

An Analysis of the Link between Water Infrastructure Financing and Water Provision South Africa

Lerato C. Bapela, Collins C. Ngwakwe, Mokoko P. Sebola
University of Limpopo, South Africa
lcbapela@gmail.com, collins.ngwakwe@ul.ac.za, mokoko.sebola@ul.ac.za

Abstract: This paper evaluated the relationship between water infrastructure financing and water provision in South Africa. The research followed a quantitative research design; secondary data for water infrastructure financing and water provision in South Africa was obtained from the Trans-Caledon Tunneling Agency (TCTA) and the World Bank for the period 1994-2014. The regression results indicated two separate findings which offers unique contribution to the current literature; results from water asset finance as a single independent variable on water provision showed a significant relationship. However, an addition of two control variables, corruption and violence, neutralised the effectiveness of water asset finance on water provision to the extent that water asset finance became less significant with a P value of 0.05. The paper makes a nuance contribution from the findings, which specifically is that finance alone may not deliver target water provision if corruption and violence is left unbridled. The paper thus recommends the need for public policy makers to control the rate of corruption and violence to enable effective application of water infrastructure finance in water provision. The paper also recommends the need for further research on other government departments to integrate corruption and violence as control variables.

Keywords: *Infrastructure finance; economic development; Water Infrastructure, water provision,*

1. Introduction

Urbanization and development of urban communities in developing countries have increased demands for water infrastructure expansion for water service delivery (Tortajada, 2014). Thus there is a more pronounced urgency for water infrastructure development in developing countries (Reddy, 2015). Whilst effective water service delivery requires improved infrastructure, the infrastructure cannot function in isolation. Infrastructure efficiency and effectiveness rely upon a blend of responsive financing, a proactive governance system and financial accountability (Tortajada, 2014). South Africa is a semi-arid country and has experienced poor water service and sanitation delivery over a prolonged period of time (Chetty & Luiz, 2014), and water is perceived as a basic human right in South Africa and globally (Mehta & Knapp, 2004). However, South Africa is experiencing a serious backlog in the investment of water infrastructure for the management and delivery of required water services (Ruiters, 2013). It is therefore not surprising that from 1994, South Africa has constantly faced a number of service delivery challenges relating to water (Nleya, 2011). At the inception of democracy in 1994, out of the 40 million population of South Africa 15.2 million people did not have to access basic water supply (Note, 2002). However, despite many years into democracy, there is still a pervasive insufficient provision of safe potable water in most parts of South Africa (Mackintosh & Colvin, 2003; Kehler, 2013). Water infrastructure financing has been blamed for the lack of the effective distribution of water to all the citizens (Bakker, 2013). The majority of capital investments in South Africa were made in the 1970s and 1980s and only catered for a small population. The increased population size in urban areas means that the existing water infrastructure is not sufficient to carry increasing demands for water services (Hanjra & Qureshi, 2010). According to Ruiters (2013), there is an under-investment of more than R600 billion per annum in the South African water infrastructure. Hence there is a dire need for putting in place new institutional structures and a water infrastructure financing framework in order to enhance water infrastructure and water provision solution to this backlog.

The importance of this research is two folds; firstly, it contributes to knowledge by bridging a gap in existing literature. This is because although the preceding literature allusions exist about low water infrastructure investment in South Africa, however, empirical research that points uniquely to the relationship between water infrastructure financing and water provision in South Africa has not yet been carried out. This research thus makes contribution to theory by providing an examination of how water infrastructure financing relates to water provision within the South African context. The second importance or significance of this research is that it provides an empirical test of previous research assertion by Tortajada (2014) that provision of finance alone might not function effectively to enhance water provision in isolation of some governance factors;

accordingly, given the rising trend of corruption and violence in South Africa (Clark, 2018; Meth, 2017; Stone, 2017), this research provides a further test on the extent of water provision in the presence of corruption and violence. Overall, the research is important as it uses the findings to provide a practical policy direction to water policy makers on the need to control corruption and violence as these factors have the propensity to neutralise the value of water asset finance if left unchecked.

Research Problem: Despite all efforts by the South African government, there are still some bottleneck in water infrastructure investment for the management and delivery of water services (Ruiters, 2013). However, this problem is not unique to South Africa. Research indicates that water infrastructure financing is a major problem inhibiting effective water provision in many developing economies (Sanders et al., 2013). There is, therefore, a dire need to improve water infrastructure finance and governance in South Africa. Although finance is important for water provision, financial provisioning without effective financial governance may still present a problem in securing the expected water service delivery (Mehta & Knapp, 2004). Efficient financial governance is crucial for attracting and retaining water infrastructure financing (De Asis et al., 2009). Current research has found that, despite sufficient water infrastructure financing, lack of financial governance and financial accountability in the water sector may present an obstacle to public water delivery (Egan, 2014). Although water infrastructure and water service provision are in dire need of expansion in South Africa (Ruiters, 2013), recent research about water delivery in South Africa has not focused much attention on the financing aspect of water infrastructure.

Rather, the attention of researchers has related more to issues such as mine water foot-printing, extractive based infrastructure with cursory highlight on financing and rescaling South Africa's water resource management (Ranchod et al., 2015; Blanc & Strobl, 2014). The closest related research is (Mostert & van Heerden, 2015) on general infrastructure expenditure in Limpopo province and Ruiters (2013) on a water infrastructure funding model. Mostert & van Heerden's (2015) research dwelt on "Computable General Equilibrium (CGE) Analysis of the Expenditure on Infrastructure in the Limpopo Economy in South Africa " (Mostert & van Heerden 2015, p. 227), but only touched briefly on water infrastructure expenditure, amongst other infrastructures. On the other hand, Ruiters (2013) focused on suggestions for a water infrastructure funding model for South Africa. Accordingly, it is evident that previous research in South Africa differs from this research focus because none of the previous researchers sought a relationship between water infrastructure financing and water provision in South Africa. Hence, after a rigorous literature search by the researchers, published research that focused uniquely on the authors' current research focus is uncommon. Therefore, this research bridges a gap in the literature and makes a contribution that is unique to water infrastructure financing by relating water infrastructure financing, corruption and violence to water provision in South Africa.

Research Question: This research addressed the following question: How does water infrastructure financing relate to water provision in South Africa?

Research Objective: In order to respond to the research question, the objective of this research was: To evaluate the relationship between water infrastructure financing and water provision in South Africa.

2. Literature Review

Agency and Stewardship Theory: A theoretical framework that underpins this research work involved both Agency and Stewardship theories. Both theories were then applied in the context of this research. The Agency theory is referred to as the principal-agent theoretical framework used as a basis for establishing organisational contract relationships and behaviour between the principal(s) and agent(s), thus describing the properties of a principal -agent behaviours (Hiller & Verdier, 2014; Atkinson & Fulton, 2013). The principal-agent model is applicable to contractual relationships within organisational structures between boards, directors, managers and employees, in private, public and non-profit organisations (Schillemans & Busuioc, 2015). In the context of South Africa, the Agency theory is applicable in a relationship between the public sector and the citizens of the country, where the public sector employees are expected to provide basic water and sanitation services to the citizens of the country who pay tax to finance the development and management of water infrastructure and water provision. The Stewardship Theory, on the other hand, is

focused on a contractual behaviour in which the emphasis is placed on common goals instead of the agent's interest (Van Slyke, 2007; Gilliland & Kim, 2014). In addition, Stewardship Theory exists where managers/stewards work is motivated by, and are aligned to the principals' objectives. The Stewardship Theory is based on the assumptions that contractual relations are based on collective aligned goals, confidence, and contribution resulting from mutual benefit, but in non-profit organisations, the stewards act in the interests of their donors (Biesenthal & Wilden, 2014; Van Slyke, 2007). Therefore, the application of a Stewardship Theory in the public sector suggests that the Department of Water and Sanitation serves as a steward to members of the public who are principals and taxpayers, who expect government administrators as stewards to deliver optimum and efficient services such as sustainable water provision to citizens. Therefore, the agency and stewardship theories are applicable to this research since government administrators (stewards) play the role of providing water to members of the public (principal). Therefore, both agency and stewardship theories constitute the theoretical foundation for this research.

Water Infrastructure Financing and Water Provision: Developing countries have critical requirements for sustainable development which involves social, economic and environmental improvement. Basic infrastructure services, such as power, transport, telecommunications, water and sanitation have to be efficient, reliable and affordable. Thus availability of water infrastructure services is essential for economic and social development. Access to inexpensive infrastructure services for consumption could improve poor household welfare (Kehler, 2013). Although the importance of water infrastructure financing is emphasised by most researchers, regrettably, the potential impact of water infrastructure on poverty alleviation and economic development has not been fully comprehended in developing economies (Jones et al., 2015). Consequently, existing water infrastructure development and services is lagging behind water requirements due to lack of financing for water infrastructure development (Marlow et al., 2013). There is lack of adequate strategies for local water and sanitation in many developing communities due to lack of appreciation for local context, challenges and dynamics (Carter et al. 1999). Most developing countries are confronted with low-impact water and sanitation infrastructure with poor maintenance programmes, which repels infrastructure investment (Chan et al., 2014). Recently, Africa's improved growth is attributable to infrastructure development, however, Africa's infrastructure lags behind other developing countries (Foster & Briceño-Garmendia, 2010). Furthermore, indirect infrastructure development and service costs in poor African countries are expensive compared to other developing countries, thus presenting a burden to local corporations and poor communities (Chan et al., 2014).

Africa's water infrastructure is generally financed domestically, mainly through the central government budget (Estache et al., 2014). Public infrastructure is largely financed by government through direct tax and user tariffs (Ahmad et al., 2015; Foster & Briceño-Garmendia, 2010). Thus, water infrastructure financial investment is important for sustainable water supply and for the refurbishment of aging infrastructure (Gleick & Ajami, 2014). However, high levels of poverty prohibit poor users from paying water tariffs (Akhmouch, 2012). Therefore, effective funding models are necessary for addressing financial challenges associated with water infrastructure development (Ruiters, 2013). Private investors have not helped matters because they invest in water infrastructure projects based on expected rate of financial returns. Consequently, water projects by private investors prove to be costly for poor communities (Arrow & Lind, 2014). Moreover, water utilities in Africa is highly inefficient due to water distribution losses and poor revenue collection resulting in reduced amounts for further water infrastructure development (Foster & Briceño-Garmendia, 2010). Consequently, most households in Africa still lack access to decent water and sanitation (Kehler, 2013; Tortajada, 2014). Poor communities resort to adopting readily available solutions such as stand posts, enhanced latrines and rainwater harvesting (Foster & Briceño-Garmendia, 2010). Although infrastructure financing is fundamental for sustainable water provision, research has indicated that policy reform, governance and accountability might impede water provision (Akhmouch, 2012; Ruiters, 2013).

Water governance involves economic, social and political administration however poor financial governance hinders effective provision of water (Pahl-Wostl et al., 2013; Tropp, 2007). For instance, the absence of legislation, regulations, decentralisation of authority, monitoring and evaluation, and public private partnerships promote poor financial governance of water (Shah, 2014). Thus, financial governance reform is necessary for efficient water infrastructure financial management. However, good financial governance, on its

own does not guarantee sustainable water provision to the public Stakeholder engagement should constitute an integral part of water governance (Henisz et al., 2014). Lack of accountability has been recognised by many researchers as being related to lack of water provision in rural areas in developing countries (Gleick & Ajami, 2014). Emphatically, many researchers agree that transparency is necessary to improve accountability by government officials and improved information delivery to the citizenry (Harrison et al., 2012). Limited financial resources, weak financial accountability and increased demands for water exerts pressure on the government to augment water infrastructure through the private sector (Alcaraz-Quiles et al., 2014). Although private companies would inherently enhance financial accountability for water provision, but they fail to meet desired affordable service delivery expectations of the public sector due to high water tariffs which may not be affordable to the poor (Odaro, 2012).

In many developing countries lack of community engagement initiatives in local water programmes, as well as poor communication and information dissemination of water related matters between the local authorities and communities contribute to poor financial accountability and inadequate water provision (Odaro, 2012). However, poor financial accountability is not solely responsible for lack of water provision; research has indicated additional factors such as lack of financial investment as well as poor financial governance (Pahl-Wost et al., 2013). In the context of South Africa, access to basic water related services continue to be a challenge which is largely attributed to water infrastructure maintenance backlogs and poor asset management within water utilities (Ruiters, 2013). Thus maintaining and managing drinking and wastewater service quality and the efficient use of water is a priority in South Africa. Research has revealed that the reactive management of water infrastructure by water utilities is unsustainable and costly as these are emergency repairs (Selvakumar and Tafuri, 2012). Therefore, adequate planning for new infrastructure and scheduled infrastructure management is fundamental for the management of water infrastructure in South Africa. Given the emphasized importance of finance on water provision in the preceding literature, the subsequent section provides the empirical analysis of how water infrastructure finance is related to water provision in South Africa.

3. Methodology

This research followed a positivist paradigm which involves the objective measurement of a relationship between variables (Ponterotto, 2005). Accordingly, a quantitative research approach was used to determine whether water infrastructure financing contribute to water provision in South Africa.

Data and Selection of Data Period: Secondary data for the entire South Africa, from 1994 to 2014 were collected from the TransCaledon Tunneling Authority (TCTA) and the World Bank archives. The TCTA is the custodian of South Africa's water asset infrastructure management. The justification for selection of data period, 1994 – 2014 (21 years) is that as at the time of completion of this research in 2017, the audited 2015/2016 water asset financial result for South Africa was not yet available; this is because South Africa runs a combined financial year, and audited financial results normally appear in the public domain around May – June of the subsequent year. Hence the researchers could not collect data beyond 2014. In addition, the researchers could not collect data before 1994 since the water asset finance data in the public domain are available from the inception of South African democracy in 1994, hence the data selection commenced from 1994.

Ols Regression Test and Justification: The regression statistics was used to determine the degree of relationship between the independent variable (water asset financing) and the dependent variable (water provision). There are two main justifications for using the OLS regression in this research; the first is that previous related research on water and water finance (Agyapong, 2017; Shi, 2000) equally applied the OLS regression test. The second justification is that the period of data collected 21 years is too short to validly conduct a time series analysis; drawing from expert indications, such a short time series would not be amenable to controlling for seasonality; one needs many years of time series preferably not below 50 observations to effectively model out seasonal components of time series (Box and Tiao, 1975). It is therefore for the preceding two justifications that the authors decided to use the OLS regression analysis in this research. The analysis was done at two levels; firstly, the regression was conducted with only the main independent variable (water asset finance); secondly, given the influence of corruption in the public sector

and violence that often erupts in various municipalities, which results in vandalisation of public infrastructure, it was deemed fit to include two control variables namely corruption and violence. These variables were collected from the archives of the World Bank for South Africa. Therefore, two regression models were applied and these are specified below. This paper also recommends further research on the application of corruption and violence as variables to examine other public service deliveries to see how these variables might impact on service deliveries such as education, housing and health service delivery.

4. Results and Discussion

Relationship between Water Asset Finance (WAF) and Water Provision

H0: there is no relationship between water asset finance and water provision

H1: there is a relationship between water asset finance and water provision

The Regression Model:

Model 1 with single independent variable

$$\gamma = \beta_0 + \beta_1\chi_1 + \varepsilon \dots\dots\dots(1)$$

Model 2 with three (3) independent variables

$$\gamma = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 + \varepsilon \dots\dots\dots(2)$$

Where:

γ = Water provision (dependent variable)

β_0 = regression intercept

$\beta_1 - \beta_3$ = regression coefficients

χ_1 = Water Asset Financing (main independent variable)

χ_2 = corruption (second independent variable [control variable-1])

χ_3 = violence (third independent variable [control variable-2])

Table 1: OLS, using observations 1994-2014 (T = 21): Dependent variable: WP

	Coefficient	Std. Error	t-ratio	p-value	
Const	79.1852	0.941583	84.0979	<0.00001	***
WAF	5.64854e-07	5.4062e-08	10.4483	<0.00001	***
	R-squared	0.851755			
	Adjusted R-squared	0.843953			
	F(1, 19)	109.1664			
	P-value(F)	2.59e-09			
	Schwarz criterion	96.43704			
	Rho	0.504086			
	Akaike criterion	94.34799			
	Hannan-Quinn	94.80137			
	Durbin-Watson	0.987779			

Table 2: OLS, using observations 1994-2014 (T = 21): Dependent variable: WP

	Coefficient	Std. Error	t-ratio	p-value	
Const	89.0127	2.48091	35.8791	<0.00001	***
WAF	1.99008e-07	9.52886e-08	2.0885	0.05211	*
Corr	-6.0968	2.38782	-2.5533	0.02057	**
Violence	-8.94969	2.28195	-3.9219	0.00110	***
R-squared	0.934801				
Adjusted R-squared	0.923296				

F(3, 17)	81.24703
P-value(F)	2.78e-10
Schwarz criterion	85.27617
Rho	-0.75974
Akaike criterion	81.09808
Hannan-Quinn	82.00483
Durbin-Watson	2.126532

Table 3: Tests for Normality and Heteroskedasticity of Data

Tests for Normality of Data

uhat1 Test for normal distribution

Frequency distribution for uhat1, obs 1-21

Test for normality of residual -

Null hypothesis: error is normally distributed

Test statistic: Chi-square (2) = 5.53266

with p-value = 0.0628923

Tests for Heteroscedasticity of Data

White's test for heteroscedasticity

OLS, using observations 1994-2014 (T = 21)

White's test for heteroscedasticity -

Null hypothesis: heteroscedasticity not present

Test statistic: LM = 7.41605

with p-value = $P(\text{Chi-square}(9) > 7.41605) = 0.593887$

Table 1 above tested the relationship between water asset finance and water provision in South Africa. The analysis was tested at an alpha (α) of 0.05. From the regression output, the P value is less than 0.01 ($P < 0.00001$). Since the p value is less than the alpha, the null hypothesis is therefore rejected in favour of the alternative hypothesis, which indicates a positive significant relationship between water asset finance and water provision in South Africa. The coefficient of determination (R^2) is 85%, this also shows a strong linear relationship between water asset financing and water provision. However, in South Africa, violent protests have been rife for years and this has often resulted to destruction of public infrastructure including water infrastructure; in addition to violent protests, corruption issues have also been rife in the public entities. It thus became important to add violence and corruption as additional independent variable (as control variables). Therefore, a new regression result appears in Table 2 and the result is very significant for research and public policy. After controlling for corruption and violence, it can be seen that the strength of water asset finance (represented by the P value) although still significant, weakened a little as the new P value for water asset finance in Table 2 became 0.05, which is equal to the 0.05 alpha value. However, the P values for corruption and violence showed stronger relationship with water provision with corruption at a P value of 0.02 and violence at a P value of 0.001. This indicates that, in the presence of corruption and violence, the effectiveness of water asset finance on water provision might weaken, which thus signifies that finance availability alone might not be the catalyst for provision of public water; corruption and violence pose obstacles to public water provision.

Furthermore, in comparison of the two models Table 1 with single predictor variable and Table 2 with three predictor variables, it can be seen that model 2 presents lower Akaike, Hannan-Quinn and Schwarz criterion, hence the lower Akaike Hannan Quinn and Schwarz criterion model in Table 2 is the better model amongst the two models (Sciendirect, 2018; Taylor Snipes & Barber, 2018; Ualberta, 2017; Bolboaca & Jäntschi, 2009). Furthermore, the Durbin Watson statistics was used to detect autocorrelation (a measure of independent of residuals); the Durbin Watson statistics value of 2 in Table 2 indicates there is no autocorrelation (Field, 2009), which shows that residuals are independent. The rank correlation (rho) of -0.75 indicates a strong but negative correlation, of which the negative correlation is largely accounted for by high level of violence and

public sector corruption and thus subduing the effect of financial provision. The F-test shows the overall significance of the combined three independent variables. The F values comprises the F-critical, which is 81.24 with associated P-value of F, which is 0.001 (lower than the alpha level of 0.05). The low P value of F-test indicates significant relationship between the combination of three independent variables and water provision. However, not all the variables contributed to this significance value, hence an examination of the significance of individual independent variables shows which predictor variable played a strong role in the overall P value of the F statistics.

The data for this research was tested further to validate the findings by testing for normality of variables and heteroscedasticity of variables in Tables 3. The uhat1's test for normal distribution and the test for heteroscedasticity were conducted at an alpha of 0.05. The resulting P value for both the uhat1's test for normal distribution and the test for heteroscedasticity were above the alpha level of 0.05. uhat1's test showed a P value of 0.062, higher than 0.05, hence the null hypothesis that data is normally distributed was accepted. Furthermore, the heteroscedasticity test showed a P value of 0.59, which is greater than 0.05 alpha level, hence the null hypothesis that heteroscedasticity is not present was accepted. These two additional tests in Table 3 validates the data used and hence adds authenticity to the findings (Halunga Orme and Yamagata, 2017).

This research finding compares with earlier assertions that apart from other technical and administrative issues, effective water financing contributes immensely to the maintenance and operations of community water provision in developing countries (Brikke Bredero Supply & Network, 2003). Another research conducted by Carlitz (2017) made a rather surprising finding, which shows that aside from water infrastructure finance, political favouritism is a strong factor that determines water provision; this finding by Carlitz (2017) seem to mimic the influence of corruption on water provision as indicated in this research finding. A related research by Ndikumana and Pickbourn (2017) supports the findings of this research as they find that improvement in water finance through improved aids support adds to increased water supply; they highlight though that this relationship is not linear in nature.

5. Conclusion

This paper examined whether water infrastructure financing, contributes effectively to water provision in South Africa. Using the OLS regression analysis, the following conclusion were drawn from the results. Within the South African context, water infrastructure financing promotes water provision when examined as a single independent variable at a p value of $P=0.001$, which is far less than the research alpha of 0.05 without controlling for other variables. However, an additional test, which includes corruption and violence as control variables, shows a new result in which water asset finance is still related to water provision at a significant level of $P = 0.05$, which is equal to the research alpha value. The increase in the P value of water asset finance when corruption and violence were introduced indicates a slight reduction in the level of significance of water asset finance, which shows that in the presence of corruption and violence, the value of water asset finance on water provision might be reduced. This became evident as corruption and violence showed stronger relationships with water provision at a P values of 0.02 and 0.001 for corruption and violence respectively. This means that a rise in violence and corruption would reduce the level of water provision. According to this result and within the years examined 1994 to 2014, the paper concludes that, against popular belief, water asset finance alone may not necessarily guarantee effective water provision especially within the context of South Africa. This means that in addition to finance, effective water provision would require effective and pragmatic control of corruption and violence. This finding offers a nuance contribution to the literature and for further research to examine the extent to which corruption and violence obscure effective water provision in other African countries.

Recommendations: drawing from the findings of this research, the paper recommends that public policy geared toward rural economic and social development through water provision need not position financial provision as the only machinery to achieve the goal of water provision. Government should institute water finance management accountability monitoring mechanisms to ensure probity in the usage of allocated water finance. Furthermore, civic education on the economic value of public infrastructure and the need to protect public infrastructure should be integrated in public water management policies. Water administrators should

receive constant training and/or workshop on the need to avoid corrupt practices to improve the usage of allocated water finance on effective and efficient provision of water. It is also recommended that education authorities may consider the need to incorporate anti-corruption and anti-violence courses at the basic education levels in South Africa.

References

- Ahmad, E., Bhattacharya, A., Vinella, A. & Xiao, K. (2015). Infrastructure Finance in the Developing World. Intergovernmental Group of Twenty-Four (G-24). Retrieved from <https://www.g24.org/wp-content/uploads/2016/05/MARGGK-WP06.pdf>
- Akhmouch, A. (2012). Water Governance in Latin America and the Caribbean: A Multi- level Approach. Retrieved from <http://www.dx.doi.org/10.1787/5k9crzqk3ttj-en>.
- Alcaraz-Quiles, F. J., Navarro-Galera, A. & Ortiz-Rodriguez, D. (2014). Factors influencing the transparency of sustainability information in regional governments: an empirical study. *Journal of Cleaner Production*, 82, 179-191.
- Arrow, K. J. & Lind, R. C. (2014). Uncertainty and the evaluation of public investment decisions. *Journal of Natural Resources Policy Research*, 6(1), 29-44.
- Atkinson, M. M. & Fulton, M. (2013). Understanding Public Sector Ethics: Beyond Agency Theory in Canada's Sponsorship Scandal. *International Public Management Journal*, 16(3), 386-412.
- Agyapong, D. (2017). Financial sustainability and cost recovery in small towns water systems in Eastern region of Ghana. *Athens Journal of Business and Economics*, 3(4), 383 – 402
- Box, G. E. & Tiao, G. C. (1975). Intervention analysis with applications to economic and environmental problems. *Journal of the American Statistical association*, 70(349), 70-79.
- Brikké, F., Bredero, M., Supply, W. & Network, M. (2003). Linking technology choice with operation and maintenance in the context of community water supply and sanitation: A reference document for planners and project staff. Retrieved from http://www.who.int/water_sanitation_health/hygiene/om/wsh9241562153.pdf
- Bakker, K. (2013). Constructing 'public' water: The World Bank, urban water supply, and the bio politics of development. *Environment and Planning D: Society and Space*, 31(2), 280-300.
- Biesenthal, C. & Wilden, R. (2014). Multi-level project governance: Trends and opportunities. *International Journal of Project Management*, 32(8), 1291-1308.
- Blanc, E. & Strobl, E. (2014). Is small better? A comparison of the effect of large and small dams on cropland productivity in South Africa. *The World Bank Economic Review*, 28(3), 545-576.
- Carter, R. C., Tyrrel, S. F. & Howsam, P. (1999). The impact and sustainability of community water supply and sanitation programmes in developing countries. *Water and Environment Journal*, 13(4), 292-296.
- Chan, A. P., Lam, P. T., Wen, Y., Ameyaw, E. E., Wang, S. & Ke, Y. (2014). Cross-sectional analysis of critical risk factors for PPP water projects in China. *Journal of Infrastructure Systems*. Retrieved from <https://opus.lib.uts.edu.au/bitstream/10453/53025/1/Open%20Access%20Full%20Paper.pdf>
- Chetty, S. & Luiz, J. M. (2014). The experience of private investment in the South African water sector: The Mbombela Concession. *Development Southern Africa*, 31(4), 563- 580.
- Carlitz, R. D. (2017). Money flows, water trickles: Understanding patterns of decentralized water provision in Tanzania. *World Development*, 93, 16-30.
- Clark, N. L. (2018). South Africa: Apartheid and post-apartheid. In *The Palgrave handbook of African colonial and postcolonial history* (pp. 1005-1029). New York, USA: Palgrave Macmillan
- De Asis, M. G., O'Leary, D., Ljung, P. & Butterworth, J. (2009). Integrity and Accountability in Water Supply and Sanitation: Retrieved from <https://www.oecd.org/env/outreach/44475062.pdf>
- Egan, M. (2014). Making water count: water accountability change within an Australian university. *Accounting, Auditing & Accountability Journal*, 27(2), 259-282.
- Estache, A., Wodon, Q. & Lomas, K. (2014). *Infrastructure and Poverty in Sub-Saharan Africa*. New York: Springer.
- Foster, V. & Briceno-Garmendia, C. (2010). Africa's Infrastructure: A Time for Transformation. Africa Development Forum. Retrieved from <https://openknowledge.worldbank.org/handle/10986/2692>
- Gilliland, D. I. & Kim, S. K. (2014). When do incentives work in channels of distribution? *Journal of the Academy of Marketing Science*, 42(4), 361-379

- Gleick, P. H. & Ajami, N. (2014). *The World's Water Volume 8: The Biennial Report on Freshwater Resources* (Vol. 8). Washington: Island Press.
- Hanjra, M. A. & Qureshi, M. E. (2010). Global water crisis and future food security in an era of climate change. *Food Policy*, 35(5), 365-377.
- Harrison, T. M., Guerrero, S., Burke, G. B., Cook, M., Cresswell, A., Helbig, N. & Pardo, T. (2012). Open government and e-government: democratic challenges from a public value perspective. *Information Polity*, 17(2), 83-97.
- Halunga, A. G., Orme, C. D. & Yamagata, T. (2017). A heteroscedasticity robust Breusch-Pagan test for Contemporaneous correlation in dynamic panel data models. *Journal of Econometrics*, 198(2), 209-230.
- Henisz, W. J., Dorobantu, S. & Nartey, J. (2014). Spinning gold: The financial returns to stakeholder engagement. *Strategic Management Journal*, 35(12), 1727-1748.
- Hiller, V. & Verdier, T. (2014). Corporate culture and identity investment in an industry equilibrium. *Journal of Economic Behavior & Organisation*, 103, 93-112.
- Jones, P., Hillier, D. & Comfort, D. (2015). Water stewardship and corporate sustainability: a case study of reputation management in the food and drinks industry. *Journal of Public Affairs*, 15(1), 116-126.
- Kehler, J. (2013). Women and poverty: The South African experience. *Journal of International Women's Studies*, 3(1), 41-53.
- Mackintosh, G. & Colvin, C. (2003). Failure of rural schemes in South Africa to provide potable water. *Environmental Geology*, 44(1), 101-105.
- Marlow, D. R., Moglia, M., Cook, S. & Beale, D. J. (2013). Towards sustainable urban water management: A critical reassessment. *Water research*, 47(20), 7150-7161.
- Mehta, M. & Knapp, A. (2004). Challenge of financing sanitation for Meeting the Millennium Development Goals. In Challenge of financing sanitation for Meeting the Millennium Development Goals. Water and Sanitation Program. Retrieved from <http://www.bvsde.paho.org/bvsacd/cd25/mehta.pdf>
- Mostert, J. W. & van Heerden, J. H. (2015). A computable general equilibrium (CGE) analysis of the expenditure on infrastructure in the Limpopo economy in South Africa. *International Advances in Economic Research*, 21(2), 227-236.
- Meth, P. (2017). Informal housing, gender, crime and violence: The role of design in Urban South Africa. *The British Journal of Criminology*, 57(2), 402-421.
- Ndikumana, L. & Pickbourn, L. (2017). The impact of foreign aid allocation on access to social services in sub-Saharan Africa: the case of water and sanitation. *World Development*, 90, 104-114.
- Note, F. (2002). The National Water and Sanitation Programme in South Africa: turning the "right to water" into reality, Water and Sanitation Program. World Bank. Retrieved from <http://documents.worldbank.org/curated/en/770671468777256950/pdf/266260PAPER0English0Blue0Gold0no-08.pdf>
- Nleya, N., Thompson, L., Tapscott, C., Piper, L. & Esau, M. (2011). Reconsidering the origins of protest in South Africa: some lessons from Cape Town and Pietennaritzburg. *Africanus*, 41(1), 14-29.
- Odaro, E. D. (2012). Causes of poor service delivery in Africa and their impact on development. *Consilience: The Journal of Sustainable Development*, 7(1), 34-45.
- Pahl-Wostl, C., Conca, K., Kramer, A., Maestu, J. & Schmidt, F. (2013). Missing links in global water governance: a processes-oriented analysis. *Ecology and Society*. Retrieved from <http://dx.doi.org/10.5751/ES-05554-180233>
- Ponterotto, J. G. (2005). Qualitative research in counselling psychology: A primer on research paradigms and philosophy of science. *Journal of counselling psychology*, 52(2), 126.
- Ranchod, N., Sheridan, C. M., Pint, N., Slatter, K. & Harding, K. G. (2015). Assessing the blue-water footprint of an opencast platinum mine in South Africa. *Water SA*, 41(2), 287-293.
- Reddy V. R. & Kurian M. (2015). Life-Cycle Cost Analysis of Infrastructure Projects. In: Kurian M., Ardakanian R. (eds) *Governing the Nexus*. Cham, Switzerland: Springer.
- Tropp, H. (2007). Water governance: trends and needs for new capacity development. *Water Policy*, 9(S2), 19-30.
- Ruiters, C. (2013). Funding models for financing water infrastructure in South Africa: Framework and critical analysis of alternatives. *Water SA*, 39(2), 313-326.

- Sanders, K. T., King, C. W., Stillwell, A. S. & Webber, M. E. (2013). Clean energy and water: assessment of Mexico for improved water services and renewable energy. *Environment, development and sustainability*, 15(5), 1303-1321.
- Schillemans, T. & Busuioc, M. (2015). Predicting public sector accountability: From agency drift to forum drift. *Journal of Public Administration Research and Theory*, 25(1), 191- 215.
- Selvakumar, A. & Tafuri, A. N. (2012). Rehabilitation of aging water infrastructure systems: Key challenges and issues. *Journal of Infrastructure Systems*, 18(3), 202-209.
- Shah, A. (2014). Decentralized Provision of Public Infrastructure and Corruption. International Centre for Public Policy Working Paper Series 14. Andrew Young School of Policy Studies, Georgia State University. Retrieved from <http://scholarworks.gsu.edu/icepp/14>
- Shi, A. (2000). How access to urban potable water and sewerage connections affects child mortality. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/19856/multi_page.pdf?sequence=1
- Stone, K. E. (2017). Smart Policing and the Use of Body Camera Technology: Unpacking South Africa's Tenuous Commitment to Transparency. *Policing: A Journal of Policy and Practice*, 12(1), 109-115.
- Tortajada, C. (2014). Dams: An essential component of development. *Journal of Hydrologic Engineering*, 20(1), 1 - 9.
- Van Slyke, D. M. (2007). Agents or stewards: Using theory to understand the government- non-profit social service contracting relationship. *Journal of Public Administration Research and Theory*, 17(2), 157-187.