DIGITAL CREDIT:
CLOSING THE WATER FINANCING GAP IN RURAL TANZANIA

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ABSTRACT

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The United Republic of Tanzania explicitly recognizes the human right to water and sanitation in its constitution. However, full implementation of this right has been complicated by Tanzania's ongoing decentralization process for water governance, which has created a significant public financing gap for cash-strapped rural water schemes. Under the framework of the progressive realization of the human right to water, this thesis examines the potential for digital credit financing to bridge the public financing gap for rural water schemes in Tanzania. The thesis utilizes (1) country-wide data on digital financial inclusion and rural water access and (2) two case studies of digital credit financing in the rural water sector to explore the viability of a digital credit financing model. This thesis challenges sector-wide intuition on a "cost-recovery" model for rural water financing, instead arguing in favor of a "cost-reduction" model that prioritizes the use of debt financing for cost-reducing asset improvements, such as low-maintenance solar pump technology. It further finds that the weak regulation of the digital credit industry creates a major risk of predatory lending toward financially-illiterate consumers and outlines clear delineations of responsibility for various government agencies in regulating lending terms and providing technical assistance for rural water schemes. Finally, the thesis explores opportunities for cross-subsidization to ensure that the improved financial sustainability of water schemes does not come at the cost of equitable access to water for the rural poor.

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Introduction

Since 2013, the United Republic of Tanzania has legally recognized the human right to water and sanitation in its national constitution. Through this recognition, Tanzania firmly established its commitment toward ensuring universal access to safe and affordable water and sanitation in line with the United Nations' Sustainable Development Goals (United Nations, 2019). Despite the government's promises, however, Tanzanians still struggle to access basic water resources. In the status quo, 21 million Tanzanians lack access to improved drinking water, just 48 percent of the population has access to an improved water source within thirty minutes of their household, and just twenty-five percent have access to water infrastructure within their household (World Bank, 2017).

The water and sanitation gap is particularly salient for the 70 percent of Tanzanians that live in rural regions (World Bank, 2017). The urban-rural gap in water services is significant—just 47.8 percent of the rural population has access to an improved drinking water source, compared to 86 percent of the urban population (UNICEF, 2018). However, the issue with rural water access isn't just constructing new water points—it's also managing to keep them operational. Of the 83,000 rural water points recorded in the national water point census as of 2014, approximately forty percent were found to be nonfunctional with a twenty percent likelihood of failing within the first year of operation (World Bank, 2017).

The precarious financial position of rural water schemes (and corresponding lack of access in rural areas) stems in part from a sector-wide decentralization effort beginning in the early twenty-first century.[1] Under the current governance structure, central authorities are tasked

[1] Tanzania was a comparatively early adopter of decentralization, largely due to its reliance of donor funds from entities such as the World Bank, which, at the time, heavily prioritized decentralization as part of its reform agenda (Carlitz & Boex, 2017).

with partially financing initial asset construction, while rural water user committees are tasked with the responsibility of overseeing managerial decisions and collecting revenues from users in the form of tariffs to cover maintenance and operating costs (Bender, 2017). However, for rural water schemes, many of which lack the means to collect sufficient savings to invest in long-term asset maintenance and operations, the process of decentralization has created a significant financing gap that has led to the high levels of rural water point inoperation.

The decentralization of water governance poses a noticeable contradiction to Tanzania's constitutional commitment toward eradicating inequality in access to water. Though the government has established its interest through centralized initiatives such as The Water Supply and Sanitation Act of 2019 and the Water Sector Development Programme, it has not yet fiscally mobilized the resources necessary to do so. Since the 2016/17 fiscal year, Tanzania's water sector budget allocations have been cut by 26 percent—a TZS 242 billion (USD $104.6 million) decrease.[2] This has occurred, surprisingly, over the same period as an overall *increase* in government spending. Meanwhile, development expenditures in water and sanitation have declined by TZS 200 billion (USD $86.5 million) in the same period of time (TAWASANET, 2019). This exposes a central paradox in Tanzanian water management, where the national government has claimed authority in overseeing development strategy for the water sector, but has remained uncommitted toward actually deploying the financial resources necessary to do so.

Given the severity of the rural water financing gap, as well as the diminished capacity of the central government to finance necessary infrastructure investments in rural areas, one proposed alternative has been to introduce commercial finance into the rural water sector,

[2] **Exchange rate:** $1 U.S. Dollar (USD) = 2,312.57 Tanzanian Shillings (TZS) (as of 5/9/2020; xe.com). All currency values in this document are listed in USD unless explicitly stated otherwise.

creating an opportunity to plug the gaps between publicly-committed resources and necessary investments. In particular, the announcement of the United Nations' Sustainable Development Goals (SDGs) has generated significant private market interest in financing SDG-related opportunities, with roughly $478 billion in assets being pledged toward SDG-related infrastructure since the Paris Agreement (United Nations, 2019). With roughly $200 trillion in global private financial assets and estimated $2.5 trillion gap in financing necessary to achieve the SDGs, commercial financing creates an opportunity to fund water infrastructure development in developing countries which may currently lack the resources to finance these objectives through public funds alone (World Investment Forum, n.d., United Nations, 2019). However, for vast swaths of the world's population, particularly in rural regions, access to financial services remains limited. One opportunity for expanding access to commercial financing for rural communities in Tanzania is the use of mobile money solutions. For traditionally underbanked communities that are located beyond the reach of existing physical financial infrastructure, mobile payment applications such as M-Pesa or Tigo Pesa have dramatically expanded the reach of formal financial services.

Through the lens of progressive realization of the human right to water, this thesis examines the potential for digital credit financing to bridge the public financing gap for rural water schemes in Tanzania.[3] In particular, this thesis poses three questions. (1) Under what conditions would a digital credit product improve the financing of rural water schemes in Tanzania? (2) What role do the various central government agencies play in regulating the flow

[3] An important omission in this thesis is a discussion of sanitation and water quality. The United Nations' sixth SDG explicitly targets universal access to *safe* and affordable water (emphasis mine). Given that the focus of this study is on the affordability and financing of infrastructure, discussion of quality was not included in a significant capacity. However, any omission is not intended to detract from the critical importance water quality plays in full realization of the human right to water and sanitation.

of digital credit to rural water schemes? (3) To what extent does the use of digital credit advance the goal of full realization of the human right to water and sanitation? To answer these questions, I apply two levels of analysis: a quantitative analysis of country-wide data on digital financial inclusion and rural water access and two case studies of digital credit financing in Tanzania's rural water sector. In particular, I rely on data provided by Tanzania's Ministry of Water and Irrigation, the Financial Sector Deepening Trust, the World Bank, Financial Inclusion Insights, and the Consultative Group to Assist the Poor.

Ultimately, this thesis concludes that carefully-controlled digital credit products can serve as a valuable tool for bridging the rural financing gap in Tanzania, contingent on careful government control and strategic use of public financing levers to offer commercial funds at concessional terms. The thesis finds that the weak regulatory environment for the digital credit industry creates a major risk of predatory lending toward financially-illiterate customers in rural areas, outlining the clear delineations of responsibility for various government agencies in regulating lending terms and providing technical assistance for rural water schemes. Furthermore, the thesis challenges sector-wide intuition on a "cost-recovery" model for rural water financing, as proposed by development institutions such as the World Bank. Instead, it argues in favor of a "cost-reduction" model that prioritizes the use of debt financing for cost-reducing asset improvements such as low-maintenance solar pump technology, thereby improving the financial sustainability of water utilities without developing "excludable" institutions that restrict access to water for the rural poor. Finally, the thesis explores opportunities for cross-subsidization to ensure that the improved financial sustainability of water schemes does not come at the cost of equitable access to water for the rural poor.

Literature Review

This thesis sits at the intersection of two subfields in international development: rural water financing and digital financial inclusion. Both fields share an interest in mobilizing capital to rural and low-income communities, groups that have historically been underserved by the financial sector. Ultimately, the thesis examines the possibility of unifying the two concepts to bridge the rural financing gap for water schemes.

The global decentralization of water management and financing was institutionalized by the Dublin Statement, an action agenda established at the 1992 International Conference on Water and the Environment. The Dublin Statement established a consensus among scientists, policymakers, and stakeholders on four guiding principles for water management in the twenty-first century, the two most important of which being that water development and management decisions should be made at the lowest-possible level with appropriate participation from all users, and that water should be treated as an economic good (Dublin Statement, 1992). The Dublin Statement, while striving to resolve issues of inefficient water consumption, resulted in major concerns with regard to equity of water access, primarily with regard to low-income communities with limited communal savings for water infrastructure management. This has contributed to numerous influential studies outlining the implications of decentralization on financial sustainability in rural areas, as well as water access for the rural poor.

A rich body of literature outlines the key struggles rural water schemes in Tanzania face as a result of the decentralization of water governance. A decade ago, two leading authors in the water poverty space—Agustí Pérez-Foguet and Alejandro Jiménez Fernández de Palencia—outlined the structural problems limiting access to rural water in Tanzania, including

improper information systems, inadequate access to water infrastructure for low-income consumers, and non-functionality of water points (Jiménez & Pérez-Foguet, 2010). In further studies, the research team found that decentralized water management often leads to an inefficient distribution of funds to the regions in most need and requires further intervention from central governments (Jiménez & Pérez-Foguet, 2011). Carlitz (2016) finds that central distribution of funds for water investments are largely unresponsive to the needs of communities and can often be subject to political bias. Mandara et al. (2013) further analyzed the communal management structure of rural water schemes, demonstrating the incapacity of rural communities to sustainably manage water infrastructure in rural areas.

One important consideration in the governance of water is the impact of organizational structure on willingness-to-pay, a relevant discussion considering the high rates of user non-payment within rural water schemes. A team of researchers at the University of Oxford's Smith School of Enterprise and the Environment and the REACH Programme have published numerous behavioral studies to this end (Hope & Ballon, 2019; Foster & Hope, 2016; Koehler, Thompson & Hope, 2015). Koehler, Thompson & Hope (2015) contributes an important, but concerning, finding: excludable "club goods" models[4] for water management actually improve user willingness-to-pay. Though the authors concede that excludable models are contradictory to the purpose of the human right to water, the paper ultimately concludes that improving the financial sustainability of rural water schemes is a necessary precursor to expanding water access

[4] In economics, there are four overarching models for public resources management: private goods, common resources, club goods, and private goods. Each category is defined based on two criteria: excludability and rivalry. The "common resources" model is non-excludable but rivalrous, creating the overconsumption of goods described in Garrett Hardin's "The tragedy of the commons." "Club goods," on the other hand, are non-rivalrous and excludable structures in which common resources are limited to a subset of the population that typically pay for access.

to the poor. These findings, though incredibly insightful, represent a philosophical divide in the existing field of literature on rural water financing. Particularly, this school of thought exemplifies an overvaluation of improved revenue collection, or "cost recovery," as a means of improving the financial sustainability of water systems, typically through the use of technology such as prepaid water meters that exclude those without immediate access to funds from receiving water. This approach, however, ignores a fundamental question that must be asked: why is the cost of water so high that the rural poor cannot afford to pay? There are two significant gaps in the literature, either or both of which must be addressed in order to support the "progressive realization" argument that many studies rely on to justify exclusive institutions. The first gap is a thorough discussion on the inefficiency of rural water infrastructure selection, including the installation of complex systems that require frequent maintenance and energy inputs in regions without access to a reliable supply chain of replacement parts and technical knowledge to maintain infrastructure. An alternate model of financial improvement proposed by this thesis, "cost reduction," seeks to prioritize investing in infrastructure that reduces the overall costs of operation, improving the margin stack without resorting to the denial of water to the rural poor. The second gap in the literature acknowledges the legitimate concern of user non-payments within the water sector, but requires more intricate policy consideration of the rural poor. If prepaid meters are to be implemented to ensure payment, what subsidization procedures (including, but not limited to cross-subsidization) exist to ensure that the rural poor who cannot afford to pay will still be able to access water under such a system?

A *sine qua non* condition in access to water and sanitation is equity—the human right to water affirms that access to water mandates structures in place to ensure the poor are not

excluded from access to a resource that is a basic necessity for human life. The current field of literature explores how such an approach can be progressively implemented from a pragmatic perspective. Recent studies such as Mitlin & Walnycki (2019) have also posed the trade-offs of universality and sustainability as a challenge for water infrastructure in low-income areas. Ó. Flores et al. (2013) contributes an important methodology for monitoring progressive realization of the human right to water in rural areas, developed for the context of rural Nicaragua. This framework rejects the "weighted arithmetic mean" approach for analyzing the various components of water access (quality, affordability, pro-poor targeting, etc.) and instead argues that access to water ought to be evaluated via a "multiplicative model." This implies that the components of water access are mutually dependent and non-compensable—exclusion of access to water for the rural poor is not compensated for by improved financial performance. This profound implication is an important framework under which studies ought to evaluate the progressive realization of the human right to water, even under a "pragmatic" lens. Under this framework, stakeholders are tasked with not just balancing the fundamental profitability equation for water schemes, but to also identify cross-subsidization mechanisms that preserve access to water for the poor while simultaneously improving revenue collection and reducing costs.[5]

A second contribution to the literature by the team of researchers at Oxford was the exploration of mobile payments as a means of reducing operational costs and improving maintenance of rural water schemes, bridging the field of rural water infrastructure sustainability with another important field in international development: financial inclusion. Through the REACH Programme's FundiFix model, a social enterprise implemented in Kitui County, Kenya

[5] Further discussion of the methodology is available in **Appendix A**.

that utilizes mobile devices to both facilitate payments for water services and track maintenance problems, the research team was able to identify the value of mobile payments in improving willingness-to-pay for water utilities (FundiFix, 2016; Foster & Hope, 2016; Koehler, Thompson & Hope, 2015). This was furthered by research at the Consultative Group to Assist the Poor (CGAP), an independent think tank that identified numerous operational costs associated with cash-based transactions for water utilities, suggesting that cash management was costing water utilities up to 20 percent of revenues (CGAP, 2017; Waldron et al., 2019). These findings have offered important insights into the value of digital payment systems; however, as discussed above, the studies focus on the cost-reduction benefits associated with the ability to collect revenues, a notion that potentially comes into conflict with issues of equity. An important bridge study connecting mobile payments adoption to access to credit was Islam, Muzi & Meza (2017) which found that mobile money adoption in business models for East African small and medium enterprises increased the overall creditworthiness of the firm.

In order to finance expansion and asset construction, academic research is beginning to explore opportunities for credit financing for water and sanitation schemes in developing countries. Pories, Fonseca & Delmon (2019) outline key barriers to mobilizing financing in the water and sanitation sector. This strategy has been readily accepted by the international development community, quickly becoming a structural part of the objectives of the World Bank, U.S. Agency for International Development, and United Nations (Castro, 2018; Kolker et al., 2016; UN-Water, 2017).

An opportunity for improving access to remote and low-income areas is quickly emerging through the introduction of digital financial services—financial transactions conducted

through digital wallets stored on mobile devices. The expansion of digital financial services has reduced the number of unbanked and underbanked individuals, especially in East Africa. Several studies have explored the implications of digital financial inclusion on poverty reduction, including Tobbin (2012). In Tanzania, two pieces of survey data are important sources of information on financial inclusion and digital financial inclusion. The Financial Sector Deepening Trust (FSDT) publishes data on financial inclusion collected through its Finscope survey (Finscope, 2017; Ephraim & Mhina, 2017). The World Bank also has country-specific data on Tanzania from The Global Findex, a database which tracks financial inclusion survey data from around the world (World Bank, 2018). Both of these databases are important sources of information used by decision-makers to assess financial inclusion policy.

The evolution of digital financial infrastructure to support lending products for rural and low-income communities has been tracked by Francis et al. (2017) as well as a partnership between Financial Inclusion Insights and The Bill and Melinda Gates Foundation, which unearthed important data on the evolution of digital credit products in Tanzania. This data provides important insights into consumer financial literacy, late-payments, and high default rates for digital credit. This has been furthered by the CGAP, which conducted an analysis of millions of digital loans to identify trends in digital lending, including risks of default and late payments (Izaguirre & Kaffenberger, 2018; Izaguirre et al. 2018; Kaffenberger and Totolo, 2018).

This leads to an important gap in the literature on digital financial access and access to credit for rural water schemes. To the researcher's knowledge, no study to date has explicitly tackled the potential for digital credit to improve access to finance for rural water schemes in

Tanzania. This lack of scholarship ignores a financing innovation that has the potential to drastically reduce the financing gap for water schemes in underserved rural areas. Thus, this thesis seeks to examine the appropriateness of introducing digital credit into Tanzania's rural water sector.

Thesis Structure

Chapter 1 of this thesis begins with an overview of the decentralization of water management in rural Tanzania, identifying the relevant organizational structures, frameworks, and legislation that shape the rural water sector. In Chapter 2, I provide an overview of the commercial financing sector, exploring the potentially applicability of private capital to rural water schemes. Furthermore, utilizing data from FinScope and the World Bank, I highlight the barriers to access to finance in rural areas. Finally, I introduce a model of "cost reduction" that shapes my advocacy with regard to the ideal case for utilizing digital credit products. Chapter 3 identifies the potential of digital financial services to provide necessary capital to rural water schemes, including an overview of key digital financial products, governing legislation and frameworks. Utilizing data from the Consultative Group to Assist the Poor, this segment thoroughly outlines the failures of current digital credit products, including high rates of default and inadequate consumer financial protections. Chapter 4 provides a discussion of the data, providing important policy suggestions and outlining the responsibilities of various central government agencies with regard to regulating a digital credit ecosystem within the rural water sector.

Chapter 1: Decentralized Water Management in Tanzania

Tanzania is a relatively "water-rich" nation, with a mean annual rainfall of 1,071 mm (42 inches) (FAO, 2016). Water is primarily managed through a system of nine drainage basins. With regard to purely internal renewable surface water resources, Tanzania has access to 84,000 million cubic meters of water per year.[6] Of these resources, the vast majority of resources are surface water. After including external renewable water sources, including those sourced from the Kanyaru and Kagera rivers in Rwanda and Burundi, respectively, the total amount of renewable water resources in Tanzania is estimated to be 96,270 million cubic meters per year, which translates to a per capita amount of roughly 1,645 cubic meters per year (FAO, 2016).

The vast majority of Tanzania's 58.5 million residents live in rural areas (Central Intelligence Agency, 2020). Poverty is acutely concentrated in Tanzania's rural regions, affecting one-third of the rural population (FAO, 2016). Agriculture is a significant portion of the Tanzanian economy and correspondingly accounts for a significant portion of land usage and water consumption. 42 percent of the total land area is agricultural land, and nearly ninety percent of total water consumption is attributed to the agricultural sector. Industry, however, accounts for a minor portion of water consumption, comprising just one percent of total water withdrawal. This is less noticeable in rural areas, given that eighty percent of industries are located in the urban center of Dar es Salaam (FAO, 2016).

Since the introduction of 2002's National Water Policy, rural water management in Tanzania has been decentralized to local governments. However, in effect, Tanzania maintains a multi-level water governance structure, with critical services provided by both central and local

[6] Internal renewable surface water refers to water that is originally sourced within the borders of Tanzania, and thus, is not dependent on water that originates from neighboring countries.

governments. In this chapter, I outline the various components of Tanzania's water governance structure and identify key challenges as they relate to the financing of water schemes.

Multi-Level Water Governance

Water governance in Tanzania has been shaped by two key development strategies: the Water Sector Development Programme (implemented in two phases between 2007 and 2019) and the recently-passed The Water Supply and Sanitation Act of 2019. The WSDP, implemented in two phases, sought to expand access to water and sanitation services to 90 percent of rural Tanzanians (Ministry of Water and Irrigation, 2014). The first phase (WSDP I), implemented between 2007 and 2014, led to the successful construction of 32,486 water points in rural areas, expanding water access to 8.2 million rural Tanzanians (Ministry of Water and Irrigation, 2014).[7] The second phase established targets of constructing 38,759 additional water points, rehabilitating 19,889 nonfunctioning water points, and extending existing infrastructure to service an additional 17,686 water points by 2019. In total, the second phase seeks to install 76,334 water points to expand access to an additional nineteen million rural Tanzanians by 2019, reaching a rural water access rate of 80 percent (Ministry of Water and Irrigation, 2014).

At the highest level, Tanzania's key governing agencies for water sector development are the Ministry of Water and Irrigation (MoWI), the President's Office - Regional Administration and Local Governance (PO-RALG), and the National Environmental Standards Committee (NESC). Under the decentralized governance structure of the WSDP, the Ministry is tasked with

[7] An important consideration is the "hidden" role of third party entities such as NGOs or religious institutions in developing water infrastructure. 27 percent of rural water points have been constructed by such third parties, which often act outside of Ministry budgets (Carlitz & Boex, 2017). This can potentially interfere with MoWI fiscal planning efforts for infrastructure construction and maintenance.

overseeing sector-wide strategic planning and assisting local governments with financing for asset construction (Katomero et al., 2017; National Water Policy, 2002). Under the two phases of the Water Sector Development Programme (WSDP), which was completed in 2019, the Ministry of Water and Irrigation held the responsibility of approving projects within each Local Government Authority (LGA) to finance and construct. Furthermore, PO-RALG coordinates resource mobilization for COWSOs through local funding, as well as external funding from NGOs and the donor community, while NESC establishes minimum quality standards for water utilities (Carlitz & Boex, 2017).[8]

Recently, the central government has further established decision-making authority over rural COWSOs. The Water Supply and Sanitation Act of 2019 (WSSA) established the Rural Water Supply and Sanitation Agency (RUWASA), which is responsible for planning, implementing, and managing water and sanitation services in rural parts of Tanzania. This marked a dramatic shift in Tanzanian water governance, relocating decision-making authority over COWSOs from LGAs back to the central government (Kwezi, 2019).[9] RUWASA assists in providing a portion of the costs for rehabilitating and expanding water schemes, providing technical and financial support for implementing water development programs, and promoting the registration of COWSOs in order to facilitate ownership of water schemes. Furthermore, RUWASA is able to cluster COWSOs to achieve efficiency and economies of scale (Ministry of

[8] At this time, it is unclear what future role PO-RALG will play as strategic decision-making power shifts from LGAs toward centralized agencies such as the MoWI and RUWASA.

[9] Under the WSDP, each LGA was tasked with developing a district-wide water and sanitation plan. Communities would then apply for funding for water schemes through the LGA plan, from which LGAs could select up to ten for funding from the MoWI. Due to numerous inefficiencies with this system, planning authority was re-centralized to the newly-established Rural Water and Sanitation Agency under The Water Supply and Sanitation Act of 2019 (Oxford Policy Management, 2013). Previous studies, including Carlitz & Boex (2017), go into detailed discussion of the role of LGAs in water management. However, post-WSSA, this discussion is no longer topical.

Water and Irrigation, 2019). One final component included in the WSSA was the establishment of a National Water Fund as a source of concessional loan financing for COWSOs and other water authorities, primarily for the purpose of asset construction (Ministry of Water and Irrigation, 2019).[10]

On the other hand, day-to-day operations for rural water schemes, including maintaining and operating water infrastructure as well as collecting user fees, are delegated to local water governance structures which vary significantly in formality. The most common governance structures include Water Users Associations (WUAs), Village Water Communities (VWCs), and Community-Owned Water Supply Organizations (COWSOs).[11] Given the push for corporatized water management structures, the Ministry of Water and Irrigation has strongly prioritized the development of COWSOs, which are legally and commercially distinct from the community, and govern a single water scheme.[12] The arguments for a COWSO structure are that legal independence reduces the risk of political corruption and increases financial transparency (Carlitz & Boex, 2017). The organizations are typically composed of elected members from each village or water point within a scheme (Fierro et al., 2019). However, there are still numerous limitations with COWSO structures, the primary of which being the limited technical experience

[10] The NWF intends to source funds from public resources, donations, and grants. This "blended financing" model provides an opportunity to combine external/market resources with public funds, allowing loans to be provided on affordable terms. A potential case study for how the NWF might be used to crowd-in market finance is the Philippine Water Revolving Fund, which blends concessional financing from development agencies with commercial loans to provide affordable terms to local water utilities (World Bank, 2016).

[11] Another form of rural governance structure is a District and Township Water Supply and Sanitation Authority (DTWSSAs), of which there are roughly 100 in number, legally controlled by the MoWI (Carlitz & Boex, 2017). Governance issues for DTWSSAs are more similar to those of urban utilities and thus have not been included in the scope of this thesis.

[12] The corporatization of water utilities is a partial-privatization model for water management supported by development banks such as the World Bank. Key tenets of the "corporatized" water utility include a separate legal entity, managerial autonomy, the appropriate ownership of assets and liabilities (subject to potential government assistance with debt liabilities), and financial independence (World Bank, 2019).

of most representatives in preparing financial reports, collecting revenues, and maintaining infrastructure (Carlitz & Boex, 2017).[13]

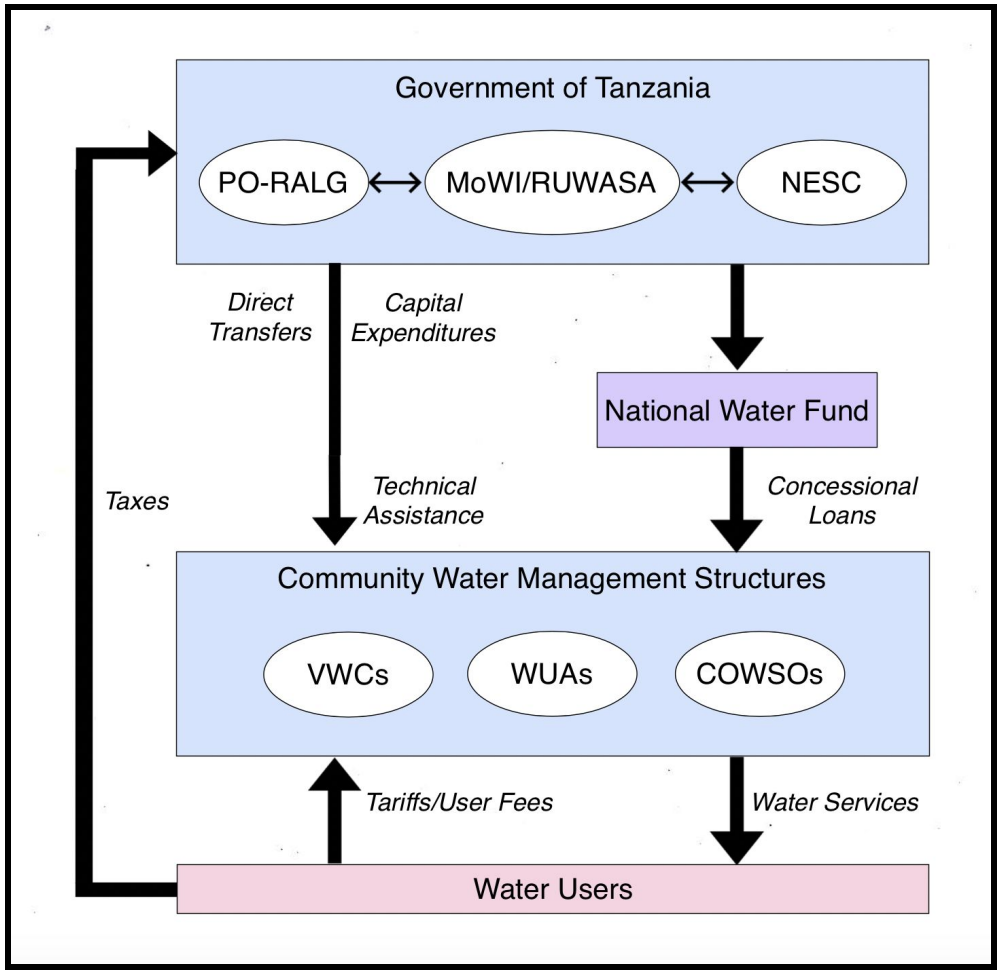

Figure 1: Tanzania's Multi-Tiered Water Governance Structure

Key Challenges

The first phase of WSDP faced numerous setbacks, largely due to many operational inefficiencies in the distribution of funding. A key criticism was the prioritization of asset construction over capacity development, leading to future issues of financial unsustainability in

[13] Due to difficulties in establishing these formalized structures, Carlitz & Boex (2017) estimates that only ten to twenty percent of Tanzanian villages are covered by COWSOs.

WSDP-financed water schemes. The key concerns with regard to rural water schemes can be separated into five distinct categories: inefficient distribution of funds, maintenance concerns resulting from poor infrastructure selection, climate change risks, trade-offs between equity and self-sufficiency, and poor revenue collection.

Inefficient distribution of central funds. One of the main problems with the Water Sector Development Programme was the slow disbursement of funds. By 2014, just 90 percent of committed funds had been disbursed (Ministry of Water and Irrigation, 2014). In addition to inefficient disbursement, funding for COWSOs was largely tied to new projects, creating a gap in financing for villages with dilapidated infrastructure or where management occurs through non-COWSO structures (Kwezi, 2020).

Maintenance concerns and poor infrastructure selection. By far, the largest criticism of the WSDP was the impractical selection of infrastructure in rural areas. In its original strategy, the WSDP set a target of having 48 percent of constructed infrastructure be simple hand pumps, which are much more simple to maintain and operate (Ministry of Water and Irrigation, 2014). However, in reality, communities often chose more complex structures, given that the central government was financing the majority of up-front asset construction costs. This resulted in eighty percent of constructed water schemes being a combination of deep-boreholes, mechanized-piped schemes, which were significantly more expensive to maintain, operate, and eventually replace (Kwezi, 2020). This contributed to the quick dilapidation of existing water infrastructure, as local communities were unable to generate sufficient revenues from tariff collections to recover operating and maintenance costs, leading to long down periods of inoperation (Foster & Hope, 2016; RWSN, 2009). The World Bank found that sixty percent of

rural water points failed within the first two to four years due to a wrong choice in pump type (World Bank, 2018). This phenomenon has been further exacerbated by Tanzania's reliance on donor financing, as donations tend to target infrastructure development rather than maintenance (World Bank, 2017).

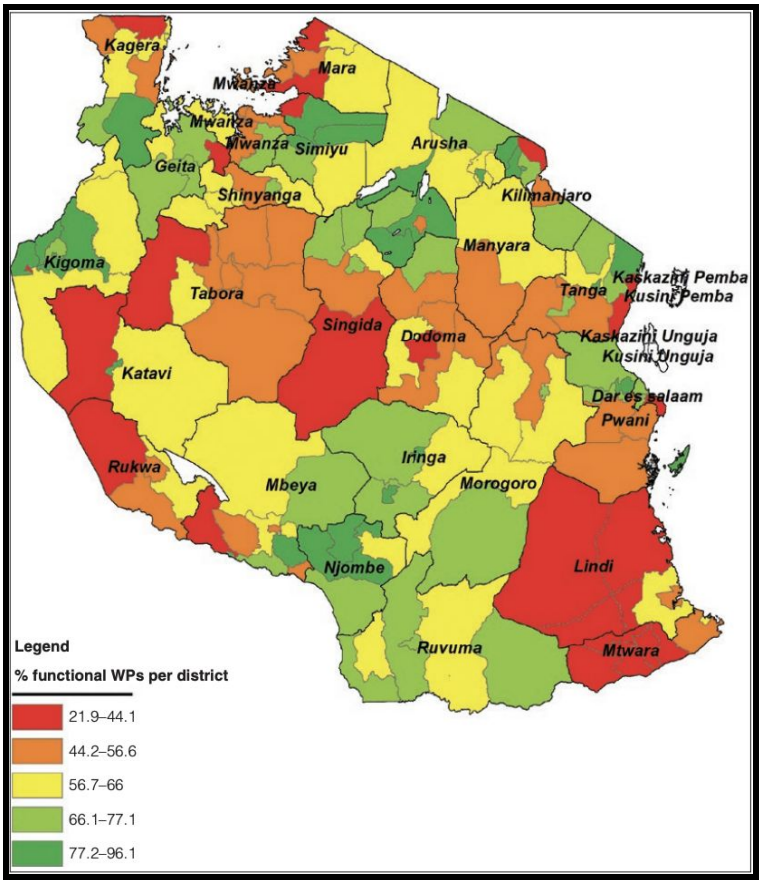

Figure 2: Functionality of Water Points by District (World Bank, 2018; MoWI, 2016).

Beyond the burden placed on communities to finance and maintain infrastructure, the expensive infrastructure selection led to an inefficient use of the WSDP's budgetary resources. The average per-beneficiary cost of WSDP-funded rural water points was roughly TZS 90,000

(USD $59),[14] a significantly higher price point than the budgeted amount of USD $36 and the comparative cost for international development agencies such as the UK's Department for International Development (DFID) at USD $22 to $36 (Oxford Policy Management, 2013). Given the higher cost of production, the Ministry of Water was forced to reduce the average number of funded water schemes per Local Government Authority to just three (Oxford Policy Management, 2013). In response to the problems created by the first phase of WSDP, the second phase prioritized low cost-per-capita projects and renewable energy-powered infrastructure to reduce operating and maintenance costs for rural communities (Ministry of Water and Irrigation, 2014). Furthermore, the second phase increased support for operation and maintenance of rural water points through increased data collection, financial support for infrastructure expansion and maintenance costs beyond the capacity of COWSOs, and technical support in rural areas (Ministry of Water and Irrigation, 2014).

Climate change risks. While Tanzania is relatively water rich, climate change will significantly impact water insecurity concerns across the country. In regions such as the Pangani and Rufiji river basins, increased precipitation rates will yield a higher risk of flooding. This poses a major threat toward water infrastructure as well as creates a risk of water contamination. Furthermore, in areas such as the Wami/Ruvu river basin, which services key urban areas such as Dar es Salaam, Morogoro, Kibaha, and Dodoma, decreased runoff will lead to significant water scarcity (USAID, 2018). This has the most salient impacts on infrastructure maintenance expenses, as well as infrastructure selection. Inoperability results from a variety of causes, and depreciation over time is not constant across geographic areas. Annual maintenance costs vary

[14] The TZS has devalued significantly from 2014, the point at which retroactive analyses were being conducted on per-beneficiary costs under the first phase of the WSDP. To better visualize the historical comparisons between actual versus budgeted costs, this currency conversion was directly taken from Oxford Policy Management (2013).

with factors including geology, depth of groundwater, and climate change patterns (Bonsor et al., 2015; Bonsor et al., 2018; Sekhri, 2014). Thus, financing of water projects requires a refined understanding of the geological, political, and economic context of the project site (Jiménez, Pérez-Foguet, 2010).

Trade-offs between equity and self-sufficiency. While COWSOs are primarily tasked with collecting sufficient funds to finance ongoing maintenance and operations, insufficient revenue collection is a nation-wide problem, particularly due to difficulties at pricing water at a sustainable rate as well as a limited ability to collect tariffs. Tanzania's constitution officially recognizes a human right to water and sanitation, which, in full realization, requires water utilities to provide a baseline of water for all users, regardless of their ability to pay. This, however, leads to a significant financial concern with regard to generating sufficient revenues to cover operating costs, with users being charged as little as TZS 0.24 per cubic meter of water (USD $0.01) and approximately 58 percent of Tanzanians paying nothing for their water supply (TAWASANET, 2019; World Bank, 2017). The trade-offs between equity and self-sustainability create gaps in internal financing mechanisms for rural water points to finance beyond basic maintenance and operations. These trade-offs are further complicated by studies such as Koehler et al. (2015), which find that excludable water management systems result in higher willingness-to-pay rates, an insight that is important for improving the self-sufficiency of water systems, but inherently contradicts the realization of a human right to water and sanitation. With regard to Tanzania's broader ambitions toward universal access to safe and affordable water, excludable water systems are a non-starter and must not be viewed as being compensable with regard to financial sustainability. This necessitates the consideration of subsidization or

cross-subsidization mechanisms in order to make necessary alterations to revenue-collection procedures without excluding the rural poor from accessing water.[15]

Poor revenue collection. In addition to pricing concerns, many rural water points face difficulties in collecting tariffs from consumers. Numerous studies have indicated the behavioral causes of nonpayment—factors such as geographic distance and unreliability of water points reduce the willingness of water point users to pay for the services they have used, as consumers believe that they are being charged too much for the quality of service received (Koehler, Thompson, & Hope, 2015; Foster & Hope, 2016; Masanyiwa, Niehof, & Termeer, 2015). This is heavily correlated with the previously-discussed issues with infrastructure maintenance. When pumps break down, users often are forced to travel to the nearest operable pump, which may be at a far distance. This is especially prevalent in rural areas, where there is a lower geographic density of water points (Foster & Hope, 2016). Koehler, Thompson, and Hope (2015) find that willingness-to-pay levels increase by fivefold as a result of experiencing a service that is more reliable and decreases average hand pump days of inoperation due to maintenance issues from 27 days to 6 days (Koehler, Thompson, & Hope 2015). However, perpetual nonpayment for water services continues to threaten the financial sustainability of rural water utilities. The World Bank estimates nearly 45 million cubic meters of non-revenue water, worth over $3 billion in forgone revenues each year. Reducing global non-revenue water losses by half provides enough in cost savings to meet the water needs of 90 million people (Kingdom, Soppe, & Sy, 2016; Foster & Hope, 2016).

[15] Further experimental research ought to be conducted into the potential for cross-subsidization payment structures, potentially including an income-based or progressive billing system that levies higher costs on wealthier or industrial users.

The Public Financing Gap

This chapter has outlined key sources of cash inflows for water utilities; however, a central dilemma is the widening financing gap that exists for rural water schemes. The next chapter outlines the potential for market-based repayable finance to plug necessary gaps in the financing structure of rural water schemes.

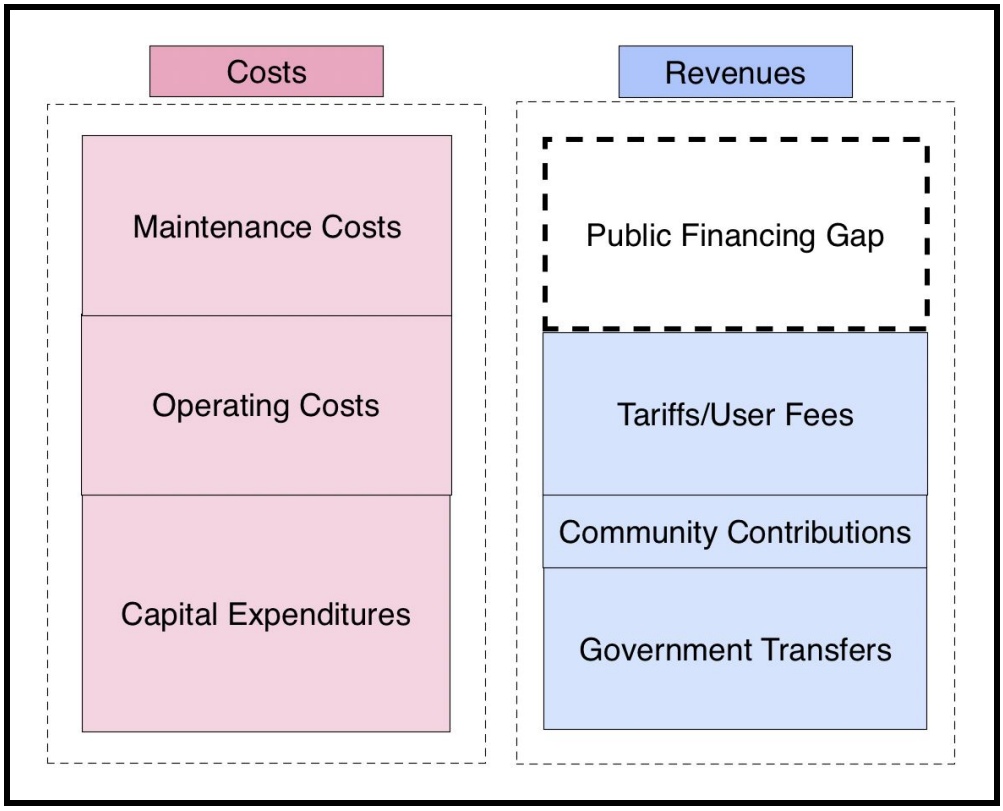

Figure 3: Public Financing Gap for Water Service Providers (Adapted from (Bender, 2017)).

Chapter 2: Introducing Commercial Financing to the Rural Water Sector

As outlined at the end of the first chapter, rural water schemes in Tanzania are tasked with securing partial financing for asset construction and fully financing operating and maintenance costs. In general, the key sources of revenues for water operators in developing countries are the so-called "3T's" of public finance: government and donor transfers, taxes, and tariffs (Bender, 2017). While in theory, these three funding sources alone should be able to cover all infrastructure investment, maintenance, and operation for water schemes, in practice, there is a significant financing gap for water and sanitation, especially in rural areas. This financing gap, typically resulting from accumulated COWSO operating losses, leads to an insufficient amount of savings for maintenance or replacement costs when infrastructure breaks down. Given the decreased commitment of Tanzanian public funds toward the water sector, rural water schemes are left with little option but to evaluate the use of commercial finance to plug the public financing gap. In this chapter, I outline the available options for commercial finance and identify relevant barriers to accessing financial services in rural regions.

Privatization Concerns in Tanzania's Water Sector

Prior to any discussion on commercial financing, the internal ambitions of this thesis toward progressive realization of the human right to water and sanitation necessitates a preemptive discussion of Tanzania's troubled history with private sector involvement in the water sector. The Ministry of Water and Irrigation has actively condoned the use of public-private partnerships within the water sector (MoWI, 2019). The Water Supply and Sanitation Act, as well as the Water Sector Development Programme clearly indicate support for

COWSOs outsourcing operations and maintenance to private sector providers, which the Ministry contends might better achieve sustainability through stronger savings for maintenance costs as they occur.

While healthy public-private collaboration in the water sector can be a financially sustainable method for maintaining the longevity of water infrastructure, it comes at a significant risk of equity (Ministry of Water and Irrigation, 2014). A key case study involves City Water's failed privatization of Dar es Salaam's water system. In August 2003, as part of ongoing negotiations with regard to World Bank, African Development Bank, and European Investment Bank loans for the Dar es Salaam Water and Sanitation Service Project, the Government of Tanzania agreed to privatize the infrastructure of the Dar es Salaam Water and Sewerage Authorities, leasing the assets to City Water Services Ltd. (CWS). While CWS established targets of reducing non-revenue water and improving infrastructure, the contractor saw a decrease in income of 37 percent (WaterAid, 2008). This corresponded with efforts to shut off taps and disconnect from poorer districts of the city which suffered from lower payment rates. In unplanned settlements, in which 80 percent of Dar es Salaam residents live, City Water delegated water access responsibilities to local NGOs (ActionAid, 2004). Ultimately, after two years of disappointing results and diminishing access to water for the poorest eighty percent of the population, the Ministry of Water and Irrigation terminated the leasing contract with CWS (WaterAid, 2008).

While just one example, this case study exposes several important considerations with regard to public-private collaboration in the water sector. First, with regard to private sector collaboration, government intervention is necessary to avoid issues of equity—as evidenced by

the nearly eighty percent of Tanzania's population which was underserved by CWS contracts due to being in peri-urban areas. Second, public-private collaborations ought to consider other forms of involvement that exclude the full leasing of state infrastructure. This is supported by WaterAid (2008), which compares survey data from the 2001 and 2003 Attitudes to Democracy and Markets survey, developed by REPOA and the Afrobarometer network. The study finds that while in 2001, 53 percent of respondents felt that state assets should remain under public control, 2003 survey data indicates that 61 percent of Dar es Salaam residents were in support of a private sector partnership with regard to the DAWASA water utility[16]. These findings indicate that a degree of private sector involvement may be supported by citizens, given that public infrastructure assets remain in control of the government. These protections are necessary to ensure that profitability concerns do not result in the poorest citizens being disconnected from water infrastructure.

Market-based repayable finance, the subject of this chapter, offers an opportunity for private sector involvement in the rural water sector in a manner that doesn't sacrifice important aspects of equity through transferring the ownership of public assets. However, as this chapter furthers discussion on this subject, it will be important to explicitly include discussions on pro-poor targeting. An ideal form of this type of partnership can improve access to water while still advancing toward the progressive realization of the human right to water.

[16] Dar es Salaam's water utility has a well-documented history of failing to provide water to its citizens at an adequate level, part of which served as the impetus for privatization in the first place. This survey, however, can and should not be interpreted as representing the beliefs of rural water users.

Two Models for Improving Financial Performance: "Cost Recovery" vs "Cost Reduction"

In the water development sector, the prevailing intuition on financial improvement for rural water schemes has been one of "cost recovery." This has been especially promoted by organizations such as the World Bank, which identify the issue of "non-revenue water," or water that is delivered but never paid for, as the key threat to long-term financial sustainability of rural water schemes (Kolker et al., 2016; Kingdom, Soppe, & Sy, 2016; Foster & Hope, 2016). This intuition correctly highlights a major concern for rural water schemes: systematic non-payment for water leading to negative revenues. However, this concern has served as the justification for the implementation of exclusionary water institutions such as the shutting off of water taps and the installation of prepaid water meters. These institutions directly contradict the premise of the human right to water and sanitation by denying access to water to the rural poor who are unable to afford the upfront cost of water.

As discussed in the first chapter, a key behavioral cause for user nonpayment is the unreliability of water infrastructure, which reduces the willingness of consumers to pay due to the belief that they are being overcharged in exchange for the quality of service they receive (Koehler, Thompson, & Hope, 2015; Foster & Hope, 2016; Masanyiwa, Niehof, & Termeer, 2015). Upon broader examination, operational costs associated with the improper selection of infrastructure play a key role in the frequent dilapidation of water infrastructure, a phenomenon which regressively puts costs back on consumers to pay for frequent repairs (World Bank, 2017). With this in mind, a contrasting model proposed by this thesis for improving the financial sustainability of water infrastructure is the "cost reduction" approach, or the use of debt-financed investments into asset improvement to reduce the overall operating costs for water infrastructure,

passing those savings, in return, back to consumers. One example which will be discussed in later chapters is the use of solar-powered pumps, which require very little maintenance, create a monthly savings by eliminating the need for diesel as fuel, and have a lifespan of up to fifty years. Combining these programs with a cross-subsidization structure, water utilities can better improve their financial performance without excluding the rural poor from water resources.

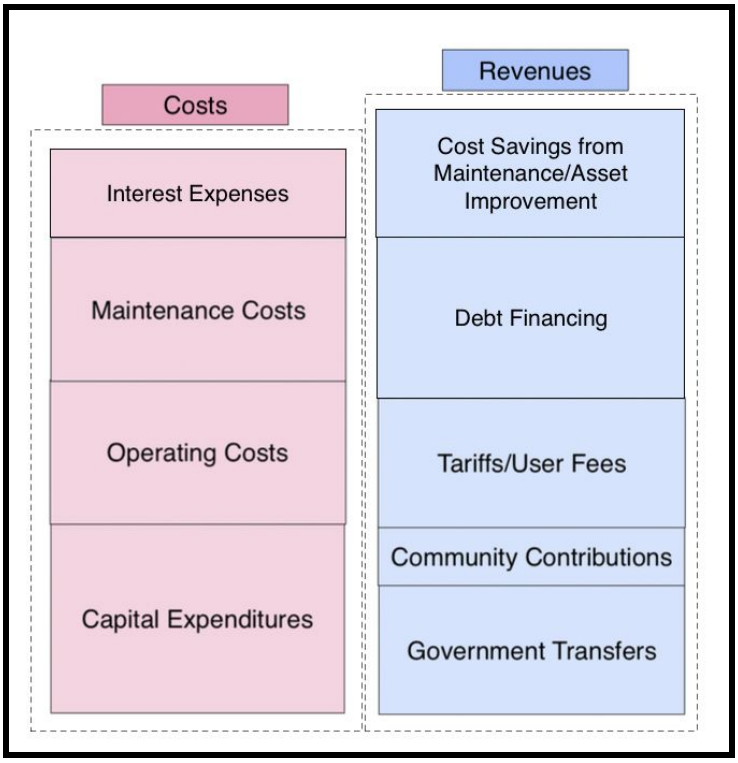

Figure 4: "Cost-Reduction Model" for Commercial Lending (Adapted from Bender, 2017)

Overview of Financial Sector

The financial sector in Tanzania is dominated by both formal and informal services. As a whole, the sector has benefitted from significant growth in recent years as a result of increasing financial inclusion, averaging a 13 percent growth in total assets over the past three years (FSDT, 2019). While the sector is largely dominated by banking institutions, Tanzanians regularly turn to other forms of credit providers, including savings and credit cooperatives (SACCOs),

non-bank payment service providers, microfinance companies, and informal and community lenders. The following section provides a high-level overview of traditional credit sources in the financial sector of Tanzania.

Banks. Banks dominate the financial sector, controlling roughly 70 percent of total assets. The banking subsector is comprised of 67 institutions with a collective 813 branches and 5,814 bank agents (FSDT, 2019). The vast majority of assets, approximately 96 percent, are held in commercial banks, while the remainder is distributed among two development-oriented banks, seven community banks, and five microfinance banks (IMF, 2018). Banks are a significant provider of credit services, accounting for 56 percent of total credit products offered in the financial sector (FSDT, 2017). While loans account for 51 percent of bank assets, more than 75 percent of the total loan portfolio focuses on the corporate sector, with addential exposure to trade, construction, real estate, and manufacturing (IMF, 2018). This creates a gap in accessible lending products offered to personal loans. Compared to their commercial banking counterparts, government-owned banks offer more agriculture and personal loans (IMF, 2018).[17]

In recent years, the Tanzanian financial sector has been negatively impacted by non-performing loans, which have increased in ratio from 6.8 percent in 2014 to 11.5 percent in 2017 across the financial system. External causes of this decrease in loan performance include a poorly-performing business environment and government inefficiency (including delays on repayment for government-guaranteed agricultural loans).[18] Nevertheless, credit to the private

[17] Since there are limited dedicated financial products that service the water sector, agriculture and personal loans serve as a valuable proxy to identify the financing potential of water-related investments within a given segment of financial service providers. This especially the case for agricultural loans, given that the agricultural sector accounts for 89 percent of Tanzania's water consumption (Bird, 2017).

[18] In particular, community and microfinance lenders suffer from uncollateralized loans, insider lending, and fraud (IMF, 2018).

sector increased by 11.1 percent in 2019 with broad exposure to loans for personal activities, trade, manufacturing, and agriculture, and building and construction (Bank of Tanzania, 2019).

Commercial banks remain a limited source of financing for water-related projects. In 2019, commercial banks offered TZS 30.02 billion (USD 12.98 million) in loans for water projects. While this is nearly a six-fold increase from the total loans offered in 2014, as a percentage of the total loan portfolio, water and sanitation-related projects remain just 0.2 percent of total loans, up from less than 0.1 percent in 2014 (Bank of Tanzania, 2019).[19]

Microfinance Institutions (MFIs). Microfinance Institutions (MFIs) target loans to low-income, rural, and women clients, accounting for 18 percent of credit products in the financial sector (FSDT, 2019; FSDT, 2017). The industry is primarily regulated by the National Microfinance Policy of 2017 (NMP), designed to expand regulatory authority to govern non-deposit MFIs and community financial groups (Ministry of Finance, 2017). There are numerous challenges endemic to the microfinance industry, including low levels of financial literacy, a lack of consumer finance protections, inadequate products and services, and a lack of a Central Loan Register (Ministry of Finance, 2017). Concerns about the business conduct of microfinance institutions include inadequate disclosure of lending terms and conditions, high interest rates, reckless lending and multiple loans contributing to over indebtedness, and unfair loan collection and recovery procedures (Ministry of Finance, 2017). This is especially problematic in the formal MFI sector, which targets poor and middle income clients with higher interest rates, requiring borrowers to demonstrate business experience, guarantors, and liquid collateral (Mengueze, 2014). The NMP attempts to establish an enabling environment to promote

[19] Full data excerpts can be found in **Appendix B**.

the development of microfinance products and services that accelerate poverty reduction (Ministry of Finance, 2017).

Savings and Credit Cooperative Organizations. In rural and low-income areas, a key source of credit financing comes from SACCOs, similar to credit unions, which offer loans from the savings of members to support projects within a community. Functionally, SACCOs recycle funds through a community to improve low-income access to formal lending and savings services (Mgema, 2019). SACCOs are favorable for borrowers as they typically require less stringent lending terms. This results from a unique advantage of the community-based lending strategy: a reduced degree of social separation between lenders and borrowers, allowing lenders to better assess risk and urge repayment for loans, based on knowledge of the personal character of the borrower (The Economist, 2017). In all, there are over 5,640 SACCOs servicing mainland Tanzania and 231 in Zanzibar, accounting for 26 percent of credit products offered in the financial sector (FSDT, 2019; FSDT, 2017). In October 2018, data collected by the Tanzanian Cooperative Development Commission, which regulates SACCO lending practices, indicated a bad debt to total loans ratio of 1.9 percent (TCDC, 2018). While SACCOs tend to fill a necessary gap in access to financial services rural and low-income communities, their more lenient lending policies can create a liquidity problem. In 2016, major SACCOs in Kenya had a loan-to-deposit ratio of 109 percent, which indicates that they had offered more in loans than they had available in deposits (The Economist, 2017). This phenomenon is reflected in Tanzanian SACCOs, which tend to face low levels of savings from their members, leading to insufficient cash reserves to meet withdrawal requests (Ministry of Finance, 2017).

Community Groups. Community Groups also serve a significant source of financial services in Tanzania, including services from Village Savings and Loans Associations (VSLAs), Savings and Credit Associations (SACAs), Village Community Banks (VICOBAs), Village Savings and Loan Associations (VSLAs), and Rotating Savings and Credit Associations (ROSCAs) (FSDT, 2019; Ministry of Finance, 2017). Informal financial services typically create opportunities for lending without official norms, rules, and practices for lending. Given the lack of regulation for community lending groups, predatory lending remains a pervasive threat. In developing countries, moneylenders can be the most accessible source of informal credit, charging interest rates reaching 120 percent (Mengueze et al., 2014).

Barriers to Commercial Finance in the Rural Water Sector

Prior to the introduction of mobile money products in Tanzania, rural and low-income populations were severely constrained from accessing basic financial products, with less than 11 percent of the adult population having access to financial services in 2006 (Kibwe, 2017). Still in 2017, just twenty percent of rural adults in Tanzania have access to an account at a financial institution (Global Findex Database, 2017). When it comes to acquiring commercial financing rural water schemes, and the individuals that govern them, face five key difficulties in accessing credit: poor operational efficiency, legal issues with providing collateral, limited availability of data for credit-scoring, geographic distance from physical banking infrastructure, and high interest rates.

Poor operational efficiency. As discussed in the first chapter, rural water schemes face numerous difficulties in generating sufficient revenues to cover operating costs. This creates a

concern for creditors with regard to the ability for rural water schemes to repay interest payments on loans. These concerns over creditworthiness are further limited by the poor managerial and operational efficiency of water utilities—issues such as poor internal records, high rates of non-payment, and significant operating costs. These operational inefficiencies make water providers in developing countries less attractive for traditional lending products (Kolker et al., 2016; Pories, Fonseca, & Delmon, 2019). Furthermore, financing terms for creditors that do end up providing loans to water and sanitation providers typically have shorter tenors, higher interest rates, and require significant amounts of collateral (Pories, Fonseca, & Delmon, 2019).

Inability to provide adequate collateral. COWSOs and other public management entities are often unwilling or legally unable to pledge infrastructure assets as collateral (for reasons including those discussed in the City Water privatization example), which reduces the ability to provide collateral or security for loans (Bender, 2017). This is furthered by limited documentation of ownership of assets such as land, a commonly-requested form of collateral. Just 37 percent of Tanzanians own the land they live on, and only ten percent of adults have any sort of documentation of this ownership. Furthermore, only three percent of adult Tanzanians have access to a title deed or Certificate of Right of Occupancy (CRO) (Finscope, 2017). This lack of security is a key barrier to accessing loans within the formal sector, which further incentivizes the use of informal lending mechanisms.

Limited availability of data for credit-scoring. A key limitation in the banking industry is a lack of centralized credit histories for potential lenders. Currently, there are only two private credit bureaus operating in Tanzania, Credit Info Tanzania Limited (CIT) and Dun & Broadstreet Credit Bureau Tanzania (D&B Tanzania), and there is no credit registry. Collectively, the two

credit bureaus account for less than 1.3 million individuals, which is less than five percent of Tanzania's adult population (Biallas, 2017). While a lack of available credit history is a key constraint on access to credit services, rising ventures such as First Access use data from MNOs to create credit scores by mining consumer data (Biallas, 2017).

Geographic distance from physical banking infrastructure. A key reason rural areas are underserved by the financial sector is due to the large geographic distance separating rural communities from financial institutions, which tend to congregate in urban areas. This underservice is largely due to a deficiency in financial infrastructure, given that there is a significant market for sending remittances from urban areas to rural regions (Ephraim & Mhina, 2019). Outside of mobile payment services, the main viable mechanism for transporting cash from urban to rural areas is by using mobile airtime as a form of currency or sending payments through commercial bus drivers. These options are largely unreliable, cost-intensive, and inconvenient (Ephraim & Mhina, 2019). 79 percent of excluded adult Tanzanians live in rural areas, and a further 76 percent are from the two lowest quintiles of the income distribution (Finscope, 2017).

In 2006, only 18 percent of Tanzanian consumers without a bank account lived within a one hour's distance of a financial institution (FSDT, 2006). This is especially concerning in rural areas, where, in 2014, just ten percent of the population lived within five kilometers of a bank branch (FSDT, 2014). Still today, just 22 percent of Tanzanian adults are aware of a bank branch within a five-kilometer radius of their homes (Financial Inclusion Insights, 2017). Consequently, 35 percent of Tanzanians without access to a financial institution account cite geographic distance as a key constraint (Global Findex Database, 2017).

High interest rates. Additional difficulties expressed by borrowers include higher interest rates and lack of collateral. Given the higher operational costs and risk associated with providing loans to rural areas, rural borrowers that are able to source credit financing are typically subject to higher interest rates. This is especially prominent in the microfinance sector, which typically charged high interest rates–reaching an effective rate ranging from three to twenty percent per month (Ministry of Finance, 2017).

Discussion

As this chapter explains, the current bankability of water and sanitation-related projects remains limited. Specifically with regard to rural water schemes, the inability to consistently generate sufficient revenues to overcome operating costs creates creditworthiness concerns for lenders. Returning to the first task posed by this thesis—identifying the proper scenarios under which digital credit might improve rural water financing— Chapter 2 provides a key insight. The creditworthiness issues of rural water schemes demonstrate that digital credit ought to be used in the case of asset improvements that ultimately reduce costs. In this manner, rural water schemes can improve their financial performance without compromising access to water for the rural poor. However, overcoming barriers to access to financing for rural water schemes requires the ability to circumvent both sector-wide deficiencies that reduce the attractiveness of rural water schemes as borrowers, as well as financial sector limitations that exclude rural communities from traditional financial networks. The next chapter provides an overview of digital financial inclusion and digital credit, identifying opportunities to improve access to financing for rural water schemes in Tanzania.

Chapter 3: Improving Financial Inclusion Through Digital Credit Products

The previous chapter outlines key difficulties with access to financing for rural water schemes, including establishing creditworthiness, high interests, and geographic distance from physical financial infrastructure. One opportunity to increase financial inclusion for rural water schemes exists in the form of digital financial services. A major contributor to Tanzania's rapid economic growth over the past decade has been the expansion of traditional financial services to low-income and rural communities through the use of mobile payment services.[20] Through applications such as M-Pesa and Tigo Pesa, mobile network providers have introduced the capability for any mobile user to directly transfer funds through digital wallets, which can then be converted into cash along a network of agents scattered throughout the country (Kibwe, 2017). This has dramatically increased the accessibility of lending, savings, payments, and insurance products to low-income and rural Tanzanians. This chapter discusses the growth of digital financial services in East Africa, identifies opportunities for usage in financing rural water schemes, and highlights key concerns that still exist in the integration of this newly-introduced financial product.

Sector Overview

The first mobile banking application, MobiPawa, was launched in Tanzania by E-Fulusi Africa Ltd, which took advantage of the market trend of using mobile airtime as a proxy currency to transfer money from urban to rural areas in Tanzania. In 2008, Vodacom launched M-Pesa, which had already gained major traction in the Kenyan payments market, in Tanzania.

[20]A key proxy indicator that suggests ability to use digital financial services is the percentage of adult Tanzanians capable of sending and receiving text messages. In 2017, more than 74 percent of the population had this capability (Financial Inclusion Insights, 2017).

Soon after, other major MNOs launched their own mobile financial services, including Airtel Money in 2009, Tigo Pesa in 2010, and Ezy Pesa in 2012 (Ephraim & Mhina, 2019).

Mobile money services work through a system of agency banking, which serves to expand the network of financial access points to rural and low-income neighborhoods by conducting transactions through approved financial agents. Through a system of alternative distribution channels, agents become a point of service for consumers to purchase digital credits for mobile wallets, as well as conduct cash-in, cash-out (CICO) transactions (Ephraim & Mhina, 2019).[21] Through applications such as M-Pesa and Tigo Pesa, mobile network providers have introduced the capability for any mobile user to directly transfer funds through digital wallets, which can then be converted into cash along a network of over 260,000 access points (Kibwe, 2017). This has dramatically increased the accessibility of lending, savings, payments, and insurance products to low-income and rural Tanzanians.

The digital financial services sector is dominated by four key actors: Vodacom, Tigo, Airtel, and Halotel (see Table 1). Initially, mobile payment operators were only capable of digitally transferring funds between users of a specific platform, such as M-Pesa or Tigo Pesa. Thus, in order to conduct a transaction with a user from another platform, a potential consumer would be required to purchase a separate SIM card. This drastically limited the potential scope of mobile payment services. Currently, however, there is a strong push in the industry to promote interoperability of digital wallets. In recent years, the major MNOs have created interoperable wallets, allowing for free transactions between users of M-Pesa, Tigo Pesa, and Airtel Money, which account for 89 percent of mobile payments users (Ephraim & Mhina, 2019; TCRA, 2019).

[21] While exclusivity agreements are not permitted, 62 percent of M-Pesa agents are exclusive to Vodacom (Biallas, 2017). However, 55% of mobile money agents provide services for multiple providers (Finscope, 2017).

Interoperability capability in mobile money services is an important trend that continues to improve. From July 2018 to April 2019, utilization capability increased 81.6 percent in volume to 146.5 million transactions worth TZS 4,886.4 billion, a 47.7 percent increase from the previous period. Furthermore, this interoperability has led to a sector-wide growth of over 15.4 percent in volume and 15.6 percent in value (Bank of Tanzania, 2019).[22]

	Vodacom	Tigo	Airtel	Halotel
Mobile Money Service	M-Pesa	Tigo Pesa	Airtel Money	Halopesa
Telecom Subscribers	15,672,390	12,572,826	12,428,969	4,641,701
Share of Telecom Market	33.0%	26.3%	26.6%	10.0%
Payment Subscribers	10,168,290	7,802,996	5,180,560	1,614,540.00
Share of Payments Market	39.0%	30.0%	20.0%	6.0%

Table 1: Key Actors in Digital Financial Services Industry (Source: TCRA Statistics, 2019)

Sector Regulation

The first mobile banking activity in Tanzania began in 2006, when the Bank of Tanzania (BOT) created an amendment to the Bank of Tanzania Act designed to establish the Central Bank's authority in regulating non-bank entities involved in payment services. During this period, the BOT issued the "Guidelines for Electronic Payment Schemes," which officially

[22] The Bank of Tanzania launched a development project to establish the Tanzania Instant Payment System, a single instant payment platform designed to connect the various mobile payment service providers in a secure manner. This platform is projected to be operational by June 2020 (Bank of Tanzania, 2019).

granted Mobile Network Operations (MNOs) the ability to provide banking and financial services (Ephraim & Mhina, 2019).[23] Since this period, the burgeoning digital financial services industry has been regulated by two additional strategic frameworks: the National Financial Inclusion Framework and the 2015 National Payments Services Act.

National Financial Inclusion Framework (NFIF). The NFIF was established in two phases, the first implemented between 2014 and 2016, and the second implemented from 2018 to 2022 (FSDT, 2019). In the first phase, Tanzania established an ambitious target of eighty percent of the adult population using a financial access point and seventy percent of the population living less than five kilometers from a financial access point (Biallas, 2017). Overall, public-private coordination between financial providers and regulatory agencies was relatively successful over this period, increasing the proportion of the adult population living within a five kilometer distance to a financial access point to 65 percent. This improvement was even more pronounced in rural areas, where the proportion of adults living within a five kilometer distance to a financial access point increased to 78 percent (FSDT, 2019).

Whereas the first NFIF sought to develop physical infrastructure that expanded the network of financial access points to underserved areas, the second phase seeks to ensure that financial services are truly meeting the needs of various consumer segments. Specific priorities that will be implemented under the second phase include alternative credit scoring, financial literacy education programs, and consumer finance protections. The second phase sets further targets for inclusion—85 percent of the rural population living within five kilometer of an access point and 90 percent having unique and verifiable identification. Specifically with regard to rural

[23] The Bank of Tanzania decided to take a "test-and-learn" approach to regulation, allowing MNOs to begin introducing products and voluntarily provide data to the BoT, which the Bank then used to develop relevant regulations (Ephraim & Mhina, 2019). This was done to avoid stifling innovation in the early years of the industry.

communities, the second phase of the NFIF seeks to expand infrastructure development in the following areas: widening telecommunication coverage, extending outreach of the national fibre optic cable network, and developing a financial access point mapping and reporting platform. Furthermore, it seeks to enforce consumer protections in the microfinance sector through the National Microfinance Policy, as well as improve the use of alternative data and credit reference systems in microfinance. This includes establishing a central collateral registry (FSDT, 2019).[24]

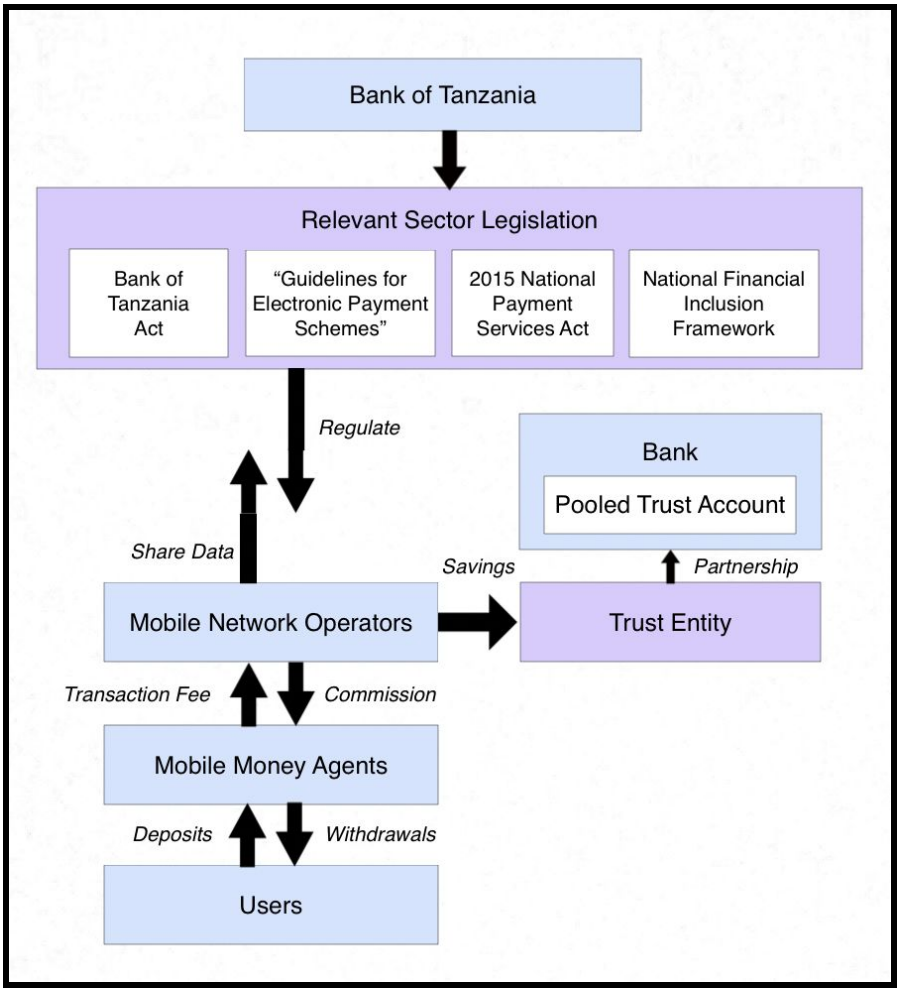

Figure 5: Overview of Digital Financial Services Sector

[24] A key target of the second phase of the NFIF is for all adults to have a profile in an integrated reference system, a centralized electronic information database that stores information on credit history and collateral (FSDT, 2019).

2015 National Payment Services Act (NPS). As the Bank of Tanzania started to wind down its "test-and-learn approach" and started to significantly expand regulatory oversight over the digital financial services industry, one of the first landmark pieces of legislation was 2015's National Payment Systems Act. An important contribution of this legislation was the establishment of firm anti-money laundering (AML) and Know-Your-Customer (KYC) procedures.[25] The NPS limited acceptable photo identification for mobile payments accounts to national ID, passport, voter registration, social security identification, employment identification, or a letter from a ward/village executive. Without approved identification, customers were no longer able to conduct cash-in, cash-out transactions (Biallas, 2017). The second development, visualized above in Figure 5, was the requirement for non-bank and non-financial institutions operating in the mobile payments sector to establish a separate legal "Trust Entity" that would be tasked with managing a trust account for all e-money deposits (Biallas, 2017). In total, these regulations demonstrate an increase in future regulatory oversight of the mobile money industry. The key challenges for regulators moving forward will be implementing necessary consumer financial protections while simultaneously fostering innovation in the space.

Overview of Digital Credit Products

As a result of the expanded access to financial services through digital payment platforms, rural and low-income consumers are also gaining access to digital credit products. In their most typical structure, digital credit products are developed through a partnership between a

[25] In order to prevent the illicit financing of criminal activity, most national governments have implemented strict AML and KYC requirements, requiring financial institutions to gather and verify personal information. This is done to ensure that financial accounts are directly traceable to a real, verifiable person. In the United States, similar regulations can be found in the USA PATRIOT Act (2001).

mobile network operator and a financial institution to distribute small, short-term loans through their payment platform (Francis et al., 2017).The first digital credit product in Tanzania, M-Pawa, was launched by Vodacom in 2014 in collaboration with the Commercial Bank of Africa. Within a calendar year, rival credit products were offered by Airtel and Tigo. Today, digital credit services are provided to five million consumer accounts through the three major lenders—Vodacom's M-Pawa, Tigo Pesa's Nivushe, and Airtel Money's Timiza (Izaguirre et al., 2018; Kaffenberger & Totolo, 2018). The market is rapidly developing, with 21 percent of Tanzanian mobile phone users utilizing digital credit (Kaffenberger & Totolo, 2018).[26]

Benefits of Digital Credit

The creation of digital credit offers unique opportunities for rural borrowers that have traditionally been excluded from the formal financial sector. Primarily, the benefits offered by digital credit can be clustered in three groups: alternative credit-scoring, reduced transaction costs, and immediate disbursement.

Alternative credit-scoring. One barrier for rural and low-income consumers in pursuing financial services is a lack of available credit data, which limits the ability of lenders to assess the creditworthiness of a loan applicant. In local communities, a potential workaround utilized by SACCOs is an informal credit assessment approach, through which personal familiarity with the borrower's character can help a lending entity make loan application decisions. However, within the formal financial sector, just 6.5 percent of adults in Tanzania are represented within the two private credit bureaus (Kolker et al., 2016).

[26] The demographic for digital borrowers in Tanzania largely sways urban, male, and young (Kaffenberger & Totolo, 2018).

A proposed alternative for these "credit-invisible" consumers is the potential usage of alternate data provided by digital platforms—mobile payment activity or social media analysis, for example—to provide a composite score of a borrower's creditworthiness that does not require a previous lending history (Francis et al., 2017). This approach has immense potential, lowering borrowing costs for customers by up to thirty percent in Tanzania through increased availability of credit data (Chen & Faz, 2015; Francis et al., 2017).

Reduced transaction costs. In addition to credit-scoring, distributing loans through digital channels reduces operating costs with regard to underwriting, disbursement, and collection as means of financing connections (CGAP, 2017). Furthermore, given the significant geographic distance that separates rural communities from traditional lenders, digital finance creates an opportunity to reduce transaction costs associated with traveling long distances to procure loans for rural borrowers. The agency banking infrastructure allows cash-in, cash-out transactions to be conducted by a network of hundreds of thousands of bank agents, improving the ease at which lending transactions can be accomplished across large distances. These benefits reduce the overall cost of borrowing for rural consumers.

Immediate disbursement. One of the most important benefits of digital credit products are the immediate disbursement of funds. As discussed in Chapter 1, one of the largest criticisms of the Water Sector Development Programme was the slow pace at which funds were disbursed. This was especially problematic in the case of repairing dilapidated infrastructure, which could often go days until the necessary funds were generated to finance repairs, contributing to high levels of non-payment (Koehler et al., 2015). The immediacy of digital cash transfers serves to reduce the repair times for dilapidated assets, a significant value-add for rural water schemes.

Current Limitations of Digital Credit

While digital credit offers numerous opportunities for expanding financial access in rural and low-income communities, the immaturity of the product has created numerous concerns with regard to the current lack of regulation within the industry. The key problems facing the digital credit sector can be summarized in five categories: limited scope, high interest rates, limited consumer finance protections, low financial literacy rates, and insufficient documentation to verify identity.

Limited scope. While there is significant potential for digital lending to be a viable source of financing for rural water schemes, in the status quo, digital loans are intended to offer a substitute to existing microcredit sources from micro-finance institutions and banks, which typically don't offer solutions for short-term loans. Loan sizes tend to be between USD $30 and $50 with an average repayment period of four weeks (Kaffenberger & Totolo, 2018; Ephraim & Mhina, 2019). At its current stage, the digital credit market does not offer viable solutions for longer-term asset construction investments. However, as the digital credit market matures, there is still a strong potential for adapting digital credit products to more long-term investments, especially given the rapid innovation occurring in the credit market (FSDT, 2017).

High interest rates. Effective interest rates for digital credit products can be much higher than market rate. For example, interest rates on Safaricom's M-Shwari lending platform reach 7.5 percent a month (138% APR), reflecting the type of loans offered by payday lenders (Francis et al., 2017). Such loans are intended to target consumers in need of immediate funds, but they can be damaging to consumers using loans for asset construction and purchase, which take longer periods of time to pay back. In Kenya, mobile loans have the second highest proportional

default rates of any credit product.[27] Digital loans also create the issue of debt stress, with 24 percent of borrowers spending more than fifty percent of monthly expenditures on debt repayments and 51 percent of borrowers having to sell assets, borrow, and reduce food expenditures due to debt (FSD Kenya, 2019).

Limited consumer finance protections. Currently, digital financial services products exist within a regulatory gap in the market. While the Bank of Tanzania oversees the digital financial services industry, consumer protections only apply to digital credit products offered through regulated financial institutions (Kaffenberger & Totolo, 2018). Currently, the only digital credit product being offered in Tanzania through a financial institution partner is Vodacom's M-Pawa service. Both Airtel Timiza and Tigo Nivushe offer digital credit through non-bank lenders (Kaffenberger & Totolo, 2018). This demonstrates a major oversight in regulation of a rapidly-expansive financial product, which can quickly become predatory in the absence of central regulation.

The increased accessibility and low credit scoring requirements for digital credit can potentially subject borrowers to predatory financial practices. 27 percent of Tanzanians that have received digital credit reported experiencing untransparent behavior by lenders including unexpected fees on unclear costs or terms of a loan (Kaffenberger & Totolo, 2018). Default on digital credit can limit future access to credit products due to damaged credit scores such as in Kenya, where two million M-Shwari customers have been reported to Kenyan credit bureaus of defaulting of small loans (Francis et al., 2017). This stresses the importance of proper financial literacy and consumer understanding of important concepts such as credit scores and interest.

[27] Given that Kenya has a more mature digital financial services sector as the initial launching spot for M-Pesa, the country serves as a good case study to understand the challenges digital credit faces in Tanzania.

In the majority of reported cases, consequences for late repayment included additional fees and reductions in future loan limits. In a limited amount of cases, respondents reported serious consequences, such as seizure of assets and legal action (Financial Inclusion Insights, 2017). 39 percent of mobile users that struggled to repay digital loans on time reported lack of money as a key cause; 29 percent also argued the repayment period was too short (Financial Inclusion Insights, 2017). Among the 53 percent who obtained mobile credit and did not repay loans on time, 58 percent experienced extra fees, 46 percent had reductions in future loan limits, 23 percent were denied access to future loans with the same lender, and 20 percent were blacklisted at the credit bureau (Financial Inclusion Insights, 2017).[28]

Low financial literacy rates. One barrier that must be addressed in expanding financial services to rural and low-income areas is the low level of financial literacy with the region. The accessibility of digital credit products creates the potential of borrowers taking on debt for minor purchases, without understanding the terms and conditions associated with the loan. Correspondingly, 56 percent of Tanzanian digital borrowers have repaid a loan late, with an additional 31 percent having defaulted on a loan. This is especially prevalent in the poorest and most rural regions of Tanzania (Izaguirre, Kaffenberger & Mazer, 2018). An even more telling statistics, the loans that are more likely to default are often acquired late at night, potentially for purposes such as purchasing alcohol (Izaguirre et al., 2018). One limitation of currently available data is the inability to differentiate between loans acquired for productive and non-productive uses. Further research ought to be conducted into the purposes for which they acquired the loan. The most available survey data, collected by the CGAP, suggests that just one-third of borrowers

[28] **Appendix C** summarizes the key findings of the 2017 Financial Inclusion Insights study on mobile credit accessibility concerns.

utilized digital credit for business purposes and instead, the vast majority of digital credit is applied toward covering basic consumption (Izaguirre, Kaffenberger & Mazer, 2018). This is especially problematic for borrowers, as lack of financial literacy could lead to worsened creditworthiness and further exclude them from the financial sector.[29]

Insufficient documentation to verify identity. While increased AML requirements improve the integrity of the digital financial system, these requirements have created a major difficulty in accessing financing for low-income and rural Tanzanians. 30 percent of Tanzanians without access to a financial institution account cite lacking necessary documentation as a key constraint (Global Findex Database, 2017). A further 25 percent of people who are financially excluded lack any form of identification, which severely restricts direct access to formal financial services (Finscope, 2017). One potential response to this concern is the expansion of voter registration, which is the most accessible form of identification.[30] However, the drawback of voter registration is that voter identification are issues on five-year cycles, coinciding with national elections. Thus, any new adult may have to wait up to five years to gain the prerequisite identification to get a mobile wallet (Finscope, 2017).

Case Studies in the Water Sector

As demonstrated above, the digital credit market has immense potential, but has numerous flaws in its implementation in the status quo, stemming largely from its invisibility under the current regulatory structure within the digital financial services industry. However,

[29] One example is that loan repayment history affects terms such as loan duration and interest rates for future loans on a given platform, such as Airtel's Timiza Wakala and Tigo's Tigo Nivushe loan products (Francis et al., 2017).
[30] 83 percent of adults have access to a Voter ID card, 9 percent have access to a National ID, 3 percent have access to a TASAF ID card, 5 percent have access to a driver's license, and 2 percent have access to a passport (Finscope, 2017).

digital credit has already seen successful applications within the water and sanitation sector. Two types of digital credit products have been introduced into the market. The first, a microfinancial approach, directly supports households in the construction of in-home piped infrastructure connections. The second, a direct loan to rural water schemes, combines donor funds with commercial funding to finance cost-reducing asset improvements. The following section introduces two relevant case studies within the water sector. The first, involving the global clean water NGO Water.org, discusses the use of digital finance to distribute Water Credit, a specialized microfinance product for in-home water connections. The second, implemented by the non-profit WaterAid, discusses a blended financial solution that helped construct a solar-powered pump in Sangara, a village in the Manyara region of Tanzania.

Household loans: Water.org's Water Credit. One successful microfinance product for in-household tap connections is Water.org's WaterCredit program, which offers technical assistance and capacity building for MFIs to identify investment opportunities and develop appropriate products for water and sanitation (Mikhael et al., 2019; UNICEF, 2019). One key barrier to accessing financing for household water connections is the preference of lenders to provide loans for "income-generating" purposes—effectively, lenders feel more assured that loans will be paid back if the funds are going toward an investment that will generate revenue streams (Water.org, 2017). Through the WaterCredit program, Water.org helps MFIs establish appropriate portfolio products to support household water connections. Digital microcredit products help reduce the burden on households for acquiring funds for up-front capital investments for household water points by increasing the accessibility of debt financing for rural and low-income communities. Thus far, the program has successfully unlocked USD $511,000

in commercial financing for household and commercial water investments with an average loan size of $1,895 (Mikhael et al., 2019; UNICEF, 2019; Mansour et al., 2016).

The WaterCredit model offers a glimpse into the first stage of digital lending in the water sector. Currently, the majority of digital credit products are targeted toward individuals at the microfinance level. This model, however, is more applicable to urban regions with distributed piped infrastructure that lends itself toward in-home connections. For rural areas, which typically rely on a single community source of water, microfinancing products are of less use. However, as the market matures, digital credit products can evolve to target broader types of borrowers, including entire water schemes.

Community loans: WaterAid Tanzania's solar-powered pumps. Given the current immaturity of the digital credit sector in Tanzania, there are limited digital credit products capable of investing in long-term projects, such as asset construction. However, WaterAid's work with solar-powered pumps provides an example of how leveraged investments into cost-reducing asset improvement can potentially improve water access.

In 2018, WaterAid Tanzania implemented an innovative financing mechanism to construct a solar pumping system in Sangara Village, a community in the Manyara region of Tanzania. The project collaborated with the local COWSO to construct a deep-borehole, solar-powered pump. The selection of a solar-powered pump was in order to reduce costs, as the solar pumps require very little maintenance and have a lifespan of up to fifty years. As part of the arrangement, eWATERpay installed pre-paid meters at a price point of TZS 30 (USD $0.01) per twenty liters. The project was financed through a concessional loan, blending grant funding from WaterAid and Habitat for Humanity with a microloan from the United Trust of Tanzania

Microfinance Institution (UTT-MFI), each funding source taking on half of the total TZS 210 million (USD $90,800) loan. Through the savings generated by switching to solar pumps, the community was expected to be able to make loan payments, while simultaneously re-investing excess savings into expanding coverage within the community (Sippy & Williams, 2019).

There are two important elements of discussion with regard to this case study. First, this example further supports the case for "cost reduction" as a financial improvement strategy. By investing in solar pumps, which require limited maintenance and completely eliminate the need to purchase diesel as an energy input, Sangara Village was able to reduce costs to a level at which they could generate sufficient savings to both pay off debt, as well as re-invest savings into expanding coverage within the community. The second element, however, creates broader concerns. The use of prepaid water meters is a controversial element of water distribution, as it creates the potential of denying access to water to the extreme poor who are unable to afford up-front payments, a non-starter with regard to the human right to water.[31] This creates the necessity to set up-front conditions for equity, whether that includes a baseline level of water that each consumer is entitled to free-of-charge, or whether such benefits should be treated as a social welfare policy, funded through cross-subsidization policies. The revolving fund structure discussed in this case study is promising in that customer revenues are reinvested into the community to expand access. A similar structure may be prudent in creating cross-subsidization mechanisms to fund access to water for the extreme poor.

[31] One prominent case litigating the legality of pre-paid meters with regard to the human right to water is South Africa's *Mazibuko v. City of Johannesburg*, a 2009 case which challenged both the installation of prepaid water meters in Soweto as well as the sufficiency of a basic six kiloliter monthly household allowance for water (*Mazibuko v. City of Johannesburg*, 2009).

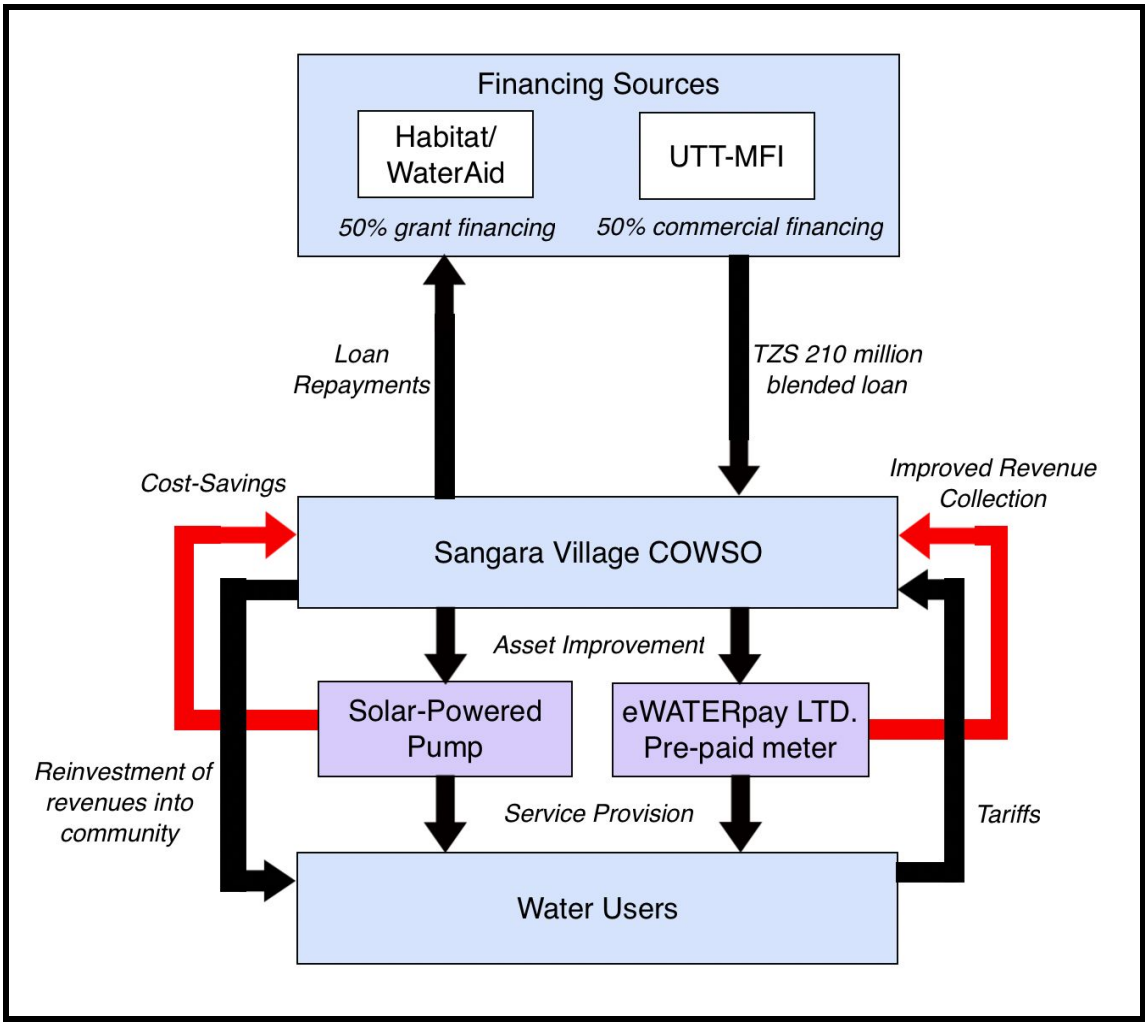

Figure 6: Digital Credit Financing Structure in Sangara Village

Chapter 4: Recommendations

In the first three chapters, I provided an overview of the difficulties in accessing financing for rural water schemes, the current limitations of traditional credit financing for the rural water sector, and the potential applications and drawbacks of introducing digital credit to the rural water sector. In this chapter, I provide a framework for how various stakeholders can develop a sustainable and mutually-beneficial market for digital credit products in the rural water sector. This chapter is separated into three sections, clustered by the relevant regulatory sector: water governance, digital infrastructure, and consumer protections.

Water Governance

Tanzania's hasty decentralization of its water management system has resulted in sector-wide financial unsustainability, largely driven by an over-investment in asset construction, rather than maintenance and improvement. In order to circumvent this cyclic issue, the Government of Tanzania, the Ministry of Water and Irrigation, and RUWASA, must invest in equipping COWSOs with the technical and financial assistance they need to succeed. Primarily, the above agencies must prioritize five tasks: providing technical assistance to COWSOs, integrating mobile payment systems into water utilities, prioritizing cost-reducing asset improvement, utilizing public financing levers, implementing cross-subsidization mechanisms, and improving data collection.

Provide technical assistance to COWSOs. In order to establish creditworthiness, rural water schemes must first establish a resilient, efficient management structure with clear delineations of procedures and authority. This involves establishing a legal framework that

defines asset ownership, which will provide a guarantee to improve access to loans (Water.org, 2017). Still today, the majority of rural water schemes are not governed by formal management structures such as COWSOs. COWSOs serve just 30 percent of Tanzanian villages, with very little support provided by central frameworks such as WSDP to assist villages in developing these formal structures (Kwezi, 2020). This is a necessary step to improve the internal operations, and consequently, creditworthiness of rural water schemes. Improved responsiveness to issues such as maintenance requests will improve consumer willingness-to-pay, allowing for a more consistent stream of income to finance operations (Koehler et al., 2015). Furthermore, formalized management structures improve the likelihood of developing a central strategy for managing, expanding, and improving water infrastructure, an aspect of creditworthiness that improves lender interest in rural water schemes ((Bender, 2017); World Bank, 2016). RUWASA and other government agencies must enable this by providing support to rural water schemes in establishing COWSOs or management structures with clear delineation of procedures and authority. This must be complemented by mandatory training in financial statement preparation, basic accounting principles, and infrastructure maintenance.

Integrate mobile payment systems. Cash-based collection systems are a significant operating cost for water service providers, especially in rural areas, costing between three to 20 percent of total revenues (Bauer, 2019; Waldron et al., 2019). The disadvantages of cash include the costs of collecting, distributing, and managing cash systems, which often require hiring additional employees. Cash-based systems are also vulnerable to embezzlement and fraud, contributing to higher rates of non-revenue water (Krolikowski, 2014). A key solution to reducing the costs of cash-based collection systems is the use of digital payment mechanisms,

which can reduce costs by between 57 to 95 percent (Waldron et al., 2019). This dramatic reduction in operating costs can improve the margin stack for rural water schemes considerably.

In addition to cost-reduction, digital payment applications improve the ease of collecting payments, which will reduce the prevalence of non-revenue water. Compared to cash-based billing systems, which are typically collected on a monthly basis, digital payment systems allow for top-up, prepaid, and pay-as-you-go financing schemes, which ensure that revenues are consistently coming in and mitigate the losses incurred due to non-payment (Waldron et al., 2019). The FundiFix model, developed by researchers at Oxford University's REACH Programme, has developed numerous studies in behavioral research that suggest improved data transparency with regard to water consumption and better communication infrastructure to identify and repair nonfunctional water points improve willingness-to-pay for water services (Waldron et al., 2019; Foster & Hope, 2016; Foster et al., 2015; FundiFix, 2016; Hope & Ballon, 2019). Investing in digital payment systems for water utilities has a dramatic potential to improve the creditworthiness of utilities by reducing operating costs associated with cash payments. In order to implement a mobile money-enabled water system, the Ministry of Water and Irrigation must provide technical assistance to rural communities in implementing these payment models.

Prioritize cost-reducing asset improvement. A key failure of the first phase of WSDP was the selection of complicated infrastructure that was expensive to maintain and nearly impossible to replace upon breaking down. Infrastructure development must carefully be selected on terms that ensure rural communities are adequately equipped with the tools to financing continual operations. Due to the high-cost of maintaining these assets, many COWSOs are

unable to generate the savings necessary to maintain or replace dilapidated infrastructure. A key conclusion of this thesis is that cost-reducing asset improvement ought to be a key priority for the Ministry of Water and Irrigation. Thus, in order to justify the use of commercial financing with imposing further financial burdens on low-income communities, it is essential that RUWASA and the Ministry of Water and Irrigation provide technical assistance to COWSOs in order to help identify infrastructure that might reduce overall costs, such as solar pump technology.

Utilize public financing levers. Given Tanzania's diminished financial commitment to the water and sanitation sector, it is critical to identify the most beneficial use of limited public funds. In order to properly attract commercial finance to the sector, and make loans more affordable for borrowers, the Government of Tanzania ought to utilize blended financing tools to "crowd-in" commercial finance through publicly-funded risk reduction tools (Kolker et al., 2016; (Bender, 2017)). Utilizing public funds to attract commercial financing creates an opportunity to increase the magnitude of each dollar of public financing by a significant amount. In particular, public financing tools should prioritize policy "levers" to improve overall water financing in rural Tanzania through credit guarantees and blended finance (Bender, 2017). This approach will require the coordination of the government, donor, and commercial sectors.

Credit guarantees. One way of improving commercial financing for water projects is a partial or full credit guarantee. These facilities, provided by an external entity, guarantee a loan to a certain amount in the case a borrower defaults. These tools have been commonly implemented in development finance projects through the World Bank, the Asian Development Bank, and USAID. Typically guarantee structures require a payment from a guarantor, which if

passed on to the consumer, should reduce the overall interest rate on the loan (Bender, 2017). Credit guarantee structures offer a unique method of reducing the risk for financial providers in lending to underserved sectors, such as rural water schemes.

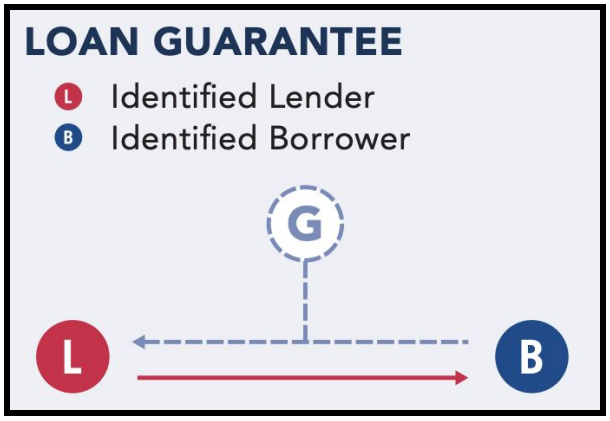

Figure 7: Overview of a USAID Partial Credit Guarantee (USAID, 2018).

Blended finance. Blended finance tools combine funding from concessionary and commercial sources to provide credit at attractive interest rates and tenors. Such as in the WaterAid case study, combining public grants with commercial lending allows COWSOs to pay back loans at more attractive terms than the market offers, creating a multiplier effect on public investment. The National Water Fund, established under the WSSA, creates significant opportunity for crowding-in private investment in the rural water sector through blended financing. This structure can blend public finances with private capital to reduce the interest rate at which loans are offered, mobilizing private capital in the rural water sector while making lending terms more favorable for rural water schemes.

Blended finance provides an important model for how donors, governments, and local water utilities can utilize public financing tools as levers to attract private investment in the rural and water sector. Credit guarantees and blended finance create the opportunity to reduce risk for

lenders and provide a larger volume of credit at more attractive terms. Government agencies such as RUWASA and the Ministry of Water and Irrigation must alter their financing tools to crowd-in, rather than crowd-out private investment in the rural water sector through public finance levers such as credit guarantees and blended finance.

Implement cross-subsidization mechanisms. In recognizing the human right to water, Tanzania has made equitable access to safe and affordable water an a priori issue—meaning, one that cannot be compensated for by improvements in financial sustainability. Thus, RUWASA and the Ministry of Water and Irrigation must identify effective means of ensuring access to water for the poorest citizens. One potential approach, utilized in South Africa, is the basic lifeline for water—a monthly limit that every citizen is alloted, cost-free. However, defining such a limit can be a problematic decision and has been heavily litigated in places such as South Africa (*Mazibuko v. City of Johannesburg,* 2009). Another option includes cross-subsidization methods, including progressive tax systems that divert funds to support water access as a form of welfare policy. One structure that has demonstrated potential and outlined in the WaterAid case study is a revolving fund, which re-invests revenues into a given community. This has been evidenced in case studies such as the Philippine Revolving Water Fund, which uses interest payments to further re-loan funds to new borrowers (Kolker et al., 2016). On the household level, revolving fund structures can be used to apply savings from revenue collections toward subsidizing low-income access to water.

Improve data collection. Effective water management requires a "bottom-up report system, whereby beneficiaries become a reliable source of information to monitor the performance of the schemes." (Giné & Pérez-Foguet, 2008). Local communities are the most

aware of the current state of their water supply. However, they typically lack the technical knowledge to report exactly what the community needs. A proposed solution to the misallocation of national resources for water projects in rural areas involves Water Point Mapping (WPM) technology. WPM gathers the geographical location of all the water points in a region. It then factors in demographic and geological trends, including weather patterns and population growth to quantifiably assess whether or not a region qualifies as having adequate access to water. Further research is necessary to discuss the flow of information across decision-makers at the local and national levels in Tanzania (Jiménez & Pérez-Foguet, 2011). The central government ought to improve the efficiency and reliability of financial flows to local governments. This involves an investment in the tracking of financial flows to accurately measure impact and identify successful strategies (World Bank, 2017).

Digital Infrastructure

While Tanzanians have dramatically expanded their access to digital financial services, many still remain without access to digital wallets. Thus, the Government of Tanzania ought to invest in policies that increase low-income access to digital financial services. In particular, two policy mechanisms ought to be followed: reducing taxes on mobile phone ownership and expanding access to identification.

Reduce taxes on mobile phone ownership. The most important criteria for accessing digital credit products is access to a mobile device. However, recent trends in deactivating phones with unregistered SIM cards has led to a net decline in mobile phone access of 15 percent from 2015 to 2016 (Financial Inclusion Insights, 2017). An important, yet under discussed means

through which governments can improve mobile access is by reducing the taxation of mobile devices, which are typically regressive and passed on to consumers. Taxes account for 35 percent of the total cost of mobile ownership in Tanzania, which is twice that of the global average (Biallas, 2017). This prevents regressive financial taxes from reducing the accessibility of digital financial services for underserved consumers.

Expand access to identification. A key factor in the reduction in access to mobile devices has been the progressively stringent requirement for customer identification in order to establish a mobile bank account. Finscope (2017) finds that identification has not historically been a barrier to accessing financial services, largely due to the fact that 83 percent of Tanzanians have access to voter ID cards. However, voter identification is an inconsistent means of establishing identity, as registration occurs every five years. This creates a major gap in identification for recent adults and eligible voters who must wait until the next election cycle to gain access to identification. This creates an opportunity for regulators such as the Tanzania Communications Regulatory Authority (TCRA) to establish a means of providing simple identity verification procedures to improve access to financial services for people without identification documents.

Consumer Protections

As demonstrated in Chapter 3, while digital credit products have immense potential, in the status quo they impose significant financial burdens on unsuspecting consumers, largely due to limited regulation from entities such as the Bank of Tanzania. Prior to implementing digital credit financing in rural water schemes, the Bank of Tanzania and the Ministry of Water and

Irrigation must implement consumer protections. First, the Bank of Tanzania must increase its oversight over non-financial institution lending. Second, RUWASA and the Ministry of Water and Irrigation should implement mandatory financial literacy programs for COWSO governing bodies to fully understand the terms of digital credit.

Expand Bank of Tanzania oversight over non-financial institution digital lending. Currently, digital credit products are only regulated if they are facilitated by a regulated financial institution. For existing digital credit products on the market, only one is currently partnered with a regulated financial institution—Vodacom's M-Pawa. This creates broader trends of predatory interest rates, lack of transparent financial transactions, and poor credit scoring models for rural and low-income borrowers. While regulators shouldn't tamper innovation in the industry, it is important for regulators to adopt a test-and-learn approach, similar to that which was adopted in the early stages of the digital payments market, to oversee constructive growth of the industry. In the mobile payments industry, this was facilitated through the issuance of letters of no objection (LNOs) through which nonbank providers were able to provide financial services provided they partner with licensed financial institutions that would establish a trust account to manage the finances of non-bank providers. This process both provided MNOs the space necessary to innovate and develop mobile lending platforms, while allowing the Bank of Tanzania to utilize provided data in the LNO diligence process, inspect provider systems, and provide a pilot period to help shape future regulations that would allow the sector to constructively grow in an inclusive manner (McKay & Mattern, 2018). In a similar manner, The Bank of Tanzania ought to expand its mandate to cover all digital credit products, increasing its oversight over critical procedures such as interest rate-setting and credit scoring through a "test-and-learn" approach.

Invest in financial literacy programs. While digital credit was intended to provide opportunities for rural and low-income communities to gain access to formal credit, these consumers were unable to take advantage of the products due to unfamiliarity with financial services. 13 percent of borrowers in Tanzania secured loans "just to try" the platform, part of the contributory factor to the nation-wide 56 percent late payment rate and 31 percent default rate (Izaguirre, Kaffenberger, & Mazer). Furthermore, loans were frequently acquired at night for non-productive uses such as purchasing alcohol, leading to a near 6 to 7 percent higher rate of default on loans acquired later at night (Izaguirre et al., 2018). Defaulting on loans further reduced the ability of borrowers to acquire future loans, both due to immediate reporting of minor defaults to credit bureau, as well as internal lender policies barring delinquent borrowers from accessing future credit (Financial Inclusion Insights, 2017; Francis et al., 2017; Izaguirre et al., 2018).

Financial literacy rates remain low in rural Tanzania, with just 16 percent of rural Tanzanian adults knowing how to use new mobile-based financial tools effectively (Financial Inclusion Insights, 2017). Finscope survey data on numeracy suggests that while the majority of adult Tanzanians have sufficient education to add and subtract, significantly less are able to perform multiplication and division (40 and 46 percent, respectively). This lack of numeracy can affect the ability of consumers to understand important lending terms such as compound interest and percentage-based fees.

The National Financial Education Framework (2016–2020) outlines a successful model for engaging various stakeholders in the improvement of financial literacy. For government actors, this requires central ministries and agencies to include financial education as a portion of

their mandates (National Financial Education Framework, 2017). In the case of rural water schemes, RUWASA and the Ministry of Water and Irrigation ought to mandate financial literacy training for COWSOs prior to approving digital credit applications. This objective can potentially be achieved through collaboration with private lenders, such as FINCA International, and MFI in Tanzania which has developed educational videos for consumers to better understand the structure and terms of loans, increasing access to financial literacy programs for rural and low-income borrowers.

	MoWI	RUWASA	BoT	TCRA
Water Governance				
Provide Technical Assistance to COWSOs				
Integrate Mobile Payment Systems				
Prioritize cost-reducing asset improvement				
Utilize public financing levers				
Implement cross-subsidization mechanisms				
Improve data collection				
Digital Infrastructure				
Reduce taxes on mobile phone ownership				
Expand access to identification				
Consumer Protections				
Expand BoT oversight over non-FI digital lending				
Invest in financial literacy programs				

Table 2: Overview of Agency Responsibilities

Conclusion

This thesis presented three questions for consideration in exploring the suitability of digital credit products in the rural water sector. (1) Under what conditions might digital credit improve rural water financing? (2) What role does the central government play in protecting consumer interests and regulating the use of digital credit within the rural water sector? (3) To what extent does the use of digital credit advance the goal of full realization of the human right to water and sanitation?

With regard to the first question, this thesis challenges the standard insight on "cost-recovery" as a model for financing water utilities on the grounds that excluding access to the rural poor is a non-starter, even if the argument supposes that improved financial sustainability will generate the performance necessary to eventually expand to support the poor. Instead, this thesis proposes that rural water schemes improve their financial positioning through a "cost-reduction," approach, in which communities leverage external financing (debt or grant, contingent on what is the most realistic funding source in the context of developing countries) to invest in asset-improvements that reduce costs of service delivery over the lifetime of the asset—solar pumps being a prime example. In this manner, rural water schemes can improve the margin stack of water infrastructure without resorting to excluding the rural poor from accessing water.

With regard to the second question, I conclude that carefully-monitored digital credit products can bridge the rural financing gap in Tanzania, contingent on the careful use of public financing levers to offer commercial funds at acceptable terms for low-income communities. The thesis finds that the weak regulatory environment for the digital credit industry creates a major

risk of predatory lending toward financially-illiterate customers in rural areas. Therefore, I carefully outline the delineations of responsibility each of the various central agencies—Ministry of Water and Irrigation, RUWASA, and the Bank of Tanzania—have in monitoring the use of digital credit within the rural water sector. Chapter 4 outlines a series of policy recommendations, grouped by sector: water governance, digital access, and consumer protections. With regard to water governance, the thesis strongly urges the Ministry of Water and Irrigation to invest in financial and technical assistance for COWSOs through the following six mechanisms: technical assistance, integrative mobile payment systems, cost-reducing asset improvement, public financing levers such as credit guarantees and blended finance, cross-subsidization, and improved data collection. Next, the Government of Tanzania is tasked with expanding access to digital financial services through reducing taxes on mobile phone ownership and expanding access to personal identification. Finally, the Bank of Tanzania is tasked with enforcing consumer finance protections within the digital credit space by expanding oversight over non-financial institution digital lending. This is supplemented by mandatory training from the Ministry of Water and Irrigation to improve the financial literacy of COWSO members.

The final question posed by this thesis—and, perhaps, the most important—asks whether or not digital credit products help attain progressive realization of the human right to water and sanitation. In committing to the notion of a human right to water, the Tanzanian government has committed itself toward equity, making this component non-negotiable (though it may not always be implemented as such by actors in the sector). Digital credit financing, as well as corresponding solutions such as prepaid water meters, create genuine concerns for the ability of

the extreme poor to access water. However, this thesis finds one key benefit of digital credit financing. Leveraged cost-reduction investments can increase the savings of a rural water scheme, creating free cash flows that can be allocated toward protecting low-income access through a variety of cross-subsidization methods. If applied with appropriate government and community support, digital credit products can be a necessary tool to equip rural communities with the resources they need to attain universal access to safe and affordable water.

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Appendix

Appendix A: Flores et al. (2013) Methodology for Assessing Human Right to Water

Criteria	Indicator	Source of Information
Availability	A1: Sufficient quantity	Households
	A2: Sufficient quantity (perception)	Households
	A3: Reliability/continuity	Households
Physical Accessibility	PA1: Proximity (spent time)	Households
	PA2: Security	Households
Affordability	AFF1: Monthly tariff (water tariff)	Households
	AFF2: Affordability (perception)	Households
Quality and Safety	Q1: Quality (perception)	Households
	Q2: Quality (perception)	CAPS
	Q3: Chlorination	CAPS
	Q4: Organoleptics	Households
Non-Discrimination	ND1: Families without service (perception)	Households
	ND2: Families without service (perception)	CAPS
	ND3: Targeting the poor (economic advantages)	CAPS
Participation/access to information	P1: Meeting participation	Households
	P2: Information about meetings	Households
	P3: Water law (knowledge)	Households
	P4: Community participation (perception)	CAPS

Source: Flores et al., 2013

Appendix B: Commercial Banks' Domestic Lending to Water Sector

End of Period	Nominal Amount (Millions of TZS)	Percentage of Total Loans
2014	4,257.2	0.0%
2015	15,398.4	0.1%
2016	14,780.6	0.1%
2017	18,334.3	0.1%
2018	27,276.4	0.2%
2019	30,019.2	0.2%
2017-Mar	15,972.6	0.1%
June	16,008.0	0.1%
Sep	19,855.4	0.1%
Dec	18,334.3	0.1%
2018-Mar	16,983.0	0.1%
Jun	16,688.4	0.1%
Sep	33,244.6	0.2%
Dec	27,276.4	0.2%
2019-Mar	27,554.0	0.2%
Jun	26,309.8	0.1%
Sep	30,016.7	0.2%
Dec	30,019.2	0.2%

Source: Bank of Tanzania, 2019

Appendix C: Consumer Difficulties in Using Mobile Credit

Concern	Percentage of Respondents Who Selected Answer
Difficulty Accessing Customer Care	11%
Couldn't Access Account or Network	12%
Insufficient Funds to Repay At All	13%
Unexpected Withdrawal	15%
Too High Costs	19%
Didn't Understand Costs or Fees	21%
Unexpected Charges	22%
Short Repayment Period	29%
Insufficient Funds to Pay on Time	39%

Source: Financial Inclusion Insights, 2017

Biography

Neil Devesh Patel was born in Plano, Texas in 1998 and moved to Austin in 2016 to attend the University of Texas at Austin. During his time at UT, Neil studied Plan II and Business Honors, spending two semesters abroad in Arusha, Tanzania as a Swahili Critical Language Scholar and in Bangkok, Thailand as an exchange student at Thammasat Business School. On campus, Neil participated in the Tejas Club, Undergraduate Business Council, Plan II/KIPP Partnership, Shakespeare at Winedale, Texas Songhorns A Cappella, and Skaaren Climate Scholars. He also interned with USAID, the Texas Civil Rights Project, and the U.S. Department of State. He graduated Phi Beta Kappa in 2020 and plans to move to Washington, D.C. to work full-time on the subject of this thesis as a Staff Associate for the Water and Sanitation group at Tetra Tech International Development.