Sustainable water financing and lean cost approaches as essentials for integrated water resources management and water governance: lessons learnt from the Southern African context

Jens Hilbig and Karl-Ulrich Rudolph

ABSTRACT

The deterioration of water quality, stressed water resources and increasing water demand are among the most serious concerns in Africa and worldwide. At the same time, there is a lack of efficient and sustainable water management. This is a major challenge for future water governance policies and processes. Economic aspects play a key role for the successful implementation of integrated water resources management (IWRM) measures. Financing mechanisms are of great influence regarding how water and wastewater facilities are designed, built and operated and how these facilities contribute to an efficient long-term management of scarce water resources. Research projects in Southern Africa have shown the need of water management efficiency and the essential role of sustainable water finance for an economically, socially and environmentally sustainable management of these resources.

Key words | incentive engineering, integrated water resources management (IWRM), operations and maintenance, sustainable water financing, water governance, water management efficiency

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INTRODUCTION

This paper presents financial approaches to bridge the gap between primary water governance targets (e.g. legal requirements, technical standards, development aspirations like the Sustainable Development Goals (SDGs) or other societal/political objectives) and the implementation of efficient water management practices. Focusing on O&M (operations and management) of water and wastewater facilities as well as economic aspects of water management, financing mechanisms such as result-based finance, forfeiting and hybrid-finance are discussed.

These financing mechanisms and operational concepts have to be interlinked to improve the performance levels in water and sanitation services and in water resources management to face growing challenges like water scarcity and pollution. Complementary lean cost approaches such as enhanced wastewater treatment pond systems or refurbishment concepts for malfunctioning facilities provide effective solutions with excellent value for money. The combination of economic concepts and customised technical solutions ('incentive engineering') offers incentives for sustainable water management and governance. The paper summarises research project experiences from one completed and two current projects in South Africa and Namibia funded by the German Federal Ministry of Education and Research (BMBF).

Trends like the decrease in available water resources, progressive deterioration of water quality and an increase in global water demand by 55% by 2050 (WWAP 2015, p. 2) are a key challenge for water governance and water management. 'South Africa will demand 17% more water

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than exists by 2030' (WRC 2015, p. 1). Evidence from water research projects in Southern Africa shows that economic aspects such as financing mechanisms and efficient water management play a key role for a successful long-term implementation of practical measures (Rudolph 2016a).

Referring to the results of a completed IWRM project in South Africa, the role of economic aspects in water resources management is shown in the first section of this paper. The second section introduces financing mechanisms for sustainable water finance and the third section gives examples for complementary lean cost approaches such as refurbishment concepts for malfunctioning facilities or enhanced wastewater treatment pond systems which are currently under research.

ECONOMIC ASPECTS OF IWRM

Economic aspects have been a key focus of the BMBF funded project MOSA – integrated water resources management in the 'Middle Olifants' river basin, South Africa (Rudolph 2016a). A modular IWRM model has been developed to be able to combine hydrological data and water utilisation information with institutional regulations and economic criteria. A core innovation of the MOSA methodology is the approach to structure the IWRM model according to the main interdependent aspects of water management: water resources, water utilisation and water management interventions.

(1) The (technical) Water Resources Module (WRM) includes different aspects like water availability, water quality or vulnerability of resources.
(2) The Water Utilisation Module (WUM) gives an overview of water utilisation and allocation including an economic evaluation of different sectoral water uses.
(3) Technical, economic and institutional measures to improve the water situation and to secure a sustainable management of water resources are summarised under the Water Intervention Module (WIM).

The MOSA research project has shown that water scarcity is rather an indication of insufficient water management than a root cause of the water-related problems in the project region. For example: water loss reduction in municipal supply (up to 70% non-revenue water, McKenzie *et al.* 2012; Hilbig *et al.* 2016) and agricultural conveyancing systems (e.g. Reinders *et al.* 2010), as just one single aspect of efficient water management, would result in savings of up to 20% of the average water deficit in the region (Hilbig *et al.* 2016). Iterative computation of the WRM and WUM modules has shown that integrated management approaches result in an improved protection and a more efficient allocation of the scarce water resources (Rudolph 2016a).

One of the main findings of the MOSA project is that both institutional conditions and economic incentives including financing mechanisms are essential prerequisites for the successful implementation of sustainable water management practices. As the enabling institutional framework 'is in place to support IWRM' (Claassen 2013, p. 329) and South Africa 'has established a highly ambitious body of water legislation [but] is now struggling with its implementation' (Herrfahrdt-Pähle 2010, p. 20), it is all about effective and efficient implementation of water management interventions.

From an economic point of view, there is a strong need for action in the area of resources management efficiency – including both water resources and funds for intervention measures (e.g. infrastructure investments). Three priority areas have been identified under the MOSA research project (Rudolph 2016a):

(1) sustainable water finance and complementary lean cost approaches,
(2) water loss reduction, and
(3) water reuse.

This paper focuses on the first priority area.

SUSTAINABLE WATER FINANCING

The costs to achieve the SDG targets 6.1 and 6.2 – access to safe drinking water and adequate sanitation for all – are estimated to be about USD 112 billion per year (Chen 2017). Besides the access to limited financial resources, a key question is how to efficiently and sustainably use these resources in the water sector. In this context, sustainable financing means the funding of priority investments with lasting impact without producing sunk costs.

Financing mechanisms have a significant influence on how water and wastewater facilities are designed, built and operated. Especially in developing or emerging countries with poor enforcement of legal and technical standards, the 'bottleneck of success' is often O&M. 'Investment only finance' based on a sovereign state guarantee does not set financial incentives for O&M. Result-based elements in financing are needed to avoid mal-functioning facilities and improve the performance levels in water and sanitation (e.g. OECD 2010). The linkages between financial resources (budgets), O&M, service quality levels and public opinion in water governance are illustrated in the 'vicious circle of water and sanitation' (Figure 1).

With regard to South Africa for example, 'an amount of R700 billion will be required to be invested by the water sector over the next 10 years, or an equivalent of R70 billion per year. […] The public sector alone will not have sufficient funds to enable full value chain financial management in the sector' (DWA 2013, p. 84). 'Service providers need better support from government institutions through improved subsidy targeting, more strategic planning, better budget execution, guarantees and risk sharing that can help them access private funds' (Rodriguez *et al.* 2012, p. 38).

Sustainable water finance is a form of results-based financing (RBF) as defined by Musgrove (2011). RBF 'refers to any program that rewards the delivery of one or more outputs or outcomes by one or more incentives, financial or otherwise, upon verification that the agreed-upon result has actually been delivered' (Musgrove 2011, p. 10). Focusing on the supply side of water services, the water financing mechanisms to be discussed are performance-based forms of RBF, directing the incentives to service providers, not to the demand side (users/beneficiaries) of a given market (Grittner 2013, p. 4).

The quantitative lack of (public sector) funds, especially in developing countries, is compounded by a lack of financing concepts to cover the growing investment need for:

(1) small and medium-sized projects (SMP), for example rehabilitation works or decentralised (waste) water purification systems,
(2) long-term investment programmes (LTP) such as water-loss reduction programmes with network improvements, and
(3) risk capital investments (RCI) including innovative technologies and solutions like high-tech water re-use plants or IT-based remote process control and operations (Rudolph 2015).

Sources of financing

Simplified, there are three different sources of financing available in the water sector. These are:

(1) public (national, provincial, municipal) loans and grants,

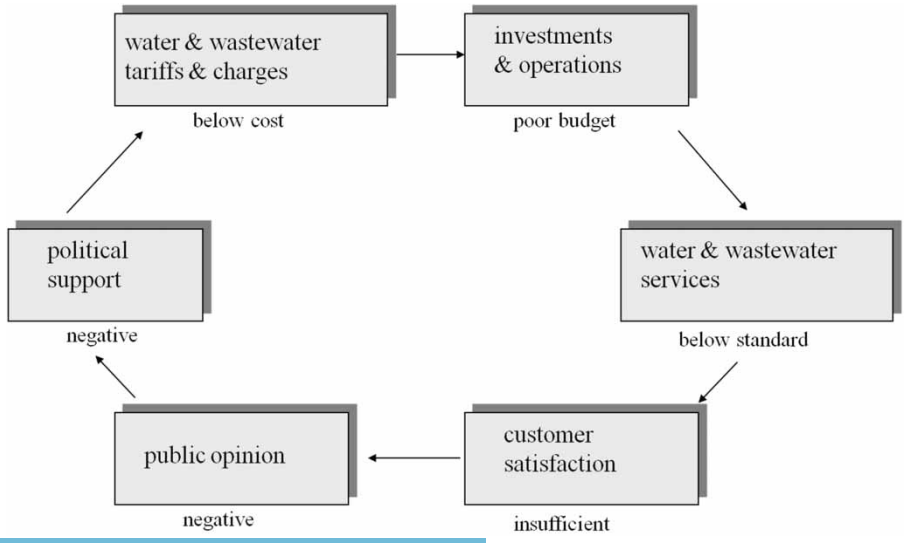

Figure 1 | The vicious circle of water and sanitation.

(2) loans from development financing institutions (DFIs), mostly from national, regional or multilateral donor banks, and
(3) commercial, private loans.

Regardless of the sources of initial financing, all investments will fail if O&M is not duly secured through the overall project development and implementation scheme. by contrast, all three financing sources can be implemented successfully, provided a professional and reliable O&M solution is secured. Public Private Partnership (PPP) models and various forms of Build-Operate-Transfer (BOT) projects are well-proven approaches to secure sustainable O&M of water infrastructure (e.g. Hermann 2015; Rudolph 2016b).

Few countries in the world have sufficient budget to pay for all water infrastructure required to achieve the SDGs. Therefore, public funds (loans, soft-loans and grants) have to be combined with other financing sources, including private investment (Michel 2016).

Funds from donor banks (soft-loans and grants), available for developing and transition countries, are usually based on a sovereign state guarantee and disbursed exclusively to a public entity ('intermediate'). Unlike with commercial loans, the donor banks bear no (or very little) commercial risk in case of project failure (which is the reason why Official Development Assistance (ODA) is cheaper in interest rates than commercial loans). Of course, DFI banks are aware that this is a critical point and may provide technical assistance, e.g. for O&M training and guidance. Unfortunately, this very often does not lead to successful results, because consultants in the water sector are seldom experienced in practical O&M; they are more focused on design, management advisory services etc. Even more important: Independent Consultants (if free of conflicts of interest) are not equipped with executive powers, unlike contracted O&M service providers. There may be cases where consultancy helps to achieve O&M success – but in no way is this guaranteed like under a competitive, integrated scheme with professional O&M, as under a BOT, DBO, PPP, Water Franchise or similar.

Private investors and banks have to calculate specific risks. Besides technical and legal risks, they must consider the political environment with all its uncertainties. Risks of debt re-payment and the difficulty to manage (mitigate) such risks over long repayment-periods as well as country level economic performance-based risk are typical for investments in water infrastructure (e.g. Gmeinbauer 2007).

A very important issue in this context is the enforcement of technical and environmental standards. If water supply services fail because the quality and continuity of services are insufficient, consumers will complain and generate political pressure sooner or later. Wastewater treatment receives less public attention – the higher public awareness about drinking water compared to wastewater services is also shown in funding priorities: drinking water absorbs the majority of funding available in the water sector while financing for wastewater treatment is 'chronically neglected' (WWAP 2015, p. 15). Therefore an independent monitoring of wastewater discharge into the environment is inevitable to make sure that O&M of wastewater treatment plants (WWTP) is in compliance with legal requirements. Corruption, poor technical equipment and lack of human capacity are further obstacles for proper O&M. It would be easy for donor banks to insist and introduce independent effluent monitoring as part of the technical auditing. Commercial banks do not have such power (compared to donor banks), just a procedure to detect and handle technical, operational risks, which must be assessed beforehand under a financial due diligence.

Financing options for SMP and innovative solutions

Banks prefer large project investments. Project finance especially needs a certain volume of at least some ten million EUR or more to cover the expenses for a bank's project development and administration, including technical, commercial/financial and legal due diligence (high transaction costs of organising finance, e.g. OECD 2010, p. 89f.). SMP as defined above with a project volume of even less than a million or 0.1 million EUR are usually too small to be financially viable (from a banking perspective). There are some DFI-Bank special programmes and special financing solutions for commercial players for SMP, but these do not satisfy the actual demand for SMPs, especially in developing and transforming countries.

There is also a funding gap for innovative solutions (RCIs). Donor banks prefer to fund practicable, well

established solutions and fear the risks related to innovations. Commercial banks can hedge specific innovation risks – if the lender is able and willing to pay the risk premium. Fortunately, there are special programmes from Governments as well as private foundations and commercial investors specialising in water innovations. However, compared to the needs of trying to achieve the SDGs, this is no more than a 'drop in the ocean'.

Forfaiting as a finance mechanism for water project investments

The basic idea of forfaiting is that the borrower 'sells' a part of the future revenues from water or wastewater tariffs to the lending bank. If the borrower is a private service contractor under a PPP, the employing public water management authority (in most countries a municipality or municipal association) is involved as third party under the forfaiting finance contract.

Figure 2 shows an example of the contractual relations under a PPP-forfaiting model with BOOT (Build-Own-Operate-Transfer).

Since in most countries (especially in emerging and developing countries) tariffs and charges do not cover the full costs of service provision, the water sector is subsidised through public funding and ODA. This subsidy can be used to minimise the risk of the lender under a forfaiting scheme. The financial agreement with the bank would need a clause wherein the lender guarantees a pre-determined cash flow (taken from the water tariff revenues) as payment for the BOT contract fee. If the municipality wants to do it without PPP this payment is due as compensation for the work of a ring-fenced municipal special purpose vehicle (SPV) which is to be made responsible for capital expenditure and operations of the facility under discussion. Furthermore, the National Government might have to issue an irrevocable commitment to compensate deficits in case the lending municipality does not comply with the contract.

A pragmatic approach towards sustainable water finance

To implement sustainable water finance will take time and needs different working principles for donor banks and bank regulators. A number of donor banks are not allowed to finance without 100% risk coverage through a sovereign state guarantee; others need permission from their board or even from the ministry of their home country. Several

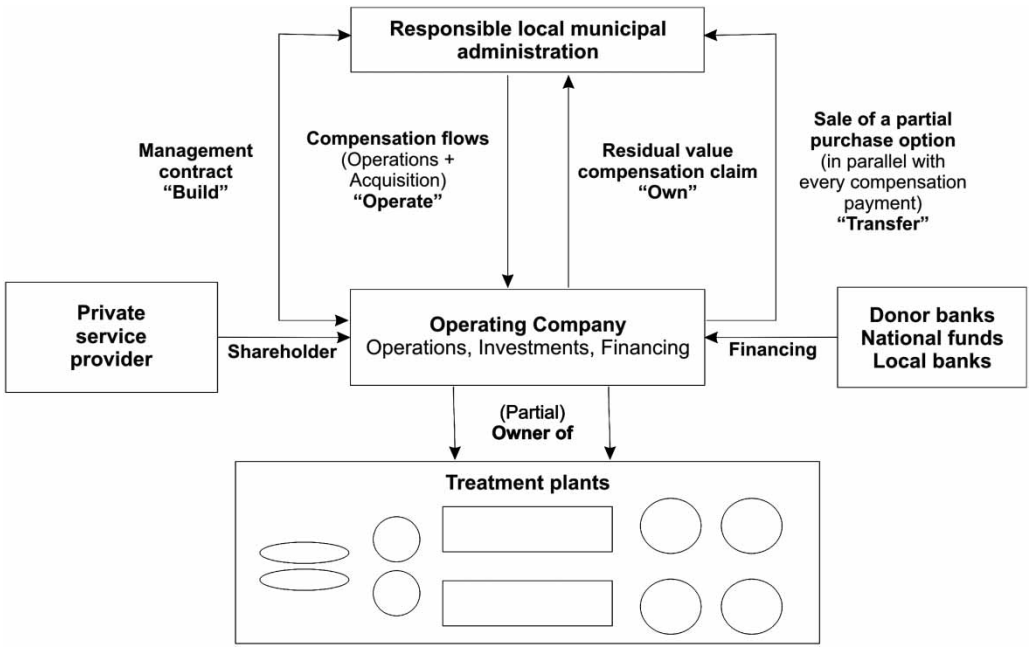

Figure 2 | Example of PPP-forfaiting with BOOT (cf. Hermann 2015, p. 265).

donor banks own affiliated banks registered as commercial banks, which provide project finance and other sorts of commercial loans, relying on the financial capacity and political protection of their state-owned proprietary bank. Trying to integrate O&M into sustainable water financing concepts (without shifting risks to the state through state guarantees) is a matter of change management in the financing sector (e.g. World Bank 2011).

Transferring findings from the German water sector to the Southern African context (Hermann 2015), a case study has been developed under the MOSA project which is currently being implemented. Initial experiences lead to the conclusion that (for the current state of development and working conditions) hybrid finance will be the most appropriate solution, consisting of:

(1) traditional, subsidised investment-only-finance from public sources and ODA, and
(2) a component of output-based finance.

A pragmatic solution for hybrid finance (including a forfeiting component) has been developed under the MOSA project and adopted for the extension of the Gammams wastewater reclamation plant (WWRP) in Windhoek/Namibia by the City Council. However, it was found that the grant component and price condition of a 'conventional' ODA loan from the best bidding donor bank were so attractive that the idea of hybrid finance under the Gammams investment itself was abandoned for this case. Instead, the following financing strategy shall be applied:

- Establish a 'ring-fenced' SPV under the municipality, which is acting like an autonomous enterprise with its own financial, technical responsibilities (tariff collection, expenses for construction works, repairs, operations, staff management etc.) currently for eight plants.
- The Gammams WWRP shall be financed under ODA and tendered under a DBO (because this allows for holistic competition and an 'open technology tender' incorporating construction and operational costs).
- Existing assets invested under output-based finance shall be transferred to the SPV.
- A professional (commercialised) operational company shall be made responsible for the consolidated operation of all water and wastewater plants and receive output-based payment for successful O&M.
- Future investments shall be prepared with an output-based financing component (like forfaiting) as far as needed, protected with a payment guarantee from the City.

Forfaiting could not be realised as a portion of hybrid financing in this case, yet, but it is recognised as the strongest driver towards sustainable O&M and towards transparency in re-financing with tariffs, taxes and transfers (TTT). Based on all these lessons learned, the following 'vision' for Sustainable Water Finance has been developed and discussed with experts from the water industry, researchers and banks (e.g. Rudolph 2015).

The sustainable water finance approach

The sustainable water finance approach is a concept which:

- is ready to bundle SMP under a standardised (lean, affordable) process of project development, due diligence and administration during the overlapping disbursement and pay-back periods ('Programme Finance', 'Bundled Finance');
- can go for a loan disbursement period of up to 15 years, bundling all core investments needed to achieve the programme targets, with a pay-back period, accordingly;
- will be implemented through a ring-fenced municipal SPV, PPP or concession enterprise;
- is supported by a professional performance O&M warranty from a professional service provider;
- may well include a grant component for Technical Assistance, Project Development and 'viability gap funding' under valid development goals;
- but does include a significant output-based loan component (may be forfaiting) re-financed through tariff revenues and land value increase ('Hybrid-Finance', 'Blended Finance' (e.g. OECD 2010, p. 63ff.)).

LEAN COST APPROACHES

We define lean cost approaches as both effective and cost efficient, but not necessarily low cost solutions. The three research projects include very different solutions depending on local conditions: from enhanced wastewater treatment

pond systems to refurbishment concepts for malfunctioning facilities. Lean cost approaches are a main component of the water intervention measures. Interlinked with adapted operational concepts, they play a key role for efficient water management and help to mitigate water stress and to improve water quality.

The MOSA project has shown that even high-tech solutions, for example membrane bio reactor (MBR) technology, could – under certain framework conditions – contribute to cost-efficient refurbishment concepts for malfunctioning WWTP. Especially where repair and maintenance requires high infrastructure investments (e.g. buildings and technical equipment) and additional modernisation measures are pending (e.g. with respect to energy efficiency), considerable financial and ecological benefits ensue (see Block *et al*. 2016).

A different 'low-tech' approach is the upgrading of wastewater pond systems to generate reuse water, for example for irrigation purposes. Pond systems are often disregarded and seen as a backward technology because in many cases they are not managed well. But they have some advantages such as low maintenance and operational costs or very low energy consumption. 'Low maintenance' must not be misunderstood as 'no maintenance': properly managed, these near-to-nature systems attain effluent of a very high standard (see for example SANParks' efforts to reach South Africa's Green Drop certification with oxidation ponds, e.g. Kotzé 2014). Under the joint German-Namibian research project EPoNa an holistic approach combining technical, ecological, economical and societal aspects will be implemented to upgrade existing pond systems in order to generate reuse water. Especially in rural and peri-urban regions with low volumes of wastewater (from mainly domestic sources) and inexpensive land available, pond systems provide some advantages compared to advanced technologies like for example activated sludge processes, which require highly qualified staff and greater O&M efforts (see for example Fuhrmann 2014).

SUMMARY AND DISCUSSION

The main goals of sustainable water financing and lean cost approaches are:

- to link funding and interventions to results through RBF approaches, and
- to improve the effectiveness and the efficiency of resource management measures (e.g. by meeting legal requirements, reducing downtimes or water losses, expanding service coverage or improving tariff collection rates).

Incentivising proper implementation and service delivery including O&M will both improve the service level and quality, and involve improvements in the governance system- for example changes in management practice and behaviours of service providers and users (World Bank 2011, p. 9). These are necessary conditions to break out of the vicious circle of water and sanitation. Evidence from both the research projects introduced here and from international assessments (e.g. WWAP 2015) has shown the importance of economic aspects like water financing and infrastructure O&M in water resources management and water governance. Sound financial arrangements are important to ensure effective implementation and a lasting, sustainable success: 'Finance and good water governance are inextricably linked' (Grau & Hall 2012, p. 5). Furthermore, studies in the water sector highlight the benefits of sound economic solutions for the (urban) poor (e.g. Marin 2009, p. 107; Zetland 2011, pp. 210–211). These results correspond to findings from research in the health sector which indicate that RBF has the potential to reach poor target groups and improve service delivery and coverage (Grittner 2013, p. 42).

Some issues and adverse effects have to be taken into account and should be further investigated. Performance based financing depends on an adequate set of performance indicators, on the capacity to properly monitor results, and on a sound economic and financial system, and it differs significantly depending on the strength of the institutional environment (World Bank 2011). Klingebiel (2012) for example points out that 'there is a "bias" of RBA [results-based aid] approaches in favour of countries with a good performance. The likelihood of "good performance" (reaching results) is much more pronounced in those cases where countries have good leadership structure, planning and implementation capacity and a functioning public financial management system' (Klingebiel 2012, p. 1–2). The implied shifting of financial risks from payers (donors/lenders) to service providers (and in the end to users) might lead to an inability to deliver services, especially in very poor performing countries with a strong need for fundamental services.

Because of this, a blended or hybrid finance approach is recommended for sustainable water finance in order to, on the one hand guarantee a minimum level of service and, on the other hand incentivise good performance and improved service delivery. To avoid or limit transaction costs, performance indicators should be kept as simple as possible (in terms of for example transparency, measurable targets and practical applicability).

CONCLUSIONS

These cases from Southern Africa have shown that there is no lack of institutional frameworks and legal conditions or a lack of physical resources – yet, there is a lack of efficient and sustainable water management. The findings of the aforementioned research projects highlight the urgent need for efficient implementation of measures and for sustainable water resources management. Adapted financing mechanisms and complementary lean cost approaches are of great influence with regard to the way water and wastewater facilities are designed, built and operated and how these facilities contribute to the economically, socially and environmentally sustainable management of scarce water resources. These economic measures play a key role in improving water services and in achieving development targets like the SDGs.

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