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Environmental Management Expenditure and Fiscal Sustainability of South African Urban Municipalities: A Panel Data Model

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ABSTRACT

Globally, instituting good environmental management practices within cities in developing countries is a climate-induced risk mitigation strategy. It is, however, an opportunity for local municipalities to achieve fiscal sustainability objectives and environmentally responsible decisions. Cash-constrained local municipalities are characterized by failures to balance environmental and financial needs, resulting in complex urban sustainability challenges. Therefore, this article examines the relationship between environmental management expenditure and fiscal sustainability (FS) in South African local municipalities to contribute to the debate concerning the sustainability of environmental protection projects in local municipalities. The study employed ordinary least squares and feasible generalized least squares to estimate coefficients of linear regression equations involving data collected from 30 local municipalities from 2012 to 2021. The results suggest that only wastewater and environmental protection expenditures positively impact FS, with solid waste management expenditure influencing the FS negatively. Lessons from the research will assist policymakers and municipal administrators in addressing environmental policy incoherence for the improved financial viability of environmental protection projects. Lastly, future research can focus on environmental data collection and reporting for improved and informed environmental protection decisions.

INTRODUCTION

The objective of achieving environmental sustainability is a pillar of modern cities for improved liveability (Ríos & Picazo-Tadeo, 2021). However, local municipalities in developing countries struggle to integrate the fiscal impacts of poor environmental management practices (EMPs) into fiscal reports (Mukwarami, 2021), resulting in fiscal sustainability challenges. Fiscal sustainability (FS) refers to the ability of the organization to meet the financial obligations within the organization's revenue constraints (Wojtowicz & Hodzic, 2021). FS has become an important policy objective for many governments, requiring a balance between tax revenues and public expenditures at national and subnational levels (Organisations for Economic Corporation and Development [OECD], 2021).

The local municipalities are under fiscal pressure to increase budgets for environmental protection to counter prevailing poor EMPs (Mukwarami, 2021) because of limited funds to provide basic services. Despite disruptive fiscal impacts on FS, local governments remain major investors in environmental protection activities (Broietti et al., 2018) within their areas of jurisdiction. Local municipalities are empowered to deal with EMPs such as solid waste management (Abdulredha et al., 2020; Tsai et al., 2020), dumping of hazardous substances (Kubanza & Simatele, 2020), maintenance of the natural ecosystem (Matsler et al., 2021), wastewater management (García-López et al., 2021) and reducing greenhouse (GHG) emissions (Nguyen et al., 2021). Instead of managing environmental practices to broaden the revenue base and expand fiscal space, local municipalities struggle to establish waste management projects as profitable business units resulting in recouping the costs.

However, evidence suggests that increased environmental responsibility activities, such as

recycling solid waste and wastewater, lead to better financial performance (FP) in local governments (Alao et al., 2022; Ríos & Picazo-Tadeo, 2021).

Recycling is regarded as the most effective method of managing waste in local municipalities, which could result in financial benefits. Significant revenue can be raised from selling recycled products and recovered materials apart from creating business opportunities that boost the economy (Ayodele et al., 2018; Bartolacci et al., 2018). Aiyetan and Das (2021) assessed Nigeria's economic, energy, and environmental benefits of municipal solid waste recycling. The results reveal that through recycling solid waste, the municipalities generated enough energy to cater to 9.8 million people and raised US$ 11.71 million in economic benefits, equivalent to 16.562 jobs annually. Fernández-Aracil et al. (2018) established a positive relationship between waste collection costs and higher wages, particularly in coastal and tourist areas.

Bartolacci et al. (2018) examined the relationship between EMPs and FP in Italy's waste management organizations, suggesting a direct linear relationship between the two variables. The results show a positive correlation, therefore disapproving the assertion that poor FP is due to improved environmental practices associated with waste collection. Manamela (2022) researched the waste management budget's effects on service delivery in South African municipalities. The results suggest a significant relationship between municipal waste management service delivery and waste capital expenditure, waste operating expenditure, waste collection revenue, and budget performance.

Managing wastewater in municipalities is a costly project requiring much-needed attention to avoid water loss, resulting in poor FP. Pajares et al. (2019) established that financial self-sufficiency in wastewater management projects is not guaranteed. Substantial investments channeled towards wastewater treatment projects cannot be only recovered through taxing residents and businesses. Therefore, the state should cover the gap to maintain the financial viability of local municipalities. However, García-López et al. (2021) acknowledged that wastewater treatment projects could be beneficial through water and energy recovery, but funding such capital-intensive projects remains a challenge.

On the other hand, Fakoya and Imuezerua (2020) blamed water authorities for failing to apply material flow cost accounting (MFCA) to capture water and related purification costs accurately, resulting in cost calculation inefficiencies. Additionally, Naidoo et al. (2016) investigated barriers and enablers of effectively implementing wastewater charges by South African municipalities. They established that a lack of resources continues to have negative impacts on wastewater management apart from failure to recoup wastewater treatment costs.

Maintenance of biodiversity through environmental protection is the duty of local municipalities (Broietti et al., 2018). Environmental protection activities are key to achieving environmental performance (Wajim, 2020; Zvobgo & Tsoka, 2021) through the reduction of GHG emissions, flood risks, and pollution (Herrera-Navarrete et al., 2022; Kim & Song, 2019; King & Shackleton, 2020), and restoration of ecosystem and pollution control (Spatari et al., 2011). Managing biodiversity benefits the environment and has strong links with local municipal performance. Horta et al. (2016) environmental efficiency of buildings construction in Portuguese. The results suggest that the environmental efficiency of the new building has a significant linkage with municipal performance. Likewise, Mukwarami (2021) established a positive and significant link between environmental protection in the form of wastewater management investment in water management of South African local municipalities. Further evidence suggests that environmental protection activities reduce carbon emissions, improving organizations' FP (Gunarathne & Lee, 2020; He et al., 2017).

Therefore, based on the argument afore-discussed, hypotheses to support the assertion are formulated as follows:

H_1 There is a positive and significant relationship between solid waste management expenditure and fiscal sustainability in local municipalities.

H_2 There is a positive and significant relationship between wastewater management expenditure and fiscal sustainability in local municipalities.

H_3 There is a positive and significant relationship between environmental protection expenditure and fiscal sustainability in local municipalities.

Therefore, this research determines the relationship between environmental management expenditure (EME) and fiscal sustainability (FS) measured through FP in South African local municipalities. The stakeholder and environmental citizenship theories provide deep insights into environmental protection in the local municipality spheres. Overall, the research contributes to the local and global discourses concerning saving the planet from further damage. The results present opportunities for municipal managers and policymakers to review environmental policies aligned with protecting the environment and maintaining FS. To the best of our knowledge, there is a lack of empirical research that investigates the relationship between EME measured through expenditure environmental protection, solid waste and wastewater management, and FS in South African local municipalities, making the originality of the idea pertinent to the ongoing debate.

MATERIALS AND METHODS

Secondary data were extracted from annual integrated reports, financial statements, sustainability reports, medium-term budget framework reports, and integrated development plans from the municipalities in South Africa. The research covered 13 financial years from 2012-2021. The availability of the data influenced the selection of the base year. However, due non-reporting of non-financial data and lack of annual integrated reports, years before 2012 were not considered. The study considered all 278 local municipalities in South Africa, and the researchers employed purposive sampling to select the 30 biggest municipalities. The selection process considered certain criteria, including population size, contribution to the country's gross domestic product (GDP), financial autonomy, and capacity to raise revenue and status as water service authorities.

The data sources considered are regarded as valid and reliable because of various policies and legislations that control and govern the reporting framework of financial and non-financial data, including the Municipal Finance Management Act (MFMA) (Act 56 of 2003) and Public Audit (Act 25 of 2004). Additionally, the Auditor General audits annual statements and municipal performance reports, ensuring minimal data manipulation. Therefore, critical considerations were made in selecting municipalities and variables.

For the data analysis, a multiple regression analysis was used to evaluate the relationship between environmental management expenditure (EME) and fiscal sustainability (FS) in South African municipalities.

The objective was to examine the influence of EME on FS in South African local municipalities. The objective was achieved using the following panel data econometric models: ordinary least squares (OLS) and robust and feasible generalized least squares in Stata. The panel data were adequately assessed to ensure the regression assumptions were not violated, namely stationarity, homoscedasticity, serial correlation, and multicollinearity, for improved statistical results.

Model Specification for Econometric Models

Regression model specification

$$\mathrm{FIARA_{it}} = \alpha_i + \beta\mathrm{WASMA_{it1}} + \beta\mathrm{EOWWM_{it2}} + \beta\mathrm{EOEPM_{it3}} + \beta\mathrm{POPSZ_{it4}} + \beta\mathrm{TVASS_{it5}} + \mathrm{E_i} \quad (1)$$

Where: $FIARA$ represents a dependent variable, $WASMA$, $EOWWM$, and $EOEPM$ explain the independent variable. Lastly, $POPSZ$ and $TVASS$ are control variables. Ei: error term, α_i: intercept, β: slope. The rest of the variables are explained in Table 1.

Table 1. Explanation of the Variables

Variable	Measure	Sources
Fiscal autonomy ratio (FIARA)	One's revenues divided by the total budgetary revenues	Municipal Budgets: Medium-term revenue and expenditure framework reports
Waste water management Expenditure (EOWWM)	Public toilets Sewerage Stormwater management Wastewater treatment	Municipal Budgets: Medium-term revenue and expenditure framework reports Integrated development plan Audited financial statement Service delivery budget implementation plans https://municipalities.co.za/municipalities/type/1/metropolitan https://municipalities.co.za/municipalities/type/2/district https://municipaldata.treasury.gov.za/
Environmental Protection Expenditure (EOEPM)	Biodiversity Coastal protection Indigenous forest Nature conservation Pollution control Soil conservation	
Solid Waste management expenditure (WASMA)	Recycling Solid waste disposal Street cleaning	
Population size (POPSZ)	Population estimates per district	Statistics South Africa, District population projection reports
Total value of assets (TVASS)	The sum of current and non-current assets	Audited financial statement https://municipaldata.treasury.gov.za/

$$\text{Fiscal autonomy ratio} = \frac{\text{Own Revenue}}{\text{Total budgetary revenue}} \times 100$$

Fiscal Sustainability

Fiscal sustainability (FS) concerns the capacity to meet present and future debt levels and other financial obligations within the organization's revenue constraints (Wojtowicz & Hodzic, 2021). According to Ryan, Robinson, and Grigg (2000), FS is measured through indebtedness, liquidity, revenue intensity, and own-source revenue reliance.

In the context of local municipalities, FS is measured through the debt service capacity, sustainability and service-level solvency ratios, and fiscal autonomy (Wojtowicz & Hodzic, 2021). For this study, the fiscal autonomy ratio measures the capability of the local municipality to generate revenue within their fiscal space, including taking advantage of revenue generation through EMPs to meet financial needs.

Panel Data Estimators

Panel data comprise time series and cross-sectional features (Lopez & Weber, 2017). Thirty local municipalities formed the sample representing the cross-section/longitudinal features, and the 13-year time frame (2012-2013) is time series. OLS, robust, and FGLS models were performed to determine the strength and significance of the relationship between EME and FS in the local municipalities to achieve the objectives.

The ordinary least squares model is one of the most common approaches to analyzing panel data, as evidenced in the literature (Maleka et al., 2017; Mukwarami & Fakoya, 2022). However, OLS has shortcomings that should be considered before relying on the results. The model's results tend to be affected by problems such as multicollinearity, non-stationary, presence of outliers, and lack of normality (Adeboye et al., 2017). Therefore, various classic assumption tests were conducted to determine the existence of the regression disturbances that tend to undermine reliance on OLS results.

The robust least squares method seeks to overcome the limitation of the OLS analysis. OLSs can produce misleading results if certain underlying assumptions are not true. Therefore, the robust regression method limits the effect that violates assumptions such as normality, heteroscedasticity, autocorrelation, multicollinearity, and stationarity. A robust least square model was conducted to determine if the underlying assumptions that violated the panel data influenced OLS.

Generalized least squares is a well-known method for estimating the unknown parameter in a linear regression model, particularly when a correlation between residuals in a regression model exists (Miller & Startz, 2019). FGLS is normally used when the covariance of the errors is unknown (Bispo et al., 2022). Compared with OLS, the feasible estimator can be ineffective for small to medium size samples. Instead, the robust least square method has been considered an alternative estimator for the variance of the estimator robust to serial correlation and heteroscedasticity, particularly when working with a small sample (Naz et al., 2019).

The sample is considered medium to large, therefore, FGLS is conducted to overcome the shortcomings of OLS. Hence OLS, robust least squares, and FGLS models were conducted as a triangulation approach that increases the credibility and validity of the panel data results.

RESULTS AND DISCUSSION

Theoretical Lens

The debate between EME and FS is quite complex because of divergent expectations from various stakeholders (Zhang et al., 2020). Moreover, since environmental issues attract the attention of many stakeholders (Ríos & Picazo-Tadeo, 2021), every stakeholder looks up to local authorities to adhere to good EMPs. Nevertheless, environmental policymakers, animals, municipalities, government, non-governmental organizations, communities and aquatic life, and customers/consumers influence environmental management activities (Boldkhuyag, 2015). Therefore, stakeholder theory provides a fertile ground to understand better what drives EMPs in local municipalities. Every stakeholder has a role to play in promoting good EMPs. For example, policymakers draft environmental policies, whereas municipalities, as ground forces, formulate environmental bylaws and enforce compliance and conformity with the laws (McCright & Dunlap, 2010).

Non-governmental organizations are environmental watchdogs that advocate for responsible environmental behaviors in every community (Hung et al., 2022). Stakeholders have to respect the rights of the environment to sustain the natural ecosystem and other dependents that rely on it (Barak, 2020). Environmental citizenship theory strives to promote the right to participate in decisions affecting the environment and its inhabitants as such, making choices on personal actions on the environment, complying with the environmental rules, and ensuring sustainable arrangements to promote better environmental performance (Jørgensen & Jørgensen, 2021).

This theory further advocates that better environmental performance is achievable through responsible citizenry when implementing environmental management decisions (Barak, 2020). The environmental citizenship theory goes beyond selecting a set of sustainable EMPs and ensuring compliance with the environmental regulatory framework (Schild, 2016). Since the EME/FS debate is still hanging, environmental citizenship theory forms the basis for understanding the background of the EME/FS debate.

Correlational Results

Correlational tests show a simple linear relationship between two (2) paired sets of data. Additionally, the test shows the strength of the relationship in terms of being strong or weak. Pearson correlation tests were conducted to determine relationships between variables, as shown in Table 2.

Table 2. Pearson Correlation Test

	FIARA	EOEPM	EOWWM	WASMA	POPSZ	TVASS
FIARA	1.00000					
EOEPM	0.00987	1.00000				
EOWWM	0.20702	0.25502	1.00000			
WASMA	-0.10090	0.33006	0.36204	1.00000		
POPSZ	0.01275	0.50950	0.42249	0.54416	1.00000	
TVASS	-0.05583	0.51267	0.46113	0.61917	0.85778	1.00000

In interpreting the results, correlation coefficients above 0.7 indicated a strong correlation. While correlation coefficients above 0.5 but less than 0.7 were regarded as averagely strong, less than 0.5 values were regarded as weak correlations. Overall, the relationship between variables further suggests a lack of strong correlation but showed a positive nexus.

Classic Assumption Test

To ensure the econometric models are adequate to produce valid and reliable results, four (4) diagnostic tests were conducted, namely, multicollinearity, normality, and heteroscedasticity.

Multicollinearity Test

Multicollinearity is the relationship between independent variables within a single data set. Failure to detect multicollinearity in the panel data may produce inaccurate results (Adeboye et al., 2017). Multicollinearity was tested using the variance inflation factor to determine its existence among the variables. The results of multicollinearity are shown in Table 3.

Table 3. Multicollinearity tests: mean-variance Inflation factor

Variable	VIF	1/VIF
WASMA	1.72	0.58272
EOEPM	1.4	0.712643
EOWWM	1.29	0.775274
TVASS	5.07	0.197413
POPSZ	3.9	0.256211
VIF	2.58	

The VIF threshold was set at 10, in line with previous studies (Mukwarami, 2021). Therefore, the mean-variance inflation factor of 2.58 shows that multicollinearity among the variables does not exist. Therefore, it is guaranteed that the regression models' results are free from bias caused by multicollinearity challenges.

Heteroscedasticity

The existence of heteroscedasticity in the dataset suggests that the variance of the errors is not constant across the observation (Naz et al., 2019). Therefore, it could result in inconsistent estimates of regression coefficients that have the potential to distort the panel data models' results. The Breusch-Pagan/Cook-Weisberg test for heteroscedasticity symptoms was conducted, and the results are shown in Table 4.

Table 4. Heteroscedasticity Results

Heteroscedasticity
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of FIARA
chi2(1) = 1.22
Prob > chi2 = 0.2692

H1: presence of heteroscedasticity; H2: presence of homoscedasticity

Based on the results in Table 4, the probability value of 0.2692 is above the confidence level of 0.05. Therefore, it can be concluded that an alternative hypothesis cannot be accepted and further suggests the presence of homoscedasticity, which is desirable.

Normality

Normal distribution of the panel data sets is one element of regression assumptions that should always be observed for improved accuracy of the models' results (Knief, 2021). Therefore, to ensure that the normality assumption is not violated, the Jarque-Bera normality test was employed, as shown in Table 5.

Table 5. Normality Tests

b resid
Jarque-Bera normality test: 11.62 Chi(2) .003
Jarque-Bera test for Ho: normality:

According to the results shown in Table 5, it can be concluded that the Jarque-Bera statistic is positive and close to zero, therefore suggesting that the sample data have a normal distribution. Given that the confidence level has been set at 0.05, the p-value of 0.003 suggests that the null hypothesis is completely rejected.

Stationarity

Panel data that shares cross-sectional and time series features and stationarity tests determined the stationarity status of variables. Levin, Lin and Chu and ADF - Fisher Chi-square tests were conducted, and the results are shown in Table 6.

Table 6. Unit Root Test

	Method	Statistic	Prob.**	Lag
FIARA	Levin, Lin & Chu t*	-14.4039	0.0000	
	ADF - Fisher Chi-square	57.2439	0.0000	2
EOEPM	Levin, Lin & Chu t*	-3.86391	0.0001	
	ADF - Fisher Chi-square	33.9456	0.0055	2
EOWWM	Levin, Lin & Chu t*	2.28228	0.0088	
	ADF - Fisher Chi-square	5.5568	0.0022	2
WASMA	Levin, Lin & Chu t*	0.57679	0.0018	
	ADF - Fisher Chi-square	17.3506	0.0533	2
POPSZ	Levin, Lin & Chu t*	-2.44011	0.0073	2
	ADF - Fisher Chi-square	23.6332	0.0978	
TVASS	Levin, Lin & Chu t*	-8.59198	0.0000	2
	ADF - Fisher Chi-square	38.7837	0.0012	

Based on the results in Table 6, it can be analyzed and concluded that all variables are stationary, as the P-value is below the threshold of 0.05. Therefore, the null hypothesis cannot be accepted.

Econometric Model Results

Three different econometric models were employed to confirm the reliability and validity of the results. To ensure the adequacy of the panel data, regression analysis, and classic assumption tests were conducted, as shown in Tables 3-6 in the preceding sections, and it is clear that none of the regression assumptions were violated. However, applying the OLS, OLS (robust), and FGSL models was to circumvent other inherent limitations of panel data caused by undetected violations of the regression assumption. The results in Table 7 relate to the main objective, which aimed to evaluate the relationship between EME and FS in South African local municipalities. The significance level was set at 0.001, 0.05 and 0.01.

Table 7. OLS, OSL, Robust, and FGLS Results

Variables	Ordinary least squares	Ordinary least squares (Robust)	Feasible generalized least squares
	FIARA	FIARA	FIARA
EOWWM	6.977**	6.977**	6.977**
	-2.87	-3.2	-2.98
EOEPM	0.0501	0.0501	0.0501
	-0.02	-0.01	-0.02
WASMA	-3.399	-3.399	-3.399
	(-1.78)	(-1.84)	(-1.85)
POPSZ	6.068	6.068	6.068
	-0.97	-0.93	-0.93
TVASS	-16.77*	-16.77*	-16.77*
	(-2.23)	(-2.31)	(-2.31)
N	390	390	390

*Note: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.01$. The smaller the probability value (as represented by three asterisks), the stronger the significance of the relationship.*

H1 There is a positive and significant relationship between solid waste management expenditure and FS in local municipalities

The results shown in Table 7 suggest the relationship between waste management (WASMA) and FS, as measured through FIARA, produced insignificant adverse outcomes, as shown by the regression coefficient of -3.399. Therefore, alternative H1 cannot be accepted. Waste management practices that include recycling, solid waste disposal, solid waste disposal (landfill), and street cleaning proved to be irrecoverable costs to

the municipalities, as alluded to in the literature (Lakhan, 2016; Abil & Kantola, 2019; Park & Lee, 2021). The negative relationship suggests that local municipalities in South Africa have failed to convert environmental management opportunities into financial benefits.

Waste management projects are costly, resulting in local municipalities failing to recoup the waste processing cost, causing further damage to the financial status of municipalities (Wang et al., 2020). Hence, the negative relationship between waste management and FP is attributed to the high cost of waste management projects. Fernández-Aracil et al. (2018) established that high waste collection and labor costs are the factors that continue to affect organizational performance.

Contrary to the results, Ayodele et al. (2018) established that recycling solid waste led to additional energy and employment opportunities in Nigeria. Therefore, it is clear that local municipalities in South Africa are yet to align their solid waste management practices with their financial management plans for improved FS.

H2 There is a positive and significant relationship between wastewater management expenditure and FS in local municipalities

The results shown in Table 7 suggest EOWWM influenced FS as measured through FIARA. The strong and positive relationship is evidenced by a regression coefficient of 6.977*** across all models' results, with three (3) asterisks implying that the relationship is strong. Hence, the alternative H2 cannot be rejected. Waste and water management expenditures mainly include water treatment costs, storage distribution, managing public toilets, sewerage, and wastewater processing and stormwater.

Despite challenges confronting wastewater management in local municipalities, particularly a lack of resources (Naidoo et al., 2016), positive relationship outcomes suggest efforts to overcome hurdles. Fakoya and Imuezerua (2021) found that capturing water purification costs and losses was not intensive, resulting in FS challenges.

Likewise, Pajares et al. (2019) conceded that waste treatment projects are capital-intensive and require substantial funding, and also recovery of wastewater treatment cost remains a factor that continues to affect the financial viability of the local municipalities. Considering the results, South African local municipalities are managing wastewater projects effectively to improve FS. However, the high-cost burden of treating wastewater remains a bone of contention that consciously requires attention.

H3 There is a positive and significant relationship between environmental protection expenditure and financial sustainability in local municipalities

According to the results shown in Table 7, the relationship between expenditure on environmental protection (EOEPM) and FP is positive but insignificant, as confirmed by the regression coefficient of 0.0501 with no single asterisk. This further suggests that EOEPM slightly caused positive changes to FP but failed to have a significant impact. Therefore, according to the results, the direction of the relationship is positive, and the alternative hypothesis cannot be rejected. However, the relationship is insignificant, showing no visible impact.

Following the results, various studies have found that expenditure on environmental protection, particularly waste reduction, carbon emission reduction, and resource management, positively influenced the performance of organizations (Maleka et al., 2017; Razzaq et al., 2021). Mukwarami (2021) found that expenditure on environmental protection in the local municipalities in South Africa impacted water provisioning performance by improving the flow of investment into the water sector. In support of the positive relationship outcome, Wei (2020) established that environmental protection supervision efforts in China caused a positive FS to state-owned enterprises.

Based on the results, it further implies that the little effort made by the local councils to improve environmental performance has proved to have a positive but insignificant impact on FS. Regarding the results, reviewing environmental protection policies in local municipalities is imperative to ensuring that all nature conservation activities directly or indirectly contribute to financial sustenance in the local municipalities. The overall results, as shown in Table 8, suggest that EOWWP has had a significant and positive influence on FS, whereas EOEPM and WASMA caused positive and adverse impacts on FS, respectively.

Table 8. Confirmation of the Hypotheses

Hypothesis	Decision (Direction	Decision (Significance)
H1 There is a positive and significant relationship between solid waste management expenditure and FS in local municipalities.	Accepted	Accepted
H2 There is a positive and significant relationship between wastewater management expenditure and FS in local municipalities.	Accepted	Rejected
H3 There is a positive and significant relationship between environmental protection expenditure and FS in local municipalities.	Rejected	Rejected

In a nutshell, it can be analyzed that the alternative hypothesis, which says that a positive relationship exists between solid waste management expenditure and FS, cannot be rejected in terms of the direction of the relationship. While the hypothesis relating to the positive link between wastewater management expenditure and FS can be accepted based on the direction, the relationship was insignificant. Lastly, an alternative hypothesis suggesting that environmental protection expenditure relates positively to FS cannot be accepted as the direction turned out to be negative. Therefore, given the results, more should be done to ensure the FS of environmental protection projects and wastewater management.

CONCLUSION

Adherence to sustainable EMPs remains a widespread hurdle for local municipalities in South Africa, as substantial funds are required to ensure environmental sustainability projects achieve desired financial benefits. Various studies concentrated on environmental and financial viability challenges in local municipalities, particularly concerning service delivery, with limited endeavors on addressing a long-standing knowledge gap regarding achieving FS through generating adequate revenue from EMPs such as recycling and biodiversity projects.

Additionally, a lack of relevant literature that focuses on the public sector, as most studies conducted mainly concern private-sector businesses, provides a motive for conducting this study. Therefore, this study looked into how EMPs, as measured through EME, affect FS to influence the implementation of environmental policies and ensure the achievement of FS objectives through environmental protection projects.

The collection of secondary data from various online sources and analysis of the data involved three (3) panel data analysis models: OLS, OLS (robust), and FGLS. The results found that all wastewater management practices and waste management have a positive effect on FS, and environmental protection has had an adverse effect.

Therefore, it is clear that EME has substantial potential to influence FS in the local municipalities, provided environmental costs are captured. Given that environmental protection failed to influence FS positively, it is clear that municipalities lacked a strong initiative to fully embrace environmental stewardship and stakeholder theories in their service delivery operations.

Since the study pioneered in this area of research, the results have far more reaching implications for various stakeholders. Policymakers and regulators are most likely to have different perspectives on the effectiveness of environmental protection policies. They are likely to start improving the coherence of such policies in line with the FS objectives of the local municipalities.

Regarding local council managers, the results indicate an ongoing and long-standing environmental crisis coupled with FS challenges. Therefore, coordination of physical and technical resources is imperative to improving leadership capacity for improved environmental performance. The local municipalities should promote the integration of fiscal impacts of environmental management decisions into fiscal reporting to ensure environmental data gathering and monitoring remain a priority in environmental protection strategies.

A few issues might have influenced the results, lack of data on certain variables and lack of environmental data reporting consistency due to changes in environmental policies during the period in question. Therefore, further studies should focus on environmental data collection and reporting for improved and informed environmental protection decisions.

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