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Public–private partnerships as investment models for water infrastructure in South Africa

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Developing countries, such as South Africa, have no choice but to look at innovative and/or alternative approaches, such as public–private partnerships (PPPs), as investment models, to ensure that they eliminate their water infrastructure backlogs. The primary objectives of this research were (*a*) to develop a PPP framework; (*b*) to identify PPP investment models for water infrastructure; and (*c*) to determine key categories, criteria and characteristics for cost-effective PPP investment models to ensure the sustainability of the water infrastructure value chain in South Africa. The framework for PPPs identified five broad categories of investment models for the water infrastructure value chain in South Africa. The research results highlight the aspects of PPPs in addressing (*a*) water infrastructure needs, (*b*) an implementation strategy for water infrastructure projects, (*c*) investment policies and (*d*) the eradication of water infrastructure backlogs. The total investment estimates in the past 20-year period (1998/1999–2019/2020) have been about US$48.36 billion, with the public sector contributing about US$44.32 billion (91.64%) and the private sector only US$4.04 billion (8.36%). Furthermore, the analysis showed that about US$2.75 billion/annum is available based on the current financial arrangements, leaving a financial gap of US$2.83 billion/annum in the water infrastructure value chain.

Keywords: economics & finance/public–private partnerships/water infrastructure

Introduction

Governments in developed and developing countries face the challenge of meeting the growing demand for new and sustainable water infrastructure. Due to limited financial resources in the public sector because of change in economic conditions and competition for resources – for example, economic crises and pandemics – governments have found that partnerships with the private sector are attractive alternative and/or innovative investment models to increase the water supply and improve the water infrastructure (Auriol and Blanc, 2007; Fall *et al*., 2009; Marin, 2009; Ruiters, 2013; Ruiters and Matji, 2015, 2016; Sepalla *et al*., 2001). Public–private partnerships (PPPs) create a platform for financial, technical and project risk sharing on infrastructure delivery and maintenance between the public and private sectors (EFAB, 2008; KPMG, 2011, 2012; Matji and Ruiters, 2014; OECD, 2008, 2010a, 2010b, 2012; Ruiters and Matji, 2016; THG, 2012).

Access to finance is the lifeblood of the water infrastructure value chain, as is the packaging of investment models (EFAB, 2008; Rowey, 2009). The backlog of water infrastructure provision and poor access to service delivery for poor communities have forced a new approach for investment models. An efficient and productive water infrastructure value chain is important for industries and hence vital for economic growth, efficiency, productivity and competitiveness (Inderst and Della Croce, 2013; Poole *et al*., 2014). Continued growth in water infrastructure productivity plays a crucial role in managing the emerging challenge of South Africa's growing population. There is, therefore, pressure to consider innovative and/or alternative investment models for improved and sustainable water infrastructure (ADB, 2008; Matta and Ashkenas, 2003; Matji and Ruiters, 2014, 2015a, 2015b; Ruiters, 2013; THG, 2012; WB, 2010).

Developing countries, such as South Africa, have no choice or alternatives but to look at innovative and/or alternative approaches, such as PPPs, to ensure that they eliminate their water infrastructure backlogs. The country has established PPP arrangements that make provision for the participation of private sector institutions in water infrastructure delivery, and these include (*a*) the private sector institution as a water infrastructure provider, (*b*) investment in a public sector utility (water) infrastructure delivery and (*c*) operations and maintenance of water infrastructure for water-management institutions (NT, 2000).

The primary objectives of this research were (*a*) to develop a PPP framework; (*b*) to identify PPPs as investment models for the water infrastructure value chain; and (*c*) to determine key categories, criteria and characteristics that should inform the development of cost-effective PPPs as investment models to ensure the sustainability of the water infrastructure value chain in South Africa.

Research methodology and analysis

Primary and secondary data were collected for PPPs as investment models in South Africa (cf. Creswell, 2013; Gray, 2014; Saunders *et al*., 2012). Primary data were collected by quantitative and qualitative methods for the analyses from (*a*) surveys and

questionnaires; (*b*) e-mail correspondence with participants; (*c*) interviews with participants; (*d*) focus group discussions on water infrastructure financing consisting of an average of >50 individuals (financial and technical/engineering specialists); (*e*) specialised workshops, conferences and water infrastructure colloquiums; and (*f*) respondent groups – that is, provincial and national organisations (cf. Creswell, 2013; Gray, 2014; Maxwell, 2012; Ruiters, 2020; Saunders *et al*., 2012). Primary data were collected from water-management institutions and/or sector organisations using purposive sampling methods, and 425 interviews were conducted and the sample included (cf. Ruiters, 2020) the following:

- public sector institutions – national, provincial and local governments; South African Local Government Association
- public sector institutions – state-owned entities (SOEs); parastatals; universities; water-management institutions; regulatory agencies/institutions; research institutions/ organisations
- private sector institutions – commercial banks; business sector partners, consulting and construction institutions and companies; fund managers, including pension fund managers
- multilateral financial institutions and agencies – Development Bank of Southern Africa; African Development Bank; European Investment Bank; World Bank; export credit agencies (ECAs); official development assistance; concessionary financing agencies
- respondent groups – non-profit organisations; unions; technical assistance providers; Southern African Development Community and African Union water commissions and councils.

Secondary data were collected from reports relating to water infrastructure needs and funding in South Africa from case studies, annual reports, databases, research reports, theses and so on for the past 20 years – that is, analysis of water infrastructure investments in 1998/1999–2019/2020 including those from the private sector. Revenue streams, local debts, expenditures and so on related to funding and financing of water infrastructure were analysed.

Statistical data transformation techniques were used. These were the application of a deterministic mathematical function to each point in the data set so that the data appeared more closely to meet statistical inference assumptions – that is, a replacement that changes the shape of a distribution or relationship (Creswell, 2013; Gioia *et al*., 2012). The research data were $\log 10(x + 1)$ transformed – that is, each data point z_j was replaced with the transformed value $y_j = f(z_j)$, and where f is a function.

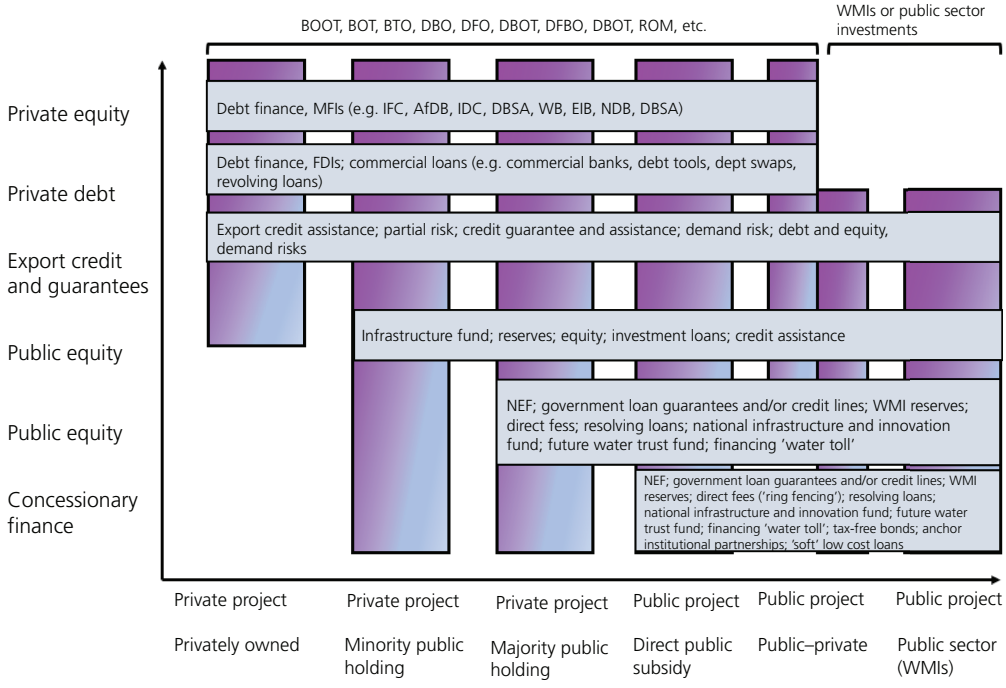

Figure 1. Spectrum of financing instruments used for investments in water infrastructure (after DWA, 2013; DWS, 2018; Head, 2006; OECD, 2014). AfDB, African Development Bank; BOOT, build–own–operate–transfer; BOT, build–operate–transfer; DBO, design–build–operate; DBOT, design–build–operate–transfer; DBSA, Development Bank of Southern Africa; DFBO, design–finance–build–operate; EIB, European Investment Bank; FDIs, foreign direct investments; IDC, Industrial Development Corporation; IFC, International Finance Corporation; MFIs, multilateral finance institutions; NDB, New Development Bank; NRF, National Revenue Fund; ROM, rehabilitate–operate–maintain; WMIs, water-management institutions

Results and discussion

Poor water infrastructure and the need for new water infrastructure capital investments have been a major concern in South Africa. Figure 1 demonstrates that PPPs generally take the form of either the design–build–finance–operate (DBFO) model or the design–build–operate (DBO) model (cf. ADB, 2008; Head, 2006; OECD, 2008, 2010a, 2010b, 2012; Ruiters, 2013; Ruiters and Matji, 2015, 2016; SmoF, 2012; THG, 2012; Unescap, 2011). In the DBFO model, the PPP provider will raise finances from the market, to develop the facilities required to deliver services to the public (Inderst and Della Croce, 2013; Leach, 2010). The PPP provider will build, operate and maintain the facilities according to the specifications prescribed by the public sector. The private sector would then be paid for services delivered satisfactorily and according to prescribed norms, standards and specifications. This will apply for the duration of the contract. In the DBO model, the public sector provides funds to design and build the infrastructure and engage the service provider for the operation of the infrastructure.

PPP framework for the water infrastructure value chain

South Africa has a hierarchical system for water infrastructure development and management, which is based on administrative and/or political boundaries (Figure 2) – that is, the hierarchy ranges from a national to a local government sphere (cf. DWAF, 1997a, 1997b, 1998; Matji and Ruiters, 2015a; Ruiters and Matji, 2015, 2016). The responsibility for the implementation varies in each government sphere for water infrastructure development and management needs, implementation strategy for large subsets or smaller projects and the impacts on investment policies (DPLG, 1998, 2000; DWA, 1971; NT, 1999, 2003).

The framework addresses water infrastructure development and management for ensuring water security and availability in specific vulnerable water-management areas (catchment or basins) (cf. Figure 3). The situation varies depending on what water-management area is under investigation for development and what performance areas are addressed by a specific water-management institution. It addresses the problem of water infrastructure investment given the financial and engineering realities of operating, maintaining, refurbishing, rehabilitation and betterment of water infrastructure to conditions that deliver the required level of the water infrastructure value chain and supply services. Lastly, full-cost recovery and maintenance of financial viability are needed to achieve these financial and engineering realities.

PPPs as investment models for the water infrastructure value chain

From the results, five broad categories of PPP investment models applied in South Africa were identified for the water infrastructure value chain (cf. Table 1; Figures 1 and 3–5). These investment models included the following.

- Contractual arrangements. The management of a part or the whole of a public enterprise is carried out by the private sector (Figures 1, 3 and 5).

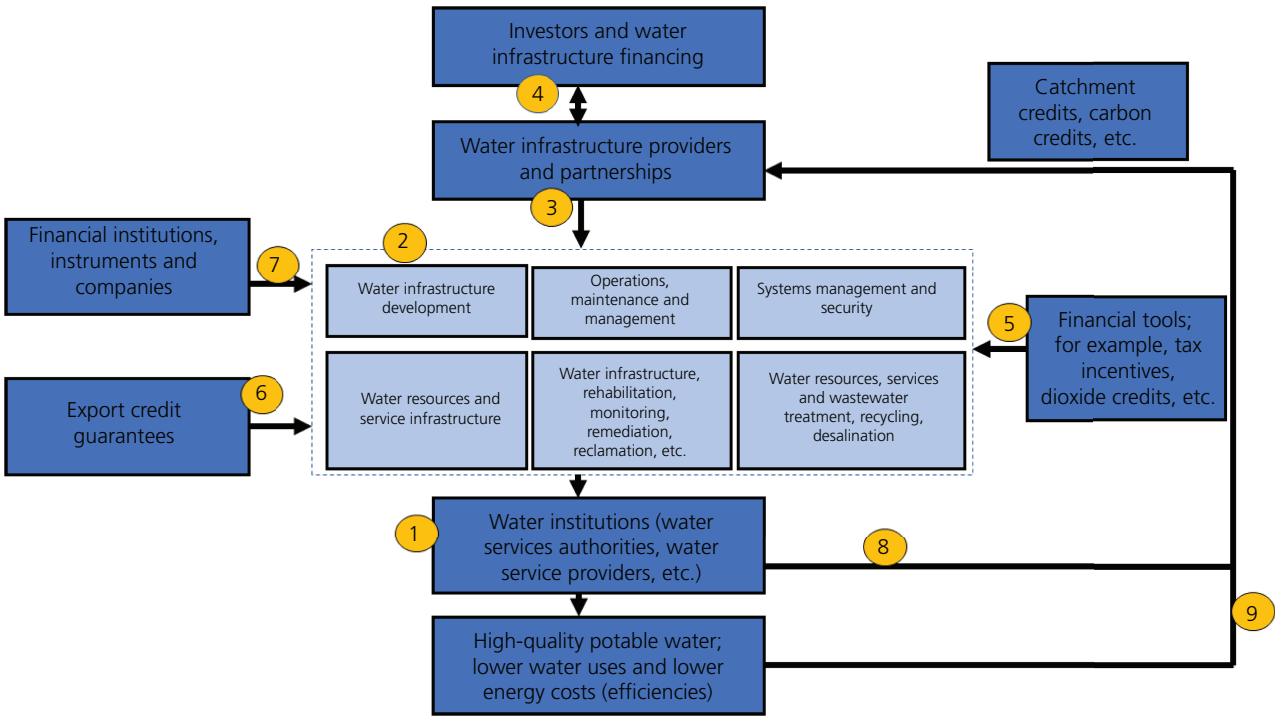

Figure 2. Water infrastructure value chain, engineering and financial interrelationships of water infrastructure development and management in South Africa

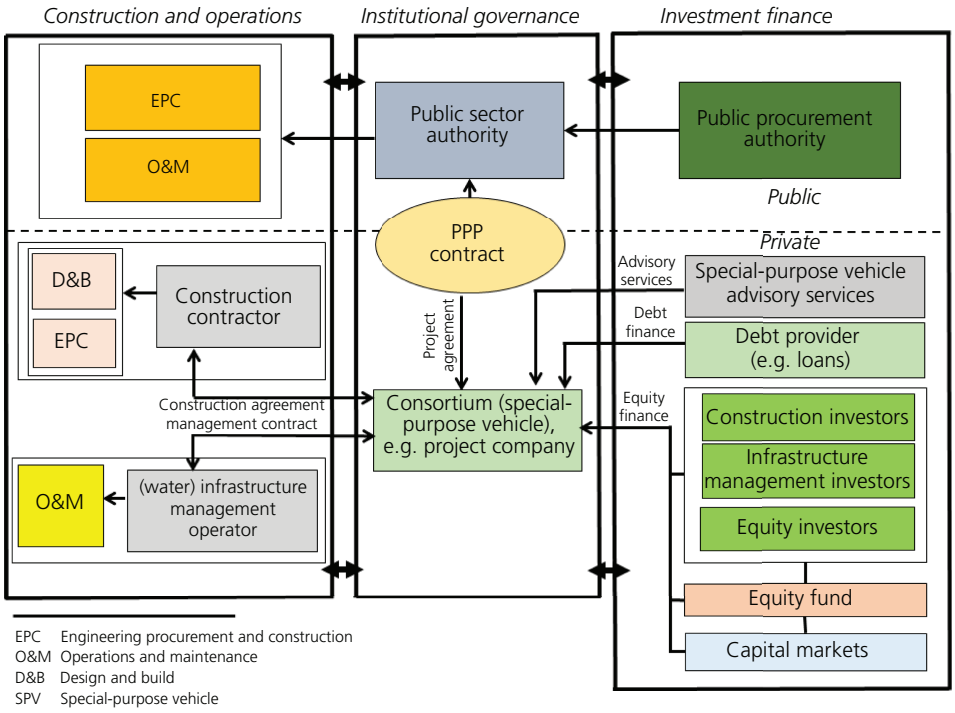

Figure 3. A new public funding model and PPP as investment models for the funding and financing of water infrastructure in South Africa

- Turnkey model. Design and build (i.e. design–finance–build–transfer–operate (DFBTO)) a facility for a fixed fee, rate or total cost, based on the contractual agreement (Figure 1, 3 and 5).
- Affermage/lease arrangements. Operation and maintenance of existing assets, plus commercial and management responsibilities, is passed on to the operator (Figures 3–5).
- Concession models. The operator assumes full responsibility for service delivery, management, operation and maintenance of existing assets and new investments (Figures 3 and 5).
- Public financial investment. The ownership of assets and accountability remains with the public sector (Figures 1 and 4).

However, the determinants or contributory parameters identified for the success of the five broad categories of PPPs as investment models for the water infrastructure value chain in South Africa from the results included (cf. Table 1)

- value of the investment – capital investment of the project as a stand-alone investment exclusive of the income stream or operational costs; projects were typically financed on an equity/debt ratio of about 30/70, although in case studies, the actual percentage of equity ranged from 15 to 40% (Figures 1, 3, 6 and 7)
- duration of the contract – duration of the PPP contractual relationship with respect to the initial investment (Figures 1 and 4)
- transfer of responsibility – the degree to which the private party is involved in the project defined by the contractual model and obligations, ownership of assets, operating rights and the project finance and operational structure (Figures 1–3)
- demand risk – the degree to which the risks of variations in market demand, competition or technological obsolescence are passed onto the public or private entity (Figures 1, 3, 6 and 7)
- availability risk – the degree to which the private sector risk delivery against the contractual specifications, failure to meet standards and quality levels, delivery of services against specifications or failure to meet agreed volumes of supply (Figures 1–3).

The results confirmed that specific criteria can be used to evaluate and support PPPs as investment models: (*a*) a special-purpose vehicle (SPV) for project finance and delivery – that is, equity and debt and so on; (*b*) contractual agreement for the type of project finance and delivery mechanism; (*c*) strong regulatory framework; (*d*) affordability and value for money, (*e*) demand risk management; and (*f*) strong and financial viable institutional and governance structures (Tables 1; Figures 1, 3 and 5).

Furthermore, the results indicate that PPP structures as investment models are dependent on the type of partnership model (Figures 1, 3 and 8; Table 2). This is complex due to several contractual arrangements between various parties such as the public sector, project sponsor/investors, project operator, financiers/lenders, suppliers, contractors, engineers, third parties and customers. Figures 1, 3 and 8 and Table 2 show the different financial

Table 1. Criteria of PPPs as investment models for the funding and financing of water infrastructure in South Africa

Criterion	Supply and management contract	Turnkey	Affermage/lease contracts	Concession contracts	Private ownership/ private finance initiative
Value of the investment	Operational efficiency and cost optimisation prioritised Affordability and revenue flows are prioritised	Contractor to design and build (i.e. design–build) infrastructure for a fixed fee, rate or total contract cost	Operation and maintenance of existing assets Commercial and management responsibilities are passed on to the operator Affordability and revenue flows are prioritised Private sector investment based on government subsidy to either capital or revenue	Operational efficiency and cost optimisation prioritised Affordability and revenue flows prioritised Private sector investment based on government subsidy to either capital or revenue	Operational efficiency and cost optimisation are of highest priority Maximisation of profits and rewards to shareholders
Duration of the contract	1–5 years	Short term – that is, normally 1–3 years	15–30 years	5–50 years	10–20 years but can be indefinite where there is a divestiture
Transfer of responsibility	Public ownership	Public ownership	Public ownership Affermage contracts combine private operation of the service with public financing.	Public ownership	Private sector ownership of the infrastructure once the debt is settled
Demand risk	The risk (10–90%) is shared by both the public and private sector institutions	The risk (10–90%) is shared by both the public and private sector institutions	The risk (10–90%) is shared by both the public and private sector institutions	The risk (10–90%) is shared by both the public and private sector institutions	100% of the risk is carried by the private sector
Availability risk	Outsourcing of maintenance and operational management – that is, public and private sectors	Public sector	Public and private sectors	BOT and franchise – that is, public and private sectors	Design, build, finance and operate – that is, private sector

instruments for the funding and financing of water infrastructure for private – that is, build–own–operate–transfer (BOOT), build–operate–transfer (BOT), rehabilitation–operate–maintain (ROM) and so on – public or 'split' or PPP projects.

Moreover, Figures 4–7 and Table 2 show the water infrastructure value chain implementation or development in relation to the project sponsor (developer) and the type of investments (funding and funders) in South Africa. The research results showed the following: (*a*) the investment models and (*b*) the choice of PPP structure for the water infrastructure value chain in South Africa (Figure 5; Table 2). The PPPs as investment models demonstrate characteristics such as the following: (*a*) there is a commercial transaction between a water-management institution (entity) and a private party; (*b*) the private party performs an institutional function on behalf of the water-management institution for a specified or indefinite period; (*c*) the private party receives a benefit for performing the function or by utilising public property; (*d*) the actual structure is dependent on the type of the partnership model; (*e*) there are contractual arrangements between the various parties; and (*f*) sufficient revenue streams exist (cf. Figures 4 and 5; Table 2).

In South Africa, the public sector (government – national and local governance spheres) is a key player in water infrastructure investment and inefficiencies within the public-expenditure-management systems are particularly detrimental – for example, there are significant problems in spending of infrastructure budgets (cf. Table 1; Figures 1, 3 and 8). The water infrastructure value chain is 100% public-owned infrastructure. Harnessing the significant potential for capital markets to finance water infrastructure, particularly local bond markets, is contingent on their strengthening and further development. Well-functioning and appropriately institutional investors (pension funds, insurance

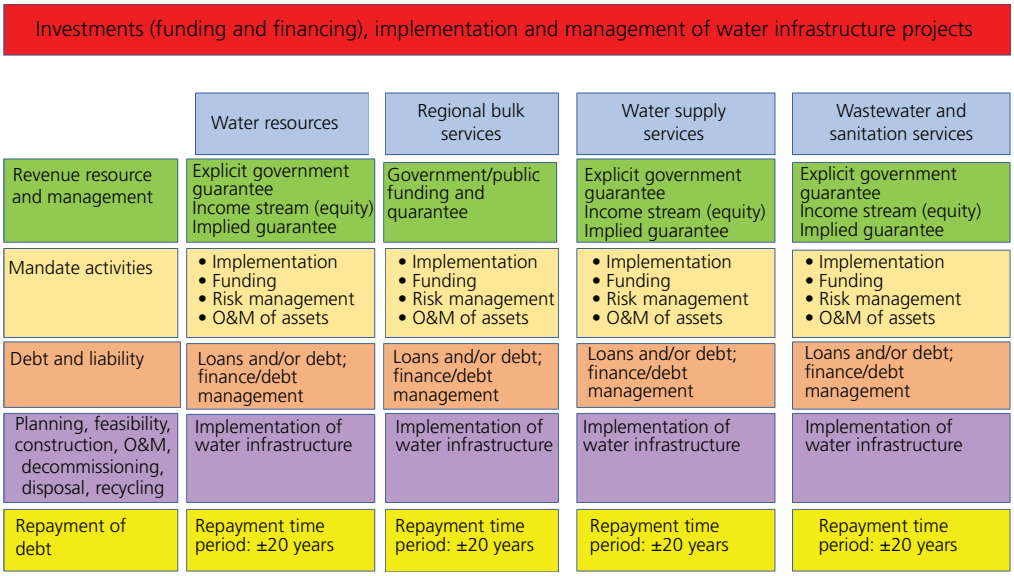

Figure 4. Investments (funding and financing), development and management of water infrastructure projects for South Africa. O&M, operation and maintenance

companies etc.) would be natural sources of long-term financing for water infrastructure because liabilities would better match the longer terms of water infrastructure projects (cf. Inderst, 2009; Inderst and Della Croce, 2013; Leach, 2010; WB, 2010). The 'split projects' of the water infrastructure value chain is a hybrid model – that is, between the public and the private sector (cf. NT, 2000; OECD, 2008, 2010a, 2010b, 2012). The use of this framework is essential in including the private sector in the implementation of water infrastructure development projects. Well-structured PPPs as investment models could be successful, on the condition that sufficient revenue streams exist and appropriate contracting models and all parameters for the framework of PPP as investment models are considered (cf. Table 2; Figures 1, 3 and 8).

The results also indicate that the water infrastructure financial realities in South Africa are threefold: (*a*) predominantly South African funding and financing, not from external financial sources; (*b*) mostly public, not private; and (*c*) through the national government. In water and sanitation, the total investment estimates in the past 20-year period (1998/1999–2019/2020) have been about US$48.36 billion, with the public sector contributing about US$44.32 billion (91.64%). However, the contribution of the private sector was about US$4.04 billion (8.36%) (Figure 9). Overall, the general expenditure on water infrastructure in South Africa was higher than previously thought, with an average of US$2.42 billion/annum (standard deviation (SD) = ±0.999). Most was paid by South Africans through domestically sourced investments: (*a*) an average of US$2.24 billion/annum (SD = ±0.463) expenditure was financed by South African taxpayers and water users and (*b*) a further US$0.179 billion/annum (SD = ±0.085) came from external private sources. Also, the analysis showed that about US$2.75 billion/annum is available based on the current financial arrangements, leaving a finance gap of US$2.83 billion/annum in the water infrastructure value chain – that is, about 50% of the requirements (Figure 10). These investment estimates exclude the requirements for climate resilience and mitigation for the water infrastructure value chain for the period 2019/2020–2039/2040, which amount to US$12.1 billion for water security and availability.

PPP investment models in the water infrastructure value chain: case studies

The public sector can choose to be efficient and play the role of a regulator or to be inefficient by sticking to traditional practices (Bender and Gibson, 2010; Moleke, 2000; Seppala *et al*., 2001). The results indicate that the water infrastructure value chain sector in South Africa has implemented a few DBFO and/or DBO water infrastructure projects in full (cf. Table 2; Figures 1–3). With the backing of the state guarantee or government balance sheet, funds were raised from the capital markets. However, once the water infrastructure is completed, it is handed over to the Department of Water and Sanitation (DWS) or the municipality, which would then operate and maintain the infrastructure, collect revenue to pay transaction costs and operations and service the debts. These are ineffective models that put a huge burden on the water users or taxpayers, because the costs of overheads and transaction costs incurred must be carried by water users or taxpayers in cases where revenues are insufficient. PPPs must create incentives for operational efficiency and cost optimisation; instead, it encourages the institution to focus on chasing more debts to boost their revenue base.

South Africa has taken important and necessary steps, and public–private initiatives have been used for the implementation of specifically mega water resource infrastructure development projects (Table 2; Figures 2 and 3). Through the PPP institutional framework,

Table 2. Investment models for the water infrastructure value chain in South Africa and their financing instruments, structures and characteristics with case studies (continued on next page)

Investment model	Financial instrument	Financial structure and/or partnerships	Investment type characteristics	Project type description (case studies)
Private 'commercial' debt	Commercial lending	■ SOE and SPV: Trans-Caledon Tunnel Authority (TCTA) ■ Build–transfer–operate (BTO) ■ DFBTO	■ Commercial lending: loans and/or bonds; private investment from the private market for the long-term funding ■ Lending is non-recourse, and repayment relies entirely on the revenue of the project company ■ Difficult and expensive to establish ■ Perception of risk determines the terms ■ Relatively expensive and of short tenor if not 'softened' by guarantees ■ Development of cost models developed for the project value chain ■ Water tariff model: revenues for the repayment of project debt from bulk raw water sales ■ Innovative and/or alternative investment models and processes ensured compliance and project sustainability – that is, commercial 'paper' funding	■ Mokolo Crocodile Water Augmentation Project I and II ■ Berg River Water Augmentation Project ■ Vaal River East Subsystem Augmentation Project ■ Berg River Voëlvlei Augmentation Scheme
Loans from private banks Commercial arms of public multilateral development banks (MDBs)	Credit enhancement facilities (guarantees)	■ Water-management institutions: TCTA, Lesotho Highlands Development Agency (LHDA), Komati Basin Water Authority (Kobwa), Bloem Water ■ BOOT	■ Provided mainly by the MDBs ■ Financial instruments converting sub-investment to investment grade projects ■ Facilitate private commercial financing ■ Cover risk that the market cannot assume – that is, 'guarantees' – sustainable and bankable bulk raw water infrastructure projects with an explicit government guarantee ■ Improving of loan terms and provision of wider access to investments ■ Developmental or concessionary finance ■ Water tariff model: project costs are recovered from the revenue generated by the sale of bulk raw water ■ Payments for the full water transfer costs incurred – that is, TCTA, LHDA, Kobwa	■ Lesotho Highlands Water Development Project (LHWDP) 1A and 1B ■ LHWDP 2 ■ Komati Water Augmentation Development Project ■ Driekoppies dam ■ Mooi-Mgeni Transfer Scheme 2 ■ Olifants River Water Resource Development Project (ORWRDP): regional bulk raw water supply ■ Vaal Gamagara Bulk Water Supply Scheme ■ Extension of Rustfontein water treatment works
Occasionally bond issues	Equity (private or public)	■ Water-management institutions: TCTA, LHDA and Lesotho Highlands Water Commission ■ Concession: BOOT, DFBTO	■ More expensive than loans ■ Return on equity typically 15–20%/annum or higher depending on the risk ■ Inclusion of the original investment recovery ■ Equity from private or public sources	■ LHWDP 1A and 1B (2001–2021)
Private equity Direct investments	Equity (private or public)	■ Water-management institutions: municipal water service entities or utilities; water service authorities	■ More expensive than loans	■ Queenstown Concession/Lukhanji Municipality Project

Table 2. Continued

Investment model	Financial instrument	Financial structure and/or partnerships	Investment type characteristics	Project type description (case studies)
made by private sponsors		■ Lease/affermage ■ Concession: BOT, BOOT, DFBTO ■ Management contract	■ Return on equity typically 15–20%/annum or higher depending on the risk – that is, commercial risk ■ Inclusion of the original investment recovery ■ Equity from private or public sources – that is, capital investment ■ Operations, maintenance/rehabilitation, management of existing water infrastructure systems ■ Finance, design, construction, operation and maintenance of water infrastructure – that is, water resources and water services ■ Management functions and capacity enhancement and support ■ Water infrastructure asset ownership	■ Stutterheim Affermage: Amahlathi Municipality Project ■ Fort Beaufort Affermage: Nkonkobe Municipality Project ■ Dolphin Coast: Ilembe-Siza Water Concession ■ Johannesburg Water (Pty) Ltd
Private equity Direct investments made by private sponsors and other private investors	Export credits (ECAs)	■ Water-management institutions: TCTA, LHDA, water service authorities ■ Concession: BOOT, DFBTO	■ Provision of official debt financing ■ Favourable terms and conditions ■ Restricted to the export value plus 15% ■ Not widely used for water infrastructure projects	■ LHWDP 1A and 1B (initial phase) ■ Nelspruit–Mbombela local municipality
Private equity Direct investments made by private sponsors and other private investors, and public MDBs	Development and/or concessionary finance	■ Water-management institutions: water service authorities; water service providers (Magalies Water, Lepelle Northern Water (LNW), Bloem Water, Johannesburg Water (JW) etc.) ■ Concession: BOT, BTO, DFBTO, ROM ■ Management contract ■ Research partnership and pilot project	■ Include grants, 'soft' loans, green financing, carbon dioxide credits and so on ■ Provided by bilateral donors and MDBs for public benefits that cannot easily be monetised ■ Unavailable in large or sufficient quantities to finance complete water infrastructure projects ■ Leveraging of other forms of project investments – that is, capital investment ■ Finance, design, construction, operation and maintenance of water infrastructure – that is, water resources and water services ■ Wastewater treatment ■ Management functions and capacity enhancement and support ■ Water infrastructure asset ownership ■ Commercial risk	■ Ethekwini metropolitan municipality water services: Waterborne Shallow Sewer System Project ■ Ethekwini metropolitan municipality water services: Durban water recycling project ■ Moretele North and South Bulk Water Supply (two projects) ■ Maluti-a-Phofung Water (Pty) Ltd ■ Mhlatuze municipality water reuse ■ Polokwane regional water reuse ■ uMgungundlovu Irrigation Project ■ Musina Dam and Water Project ■ Desalination projects: Witsand (Hessequa Local Municipality); Sedgefield (Knysna Local Municipality); Nelson Mandela Bay Metropolitan Municipality; City of Cape Town Metropolitan Municipality; Ethekwini Metropolitan Municipality ■ Pilanseberg Bulk Water Supply Scheme Phases 2 and 3 (five projects) ■ Wallmansthal Water Treatment Works Upgrade

Table 2. Continued

Investment model	Financial instrument	Financial structure and/or partnerships	Investment type characteristics	Project type description (case studies)
				■ JW: New Lanseria Wastewater Treatment Works ■ JW: Bulk Water Mains Rehabilitation and Replacement ■ JW: Water Conservation and Demand Management (WCDM) ■ JW: alternative energy for water and wastewater treatment works ■ LNW: Upgrading of the Olifantspoort and Ebenezer Water Supply Schemes (Phase 1)
Public finance Direct public investment with government support	Tax finance (National Revenue Fund)	■ Water-management institutions: DWS, water agencies (SPVs), water boards (utilities), water user associations, water service authorities ■ Public finance: big financial initiative, grants and so on ■ Concession: BOOT, BTO, design–finance–build–operate	■ Financing of most water infrastructure projects ■ Implementation can be in the public or private sector ■ Large, mega and/or complex projects are not suitable for development under the auspices of a private company	■ Regional bulk water projects or water schemes ■ Mzimvubu water project ■ Clanwilliam Dam Water Distribution Infrastructure Project ■ ORWRDP: De Hoop dam ■ Rehabilitation of the Vaalharts–Taung Irrigation Scheme ■ Mountain View Dam (Crocodile East Water Project) ■ Trichardt Wastewater Treatment Works ■ Foxwood Dam and Water Project

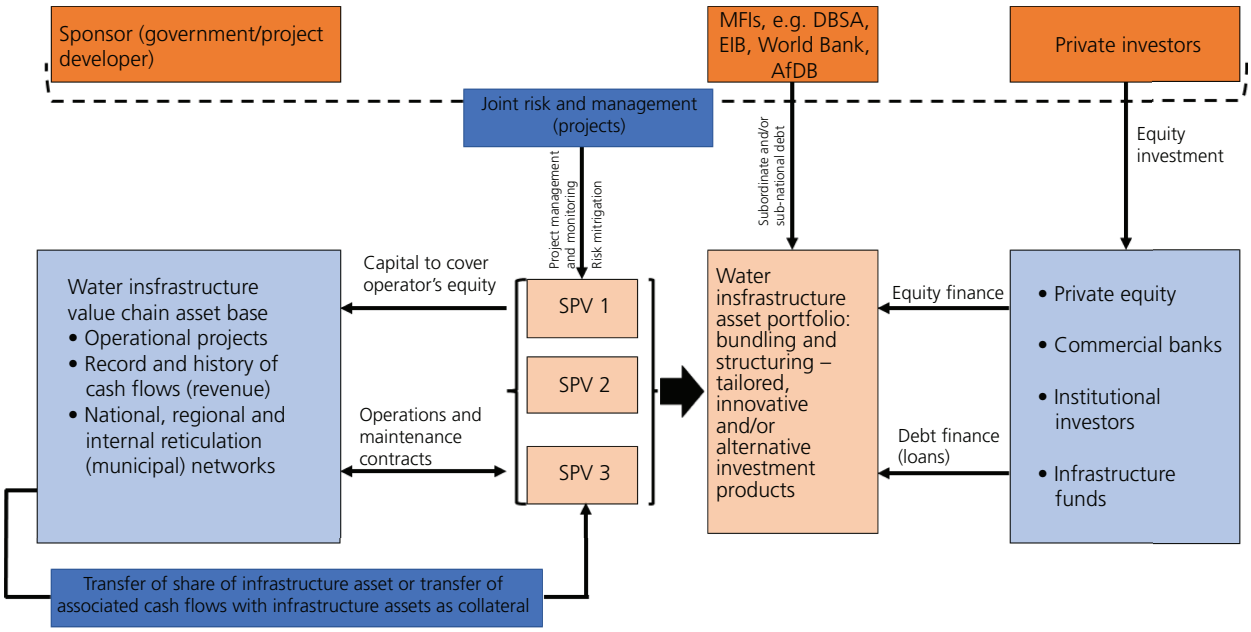

Figure 5. 'Balance sheet off-loading or leverage' existing water infrastructure assets for the 'free-up' of investments for new water infrastructure (after Ackermann, 2015). AfDB, African development Bank; DBSA, Development Bank of Southern Africa; EIB, European Investment Bank; MFIs, multilateral financial institutions; SPV, special-purpose vehicle

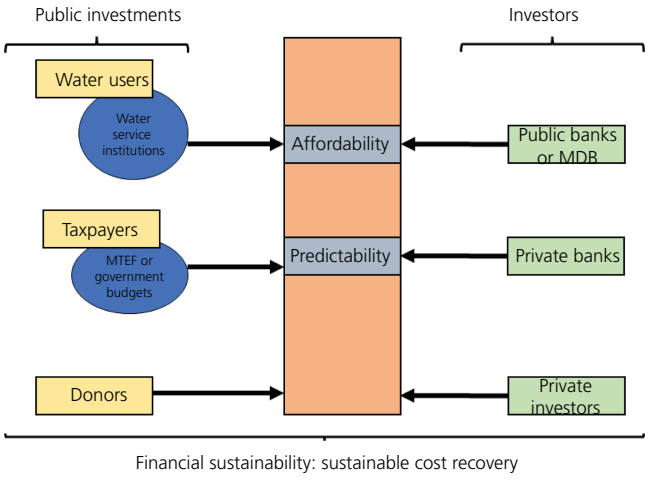

Figure 6. Categories of water infrastructure investment models for financial sustainability for water development in South Africa. MDB, multilateral development bank; MTEF, Medium Term Expenditure Framework

these types of water infrastructure development projects were guided, accounted for and contributed in part to the mixed experiences. This would also help convince the public that private involvement or other forms of non-traditional funding or delivery are appropriate.

The results confirmed the distinct benefits for using PPPs as investment models in the water infrastructure value chain – that is, cost optimisation, risk sharing between the public and private sectors, transfer of scarce skills and knowledge, capital, innovation and creativity, development and maintenance (cf. Table 2; Figures 1 and 5). To achieve these benefits, PPP agreements/contracts should be properly structured and regulated. Due to the complex nature of some PPPs, stronger regulatory mechanisms or frameworks are crucial to ensure efficient performance of PPPs as investment models. However, short-term management contracts as alternative investment models are common in South Africa as a first step before a concession.

Conclusion

PPPs as investment models were employed in the water infrastructure value chain of South Africa. Thus, to facilitate and/or enhance water infrastructure development and management for socio-economic growth, the country has developed a PPP institutional framework or structure for the implementation of water infrastructure projects. The choice of the appropriate PPP as the investment model is informed by the project type (water infrastructure component), duration of the contract, type of contractual arrangements, investment requirements, risk sharing or transfer, institutional model for risk mitigation and long-term implications of such decisions. The key categories, characteristics and/or parameters informed the PPP framework arrangements for well-structured and regulated PPPs, which can lead to increased efficiency in project delivery, operation and maintenance, access to advanced technology, innovative approaches, availability of additional investments and/or finances and human resources to meet the growing infrastructure investment needs in the South African water infrastructure value chain.

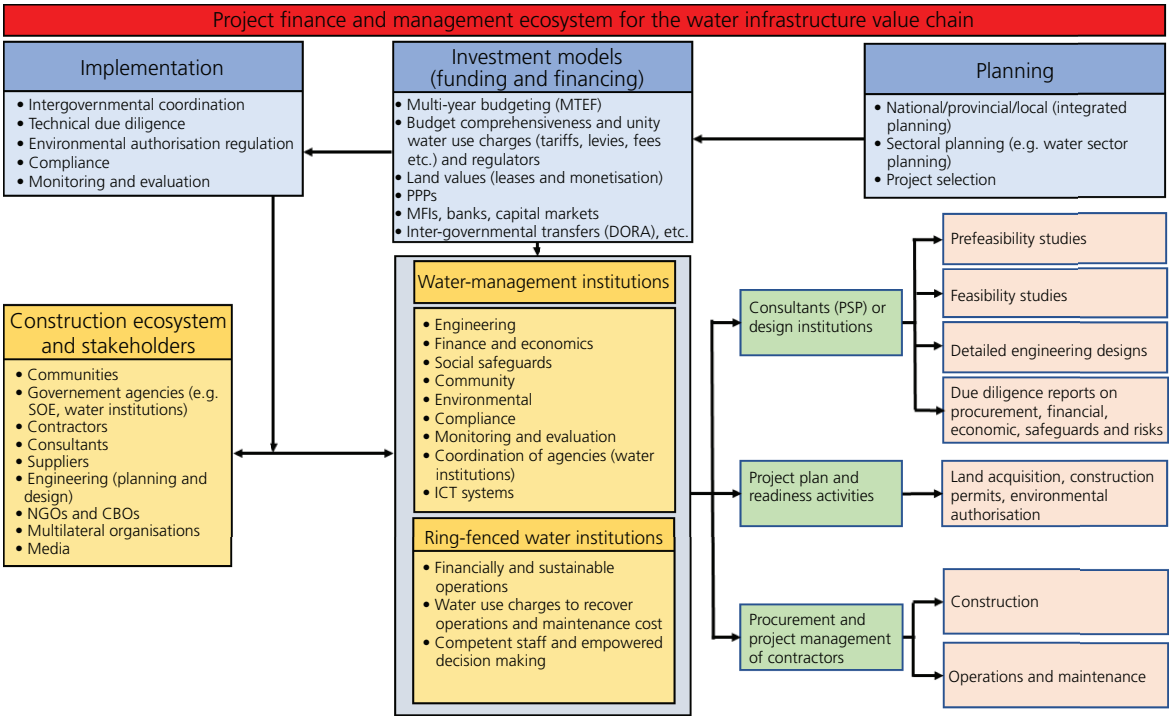

Figure 7. Funding of different types and categories of water infrastructure. CBOs, community-based organisations; DORA, Division of Revenue Act; MTEF, Medium Term Expenditure Framework; NGOs, non-governmental organisations; PSP, professional service provider; SOE, state-owned enterprise

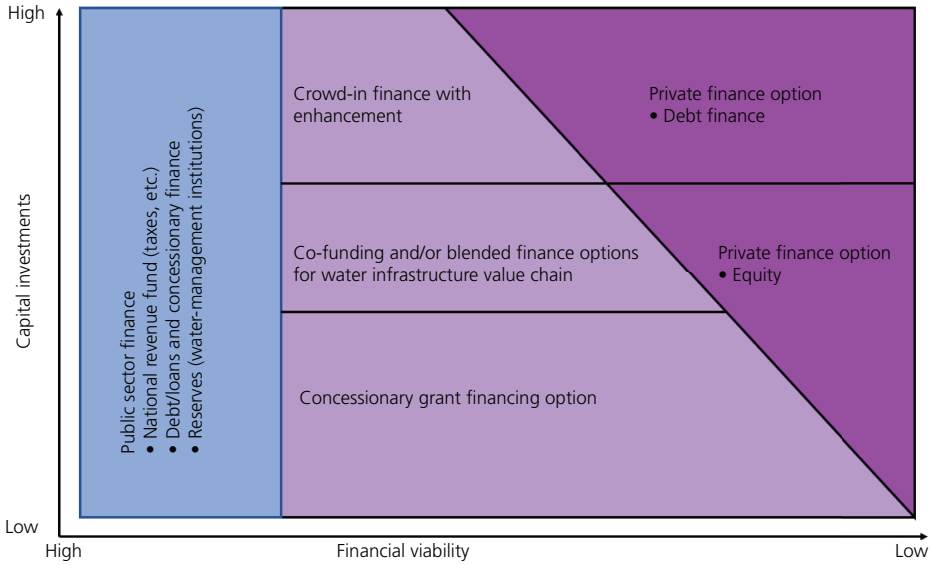

Figure 8. Financing options and the closing of the financial gap associated with the investment in the implementation of water infrastructure (cf. Head, 2006; KPMG, 2015; OECD, 2014)

The research results, as demonstrated by the case studies, showed that South Africa has the ability to use PPPs as investment models to ensure delivery of water infrastructure projects and the sustainability of its water infrastructure value chain. Therefore, South Africa has recognised that new investment models – that is, PPPs – are required to close the water infrastructure delivery gap – that is, (*a*) long-term growth and water infrastructure renewal, (*b*) determination of project priorities and (*c*) utilisation of the expertise

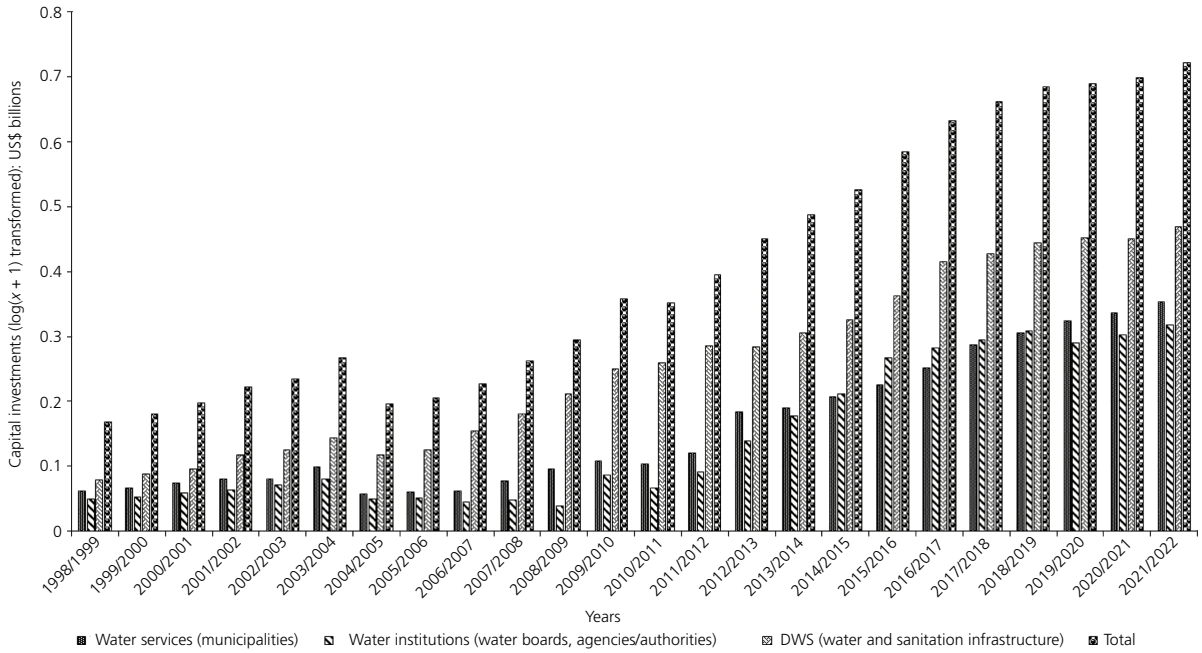

Figure 9. Water infrastructure investments in the past 20 years and current Medium Term Expenditure Framework (2019/2020–2021/2022) in South Africa

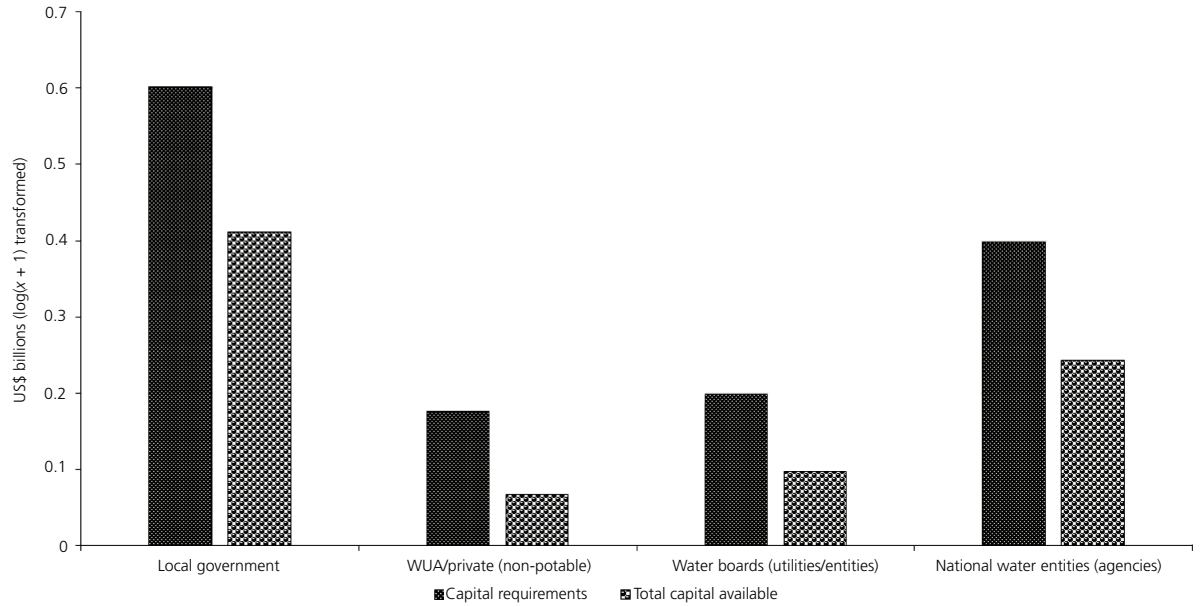

Figure 10. Capital finance gap (US$ billions (log(x + 1) transformed) for the water infrastructure value chain in South Africa. WUA, water users association

in the public and private sectors to manage the implementation of water infrastructure projects. With overwhelming demand for the provision of water infrastructure assets to be accelerated, implementation of any of PPPs as investment models will provide the leverage for private sector investment in economic infrastructure assets and allow the public sector to recycle its capital for socio-economic needs and development while at the same time addressing demand risk.

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