing facilities at their homes. The lack of water in towns is increasing, and it is estimated to grow further. Almost 84 million people in most of the developing world live in cities that are facing seasonal shortages, where supply is below 85 – 100 L/day at least once in a month each year. It is estimated that by 2050, these numbers will grow to 1.86 billion in Africa and 3.1 billion globally (Britto, Krishna & Kellermayer, 2019). According to Xylem (2013), it is predicted that by 2050, there will be a shortage of water in most cities in Africa, both for commercial use and home consumption. Currently, about 400 million people in African cities do not have access to clean water (Grasham et al. 2019).

Resilience in water services provision in African countries during COVID-19

To fight the spread of the COVID-19 pandemic, the WHO emphasised frequent handwashing with soap and water. Countries were urged to ensure that their citizens had access to safe water both for drinking and washing of hands to fight against the global COVID-19 pandemic. To fight the rapid spread of COVID-19, governments were urged to supply all the communities with enough water to maintain hygiene. According to Aboelnga et al. (2020), in sub-Saharan Africa, about 63% of the people living in urban areas do not have access to basic water services, and therefore they found it difficult to wash their hands. Approximately about 70% – 80% of the continent's diseases are caused by the lack of quality of water supply. In Ethiopia, Ghana, Egypt, Angola and Senegal, 53.8% of people have access to safe water for drinking and 23.4% – 22.4% have access to handwashing facilities at home.

This situation constrains the use of water and sanitation as a measure to contain the spread of COVID-19 and other water-related infectious diseases (Mizumoto & Chowell 2020).

In Ghanaian communities in some parts of Accra, there was a high spread of COVID-19 infection caused by water rationing and water shortages. Although the Ghana Water Company Limited advised their consumers to store more water and use it wisely, because of the high population density, water shortages were still experienced. To overcome the shortage of water in Ghana, several water programmes such as Water and Sanitation for the Poor, GSMA and digital water initiatives were introduced to supplement the water supply in the country. Egypt is also one of the African countries experiencing water challenges to supply its citizens. The outbreak of COVID-19 has forced Egypt to implement several water programmes to augment water supplies in their country. Laud (2020) mentions that Egypt has started a joint venture with six water and sanitation companies in the Nile Delta governorates of Dakahlia, Beheira, Sharkiya, Menoufia, Damietta and Gharbia in the implementation of the Sustainable Rural Sanitation Services programme, which has cost \$550 million. In addition, the Beheira Water and Drainage Company increased its wastewater treatment plants from 9% to over 55% between 2015 and 2020 by improving maintenance management and ensuring the availability of spare parts and chemicals (Abadi, Cooper & Teckman-Fullard 2020).

During the outbreak of the COVID-19 pandemic, Angola was also one of the African countries implementing water programmes to expand its water supplies. The government supplied fuel to trucks and cisterns to distribute water in some communities. Angola has supplied 176 tank trucks and 218 motorised tank trucks to help the citizens to access water following WHO requirements (Miller et al. 2020). It has also supplied fountains with free water where there are no trucks. In Ethiopia, the Ministry of Health and the Addis Ababa Water and Sewage Authority worked to ensure that all health care facilities had around-the-clock access to water. In addition, water pumps and boreholes in Addis Ababa were replaced and rehabilitated to provide services to those living in this dense urban area. In Senegal, Mizumoto and Chowell (2020) point out that, 'with a population of 15 400 000 inhabitants, access to water in the country is estimated at 98.8% and 91.8% in urban and rural areas, respectively, although sanitation services account for 67.4% and 42.3% for urban and rural areas, respectively'. Furthermore, most of the Senegalese population (< 80%) have on-site sanitation. These examples show the extent to which many African countries tried to become resilient in water services provision during the outbreak of COVID-19 pandemic towards attaining SDG 6.

COVID-19 water supply measures in South Africa

The delivery of water and sanitation services was one of the prominent strategies that local municipalities employed in

South Africa in response to COVID-19 (Khambule 2020). As confirmed by the WHO (2020), the key strategies for fighting the spread of COVID-19 are to maintain high standards of personal hygiene through constant washing of hands and fumigation of surfaces. The introduction of the 'Safe Hands' campaign by WHO increased the demand for water in the communities. As noted by Staddon (2020), washing hands regularly reduces the chance of catching any viral particles, thereby reducing the transmission of infectious diseases. Whilst millions of people living in developing countries lack access to safe drinking water, handwashing remains, at this stage, as one of the efficient strategies for combatting COVID-19. This requirement has seen many local authorities actively improving their water delivery services to their residents (Khambule 2020).

According to Wegerif (2020), provinces such as the Northern Cape and Gauteng responded to the COVID-19 pandemic by rolling out water programmes to sustain their communities during the outbreak of the pandemic. The Northern Cape Province installed 837 water tanks in water-scarce communities, mainly for home consumption and promoting hygiene during the COVID-19 period (Wegerif 2020). Furthermore, in the Gauteng Province, areas such as Kamiesberg Municipality, Maquassi Hills and Rietfontein quarantine area had water tanks installed to ease water demand in these areas. In addition, the Department of Water and Sanitation (DWS) provided 500 water tanks, including 56 water tankers (trucks), in different municipalities of Mpumalanga Province (DWS, 2020a; 2020b). Some of the district municipalities that had received water tanks include Ehlanzeni, Gert Sibande and Nkangala. The distribution of water tanks is an effective intervention by the DWS to provide a dependable supply of water to communities so that people regularly wash their hands with soap and water, which is vital for preventing the spread of COVID-19 (Barbier & Burgess 2020). The next section breaks down the details of water supply in local municipalities in South Africa.

Water and sanitation supply in the South African municipalities during the COVID-19 pandemic

The supply and distribution of water in municipalities was seen as a positive step in combating the rapid spread of the COVID-19 pandemic with a focus on hotspot areas that have limited access to basic potable water supply. The National DWS had been responsible for this task through a directive from the DWS Minister to ensure that all communities have access to water and sanitation, including high-density public areas, informal settlements and rural areas (Provincial Monitoring Group [PMG] 2020a). Rand Water was appointed to coordinate all activities in respect to distribution, in conjunction with other entities across South Africa. The major objective was to deliver water tanks, water tankers and standpipes (DWS 2020a). The other water entities included Lepelle Northern Water in Limpopo, Amatola Water in Eastern Cape, Overberg Water in Western Cape,

Sedibeng Water in Free State and the Northern Cape and Magalies Water in Northwest Province. Rand Water was responsible for the supply of water in Mpumalanga and Gauteng provinces. This distribution is broken down subsequently.

As Table 1 shows, the Eastern Cape received 4537 water tanks out of the 5533 water tanks allocated to the province. Of these, 2490 were installed. Although 191 tankers were allocated to the province, 187 were delivered and in use as of 15 July 2020. Buffalo City Metropolitan Municipality received 310 water tanks, Nelson Mandela Metropolitan Municipality 135, Alfred Nzo District Municipality 595, Amathole District Municipality 516, Chris Hani District Municipality 803, Joe Gqabi District Municipality 112, OR Tambo District Municipality 978 and Sarah Baartman District Municipality 1078. The Eastern Cape Government also declared the province a drought disaster area to enable it to release funds to the affected municipalities.

In the Limpopo Province (Table 2), 726 water tanks were allocated. By 15 June 2020, Limpopo Province received 440 water tanks throughout the province. Vhembe District received 132 water tanks, Waterberg District 122, Sekhukhune District 80, Capricorn District 53 and Mopani District 53. To augment these water tanks, the DWS also delivered 27 water tankers to remote communities through its entity Lepelle Northern Water. The tankers were also delivered to Vhembe, Sekhukhune, Bela-Bela, Polokwane, Lephalale, Mogalakwena, Thabazimbi and Mookgopong or Modimolle. Of the 43 tankers allocated to the Limpopo Province, 34 had been delivered as from 15 June 2020.

TABLE 1: Eastern Cape intervention as of 15 June 2020.

Name of the municipality	Number of tanks allocated	Tanks delivered	Tanks installed	Number of tankers allocated	Tankers or trucks delivered	Tankers in use
Buffalo City Metropolitan	400	310	284	25	21	21
Nelson Mandela Metropolitan	150	135	0	20	20	20
Alfred Nzo District	656	595	88	10	10	10
Amathole District	740	516	251	36	36	36
Chris Hani District	890	803	428	41	41	41
Joe Gqabi District	265	112	56	12	12	12
OR Tambo District	1251	978	634	22	22	22
Sarah Baartman District	1181	1088	749	25	25	25

TABLE 2: Limpopo intervention as of 15 June 2020 (DWS 15 June).

Name of the municipality	Number of tanks allocated	Tanks delivered	Tanks installed	Number of tankers allocated	Tankers or trucks delivered	Tankers in use
Capricorn District	87	53	17	5	5	5
Sekhukhune District	150	80	4	13	4	3
Mopani District	115	53	8	4	4	4
Vhembe District	132	132	32	5	5	5
Waterberg District	211	122	428	41	41	41

Table 3 shows that 2812 water tanks were allocated to Gauteng Province, and of these, 1785 water tanks had been delivered and 667 installed as of 15 June 2020. Although 56 tankers had been allocated, 46 were delivered and 37 were installed. By 02 June 2020, the DWS had provided 2211 water tanks in densely populated areas such as the City of Johannesburg, City of Tshwane, Ekurhuleni, Sedibeng and West Rand District municipalities (DWS 2020a, 2020b). More water tanks were allocated to West Rand (555), whilst the least were allocated to Sedibeng (254). Various areas in the province, including Roodepoort, Soweto and Ennerdale in the City of Johannesburg, Hammanskraal in the City of Tshwane and Benoni in the City of Ekurhuleni, benefitted from these efforts (Amatola Water 2020).

Finally, the Western Cape Province had been allocated 719 water tanks with 526 tanks delivered and 125 installed by 15 June 2020. Around 59 tankers were delivered in the Western Cape, with 53 delivered and 49 tankers in use as of 15 June 2020. Table 4 illustrates that water tanks and trucks were delivered to the district municipalities and metros across the province, i.e. the City of Cape Town with 93, Overberg 50, Cape Winelands 75, Central Karoo 63, Garden Route 68 and West Coast 33 as of 15 June 2020 (DWS 2020b).

The attainment of Sustainable Development Goal 6 in South African municipalities

The attainment of SDGs globally has been hindered by the outbreak of the COVID-19 pandemic, as countries grapple with controlling the spread of the virus in ways that are not consistent with the demands of SDG 6 (McKibbin & Fernando 2020). COVID-19 has pushed the development budgets of countries into disarray and has diverted development attention and resources from the SDGs' dimension towards fighting the COVID-19 pandemic (Ozili & Arun 2020).

TABLE 3: Gauteng intervention as of 15 June 2020.

Name of the municipality	Number of tanks allocated	Tanks delivered	Tanks installed	Number of tankers allocated	Tankers or trucks delivered	Tankers in use
City of Johannesburg	410	410	336	4	4	4
City of Tshwane	416	416	56	9	9	9
Ekurhuleni	300	217	58	8	8	8
Sedibeng	254	254	78	15	15	15
West Rand	555	555	65	10	10	10

TABLE 4: Western Cape intervention.

Name of the municipality	Number of tanks allocated	Tanks delivered	Tanks installed	Number of tankers allocated	Tankers or trucks delivered	Tankers in use
City of Cape Town	267	93	61	31	31	31
Overberg	50	50	5	3	1	1
Cape Winelands	75	75	33	5	5	5
Central Karoo	63	63	0	3	3	1
Garden Route	88	88	21	5	2	1
West Coast	55	55	5	4	2	2

Despite these challenges, Sachs et al. (2019) argue that South Africa is poised to salvage something out of the SDGs despite the ruinous COVID-19 pandemic. This is mainly because the responses of local municipalities to the adverse effects of the pandemic are indirectly aiding the achievement of SDG 6. Melzer and Rust (2020) affirm that during the outbreak of the COVID-19 pandemic in South Africa, the government responded by assigning local municipalities roles to play to support vulnerable communities that needed clean water and sanitation, which are both dictates of attaining SDG 6. These efforts by local municipalities were strategic, as they enabled the achievement of SDG 6 in South Africa during the COVID-19 outbreak. Whilst these water supply interventions were primarily focused on containing the spread of the COVID-19, they enabled the establishment of portable water supply infrastructure that will further assist local municipalities post the pandemic.

Challenges associated with accessing clean water and sanitation during COVID-19

South African municipalities faced a multiplicity of challenges when supplying water and sanitation during the outbreak of the COVID-19 pandemic. There were delays in the supply and distribution of tankers to various municipalities (PMG 2020b). The reason for this delay, according to the Minister of Tourism, South Africa, was the building of platforms needed to mount the tankers (PMG 2020b).

Furthermore, the municipalities faced difficulties in accessing cement and bricks in mounting and fixing the tanks in position, as hardware shops were closed during the COVID-19 total lockdown. All supplies from hardware stores had dried up. To address this challenge, the Minister of Trade and Industry declared hardware shops as essential services selling essential goods (PMG 2020a). The opening of hardware stores was expected to allow the roll-out of water tanks to continue.

Despite the supply and distribution of water tanks and tankers in the different provinces, some challenges had been noted. For instance, according to Mnisi (2020), information gleaned from the Ga-Kobe and Ga-Mphakani villages in Limpopo Province had revealed continuing deficits in water and sanitation provision where these water and sanitation disaster relief facilities had not yet been received. Complaints about the lack of water or quality of water had been noted in these communities. These complaints included instances where water was sold by those with boreholes, limited times of access to water and residents queuing for water and shared standpipes making social distance a challenge (Mnisi 2020). Monyakeni (2020) indicated that in Mbizana, in the Eastern Cape, emergency tanks were empty since they had only been filled when they were delivered. In a similar observation, it was reported that emergency tanks in Ramaphosa informal settlement in Motherwell, Port Elizabeth, periodically ran dry.

In the Western Cape, the number of households sharing communal standpipes and toilets was reported to be a huge problem in terms of dealing with the COVID-19 pandemic. The City of Cape Town apparently aimed to provide one water tap for every 25 families within a 200-m radius and one toilet for every 5 families, which would comply with the Emergency Housing Programme (Hara, Ncube & Sibanda 2020). But this had proven to be insufficient because, for example, in the Marikana informal settlement in Philippi Township, the City of Cape Town had provided 50 communal standpipes for more than 60 000 residents (Hara et al. 2020). In Endlovini, Khayelitsha, an estimated 20 000 people shared 380 communal toilets, which translate to about 53 people per toilet (Hara et al. 2020), and this was far beyond the required one toilet for every five families.

Reports on the 'Voices of South Africa's Informal Settlement Residents' in major cities during the COVID-19 crisis also noted severe basic service shortages concerning access to water, clean toilets and waste removal (International Budget Partnership 2020). The major cities included Johannesburg, Ekurhuleni and Tshwane in Gauteng Province, Cape Town in the Western Cape Province and Buffalo City in the Eastern Cape Province. The 30 June 2020 report on metro municipalities noted that sanitation remained a serious problem, with some residents in Johannesburg and Cape Town reporting that they did not have access to sanitation; some complained about dirty toilets in Johannesburg and Cape Town, and residents reported that broken and blocked toilets were not being fixed in Cape Town (International Budget Partnership 2020). The same report on local (nonmetro) municipalities noted that many residents in Port St. Johns, Eastern Cape, did not have access to municipal sanitation and had to construct pit toilets, did not have regular access to water and were not provided with soap or hand sanitizers (International Budget Partnership 2020).

Overcoming challenges of clean water supply and sanitation in South African municipalities

This section presents findings drawn from the analysis of expansive literature sources relevant to SDG 6, COVID-19 and clean water supply and sanitation. Thematic analysis was used in line with the objectives of this article.

Limited community participation and its effects on clean water supply and sanitation

Notwithstanding that many positives can be drawn from the current COVID-19 containment efforts by local governments in South Africa for the achievement of SDGs, some practical challenges are threatening the achievement of these goals (Mutangabende & Shava 2016). Amongst some of the prominent threats to the SDGs in local municipalities is the issue of diminished opportunities for the participation of communities in their development processes. Notably, restrictions such as the banning of mass gatherings mean local governments cannot fully consult their residents on developmental issues. Inopportunistly, this is working against

the visions and principles of sustainability embodied in the SDGs (Mutangabende & Shava 2016). To have an effective service delivery, the municipality works hand-in-glove with communities to bring development to the local communities. Lues (2014:789) notes that inclusive participation of citizens in development projects that seek to improve access to water, sanitation and other entrepreneurship projects is crucial. David (2018) submits that public participation promotes adequate representation in decision-making processes that affect the lives of people. In South Africa, Campbell (2016:34) notes that in all three spheres of government (national, provincial and local), there is a need to involve people in decision-making processes (participation), and this enhances the legitimacy and responsiveness of institutions, especially when resources are scarce.

Inadequate revenue collection and clean water supplies

Impediments to water insecurity that are confronting South African municipalities can be a threat to the attainment of SDG 6, which demands clean water supplies to enhance the sanitation in communities. The water security woes are further compounded by poor revenue collection, which results in minimal funding for water supply projects (Shava 2020). The shutdown of some social and economic operations to combat the spread of COVID-19 resulted in a revenue loss for local governments (Barbier & Burgess 2020). The analyses of documents have shown that under normal conditions, local authorities collect revenue from a wide variety of social and economic activities. However, under conditions of a national lockdown in South Africa, revenue streams of local governments shrank, resulting in an inability to sustainably finance the water development activities that enable the attainment of SDG 6. Since the outbreak of COVID-19, little attention was being given to SDG-specific programming (Barbier & Burgess 2020). Owing to immense pressure to respond to COVID-19, South Africa, just like any other country hit by the pandemic, could not adequately monitor and evaluate processes of water projects to ascertain if current efforts were still in accord with SDG 6 (Ozili & Arun 2020). Morris-Paxton, Reid and Ewing (2020) lament the water provision programmes that were undertaken during the COVID-19 pandemic by South African municipalities, as they could be discontinued as a result of inadequate funding. For future water-service delivery programmes in South African municipalities, collaboration with stakeholders is required as funding can be channelled towards water provision to informal settlements, especially to enhance sanitation and hygiene towards attaining SDG 6 (Shava 2020). Although COVID-19 cases have been reduced, continuous provision of clean water to struggling communities is also imperative in the realisation of SDG 6 (Djalante, Shaw & DeWit 2020).

Embezzlement of COVID-19-related funds

A study by Staunton et al. (2020) revealed that embezzlement of COVID-19-related funds had been a problem in the

attainment of SDG 6 in South African municipalities. Their study revealed further that local municipalities have experienced high levels of corruption by the authorities in local government. Such corruption will most likely negatively affect the efforts towards reducing poverty, uplifting livelihoods and improving the health outcomes for all people in South Africa, and this will discourage local municipalities from achieving SDGs. Moreover, procuring goods and services in municipalities remains a challenge because of unclear roles between the administrators and the political office bearers (Ambe & Badenhorst-Weiss 2011; Christopher 2015).

The political-administrative interface in municipalities is a huge problem, resulting in poor or substandard service delivery (De Visser 2009:18–20; Kroukamp & Cloete 2018:70; Onyango 2019:3–4). There is an absence of proper distinction between administrative and political functions because the political office bearers are concerning themselves more with administrative duties than with political ones (Stocker & Thompson-Fawcett 2014:806). In their study, Sibanda, Zindi and Maramura (2020) affirm that contestations regarding the administrative and political office bearers trigger political interference that may adversely affect service delivery in communities.

In response to the COVID-19 pandemic, water provision programmes were affected by political interference, as politicians hijacked the situation to brand and reposition themselves in the time of crisis. A review of McKibbin and Fernando's (2020) study shows that the embezzlement of COVID-19 funds, which were fundamental to steer water development projects in South Africa, is worrying. A gap that required the government to impose strict internal control measures in local municipalities evolved to ensure that water and sanitation projects were successful towards achieving SDG 6.

Poor water infrastructure in local municipalities

The availability of portable water infrastructure in South African municipalities helps in the provision of a clean water supply to communities. Although local municipalities are required to play a pivotal role in providing clean water and sanitation, evidence points to water shortages in South Africa, especially in informal settlements (Ngcukana 2020). The study by San Lau et al. (2020) shows that water challenges affecting informal settlements adversely affect governments in their attempts to control COVID-19. The lockdown imposed in South Africa triggered overcrowding as people in informal settlements could not adequately obtain clean water to wash their hands in line with WHO guidelines for preventing COVID-19. The absence of proper water infrastructure, as noted by Nyashanu, Simbanegavi and Gibson (2020), increased vulnerability to waterborne diseases and COVID-19 viral infection in the informal settlements in Gauteng Province. Achieving SDG 6 in many informal settlements across the country demands local municipalities to devise alternative strategies for every person to have

adequate access to clean water and sanitation (Morris-Paxton et al. 2020). Revamping water infrastructure is another issue of concern, noting that local municipalities should consider ensuring that all water projects are implemented. In that sense, therefore, the DWS Services in South Africa need to provide water tankers, boreholes and storage tanks in support of COVID-19 prevention measures as well as working towards achieving SDG 6.

Limited accountability in water projects

As indicated by literature, water is very scarce in South Africa and hence water projects must be designed to meet the increasing demand because of urbanisation. Therefore, accountability of municipal officials is vital for ensuring that citizens can access clean water to meet the sanitation demands amidst the COVID-19 pandemic. Sakamoto, Begum and Ahmed's (2020) study points to a lack of accountability in water provision programmes to underprivileged communities, which they describe as detrimental to the attainment of SDG 6.

Christopher (2015:957) identifies the lack of transparency and accountability measures in various South African municipalities as triggering inequalities and distracting municipal efforts of providing clean water and sanitation to the communities in need. In another study, Sibanda et al. (2020) lament the lack of accountability measures in municipalities that affect the effective delivery of goods and services to satisfy human needs and wants as enshrined in the HRBA. The worrying trend of limited accountability in municipal development programmes acts against government efforts to curb the spread of COVID-19. For instance, in South Africa, Sibanda (2017:314) condemns rampant corruption in the Eastern Cape province, which may adversely affect the provision of clean water and sanitation to communities in response to the COVID-19 pandemic. The absence of strong control systems and institutional cultures for accountability triggers service delivery backlogs and deters the attainment of SDG 6 amidst the outbreak of the COVID-19 pandemic. Analysis of these arguments, therefore, shows that to attain SDG 6 amidst COVID-19 in South Africa, municipalities must uphold accountability and transparency, which are crucial elements in ensuring that funds meant to provide clean water projects are used for the intended purpose without any unnecessary deviations.

Conclusion

In conclusion, the article explored the impact of COVID-19 on the attainment of SDG 6 by local municipalities in South Africa. Using HRBA, we witnessed that, despite the significant setbacks triggered by COVID-19 towards achieving SDGs, several interventions by local governments in the country could potentially elevate the possibility of achieving these universal goals. However, it was also noted that some challenges are potentially set to derail the achievement of SDGs in South African municipalities. The researchers, therefore, recommend that the South African government embrace a truly bottom-up approach as opposed to trickle-down approaches. This is

because local authorities have greater proximity and thus a better understanding of the social and economic challenges within their communities and can effectively implement strategies towards addressing these challenges.

Further empirical research into the interface of COVID-19 and achievement of SDGs can be conducted to examine whether measures undertaken by countries globally have effectively helped to alleviate poverty.

Acknowledgements

The authors respectively acknowledge the University of Fort Hare and the University of Johannesburg in South Africa for relevant affiliation support.

Competing interests

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this article.

Authors' contributions

B.Z. conceptualised the study, analysed the data and wrote the original draft. E.S. wrote, reviewed and edited the manuscript.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

Funding information

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Data availability

Data sharing is not applicable to this article as no new data were created or analysed during this study.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

References

- Abadi, M., Cooper, H. & Teckman-Fullard, M., 2020, How Coronavirus compares to SARS, swine flu and Zika, and other epidemics. Business Insider. viewed 02 August 2021, from <https://www.businessinsider.in/international/news/how-the-coronavirus-compares-to-sars-swine-flu-zika-and-other-epidemics/ar/>.
- Aboelnga, H.T., Elmahd A., Unver, O. & Thomson Reuters Foundation, 2020, *OPINION: Coronavirus – Wake-up call to ensure water and sanitation for all*, viewed 30 July 2020, from <https://news.trust.org/item/20200326104523-wfz4n>.
- Amatola Water, 2020, Water Tanks in Transit to Municipalities Across SA, viewed 25 August 2020, from <http://www.amatolawater.co.za/news/details/water-tanks-in-transit-to-municipalities-across-sa>
- Ambe, I.M. & Badenhorst-Weiss, J.A., 2012, 'Supply chain management challenges in the South African public sector', *African Journal of Business Management* 6(5), 1103–1114. <https://doi.org/10.4102/jtscm.v6i1.63>
- Barbier, E.B. & Burgess, J.C., 2020, 'Sustainability and development after COVID-19', *World Development* 1(35), 10–18. <https://doi.org/10.1016/j.worlddev.2020.105082>

- Britto, S.L., Krishna, M. & Kellermayer, R., 2019, 'Weight loss is a sufficient and economical single outcome measure of murine dextran sulfate sodium colitis', *Bio Advances* 1(8), 493–497. <https://doi.org/10.1096/fba.2019-00035>
- Campbell, J., 2016, 'A collaboration-based model of work motivation and role ambiguity in public organizations', *Journal for Public Performance & Management Review* 39(3), 655–675.
- Chigonda, T. & Chazireni, E., 2020, 'Once rural, always rural? Social services provision in selected rural cases from Zimbabwe', *National Journal of Multidisciplinary Research and Development* 3(1), 469–479.
- Christopher, J., 2015, 'Internal audit: Does it enhance governance in the Australian public university sector?', *Educational Management and Leadership* 43(6), 954–971. <https://doi.org/10.1177/1741143214543206>
- David, N., 2018, Democratizing Government: What We Know About E-Government and Civic Engagement. In: Alcaide Muñoz, L., Rodriguez Bolivar, M. (eds) *International E-Government Development*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-63284-1_4
- De Visser, J., 2009, 'The political-administrative interface in local government: Assessing the quality of local government democracy', *Local Government Bulletin* 1(8), 18–20.
- Department of Water and Sanitation, 2020a, *Water and sanitation on 180 more water tanks supplied in Gauteng to help fight spread of Coronavirus COVID-19*, viewed 15 June 2020, from <https://www.gov.za/speeches/water-and-sanitation-180-more-water-tanks-supplied-gauteng-help-fight-spread-coronavirus>.
- Department of Water and Sanitation, 2020b, *National water and sanitation master plan; Report on Covid-19 intervention by Department of Water and Sanitation*, viewed 20 September 2020, from <https://pmg.org.za/committee-meeting/30279/>.
- Djalante, R., Shaw, R. & DeWit, A., 2020, 'Building resilience against biological hazards and pandemics: COVID-19 and its implications for the Sendai Framework', *Progress in Disaster Science* 6(3), 21–30. <https://doi.org/10.1016/j.pdisas.2020.100080>
- Donnenfeld, A., Crooke, C. & Hedde, S., 2018, *A delicate balance: Water scarcity in South Africa*, Southern Africa Report 13, Institute of Security Studies, viewed 19 November 2021, from https://media.africaportal.org/documents/Delicate_balance_water_scarcity.pdf
- Englund, H. & Francis, N.B., 2004, *Rights and the politics of recognition in Africa*, Zed Books, London.
- Fredman, S., 2008, *Human rights transformed: Positive rights and positive duties*, Oxford University Press, Oxford.
- Gargarella, R., Pilar, D. & Theunis, R., 2006, *Courts and social transformation in new democracies: An institutional voice for the poor?* Routledge, Taylor and Francis Group, viewed 03 January 2022, from <https://www.routledge.com/Courts-and-Social-Transformation-in-New-Democracies-An-Institutional-Voice/Gargarella-Roux-Domingo/p/book/9781138264540#>
- Gauri, V., 2011, 'The cost of complying with human rights treaties. The convention on the rights of the child and basic immunisation', *The Review of International Organisations* 6(2), 35–56. <https://doi.org/10.1007/s11558-010-9100-7>
- Gauri, V. & Daniel, M.B., 2008, *Courting social justice: Judicial enforcement of social and economic rights in the developing world*, Cambridge University Press, New York, NY.
- Grasham, D.J., Baro, E., Zhang, R., Southworth, M.R., MaCurdy, T.E. & Kelman, J.A., 2019, 'Comparative stroke, bleeding, and mortality risks in older medicare patients treated with oral anticoagulants for nonvalvular atrial fibrillation', *The American Journal of Medicine* 13(2), 596–604. <https://doi.org/10.1016/j.amjmed.2018.12.023>
- Haddout, S., Baimik, I., Maslouhi, A., Igouzal, M., Magrane B. & Marah, H., 2019, 'The influence of spring and neap tide on salt intrusion and stratification in Sebou estuary (Morocco)', *International Journal of River Basin Management* 1(7), 131–142. <https://doi.org/10.1080/15715124.2018.1476365>
- Hara, M., Ncube, B. & Sibanda, D., 2020, *Water and sanitation in the face of COVID-19 in Cape Town's townships and informal settlements*, PLAAS, viewed 20 December 2021, from <https://www.plaas.org.za/water-and-sanitation-in-the-face-of-covid-19-in-cape-towns-townships-and-informal-settlements/>
- International Budget Partnership, 2020, *Voices of South Africa's informal settlement residents during the COVID-19 crisis*, viewed 15 December 2021, from <https://www.internationalbudget.org/Covid-monitoring/>.
- Khambule, I., 2020, 'The effects of Covid-19 on the South African informal economy: Limits and pitfalls of government's response', *Loyola Journal of Social Sciences* 3(4), 1–20.
- Kroukamp, H. & Cloete, F., 2018, 'Improving professionalism in South African local government', *Acta Academica* 50(2), 61–80. <https://doi.org/10.18820/24150479/a50i1.4>
- Laud, G., 2020, *Coronavirus explained: Why is it called coronavirus? What does corona mean?* Medical World Council. viewed 11 January 2022, from <https://www.express.co.uk/life-style/health/1235282/coronavirus-explained-why-is-it-called-coronavirus-what-does-corona-mean-china-virus-news>
- Lues, L., 2014, 'Citizen participation as a contributor to sustainable democracy in South Africa', *International Review of Administrative Sciences* 80(2), 789–807. <https://doi.org/10.1177/0020852314533450>
- Maphela, B. & Cloete, F., 2020, 'Johannesburg's implementation of the National Water Act, 1998 in Soweto, South Africa', *Development Southern Africa* 3(7), 535–552. <https://doi.org/10.1080/0376835X.2019.1647834>
- McKibbin, W. & Fernando, R., 2020, *The economic impact of COVID-19. Economics in the time of COVID-19*, Centre for Economic Policy Research (CEPR), London.

- Melzer, I. & Rust, K., 2020, *Covid-19 and housing – Strategies for resilience in South Africa*, Centre for Affordable Housing Finance Africa, viewed 10 July 2021, from <http://saaffordablehousing.co.za/covid-19-and-housing-strategies-for-resilience-in-south-africa/>.
- Miller, J.D., Budds, J., Geere, J., Meehan, K., Charles, K., Stevenson, E.G.J., et al., 2020, 'Water insecurity compounds the global coronavirus crisis', *Water International Journal* 2(1), 1–7.
- Mizumoto, K. & Chowell, G., 2020, 'Estimating risk for death from 2019 novel coronavirus disease, China, January–February 2020', *Emerging Infectious Diseases* 26(6), 1251–1256. <https://doi.org/10.3201/eid2606.200233>
- Mnisi, N., 2020, *COVID-19: Opportunities and challenges for the water, sanitation and hygiene sector*, HellenSuzman Foundation, viewed 05 December 2021, from <https://hsf.org.za/publications/hsf-briefs/Covid-19-challenges-andopportunities-for-the-water-sanitation-and-hygiene-sector>
- Monyakeni, M., 2020, 'Vandalising Covid-19 water interventions: Not in my name', *Daily Maverick*, viewed 01 January 2022, from <https://www.dailymaverick.co.za/article/2020-04-30-vandalising-covid-19-water-interventions-not-in-myname>
- Morris-Paxton, A.A., Reid, S. & Ewing, R.M.G., 2020, 'Primary healthcare services in the rural Eastern Cape, South Africa: Evaluating a service-support project', *African Journal of Primary Health Care Family Medicine* 12(3), 22–34. <https://doi.org/10.4102/phcfm.v12i1.2207>
- Muller, M., 2017, *Understanding the origins of Cape Town's water crisis*. *Civil Engineering June 2017*, viewed 26 August 2020, from <https://ssrn.com/abstract=2995937>.
- Mutangabende, S. & Shava, E., 2016, 'Africa's public service delivery and performance review – Assessing progress and pitfalls of the millennium development goals in Zimbabwe: A critical analysis', *Africa's Public Service Delivery and Performance Review* 4(2), 573–605. <https://doi.org/10.4102/apsdpr.v4i4.141>
- Ngcukana, L., 2020, Eastern Cape is fighting for its survival, battling the deadly Covid-19 outbreak on the one hand, and the cancerous spread of corruption on the other, viewed 18 November 2021, from <https://www.news24.com/citypress/news/eastern-cape-premier-calls-for-help-from-siu-to-investigate-covid-19-linked-corruption-20200712>
- Nhemachena, C., Nhamo, L., Matchaya, G., Nhemachena, C.R., Muchara, B., Karuaihe, S.T., et al., 2020, 'Climate change impacts on water and agriculture sectors in Southern Africa', *Threats and Opportunities for Sustainable Development* 2(1), 2–17. <https://doi.org/10.3390/w12102673>
- Nyashanu, M., Simbanegavi, P. & Gibson, L., 2020, 'Exploring the impact of COVID-19 pandemic lockdown on informal settlements in Tshwane Gauteng Province, South Africa', *Global Public Health* 15(10), 1443–1453. <https://doi.org/10.1080/17441619.2020.1805787>
- Odendaal, N., 2013, 'Increasing the relevance of urban planning education in African cities', *International Journal of E-Planning Research* 2(3), 30–37. <https://doi.org/10.4018/ijep.2013070103>
- Olando, S., 2020, *Kenya: Keeping water and information flowing in informal settlements*, viewed 15 September 2020, from <https://www.Citiesalliance.org/newsroom/news/results/kenya-keeping-water-and-information-flowing-informal-settlements>.
- Onyango, G., 2019, 'Legislative oversight and policy-reforms in unsettled political contexts of public administration', *International Journal of Public Administration* 4(2), 1–16.
- Ozili, P.K. & Arun, T., 2020, *Spillover of COVID-19: Impact on the global economy*, MPRA Paper 99317, University Library of Munich, Munich.
- Parliamentary Monitoring Group, 2020a, *Water provision to Limpopo residents human settlements, water and sanitation*, Government of South Africa, viewed 03 March 2020, from <https://pmg.org.za/committeemeeting/29933/>.
- Parliamentary Monitoring Group, 2020b, *COVID-19 initiatives on water, sanitation & de-densification: Briefing by minister and DHS*, Government of South Africa, viewed 21 April 2020, from <https://pmg.org.za/committee-meeting/30104/>.
- Republic of South Africa, 1996, *Constitution of the Republic of South Africa, Act 108 of 1996*, South African Government, viewed n.d., from <https://www.gov.za/documents/constitution-republic-south-africa-1996>.
- Sachs, J.D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N. & Rockström, J., 2019, 'Six transformations to achieve the sustainable development goals', *Nature Sustainability* 2(1), 805–814. <https://doi.org/10.1038/s41893-019-0352-9>
- Sakamoto, M., Begum, S. & Ahmed, T., 2020, 'Vulnerabilities to COVID-19 in Bangladesh and a reconsideration of sustainable development goals', *Sustainability* 12(13), 10–16. <https://doi.org/10.3390/su12135296>
- San Lau, L., Samari, G., Moresky, R.T., Casey, S.E., Kachur, S.P., Roberts, L.F. & Zard, M., 2020, 'COVID-19 in humanitarian settings and lessons learned from past epidemics', *Nature Medicine* 1(2), 20–28. <https://doi.org/10.1038/s41591-020-0851-2>
- Sarah, L., Smiley, B.D., Agbemor, E.A., Adams, P. & Tutu, R., 2020, 'COVID-19 and water access in sub-Saharan Africa: Ghana's free water directive may not benefit water insecure households', *African Geographical Review* 3(1), 1–7. <https://doi.org/10.1080/19376812.2020.1810083>
- Shava, E., 2020, 'Exploring revenue collection impediments in South African rural municipalities', *International Journal of Innovation, Creativity and Change* 1(4), 396–412.
- Sibanda, M.M., 2017, 'Control, ethics, and accountability in the financial management performance of Eastern Cape municipalities', *Journal of Public Administration* 5(2), 313–339.
- Sibanda, M.M., Zindi, B. & Maramura, T.C., 2020, 'Control and accountability in supply chain management: Evidence from a South African metropolitan municipality', *Cogent Business & Management* 7(2), 1–15. <https://doi.org/10.1080/23311975.2020.1785105>
- Smiley, S.L., 2016, 'Water availability and reliability in Dares Salaam, Tanzania', *Journal of Development Studies* 5(2), 1320–1334. <https://doi.org/10.1080/00220388.2016.1146699>
- Solomons, J., 2013, *Corporate governance and accountability*, John Wiley and Sons, Inc., Chichester.
- Staddon, J.E.R., 2020, 'The dynamics of behavior: Review of Sutton and Barto: Reinforcement learning: An introduction (2nd ed.)', *Journal of the Experimental Analysis of Behavior* 11(3), 485–491. <https://doi.org/10.1002/jeab.587>
- Staunton, C., Swanepoel, C. & Labuschagine, M., 2020, 'Between a rock and a hard place: COVID-19 and South Africa's response', *Journal of Law and the Biosciences* 3(3), 1–7. <https://doi.org/10.1093/jlb/lsaa052>
- Stiegler, N. & Bouchard, J.P., 2020, *South Africa: Challenges and successes of the Covid-19 lockdown in Annales Médico-psychologiques, revue psychiatrique*, Elsevier Masson. viewed 10 December 2021, from <http://repository.uwc.ac.za/xmlui/bitstream/handle/10566/5627/1-s2.0-S0003448720301785-main.pdf?sequence=1&isAllowed=y>
- Stocker, N. & Thompson-Fawcett, M., 2014, 'It's not like never-the twain-shall-meet: Politician-staff relationship structures in local government', *Local Government Studies* 40(1), 791–808. <https://doi.org/10.1080/03003930.2014.887563>
- United Nations Millennium Project Report, 2015; United Nations, Department of Economic and Social Affairs, Population Division, 2018, viewed 06 January 2022, from [https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%2015\).pdf](https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%2015).pdf)
- United Nations, Department of Economic and Social Affairs, Population Division, 2017, *World population prospects: The 2017 revision*, United Nations, New York, NY.
- United Nations, Department of Economic and Social Affairs, Population Division, 2018, *Population facts No. 2019/5, December 2019: Potential impact of later childbearing on future*, New York, NY.
- Wegerif, M.C., 2020, 'Informal food traders and food security: Experiences from the Covid-19 response in South Africa', *Journal for Food Security* 1(3), 1–4. <https://doi.org/10.1007/s12571-020-01078-z>
- World Bank, 2020, *In Ethiopia, keeping the water flowing during the COVID-19 (Coronavirus) response*, viewed 20 September 2020, from <https://www.worldbank.org/en/news/feature/2020/05/11/in-ethiopia-keeping-water-flowing-during-the-covid-19-coronavirus-response>.
- World Health Organization, 2020, *Timeline of WHO's response to COVID-19*, viewed 29 June 2020, from <https://www.who.int/news-room/detail/29-06-2020-covidtimeline>.
- World Health Organization & United Nations Children's Fund (UNICEF), 2020, *Water, sanitation, hygiene and waste management for COVID-19: Technical brief*, World Health Organization, Geneva, viewed 03 March 2020, from <https://apps.who.int/iris/handle/10665/331305>.
- Worldometers, 2022, *COVID-19 Coronavirus pandemic*, viewed 29 August 2021, from https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?
- Xylem, I., 2013, *A drop is everything Xylem sustainability report*, viewed 15 August 2020, from <http://www.xylemsustainability.com/>.
- Yanow, S.K. & Good, M.F., 2020, 'Nonessential research in the new normal: The impact of COVID-19', *The American Journal of Tropical Medicine and Hygiene* 10(3), 11–24. <https://doi.org/10.4269/ajtmh.20-0325>
- Zhao, Z., Li, X., Liu, F., Zhu, G., Ma, C. & Wang, L., 2020, 'Prediction of the COVID-19 spread in African countries and implications for prevention and controls: A case study in South Africa, Egypt, Algeria, Nigeria, Senegal and Kenya', *Science of the Total Environment* 1(3), 1–158. <https://doi.org/10.1007/s12571-020-01078-z>