ANALYSIS OF THE RELATIONSHIP BETWEEN SOCIAL FACTORS AND WATER SERVICES DELIVERY IN THE PUBLIC SECTOR: A CASE OF AN EMERGING ECONOMY

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Abstract

This article evaluates the linkage between social factors and water services delivery in the biggest municipalities in South Africa for improved service delivery. The study is conducted against the failure of several studies to focus on social practices' impacts on service delivery. Social practices have huge impacts on service delivery and tend to have financial implications on municipalities (Morudu, 2017). Therefore, this article sought to introduce another dimension of addressing water service delivery challenges (WSDCs) by examining the relationship between social practices and service delivery. A multivariate regression analysis using the panel data (2013–2021) collected from the 20 largest municipalities in South Africa. While ordinary least squares (OLS) and feasible generalized least squares (FGLS) results show that job opportunities created have had a positive impact on service delivery performance (SDP), service delivery protests adversely influenced SDP. On the same note, expenditure on housing, population, and educational level produced a neutral effect on SDP. The results provide deep insights to policymakers and city managers to consider aligning social practices with a regulatory framework that governs the provisioning of water services. Although the paper provides vital information, further studies focus on reviewing and reconfiguring laws and regulations that govern social practices to further reduce the negative impacts of social practices on water provision efforts.

Keywords: Investments, Water, Local Government, Municipalities, Service Delivery

Authors' individual contribution: Conceptualization — S.M. and H.M.v.d.P.; Methodology — S.M.; Investigation — S.M.; Resources — S.M. and H.M.v.d.P.; Writing — S.M. and H.M.v.d.P.; Supervision — H.M.v.d.P.; Funding Acquisition — S.M. and H.M.v.d.P.

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1. INTRODUCTION

Water is a common denominator in maintaining energy and food security, and sustaining livelihoods within an ecological environment (Samuel et al., 2016; Olela & Wanyonyi, 2018). This confirms the intertwined relationship between water and society, as confirmed in the literature (Morudu, 2017; Gomez et al., 2019; Mukwarami, 2021). A lack of an effective water delivery system can lead to service delivery protests (SDPs) resulting in more severe socio-economic consequences. Water's importance in sustaining every nation's socioeconomic well-being of every nation remains an uncontested fact (Goswami & Bisht, 2017). However, it remains a fact of note that 40,7 million people reside in areas experiencing economic and water scarcity constraints, and these areas are mostly in sub-Saharan Africa and parts of Asia (Oki & Quiocho, 2020). As such, the provision of water services to vulnerable people remains an imperative goal to achieving Sustainable Development Goal 6.3 (Leal Filho et al., 2018) and Agenda 2063, Goal 7 targeting to reduce water inaccessibility rate by 95% in 2023 in Africa (Makinda et al., 2015). Though efforts to improve water security through increasing water investment remain central to the provision of water services (Ruiters & Amadi-Echendu, 2022), the effect of social practices on the delivery of water service, is still underestimated in water research. Hence, it is imperative to interrogate how social practices affect the delivery of water services to broaden the narratives of addressing water service delivery challenges (WSDCs).

The deepening socio-economic challenges in the South African local municipalities are mostly driven by poor service delivery (Masiya et al., 2019) and other factors such as politics and nepotism (Masuku & Jili, 2019). Further, Nkabinde et al. (2018) and Kleynhans and Coetzee (2019) confirm that migration and the surge in the population are critical factors that have a substantial influence on service delivery. The high rate of rural-urban migration has resulted in high accommodation demand, forcing people to develop makeshift temporary houses (Turok & Borel-Saladin, 2016), and this has resulted in worsening WSDCs. Lack of adequate education in the leadership of municipal councils has stopped progress in the areas of technology that could provide solutions to service delivery challenges (Kalonda & Govender, 2021). Failure to control social practices has affected service delivery and led to social protests often turning violent and destructing property (Morudu, 2017; Alexander et al., 2018). Therefore, addressing challenges related to social practices may present important contributions to water provisioning efforts aimed at addressing WSDCs.

Notwithstanding the contributions made by studies that investigated the WSDCs (Mamokhere, 2020; Aiyetan & Das, 2021; Mamokhere et al., 2022), the study acknowledges that the concentration on increased investments in water management (IWM) in South Africa is quite dominant to address WSDCs (Ruiters & Amadi-Echendu, 2022). However, it has been noted that issues behind WSDCs challenges in South Africa are quite diverse and complex, and therefore, concentrating on increasing IWM has failed present a sustainable solution (Mukwarami, 2021). This article brings in a new dimension of relooking social practices and how they greatly influence service delivery performance in local municipalities. In South Africa, democracy is centered on power to the people and people shall govern approaches (Tadesse et al., 2006; Mamokhere et al., 2022), this further implies that the participatory theory of democracy underpins the interaction between all stakeholders within the water sector. The Constitution of the Republic of South Africa empowers communities to express their views through various actions, such as protests and strikes (Reddy, 2016), implying public participation in all decisions influence service delivery is not a privilege but a right. Therefore, evaluating the impacts of social practices on service delivery might be an alternative approach to addressing WSDCs.

In the context of South Africa, many studies have blamed social practices for increased expenditure in the water sector, as significant funds are used to replace damaged infrastructure instead of improving the water infrastructure footprint (Mukwarami, 2021; Mukwarami & Fakoya, 2022). It has been noted that strikes and protests have caused harm to service delivery (Reddy, 2016; Morudu, 2017). On the same note, the quality of service delivery has a close connection with social practices such as population (Kleynhans & Coetzee, 2019), unemployment (Khale & Worku, 2013), housing programmes (Meyer, 2014) and educational level (Mbandlwa & Mishi, 2020). Therefore, focusing on evaluating the extent to which social practices can influence the water service delivery system in South Africa, can present untapped potentials that could result in better management of water investments (Mukwarami & Fakoya, 2022). The quest to find a convergence point to seek consensus between social practices and the delivery of water services remains an imperative objective in addressing WSDCs.

The purpose of the article is to seek a holistic approach that does not undermine the influence of social practices on service delivery for improved and progressive water investment decisions. To achieve this objective, the participatory theory of democracy provides fertile ground for enriching the narratives around how democratic rights lead to certain social practices as envisaged in the South African constitution to a certain extent influence the service delivery performance. Therefore, due to the non-existence of studies that specifically examined the relationship between social practices (population changes, literacy rate, SDPs, and housing programmes) and SDP as measured through the water access rate and investment in water management (IWM), this article sought to present an integrated approach of addressing WSDCs in developing economies. Further, this article is not only arguing for increased IWM to address WSDCs (Ruiters & Amadi-Echendu, 2022) but it advances the narrative regarding the impacts of social practices on SDP in South African municipalities (SAMs). Additionally, it seeks to prove that social practices are key determinants of IWM and acknowledges that without proper accountability of social practices, WSDCs as well as the investment gap remain unresolved. Given that study discovered a potential approach helpful to address WSDCs, it

can theorised that local governments are likely to factor in social practices with much consideration for improved service delivery performance. Furthermore, the practical implication of the study is that policymakers and local municipalities do not need to underestimate the influence of social practices on service delivery, and re-routing efforts to address WSDCs is critical in further exploring a mix of variables that provide great opportunities for managing IWM.

The remainder of this paper is structured as follows. Section 2 discusses the theoretical perspective and review of the related literature. Section 3 presents the methodology employed to collect and analyse the data. Sections 4 and 5 provide the results and discuss the main findings of the research, respectively. Lastly, Section 6 presents the conclusion and perspective for further studies.

2. LITERATURE REVIEW

This section presents a discussion on the participation theory of democracy and reviews all related empirical studies that provide the basis for hypothesis development, as shown in Figure 2.

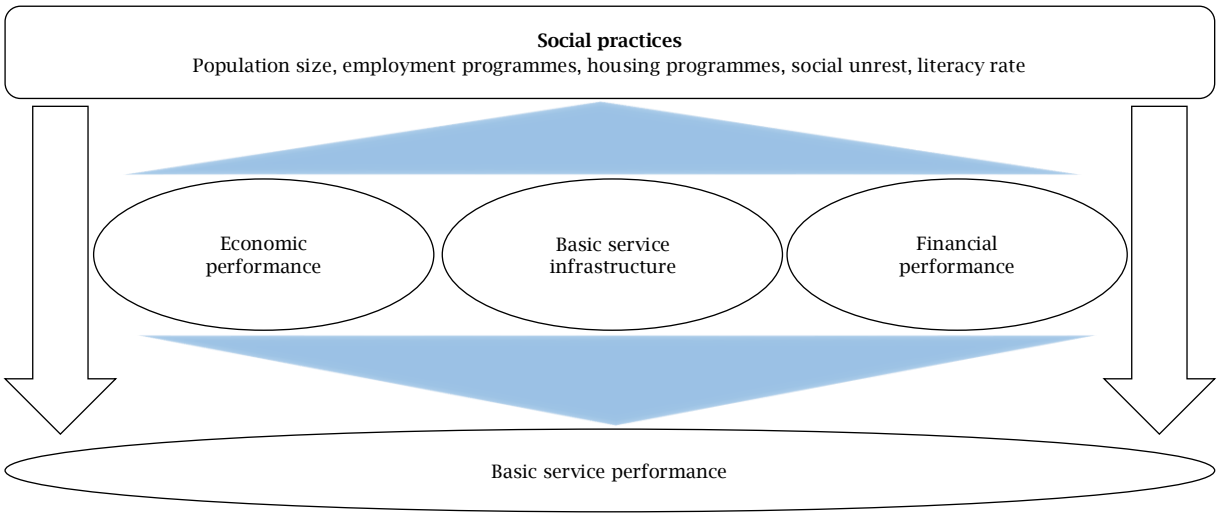
2.1. Participatory theory of democracy

The participatory theory of democracy stresses the participation of individual citizens or groups of stakeholders directly to make political decisions that affect their lives. In the context of South Africa, democracy as a practice is guided by rules, decisions, and laws that are justified and should result in the free participation of citizens (Breakfast et al., 2015). Municipalities are obliged to apply a *people-first* approach to implement all decisions that are related to service delivery by responding to electorates' queries (Mamokhere et al., 2022). Therefore, in conjunction with stakeholder theory, the participatory theory of democracy provides the impetus to gain a deep understanding of the rights of citizens as important stakeholders to participate in basic service delivery decisions as mandated by the Constitution of the Republic of South Africa (1996). The incorporation of the participatory theory of democracy in the discussion provides fertile ground to understand the social practices' effects on service delivery. South Africa is a country that respects the constitutional rights of its citizens and all decisions are made based on stakeholder participation (Breakfast et al., 2015). Similarly, social protests represent citizens' understanding of their democratic rights to express their dissatisfaction to seek attention from the service providers. Henceforth, the participation theory of democracy provides insights into citizens' rights in seeking transparency and accountability from the local municipalities.

2.2. Social practices and basic service delivery

Transitioning social challenges have continued to have an impact on water security and service delivery. According to Kleynhans and Coetzee (2019), social factors such as population size, gender disparity, literacy rate, economic inequalities, and employment rate are key determinants of service delivery. Given the rate at which cities are growing against the increasing demand for services, it is vital to interrogate social practices' effects on service delivery. Figure 1 illustrates linkages between social practices, financial performance, economic performance, and basic service infrastructure.

Figure 1. Linkages between social practices and service delivery



The review of the literature regarding the relationship between social practice and service delivery is guided by the information shown in Figure 1. Social practices can, directly and indirectly, influence SDP by affecting financial performance, the functionality of infrastructure, and economic performance (Morudu, 2016; Kleynhans & Coetzee, 2019).

SDPs have become a channel of communication used by dissatisfied citizens to convey their queries in developing countries, particularly in South Africa (Morudu, 2017; Mamokhere, 2020; Mamokhere et al., 2022). The frequency of service delivery protests has perpetuated social unrest across several municipalities in South Africa as evidenced in the literature (Ndevu & Muller, 2018; Masiya et al.,

2019). Khale and Worku (2013) established that SDPs around the municipalities of Gauteng and North West Province were characterised by low income, unemployment, low education, and poor level of artisan skills. The frequency of SDPs has increased, with private property and public infrastructure facing the significant challenge of being destroyed and increased social costs (Alexander et al., 2018). Besides, political interferences (Masuku & Jili, 2019), lack of public participation (Rivenbark et al., 2019), and a lack of trust (Msenge & Nzewi, 2021). Additionally, factors that lead to service delivery include the inadequate provision of basic services such as water and sanitation, poor governance practices, inadequate housing, trust deficit, corruption, and financial mismanagement (Kalonda & Govender, 2021).

Additionally, Ndebele and Lavhelani (2017) analysed the linkage between local government and the quality of service delivery in Limpopo Province and established that the increasing number of SDPs is propelled by a lack of public participation in all decisions regarding the delivery of basic services. However, protesting is a way to seek an audience with local service providers, however, its effects are sometimes costly. Morudu (2017) analysed the relationship between SDPs and the extent of services delivered by local municipalities in South Africa. Through a quantitative approach, it was established that poor services in the areas of electricity, sanitation, water, health care, education, and housing have spurred endless, violent, and destructive SDPs that resulted in infrastructure sabotage. Similarly, Reddy (2016) evaluated the nexus between politics and service delivery in South Africa and found that the frequency of SDPs across the country is a matter of great concern since they have adverse effects on the development of local economies and the functioning of municipalities. In a study involving Tzaneen municipalities in South Africa, Mamokhere (2020) found that SDPs have intolerable impacts on socio-economic development, therefore municipalities should be proactive in dealing with communities' demands to avoid escalation of social unrest. Therefore, interrogating the relationship between SDPs and service delivery performance may assist to address WSDCs.

H1: There is a positive relationship between SDPs and the extent of water SDP in SAMs.

As cities are growing, urban challenges become visible, and cities require to plan effectively to address service delivery and infrastructure development needs (Asoka et al., 2013). It is important to recognise that unprecedented growth in the population in urban areas (Rivenbark et al., 2019) has given rise to many service delivery challenges that have influenced the performance of local municipalities. In understanding the impact of population on the performance of municipalities, various studies have confirmed that population growth has a significant influence on the performance of municipalities as measured through service delivery and financial performance (Turok & Borel-Saladin, 2016; Tripathi, 2017). Kleynhans and Coetzee (2019) analysed data spanning from 2009 to 2015 regarding the financial condition of municipalities in KwaZulu-Natal, South Africa. The results suggest that the number of unemployed people compared to the whole urban population was found to be very significant in determining the financial condition of municipalities.

Likewise, Balie and Horn (2021) evaluated the link between pollution growth and municipal revenue in SAMs. They confirmed that the growth of the population failed to give rise to a comparable change in revenue that would affect service delivery. Therefore, they concluded that municipal revenue increased at a much higher rate than population growth. In contrast, Mahabir's (2010) study on the influence of population density on the performance of municipalities in South Africa found adverse results. This implies that municipalities' capacity to provide basic services becomes constrained by the growth in population. Likewise, Gomez et al. (2019) established that an increase in population without a proportionate increase in investment in middle-income areas put a strain on the functionality of the infrastructure resulting in service delivery challenges. Given the inconclusive relationship between population and SDP, the study's motive is to interrogate this narrative further to seek solutions to WSDCs.

H2: There is a significant and positive relationship between the population size created and the extent of water SDP in the SAMs.

The rate of urbanisation in developing countries has reached an alarming level (Rivenbark et al., 2019), and this has continued to put pressure on local governments to intensify efforts to address the basic service delivery crisis. Hence, it is important to establish a relationship between housing projects and SDPs for improved municipal performance. Zafra-Gómez et al. (2010) studied ways of overcoming cost-inefficiencies within small municipalities for improved financial conditions. The ordinary least squares' results established that housing taxes determine the local government's potential to generate revenue. This implies that the more housing units in urban areas, the higher the taxes remitted to the local government resulting in better financial performance. Likewise, regarding housing as a social factor, Glossop (2008) acknowledged that a positive relationship existed between housing and economic development in London. Further, it was established that housing can increase investments and assist in attracting and retaining required skills.

In the South African context, the housing crisis is a result of the government's failed promise to provide free accommodation (Marutlulle & Marutlulle, 2021). Ogra and Onatu (2013) reviewed the housing situation in Gauteng metropolitan municipalities and reveal that the increasing urban population has resulted in high demand for accommodation which municipalities cannot provide, and this has resulted in the construction of informal settlements in undesignated areas. Meyer (2014), through a study regarding the impacts of housing and basic service delivery in low-income communities in South Africa, found that housing programmes and service delivery can have a positive impact on poverty reduction. Housing delivery can create a lot of benefits including asset ownership, wealth, and employment opportunities creation. Therefore, the provision of housing services has a substantial influence on the quality of life resulting in an improved service delivery system. On the same

note, Buckley et al. (2016) suggest that the emergence of large-scale housing programmes is important to address housing backlogs in developing cities in emerging economies, and therefore have an impact on public finance. Hence, local authorities should look beyond the public finance perspective to address the housing crisis in the growing cities.

H3: There is a significant and positive relationship between expenditure on housing opportunities created and the extent of water SDP in the SAMs.

The role of the local government is to promote local economic development by creating employment opportunities and promoting a conducive environment for businesses to operate freely (Mukwarami et al., 2020). Apart from government funding, local government entities mostly rely on income generated through various fiscal activities such as rates and taxes. Therefore, local economic development projects which promote employment creation are pertinent to promote the financial viability of local municipalities. However, it is against this background that municipalities in developing countries are facing viability challenges since socioeconomic challenges affect the income of the residents (Godfrey et al., 2017). Mori-Clement (2019) established that clean development projects (biomass energy, hydro, landfill gas, renewable energy, and waste handling) have stimulated local economic development in Brazil leading to increased income levels and the creation of more labour opportunities.

Wong and Guggenheim (2018) attested that the government's community-driven development projects work better to achieve the government goal aimed at improving the lives of the poor and disadvantaged people in the local communities. Particularly when a broader government strategy encompassing governance reforms and integration efforts to improve the quality of public services is implemented. The creation of employment is a key determinant in assessing the citizens' potential to pay for municipal services. Consistent with the above assertion, Kulaba (2019) looked at local government and the management of urban services in Tanzania and revealed that urban local governments are confronted with the challenge of creating productive employment opportunities to improve affordability to pay for urban services. Therefore, for municipalities to function effectively, Masuku and Jili (2019) stressed that the provision of public services can lead to employment creation, and is perceived as the most important aspect of reducing poverty. They further noted that local municipalities should create job opportunities to benefit vulnerable people as stated in the South African Government's white paper on transforming public service delivery. Khale and Worku (2013) explained in a study that involves service delivery in Gauteng and North West Province of South Africa that the quality of services provided by political appointees (including counsellors and some council officials) is influenced by unemployment, poor education, and low household income. Therefore, the creation of employment is key to SDP in developing economies.

H4: There is a positive relationship between job opportunities created through empowerment programmes and the extent of water SDP in the SAMs.

The role of education in management and leadership is vital to provide quality leadership in local government (Kalonda & Govender, 2021), particularly during the digital era where the fourth industrial revolution is becoming a dominant feature (Ismagilova et al., 2019). Given the new world characterised by digital transformation, national governments have increased their capacity to offer e-services within their areas of jurisdiction. However, the literacy rate is a measure of the effectiveness of education and plays an important role in the digital transformation of government services. Amuche (2019) analysed the link between electronic governance and service delivery in selected ministries in Ebonyi State, Nigeria, and established that the introduction of electronic governance resulted in many benefits such as reducing corruption and red tape and promoting accountability and transparency. Likewise, Dhonju and Shakya (2019) evaluated the changes in implementing e-government services in municipalities located in Kathmandu Valle and found many problematic challenges that have adverse effects on digital transformation including lack of knowledge and leadership support and low levels of literacy rate among the citizens. This further implies that the successful implementation of e-government programmes is determined by the level of education.

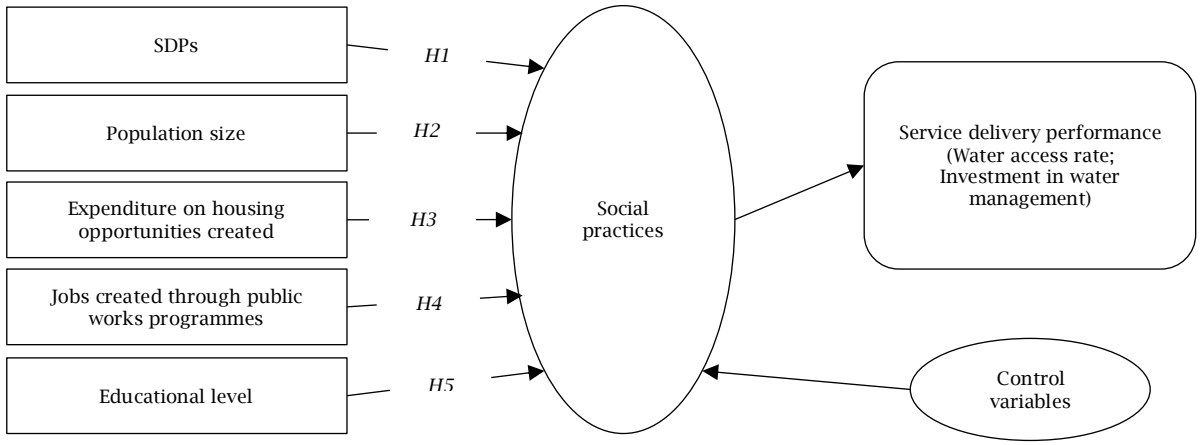
After assessing electronic service delivery in municipalities, Budding et al. (2018) found a significant nexus between e-government adoptions with demographic characteristics, such as population, population density, and both older and younger age groups. However, they revealed an insignificant relation between allocated government cost and cost saving, therefore failing to understand if the introduction of digital can lead to cost reduction. On the same note, Ngomuo and Wang (2015) established in Tanzania that poor-performing local government entities are linked to poor financial performance rather than social performance as measured by education sector performance and health sector performance. Mbandlwa and Mishi (2020) viewed ward councillors leadership characteristics and their impacts on service delivery in eThekwini Metropolitan Municipality in South Africa. They found that education and experience as measures of leadership quality increase the chances of getting better service delivery and less frequency of SDPs. This implies that digital literacy (gained through educational programmes) among the local people enhances interaction with service providers. Given the literature, the government must improve the quality of education for improved literacy levels to pave the way for e-participation that could have an impact on service delivery.

H5: There is a significant and positive relationship between educational level and the extent of water SDP in SAMs.

2.3. Conceptual framework

This article is built based on common social practices in local municipalities, namely population changes, job opportunities created, educational level, and SDPs. As depicted in Figure 2, the conceptual framework illustrates the interaction of the social practices and service performance indicators measured through water access rate (WAARA) and total investment in water management (TOIWM).

Figure 2. Conceptual model



3. METHODOLOGY

The research focused on local municipalities in South Africa. According to the Constitution of South Africa Act No. 108 of 1996, local municipalities have the constitutional mandate to deliver water services to the people within their area of jurisdiction. Similarly, the same constitution empowers water consumers to engage in all decisions that affect water service delivery. Given existing WSDCs challenges in various municipalities in South Africa (Mukwarami, 2017), the study focused on social practices as determinants of service delivery for improved water delivery performance. Therefore, the empirical approach employed in this paper allowed the researchers to achieve the objective of evaluating the relationship between social practices and SDP in South Africa. The quantitative approach allows the researchers to collect observable and numerical data to be statistically analysed to conclude in line with other previous studies. Consistent with Saunders et al.'s (2019) research onion, the article elaborates on all the elements of the research explicitly to unpack the layers of the opinion. The anthological assumption of this article is based on the fact that South Africa is faced with unique socio-economic problems which make the government face difficulties to address the WSDCs. The fact that SDPs prevail in the country further suggests that epistemologically the unique social problems in South Africa are real as evidenced by social discontentment among the communities (Morudu, 2017). Further, the article adopted the objectivism approach since observable quantitative numerical data were used which is real and independent of the researcher, and the data can be analysed independently. Therefore, the deductive approach is followed to either confirm or refute the research hypotheses to allow for improvement in the existing theories.

The data involves the use of longitudinal data drawn from various online and portable document format (PDF) sources of 20 purposively sampled municipalities in South Africa for the period from 2009 to 2021. The reasons for the selection of the 20 biggest municipalities include financial autonomy as they generate more the 50% of income within their fiscal space (The Republic of South Africa Department of National Treasury [RSADNT], 2018), they accommodate a substantial population leading high water demand (Statistics in South Africa [Stats SA], 2022) and the majority of them are water service authorities which imply that they are responsible for providing water to end users (Department of Water and Sanitation [DWS], 2018). The data sources from which data was extracted include municipal finance data from the National Treasury, Municipalities of South Africa, Statistics South Africa (Stats SA), The South African Local Government Association (SALGA), South Africa's Incident Registration Information System (IRIS), annual reports, and integrated development plans. To ensure the validity and reliability of the data collected for the study, the researcher used multiple data sources for improved accuracy. Additionally, Section 71 of the Municipal Finance Management Act (MFMA) (Act No. 56 of 2003) ensures that local municipalities ensure transparency in reporting the financial performance of local municipalities. Similarly, the Public Audit Act No. 25 of 2004 together with the Constitutional of South Africa allows the auditor general to check the spending of public funds and ensures that National Assembly receives accountability reports. Therefore, the assertion that the data used in the study is reliable and verified is true.

3.1. Regression analysis

Regression analysis is useful to determine the cause-and-effect relationship in variables (Saunders et al., 2019). The regression analysis is one of the most common approaches applied in studies that determine how the dependent variable changes concerning the explanatory variable (Morudu, 2017; Mukwarami, 2021). For the study, the application of regression analysis allowed the researchers to gain a better understanding of the social practices variable that has the most impact on the SDP. The study in addition to one control variable (total value of assets) used five (5) independent variables (SDPs, population size, expenditure on housing opportunities created, and educational level represented by literacy rate). Regressors are represented by SDP measured through water access rate and total investment in water management).

Regression model:

$$WAARA_{it} = \alpha_i + \beta SEDPR_{it1} + \beta POPSZ_{it2} + \beta EHOCR_{it3} + \beta JCPWP_{it4} + \beta LITRA_{it5} + \beta TVASS_{it6} + \varepsilon_{it} \quad (1)$$

$$TOIWM_{it} = \alpha_i + \beta SEDPR_{it1} + \beta POPSZ_{it2} + \beta EHOCR_{it3} + \beta JCPWP_{it4} + \beta LITRA_{it5} + \beta TVASS_{it6} + \varepsilon_{it} \quad (2)$$

where,
$WAARA_{it}$ = Water access rate;
$TOIWM_{it}$ = Total investment water management (ZAR);
α_i = Intercept;
β = Slope;
$JCPWP_{it4}$ = Jobs created through public works programmes;
$SEDPR_{it1}$ = Service delivery protests;
$POPSZ_{it2}$ = Population size;
$LITRA_{it5}$ = Literacy rate;
$EHOCR_{it3}$ = Expenditure on housing opportunities created;
$TVASS_{it6}$ = Total value of assets;
ε_{it} = Error term.
$TOIWM$, $POPSZ$, $EHOCR$, and $TVASS$ are given in their natural logarithm form.

3.2. Explanation of variables

The study used many variables that represent service delivery performance and social practices. The information in Table 1 shows the information regarding the explanation of variables, data sources, and related literature.

Table 1. Explanation of variable and data sources

Variable	*Explanation*	*Data sources*	*Related literature*
Dependent variables			
WAARA	The access rate to pipe-borne water was calculated based on the number of households accessing pipe-borne water within 200 meters from their yards.	Statistics South Africa, Integrated Development Plan	Mukwarami (2021), De Carvalho et al. (2009)
TOIWM	The sum of expenditure on maintenance of water assets total and capital expenditure on new water assets.	National Treasury's municipal finance data, integrated reports, municipal budgets: Medium-term revenue and expenditure framework reports	Mukwarami (2021)
Independent variables			
JCPWP	Measured through employment opportunities created by the public works programmes that are monitored by the local municipalities.	Annual integrated reports	Wong and Guggenheim (2018)
SEDPR	Several service delivery protests occurred in the local municipalities.	Municipal data and intelligence, South African police service incident registration information system	Morudu (2017), Mamokhere et al. (2022)
POPSZ	Measured through the number of people residing in municipalities.	Statistics South Africa, Integrated Development Plan	da Motta and Moreira (2006), Kleynhans and Coetzee (2019).
LITRA	Number of people who can read and write.	Annual integrated reports	Mbandlwa and Mishi (2020)
EHOCR	Expenditure on housing development projects was considered a relevant variable because of its potential to directly affect investment in SWI as newly developed housing units require water connections.	Annual integrated reports	Mukwarami (2017), Mukwarami et al. (2021)
Control variable			
TVASS	Measured through the value of assets the municipalities own. This includes current and fixed assets.	Annual integrated reports	Mukwarami (2017)

3.3. Data analyses and panel data analysis

The secondary data collected shared two main features that are associated with panel data. According to Baltagi (2008), panel data shares two features, namely cross-section and time series. The collected data were checked for accuracy, missing data, and duplication in the Excel spreadsheet and later imported into EViews and Stata for further analytical procedures in line with previous research (Mukwarami, 2017). To address the research objective, the data analysis involved the use of panel data estimators. Therefore, the quantitative data analysis followed inferential statistics that involved the use of the study employed ordinary least squares (OLS) and feasible generalised least squares (FGLS) to examine the relationship between social practices and SDP. The OLS is one of the unbiased estimators, and it is known for having the least variance among all linear estimators (Lukman et al., 2020). However, certain regression assumptions need to be observed to rely on OLS results such as normality, heteroscedasticity, and absence of serial correlation (Lukman et al., 2020). Therefore, in line with previous studies (Mukwarami & Fakoya, 2022; Mukwarami, 2017), an adequacy test was conducted to check if regression assumptions are not violated. Additionally, FGLS were performed to further confirm the robustness of the results. According to Nakale et al. (2013), FGLS has the advantage of addressing cross-sectional, heteroscedasticity, and serial correlation which makes the model to better than OLS. Therefore, the FGLS was used as an alternative model to validate OLS results.

4. RESULTS

4.1. Correlation matrix

The correlation matrix shows a simple linear relationship between selected variables (Saunders et al., 2019). As shown in Table 2, all variables are positively correlated to *TOIWM* except *WAARA*, which is negative (-0.3737). On the same note, the weakest correlation (0.0713) was found between *EHOCR* and *WAARA*.

Table 2. Correlation matrix showing the relationship between variables

	TOIWM	*EHOCR*	*SEDPR*	*LITRA*	*WAARA*	*JCPWP*	*POPSZ*	*TVASS*
TOIWM	1							
EHOCR	0.3176	1						
SEDPR	0.5907	0.3756	1					
LITRA	0.3737	0.3366	0.5941	1				
WAARA	-0.1385	0.0713	-0.4207	-0.4543	1			
JCPWP	0.5842	0.2768	0.5924	0.4358	-0.2216	1		
POPSZ	0.5782	0.5632	0.6998	0.564	-0.1922	0.6743	1	
TVASS	0.5655	0.5975	0.6524	0.5643	-0.1784	0.5146	0.8959	1

Additionally, there is a negative and weak correlation (-0.4207) between *SEDPR* and *WAARA*, while *POPSZ* and *SEDPR* showed a strong positive correlation (0.6998), this suggests that increasing population increases the demand for service increases resulting in municipalities failing to meet demand and people resorting to protests.

4.2. Trend analysis for dependent variables

The government is making efforts to increase *TOIWM* as shown in Figure 3. Although fluctuations in the trend analysis exist for the period from 2009 to 2021, the constant growth in *TOIWM* was witnessed in the metropolitan municipalities.

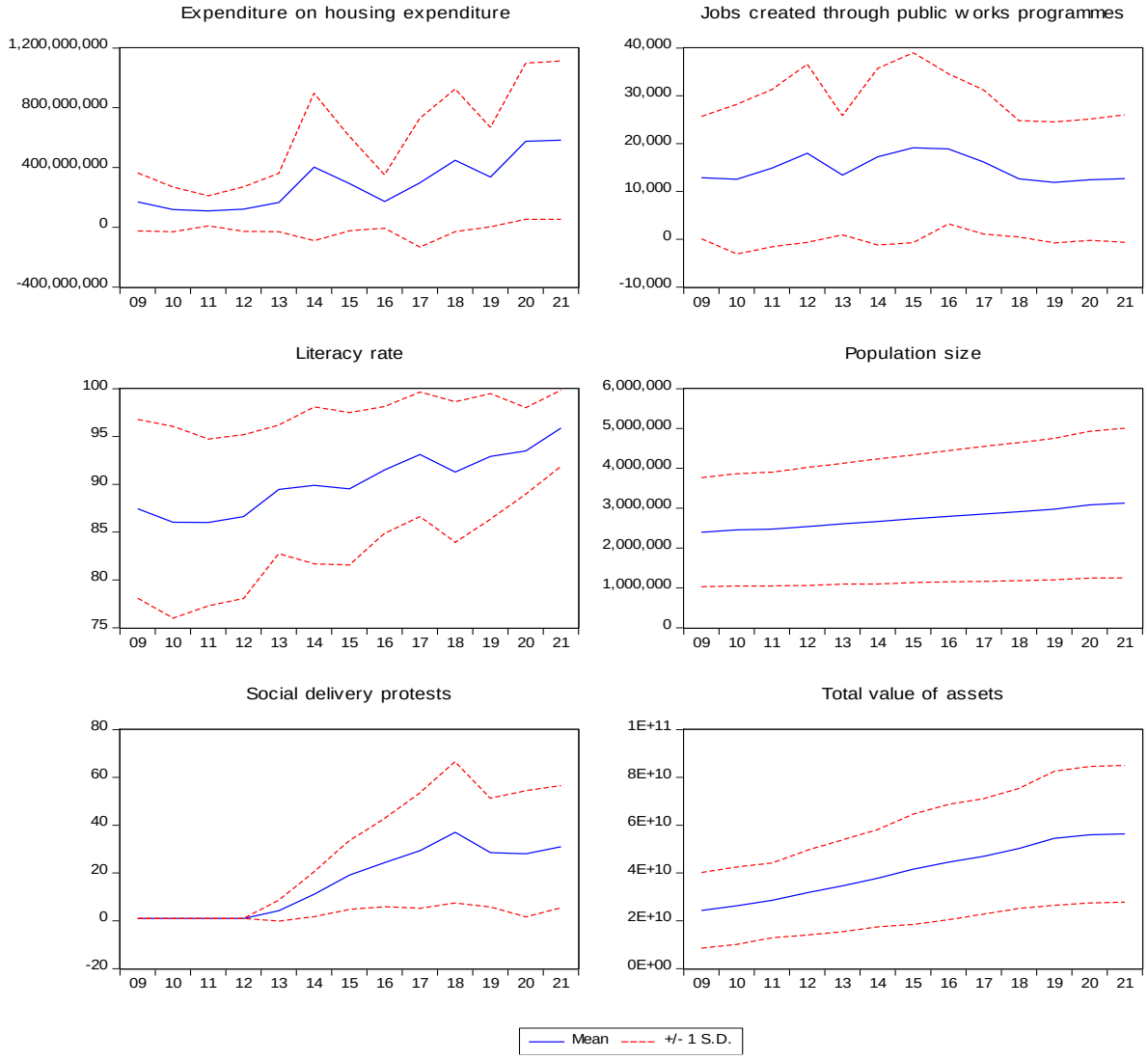
Figure 3. Trend analysis showing total investment in water management and water access rate

Even though the *TOIWM* increased steadily over time, the *WAARA* slightly decreased but remained constant. The trend analysis for *WAARA* suggests that not only an increase in *TOIWM* can address WSDCs, thus providing impetus for this study.

4.3. Trend analysis for social practices

The trend analysis for *EHOCR* (as shown in Figure 4) suggests that the government and the local municipalities have made progress in improving accommodation in metropolitan cities. Therefore, this implies that calls for improved service delivery systems continued to receive attention. The trend for *JCPWP* shows that the socio-economic outlook in the metropolitan municipalities and national level gives a blinking picture. As such, the slow progress in employment generation directly coincided with a surge in *SEDPR*. The trend analysis for *SEDPR* and *JCPWP* is consistent with the findings of Khale and Worku (2013), who established that the increasing number of *SEDPR* is propelled by high levels of unemployment.

Figure 4. Trend analysis for housing opportunities created



LITRA in the metropolitan municipalities improved significantly over the period in question. The improvement in *LITRA* proved the government's efforts toward educating citizens. While the steady increase in population in the metro cities further confirms the effects of rural-urban migration confirmed in various studies (Rivenbark et al., 2019).

4.4. Model adequacy tests

Panel data is a set of data containing observations that have two (2) characteristics, namely cross-section and time series (Pillai, 2016). For this study, the time series feature is represented by the time frame of the study which spans from 2013 to 2021. The cross-sectional feature is explained by the 20 municipalities located in South Africa which represent 20 panels. The use of panel data is associated with many advantages including the ability to deal with complicated relationships (Hurlin, 2008), and increasing degrees of freedom not applicable with either time series or cross-section alone (Smith & Fuertes, 2012). Torres-Reyna (2010) attests that panel data allows for the control of variables that cannot be observed or measured, and in simple terms, it accounts for individual heterogeneity. However, panel data can be associated with analytical problems such as multicollinearity, heteroscedasticity, autocorrelation, and non-normality problems (Lukman et al., 2020). Therefore, the data analysis involved diagnosing problems associated with assumptions of regression to ensure that appropriate regression models are selected.

4.4.1. Multicollinearity

The presence of multicollinearity in the panel data creates an undesirable situation for the regression results by weakening the statistical power (García et al., 2015). To detect if independent variables strongly correlated or not, the variance inflation factor (VIF) was employed, and the results are shown in Table 3.

Table 3. Variance inflation factor for multicollinearity

Variable	*VIF*	*1/VIF*
Population size	12.80	0.078115
The total value of assets	9.76	0.102460
Jobs created	2.58	0.387688
Social delivery protests	2.37	0.422341
Literacy rate	1.77	0.563869
Housing opportunities created	1.40	0.714182
Mean VIF	5.11	

The results are proving that the multicollinearity problem does not exist in the panel data. Overall, VIF is far below the threshold of 10 recommended in the literature (García et al., 2015) and this further confirms that multicollinearity challenges were completely ruled out.

4.4.2. Normality

While testing for normality might not be necessary for panel data, it was found necessary to ensure that all regressors and regresssands are normally distributed. Lack of normality in the panel data results in untrustworthy inferences and distortion of the relationship, particularly in OLS (Beyaztas et al., 2021). Normality test results are shown in Table 4.

The results in Table 4, suggest that the panel data is normally distributed as the p-value is above the confidence level of 0.05. This further suggests that the assumption of normality in panel data is not violated.

Table 4. Normality test result

Normality test for multiple variables	
Jarque-Bera normality test: 7.562 Chi(2) Jarque-Bera test for H_0: normality	0.0628

4.4.3. Panel unit root

Testing for a unit root in panel data has become a new development in recent studies (Hurlin, 2008). The validity of the panel models requires that the underlying data is stationary (Torres-Reyna, 2010). Hurlin (2008) confirms that the presence of unit roots in the panel data may cause misinterpretation of the estimated results. The Levin–Lin–Chu unit root results are displayed in Table 5.

Table 5. Levin–Lin–Chu unit root results

Variable	*Order on integration*	*Statistics*	*Probability value*
TOIWM	1(0)	-3.87084	0.0001
WACER	1(1)	-2.49644	0.0063
EHOCR	1(1)	-8.5965	0.0000
JCEPW	1(1)	-5.43880	0.0000
LITRA	1(1)	-1.57694	0.0574
POPSZ	1(1)	-3.92355	0.0000
SDIPR	1(1)	-4.37961	0.0000

The results shown in Table 5, suggest that most of the variables are stationary at 1 difference and only *TOIWM* is stationary at zero difference.

4.4.4. Heteroscedasticity results

The most common problem in panel data is heteroscedasticity which results in heterogeneity problems. Lack of homoscedasticity in the panel data leads to biased results, in the form of inconsistent estimates of the regression coefficient (Born & Breitung, 2015). Therefore, the existence of heteroscedasticity was determined by conducting the Cook–Weisberg test, and the results are shown in Table 6.

Regarding the results, the assumption of homoscedasticity is not violated as the panel data lack heteroscedasticity which is undesirable. The p-value represented by 0.62 is above the threshold of 0.05, which represents the confidence level.

Table 6. Heteroscedasticity results

Breusch–Pagan/Cook–Weisberg test for heteroscedasticity
H_0: Constant variance
Variables: Fitted values of *TOIWM*
$Chi^2(1) = 0.62$
Prob. > $Chi^2 = 0.4322$

4.4.5. Serial correlation

Although serial correlation is mostly found in time series (Born & Breitung, 2015), it has been argued that failure to observe the problem of serial correlation in panel data may result in inefficient estimates of the regression coefficient and biased standard errors (Baltagi, 2008). The serial correlation results are shown in Table 7.

Table 7. Run-test results showing statistical significance

Run-test results showing serial correlation
N(resid_D ≤ 0) = 78
N(resid_D > 0) =102
Obs. = 180 N(runs) = 120 z = 0.26
Prob. > z = 0.79

The run-test results displayed in Table 7 show that there are 120 runs in 180 observations, which is above a threshold of 50%. Building on the normal approximation to the distribution of the number of runs, in this case, the number of runs is more than 50% of the number of observations implying that regression residuals are serially independent. Similarly, the p-value is 0.79 is more than the significant level of 0.05 and further suggests that the null hypothesis (H_0) cannot be rejected. Therefore, the presence of serial correlation in the panel data was ruled out completely.

4.4.6. Panel data models results

OLS and FGLS were utilised to estimate the relationship between social practice and SDP. The absence of multicollinearity, heteroscedasticity, and serial correlation further suggest that the model estimates results presented in Table 7 are robust and lack bias. Table 8 shows the results of the panel models conducted in Stata.

Table 8. Panel data model results

Variable	*OLS*	*FGLS*	*OLS*	*FGLS*
	WAARA		*TOIWM*	
SEDPR	-0.0577	-0.0577	-0.000115	-0.000115
	(-1.50)	(-1.59)	(-0.03)	(-0.03)
POPSZ	-5.156	-5.156	0.161	0.161
	(-1.72)	(-1.83)	-0.52	-0.55
EHOCR	1.104*	1.104**	-0.00986	-0.00986
	-2.45	-2.6	(-0.21)	(-0.22)
JCPWP	0.3	0.3	0.160*	0.160*
	-0.41	-0.44	-2.1	-2.23
LITRA	-0.405***	-0.405***	0.0223	0.0223
	(-3.49)	(-3.71)	-1.84	-1.95
TVASS	5.356	5.356	0.533	0.533
	-1.72	-1.83	-1.64	-1.74

*Note: *** p < 0.01, ** p < 0.05, * p < 0.1.*

As shown in Table 8, both OLS and FGLS show a positive and insignificant relationship between the water access rate (*WAARA*) and the job created through public works (*JCPWP*) as evidenced by a regression coefficient of 0.3 with no single asterisk. On the other hand, a positive and significant relationship (0.160) existed between *JCPWP* and *TOIWM*. This indicates that an increase in *JCPWP* will lead to an increase of 16% in *TOIWM*.

Furthermore, the results show there is a negative and insignificant between *SEDPR* and *WAARA*, and *TOIWM*, as evidenced by regression coefficients -0.0577 and -0.000115, respectively. Moreover, population size (*POPSZ*) influenced the *WAARA* negatively (-5.156), and this suggests that population increase in the metropolitan municipalities created a water supply gap resulting in water access challenges. Contrary to the results, a positive but insignificant existed between *POPSZ* and *TOIWN*, indicated by a 0.161 coefficient.

While a negative and significant relationship existed between *LITRA* and *WAARA*, as shown by the -0.405 coefficient with three asterisks, *LITRA* influenced *TOIWM* positively, as evidenced by a coefficient of 0.0223. The results also show that there is a positive correlation between *EHOCR* and *WAARA*, as represented by a coefficient of 1.104 and the presence of two asterisks further suggests that the relationship is quite strong. Lastly, *EHOCR* has had an adverse impact on *TOIWM*.

5. DISCUSSION

The analysis of the relationship between social practices and SDP was conducted using OLS and FGLS in Stata and the summary of the results is presented in Table 9.

Table 9. Summary of the aggregated OLS and FGLS results

Variable	*WAARA*	*TOIWM*	*Final outcome*
SEDPR	- (insignificant)	- (insignificant)	Negative
POPSZ	- (insignificant)	+ (insignificant)	Neutral
EHOCR	+ (significant)	- (insignificant)	Neutral
JCPWP	+ (insignificant)	+ (significant)	Positive
LITRA	- (significant)	+ (insignificant)	Neutral
TVASS	+ (insignificant)	+ (insignificant)	Positive

The summary of the results in Table 9 indicates a negative relationship existed between *SEDPR* and SDP as measured through *WAARA* and *TOIWM*. This suggests that an alternative hypothesis *H1* is, therefore, rejected. The results imply that the frequency of *SEDPR* in the cities may have led to the destruction of infrastructure resulting in limited water access. To support the results, Morudu (2017) found out that *SEDPR* often turns out to be violent causing the destruction of infrastructure which provide basic services to the people. In support of the same point, Reddy (2016) and Mamokhere (2020) argued that the frequency of social delivery protests causes major destruction to the local economic development and

functioning of the municipalities, as a place with protests becomes inaccessible because of the disruptive behaviour of protesters. Therefore, the government is forced to source funds to replace and repair damaged infrastructure instead of concentrating on expanding the water infrastructure footprint.

Change in population size in urban areas is one of the key determinants of service delivery in cities. Looking at the results, as given in Table 9 there is a negative and insignificant relationship between *POPSZ* and *WAARA*. On a different note, *TOIWM* responded positively to *POPSZ*. Overall, the combined effects of *POPSZ* on *WAARA* and *TOIWM*, suggest a neutral relationship. Therefore, an alternative hypothesis *H2* cannot be accepted. The results are consistent with the previous studies that found that population increase may lead to poor financial performance and service delivery challenges in local municipalities (Kleynhans & Coetzee, 2019; Rivenbark et al., 2019). Gomez et al. (2019) accepted that increasing the population without addressing supply capacity issues regarding infrastructure upgrades definitely leads to poor service delivery. Additionally, Mahabir (2010) established that high population density in South African cities resulted in overwhelming service delivery infrastructure and compromised service delivery systems. The growth of the urban population is not proportionate to the flow of investments into the water sector, resulting in a widened gap between the supply and demand of basic services. As such, population size always remains a major factor in accelerating service delivery in growing cities.

Given the results indicated in Table 9, *EHOCR* has had a positive influence on the *WAARA*. Contradictorily, *TOIWM* responded negatively to the changes in *EHOCR*, implying that both variables failed to move in the same direction. Based on the results, an alternative hypothesis *H3* cannot be accepted because the combined effect of *EHOCR* on SDP is neutral. The neutral results are, however, inconsistent with previous results that support housing programmes enhanced service delivery and financial performance in the local governments. Zafra-Gómez et al. (2010) confirmed that an increase in the number of housing units led to a surge in housing taxes that determine the local government's potential to raise the revenue needed to spur financial performance. Glossop (2008) confirmed that housing projects have had a positive impact on economic development in London by increasing investments and attracting talented skills. In a way, cities can attract better-skilled people to contribute to the local government's fiscal system through paying rates and taxes which could channelled towards water provisioning efforts. Moreover, the results fit well into the South African narrative regarding the causes of WSDCs in cities. Marutlulle and Marutlulle (2021) admitted that the high demand for basic services like water and sanitation is driven by high rural-urban migration that has put a strain on basic services' supply capacities resulting in reduced access to water. Therefore, the local government should continue to invest in accommodation for improved service delivery.

As shown in Table 9, the aggregation of OLS and FGLS results shows an outright positive relationship between the effects of *JCPWP* on both *WAARA* and *TOIWM*. Therefore, an alternative hypothesis *H4* cannot be rejected based on the positive direction of the relationship. The results suggest that the creation of employment opportunities has contributed a lot to the *WAARA* and increased *TOIWM*, particularly due to increased incomes of residents associated with paying for services offered. This had been confirmed by Kulaba (2019) who established that if the local governments create employment, paying for urban services by citizens might be easy and affordable. The positive relationship between the two variables is consistent with other previous results (Wong & Guggenheim, 2018; Masuku & Jili, 2019). Mori-Clement (2019) focused on local municipality-driven clean development projects in Brazil and found out that these projects stimulated local economic development leading to employment creation and subsequently increased income levels. Therefore, local governments should initiate employment creation projects to ensure residents' incomes are enhanced for improved service delivery. This sentiment is consistent with Masuku and Jili (2019), who stressed that local municipalities should create job opportunities as envisaged in the South African Government's white paper on transforming public service delivery.

Education level is an important factor in the management of local municipalities (Kalonda & Govender, 2021). The results in Table 9 show that a significant and negative relationship between *LITRA* and *WAARA* existed. The results further indicate that there is a negative relationship between *LITRA* and *TOIWM*. Despite a positive and negative outcome, the study considers the overall results based aggregated influence of *LITRA* on *WAARA* and *TOIWM* to be neutral. The neutral results suggest that an alternative hypothesis *H5* cannot be accepted. The results are not similar to previous studies of Mbandlwa and Mishi (2020), they found that education and experience in leadership improve services delivery in eThekwini Metropolitan municipality in South Africa. Moreover, Ngomuo and Wang (2015) established that poor financial performance in Tanzania's municipalities is linked to the education sector's performance. While it is important to acknowledge that education is a vehicle for the adoption of the fourth industrial revolution for improved service delivery, Dhonju and Shakya (2019) accepted that a lack of education and knowledge continues to cause problems in adopting new technology that has the potential to improve service delivery. Therefore, improving the literacy rate through various educational programmes may provide opportunities for municipalities to have quality leadership and adoption of new technology to allow optimal interaction, particularly through e-participation and e-government services.

6. CONCLUSION

Given the surge in WSDCs in South Africa, this study sought to quantitatively examine the relationship between social practices and SDP involving the 20 biggest municipalities in an endeavor to propose policy actions that govern social practices, to augment efforts towards managing water investments for improved SDP. The article further identified a gap in the extant literature with most

research being qualitative and few quantitative studies that used a limited mix of measures of social practices. Also, a lack of studies that acknowledge the impacts of social practices on SDP as most studies focus on increasing funding and addressing corruption to address WSDCs, has propelled the researchers to partake this study. To enhance the understanding of the discussion, the participation theory of democracy was incorporated for an improved understanding of social practices, particularly concerning various forms of public participation in decision-making involving the provision of basic services.

Despite problems in accessing data regarding some variables, the researchers managed to gather data on all social practices and SDP from various online sources. Through the use of ordinary least squares, and feasible generalized least squares, the study established that job opportunities have had a positive influence on SDP, and SDPs adversely impacted service delivery. Lastly, the rest of the social practice measures did not influence SDP.

The fact the study pioneered in this field of study, the theoretical implications of the study is that an alternative approach to addressing WSDCs by considering social practices can be further explored in this field of study. The practical implication of the study is that municipal managers and politicians involved in the management of local government have to consider and explore the practical benefits of managing social practices for improved water service delivery performance. Similarly, the study results provide opportunities for policymakers and regulators to improve the regulatory framework for improved coherence with water service planning.

Based on the results, it is recommended that local municipalities consider working on aligning social practice with service delivery improvement strategies. Population accountability and further alignment with housing programs may provide alternative dimensions for improved water investment budgets to close the service delivery gap. While improving the quality of education across the country could help in achieving quality leadership and constructive engagement with well-enlightened citizens, it should be acknowledged that with educated people, the introduction of e-government and e-services could go a long way in addressing WSDCs. The improvement in data collection and management regarding social practices could be a progressive step towards empirical studies that have the potential to impact investment and service delivery decisions. Lastly, service delivery protests can be better managed by adopting the participation theory of democracy which is central in all decisions involving governance WSDCs.

Therefore, the study's contributions to the body of knowledge regarding service delivery in the local government cannot be underestimated amid growing dissatisfaction expressed through SDPs. Additionally, the study contributes to the policy frameworks by unearthing the undeniable negative impacts of social practices on SDP and allowing policymakers and government to relook at the collaborative approach to addressing WSDCs.

The study has potential limitations within which our results need to be interpreted carefully. While missing non-financial data might have impacted the interpretations of the results, a small sample including the biggest municipalities in South Africa could impact on generalisation of the results. Additionally, panel data econometric models' results might have a bias due to the employment of limited variables for social practices. Given the limitations, future studies should focus on increasing the sample size and adding more variables that measure social practices to gain deep insights into how social practices influence service delivery performance.

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