NUDGING FOR MUNICIPAL WATER SERVICES REVENUE COLLECTION IMPROVEMENT (NuWRev): SCOPING REVIEW

Final Report

to the

WATER RESEARCH COMMISSION

by

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WRC Report no. 3238/1/25

ISBN 978-0-6392-0753-7

February 2026

WATER RESEARCH COMMISSION

This is the final report of WRC project no. C2024-2025-01605.

Executive Summary

Utilities must provide water as a constitutional obligation. However, the sustainability of services and potential for expansion and efficient infrastructure maintenance depend critically on the cost recovery ability of the authority. In the Global South, rising utility bill debt is a common challenge, with various conventional strategies for debt recovery proving inefficient. While disconnection is an option, the associated political costs faced by the authority are much higher than the financial costs of reconnection by the customer. As a result, water authorities (utilities) are running at a loss, which compromises the reliability and quality of water provided. Alternative approaches are urgently needed. We note the following caveats:

- Water price charge (tariff) is regulated to ensure broad access, and it is based on the principle of cost recovery for sustainable water supply.
- Due to low tariff (cost) compared to other goods and services in the economy, using monetary price in managing water demand or bill payment has proven to be ineffective.
- Therefore, a 'moral price' – a latent sense of obligation could be exploited by making it more salient. But how can authorities achieve this?
- There is limited knowledge on whether a moral price really exists, how it can be made effective for improving bill payments, and whether other strategies impose high monetary costs on the utility.

South Africa is not spared from the crisis of non-payment of water bills, which has been worsening and compromising the financial viability of many water authorities. With approximately 41% of municipal water already lost as non-revenue water, non-payment of water bills compounds the situation. This creates a risk of a vicious 'low-equilibrium trap', where low-cost recovery leads to a decrease in the quality of services, which, in turn, further provides justification for consumer non-payment behaviour.

This scoping report introduces the notion of a "moral price" as a latent sense of obligation that can be made more salient through behavioural interventions. Yet, there is limited empirical evidence on its existence and effective activation. The urgency is heightened by the pre-existing 41% non-revenue water rate in South Africa. Rising default rates are intensifying a low-revenue, low-service equilibrium trap.

The scoping review found that conventional, punitive approaches are neither efficient nor sustainable. By contrast, nudging strategies (low-cost behaviourally informed interventions) have demonstrated significant, persistent, positive effects on bill payment and resource conservation across multiple contexts. Key effective nudging strategies include:

- Social norm messaging that highlights collective responsibility or descriptive norms (for example, "9 out of 10 households in your area pay their utility bill on time"
- Timely and personalised reminders
- Simplified billing formats that reduce cognitive overload
- Framing that emphasises reciprocity and the positive outcomes of payment

- Institutional nudges that build trust by demonstrating service quality and fairness and service quality nudges that reinforce trust and fairness.

The study underscores that, while nudges are cost-effective, their success depends on contextual adaptation. Evidence from South Africa shows nudges are widely applied for water conservation but remain under-utilised for bill payment compliance. Given the financial crisis faced by water authorities, nudging offers a low-cost, high impact complement to enforcement measures, with the potential to strengthen consumer trust, improve compliance, and enhance long-term service sustainability.

This project therefore proposes a behaviourally informed intervention protocol for South African municipalities, to be co-developed and tested with local water authorities. The protocol aims to shift consumer decision-making at the earliest point of bill payment, reducing defaults and reliance on punitive strategies. Ultimately, this approach can help municipalities to improve revenue collection, safeguard water security, and build more resilient water service provision.

In conclusion, nudging offers a politically feasible, low-cost, and high-impact strategy to complement traditional enforcement measures. Through embedding behavioural insights into municipal credit management, South African water authorities can safeguard revenue, improve service delivery, and secure long-term water security for communities.

Acknowledgements

Silindile Ndamase (appointed Administrator), Khanyisa Nomda, Oyama Tyhalibongo, Dedre Erasmus, Judy Keir for the various administrative roles they played on this project; critical peer reviewers; as well as inputs from Miss Siphesihle Booi and Mr Farai Mushonga. The final product, views, errors and omissions remain the responsibility of the authors.

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1. Introduction

South Africa's water is, as is the case in many countries across the globe, under pressure[1][2]. Water insecurity is recognised as one of the most prominent challenges for South Africa (Muller, et al., 2009; Crookes, Hedden, & Donnenfeld, 2018; Nepfumbada, & Seetal, 2020; Briand, Reynaud, Viroleau, Markantonis & Branciforti, 2023; Prins, Etale, Ablo, & Thatcher, 2023). Resultantly, Du Plessis (2023) confirms that South Africa is consequently ranked as the 40th driest country in the world and considered to be water stressed; therefore, an efficient management of this limited resource is essential (Olley, Cvitanovic, Ginige, et al., 2024). Such efficient management should entail ensuring timely and full payment of water bills by consumers where it is applicable, which is critical for sustainable provisioning of quality water (Randriamaro et al. 2024). That often requires strong institutions (Muller, et al. 2009), not only from the heavy handedness of enforcement, but strategic enough to modify behaviour for good (United Nations Development Programme, 2016; Kuehnhanss, 2019; Naru, 2024).

The physical water scarcity is compounded by a critical financial challenge resulting from the widespread non-payment of municipal water bills. Compounding the situation is that conventional enforcement strategies have been inadequate to realise timely and full payment of bills, hence behavioural change interventions provide hope in sustainable water resource management (Koop, Dorssen & Brouwer, 2019; Haeffner, Jackson-Smith & Barnett, 2023; Joseph, Ayling, & Quevedo-Cardona, 2023).

Tradable services such as water require that citizens pay the bill in full and within the due date. However, it has emerged that the amount of uncleared bills is increasing in volume as well as value (Ngobeni & Breitenbach, 2021; Motsoeneng, 2022). This is despite elaborate enforcement measures in place that appear to be ineffective or, at worst, resulting in the boomerang effect (even increased non-payment) (Mojanaga, 2023). Many utilities have raised concerns on the ineffectiveness of current strategies such as fines and disconnection of services (Aliamutu & Mkhize, 2024). *Can the behaviour of non-payment of water bills be changed, and if so, how can this be effectively done?* These are the questions that guide this inquiry.

[1] https://www.wrc.org.za/
[2] https://www.2030wrg.org/water-cities

Application of behavioural insights to water management is evidence through Water Research Commission (WRC) supported interventions for water saving (see Smith & Visser, 2013; 2014; Bhagwan, 2018; Visser, Bruhl, & McLaren, 2019; Visser, Bruhl, McLaren & Tatham, 2022; Brick, De Martino & Visser, 2023), water bill payment (Slabbert et al, 2010; Walsh, Shai & Mbangata, 2019) and global increase in application of behavioural insights in public policy (Naru, 2024). Of concern is the preparedness of institutions to implement successful behavioural modifications (Dewies, Denktaş, Giel et al., 2022; Naru, 2024), noting the need to contextualise interventions (Dewies et al., 2022; Brick et al., 2023). In addition, lessons can be drawn from other sectors, such as electricity (Burgess et al., 2020; Klege, Visser, Datta & Darling, 2022), which operate from a utilities point of view, just as water provisioning. There is a growing body of work on behavioural interventions in the water sector of South Africa (see Table 1 for a summary).

As a reminder, behavioural insights application to the water sector is not new globally nor in South Africa. Past studies in South Africa have focused on the use of behavioural insights, nudges and interventions in water demand/use reduction, as presented in the introduction. There is need to institute nudge units with public bodies (Halpern, and Sanders, 2016) as is happening globally to support public policy (Ball & Head, 2021). In South Africa, for public policy, the Western Cape Government has been using behavioural insights since 2012, and the South African Revenue Services has established one to improve compliance.

Behavioural change interventions in the water sector are increasing, as outlined in Table 1. Ongoing works include research by Sithole and Mishi (forthcoming) for the Eastern Cape; Mishi, Mushonga and Tyhalibongo (forthcoming) for large housing blocks where residents do not pay water directly and have no specific meters; Katsande and Mishi (forthcoming) on willingness to pay for water quality improvement. South Africa's water payment system is based on an increasing-block tariff structure, where the unit price of water increases with higher usage levels (Metcalf-Wallach, 2008) and non-payment is addressed through the credit management policy of each utility, developed under the guidelines of the Municipal Financial Management Act of 2003 (MFMA 2003). The tariff structure is argued to encourage conservation while ensuring affordability for basic needs (Heino, & Takala, 2015), a critical role pricing is considered to play in the water sector (Berbel & Expósito, 2020).

Table 1: Water Research Commission supported studies on Behavioural interventions

Author(s)	Year	Origin	Purpose	Population & Sample	Methodology	Intervention	Outcome	Key Findings	Relation to Nudging
Slabbert et al	2010	South Africa	To standardise domestic water account presentation across municipalities.	Municipal officials and residents (surveys, interviews, workshops)	Qualitative (surveys, interviews, workshops)	Guidelines and Evaluation & Monitoring Instrument (EMI) for billing formats	Consumer comprehension, trust, and payment compliance	Bills were inconsistent, technical, and confusing. Consumers preferred clarity, plain language, and comparative usage data.	User-friendly bills act as nudges by improving salience and comprehension.
Walsh, Shai & Mbangata	2019	South Africa	To measure affordability of residential water services.	Four municipalities with billing data linked to Census 2011	Econometric analysis (affordability ratios, residual income)	Assessment of tariff structures and affordability metrics	Affordability across income groups	Low-income households face affordability challenges beyond the free basic water allowance. Pro-poor tariffs recommended.	Nudges can complement tariff reforms, ensuring compliance while maintaining fairness.
Slabbert et al	2010	South Africa	To propose standards for municipal invoices as communication tools.	Municipalities and consumers	Legal review + consumer feedback	Evaluation & Monitoring Instrument (EMI) for invoices	Invoice clarity, understanding, and payment compliance	Invoices lacked clarity and structure. Clear summaries, historical consumption, and layout improvements enhanced compliance.	Well-structured invoices nudge households toward timely payment and conservation.
Smith & Visser	2013	Cape Town, South Africa	To test behavioural nudges as water-saving strategies.	400,000+ households	Quasi-experimental, large-scale trial	Nudges: visibility of usage, peer comparisons, conservation tips	Water consumption reduction	Nudges achieved average savings of 2–3.5%. Social norms and recognition were most effective.	Demonstrates cost-effective impact of nudges on resource use.
Bhagwan (WRC)	2018	Cape Town, South Africa	To test behavioural nudges during Cape Town's drought.	400,000 households, six-month trial	Field experiment	Nine message types: tips, clearer bills, comparisons, recognition, public good appeals	Household water consumption	All nudges reduced use. Recognition was most effective (up to 2.7% savings). Wealthier households more responsive.	Shows design of messages (recognition/public good) shapes effectiveness.
WRC & CoCT	2018	Cape Town, South Africa	To evaluate nudges during water stress.	400,000+ households	RCT with treatment and control groups	Water-saving tips, tariff breakdowns, comparisons, recognition, public good appeals	Household water usage reduction	Reductions of 0.57–1.86%. Recognition most effective, especially in wealthy households.	Nudges outperformed financial messages where water was inexpensive.
Smith & Visser	2014	Cape Town, South Africa	To test RCT nudges in urban water demand management.	Cape Town households, 2012 RCT	RCT	Feedback on usage, social norms, conservation tips	Consumption reduction	Raising salience (last month's usage) worked best. Simple messages beat complex ones.	Simplicity in design strengthens nudge effectiveness.
Klege, Visser, Datta & Darling	2022	South Africa	To test nudges for electricity savings in non-residential buildings.	24-floor government office building	RCT by floors	Tips, social comparison, responsibility assignment (energy advocates)	Electricity savings across floors	Competition and responsibility cut electricity use by 9–14%.	Extends nudging to non-residential settings; transferable lessons for billing/payment.
Brick, De Martino & Visser	2023	Cape Town, South Africa	To study nudges across income groups during severe drought.	360,000+ households	Experimental analysis	Behavioural messages: recognition, public good appeals, comparisons, financial feedback	Water consumption reduction	Average reductions of 0.6–1.3%. Recognition and public good appeals most effective. Wealthy households responded more than poor households.	Shows heterogeneity: nudges work best for higher-income groups.
Visser, Bruhl & McLaren	2019	Cape Town, South Africa	To evaluate behavioural interventions in reducing urban water use.	400,000 households; sample sizes vary by arm	Quasi-experimental	Monthly usage feedback (email/SMS), social comparison, emotive appeals, dashboards	Changes in household water use; compliance with restrictions	Personalised, comparative, and emotive messages reduced use, especially in higher-income areas.	Confirms nudges' effectiveness during crises.
Visser, Bruhl, McLaren & Tatham	2022	Cape Town, South Africa	To assess combined effect of tariffs and behavioural nudges on demand.	400,000+ accounts	Experimental & econometric	Differential pricing + non-price nudges (social norms, emotive communications)	Water consumption and responsiveness	Tariffs strongly influenced demand; nudges enhanced conservation, especially when socio-economic context considered.	Shows synergies between tariffs and behavioural nudges.

Source: Author's compilation

The sustainability of water systems is highly dependent on revenue collection success (Foster & Hope, 2017; Olley, Cvitanovic, Ginige, et al, 2024). Many strategies have been put forward for an efficient revenue collection (bill payment) process, including, among others, the billing structure, as well as the accuracy and timing of billing (Mazibuko, 2014; Chauke et al., 2024).

There are various reasons for non-payment of water bills, including unaffordability (Akinyemi, Mushunje & Fashogbon, 2018). It is important to acknowledge that the South Africa MFMA 2003 recognises that there are households that can be waived from payment, such as those which are indigent (Tissington, 2013), while the rest are to pay a monthly bill which, although known as water bills, includes refuse, sewage and rates. Water is the greatest element that leads to variation in the bill on a month-to-month basis; hence the referral to it as a water bill. In this report, where reference is made to 'water bill', it shall mean the total utility bill. The bill is often issued mid-month (by the 15th of each month) or by the end of the month (by the 30th, or last day of each month). The customer is given 14 days to pay before the bill is considered overdue, and ready for attracting interest or other penalties like deduction from electricity top-up, or blockage of an electricity account.

In the case of South Africa, Szabó and Ujhelyi (2015) found that strategies other than increased enforcement can lower non-payment, although based only on an educational campaign that provided short-term impact, with effects dissipating quickly. This is echoed in Joseph et al. (2023), providing a case for behavioural change interventions through nudging.

Benartzi et al. (2017) argue that nudging is a powerful, low-cost, and highly effective policy tool compared to traditional approaches, such as subsidies, fines, or mandates. Nudges change behaviour by altering the choice architecture, and the way options are presented, without restricting freedom or significantly changing financial incentives. Water utilities can use social norm feedback, recognition, or planning prompts to shift household water-use and bill payment behaviours at low cost (Nauges & Whittington, 2019). Many defaults, such as ignoring bills, procrastinating payments, or underestimating usage, mirroring those in savings and energy consumption, can be directly addressed by nudges (Randriamaro et al., 2024). While traditional tariffs may be politically difficult or regressive, nudges can achieve compliance and conservation goals more equitably. The design and implementation of such nudges is not straightforward, and many utilities are unfamiliar with the practice and thus lack the necessary expertise. Thus, there is a need to contextualise nudges to each local authority (Naru, 2024).

The political pressure in water provision is sometimes overlooked when devising strategies (Heino, & Takala, 2015). In that light, Randriamaro et al. (2024) developed a game-theoretic model of utility bill payment behaviour in the Global South, where late or non-payment undermines utilities' financial sustainability and service expansion. The two-stage model captures strategic interaction: households decide whether to pay bills, while utilities weigh the financial cost and political risks of disconnection, which may be revealed through the lack of enforcement of a credit management policy (Masungini, Maseko, & Robbetze, 2023). The analysis introduces moral cost (the internal or social penalty households feel for nonpayment) and political cost (pressure on utilities to avoid disconnections). Results show that lower moral aversion to nonpayment increases default risk, requiring harsher enforcement, while higher moral cost or expensive alternative water sources incentivize timely payment (Berlinger, Dobránszky-Bartus, & Molnár, 2021). There has been an increase in alternative water provisioning in South Africa, with many households preferring alternative sources for drinking and cooking, while utilising the municipal source for other household use due to claimed poor quality (Turpie, & Letley, 2023). Crucially, when utilities highlight (make salient) social norms and moral obligations, forms of nudging, households are more likely to pay without costly disconnections. It can be argued that such low-cost behavioural interventions can improve compliance and financial sustainability, making nudging an effective, scalable and politically feasible tool for governments, including water utilities (Naru, 2024).

Our interest is in exploring the context in which customers default on municipal services bill payment, based on reporting in literature and assessing the possibility of behavioural insights to address related challenges - bills in general, and municipal services bills in particular; and to develop a protocol for behavioural change intervention which can be implemented in future. It is considered imperative to assess decision-making under scarcity, given the level of poverty and other socio-economic ills within South Africa. This includes examining existing interventions designed to encourage compliance and identifying new, context-appropriate behavioural strategies that could be proposed. Benartzi et. al. (2017) agree that the government must increase investment in nudging as it is more cost-effective.

We take bill payment as a decision-making process that can be modelled using a decision tree in a sequential game theoretical framework, as argued by Randriamaro et al. (2024). This is depicted in Figure 1 below.

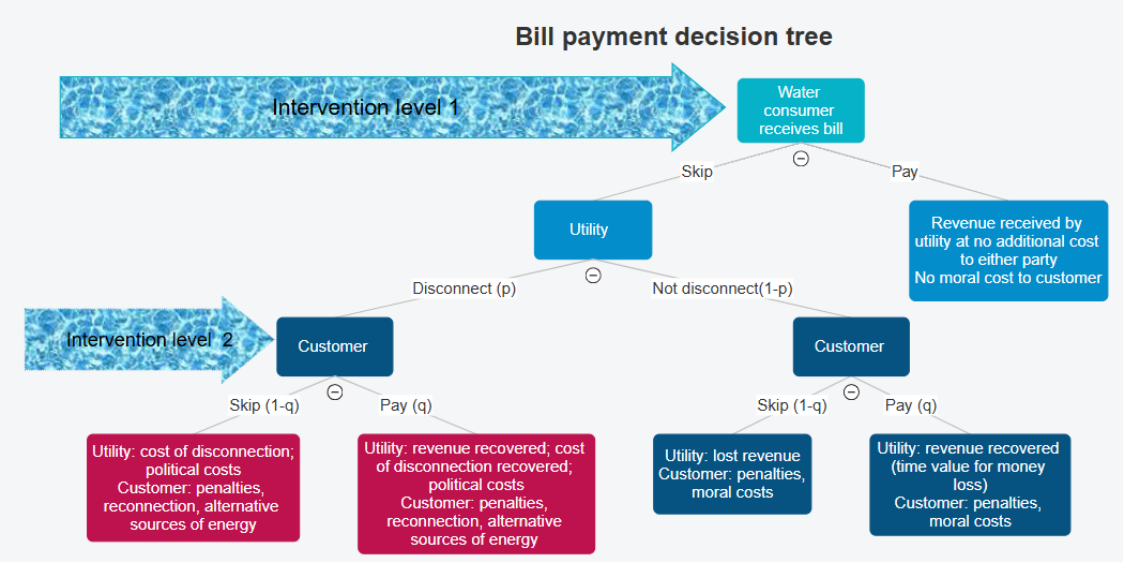


Figure 1: Utility bill payment decision tree
Source: Modified from Randriamaro et al. (2024)

As depicted in Figure 1, when the bill is issued, the consumer 'decides'[3] whether to pay or skip payment. This is the first possible level of intervention, to ensure that the first 'decision' must be to honour the bill. When payment is made at that level, costs of enforcement (disconnection), costs of alternative water sourcing or moral costs are avoided (Brown, Schmitz & Zehnder, 2023), that is a more efficient water accounts management process. This is a positive sum outcome. The water utility observes the consumer's payment decision in the first stage and, if the consumer chooses not to pay, the utility must decide whether to disconnect the consumer or not. This is, however, a simplification, as utilities may respond in multiple ways to delinquent consumers, including reminders, visits, or offers to put consumers on payment plans. The utility then faces uncertainty about receiving payment in the second period, assigning a probability q to payment and $(1 - q)$ to non-payment, where $q \in [0, 1]$. The payoffs associated with each decision path are summarised in Figure 1, and it is evident that non-payment (skip) 'decision' by the consumer at the first stage is costly to society and should be avoided as an inefficient way to manage water accounts.

Bill payment is a decision that is linked to human behaviour, which can be influenced by the interplay of psychological, social, and financial considerations. According to Boyle, Yu, Mottola, Innes, and Bennett (2022) any decision-making is considered a complex behaviour that involves evaluating alternative options, weighing risks and benefits, forecasting future outcomes, and ultimately making a choice. We consider that customers are making a choice,

[3] We acknowledge that in some instances households have no financial means to clear the bill due to socio-economic challenges in South Africa, which result in over indebtedness

whether to pay the bill, not yet or not at all. Having this choice then translate to preferences for example, at what point (prioritisation of outstanding bills in the face of constraints) and what amount of the bill one will pay. This assumes that the customer receives a bill, by any means (via email statement, postal or checking online, receiving an SMS, among other modes).

In line with Shani's (2017) thinking, the possibility of sharing (splitting) bill payment among different payers, brings another layer of complexity. Although Shani's works was on restaurant bills, it is worth noting that sharing of bill is possibility in many dwellings. There are different sharing scenarios: i) know beforehand how sharing is done – predetermined formula for the full bill ii) specific amount being part of rental bill, then sharing of utility bill beyond a certain threshold – basic plus. In both cases, there is uncertainty of the actual amount to be paid, therefore in the absence of split metering, consumption of water is high to increase marginal benefit (thus reducing personal loss due to sharing in any case, the bill will be split in a pre-determined formula). The water authority cannot compel the way a bill is paid (shared), however, such manner does affect the bill payment and may explain partial bill payments.

Bill payment as an economic action has the best choice depending on:

- What information is available – Is it complete? Is the bill/statement available, is it correct?
- What are the skills available to search and process the information? To understand the charges reflected on the bill, e.g., the tariffs
- How much time is available to search and process the information? To understand the charges reflected on the bill, e.g., the tariffs variation
- How does the choice and its outcome compare with those of others around me? Social status, social proofing are others paying – pluralistic ignorance, distance to the reference group
- What implications does my choice have for future choice sets and for the choice sets of others – to care for others – *if I do not pay now, will I have access to water in the future or will I be able to develop my property further, receiving necessary approvals from municipality?*

There is therefore a need to carefully design the environment within which individuals are making choices, which is known as choice architecture (Thaler, Sunstein, & Balz, 2013). The

theory of bounded rationality, emerging from behavioural economics and psychology works, posits that humans rely on incomplete information and process it within their cognitive limitations and time constraints (Boyle, et al, 2022). Figure 2 illustrates the decision-making process, which through the inevitable bounded rationality leads to sub-optimal (satisficing not maximising) outcomes.

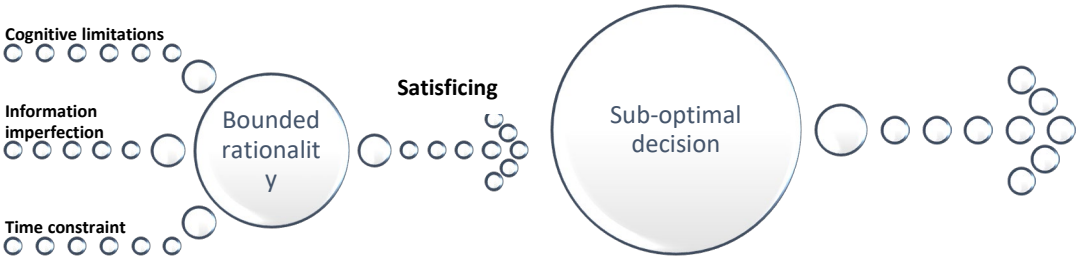


Figure 2: Presence of bounded rationality and the sub-optimal outcomes
Source: Authors Compilation

The three elements lead to suboptimal decisions due to bounded rationality, one cannot be truly rational. Cognitive limitations arise from scarcity, lack of salience dissonance; information imperfection is a great reality, while time to think and act is always limited. There is something inert in human beings that need to be ignited, in a systematic way to help achieve optimal decisions.

This is explained from the notion that decision making is argued to be driven from two systems (Carminati, 2020; Grayot, 2020; Arnott, & Gao, 2021). System 1 is made up of the unconscious thoughts (effortless, default, based on experience), System 2 is more conscious, being slow, deliberative and follows logic (Da Silva, 2023). In that regard, elements, such as loss aversion, endowment effect, procrastination and inertia, in varied ways, lead people to path dependency, where decision makers stay with the default option.

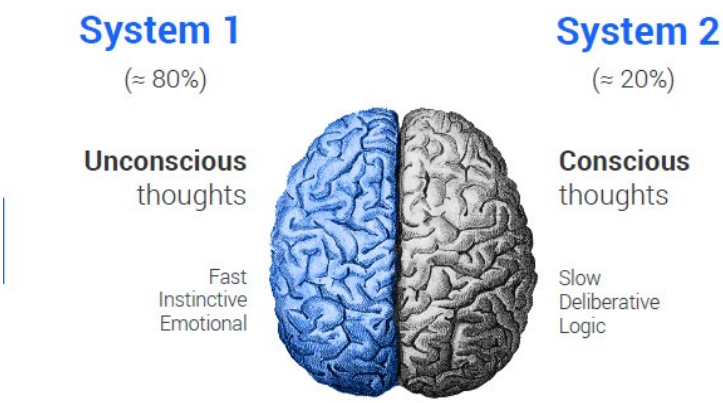


Figure 3: Human brain functioning
Source: Kahneman, (2011)

This means, making people "aware" of a problem or path of action will not translate into 'desired' action - there is need to activate system two. It implies that honouring of a payment can be nudged (Szabó & Ujhelyi, 2015; Saulītis, 2023), using techniques such as a specifically worded (framed) single sentence within the bill (Kettle, et al., 2016) or changing the paper colour or information layout (Sandri, Hussein & Alshyab, 2020; Visser et al 2019; Brick et al., 2023). However, techniques successful in one context, cannot be directly transferred to another jurisdiction without testing applicability (Holzmeister, Huber, Kirchler & Schwaiger 2022). From this, it is necessary for a scoping diagnostic review to identify, fully, the strategies used in literature, and circumstances where they were impactful, and identify ones that can be applied in the case of South Africa, with the necessary implementation plan.

The exploration of the context in which client default will begin with a literature review of the application of behavioural insights to similar challenges. This goes a long way in ensuring efficiency of one of the scarcest resources in South Africa, water. This scoping project will facilitate the co-creation of intervention plans with the water authorities in Eastern Cape province as lessons from literature will be contextualised. It takes an exploratory approach to inquiry, to get to understand the topic deeply and design implementation and measurement plans. We seek to identify and map full breadth of evidence.

Techniques successful in one context, cannot be directly transferred to another jurisdiction without testing applicability … it is necessary for a scoping diagnostic review

We hypothesise that: Bill payment is a behaviour that can be modified. Decision triggers are necessary to increase probability of payment:

- ❖ Increasing moral costs, increases the probability of payment at level 1; if reason for non-payment at first instance is beyond customer control (intermittent rise in other expenditures), a higher moral cost increases payment in the next level compared to punitive strategies.
- ❖ Making the costs of non-payment salient improves payment
- ❖ Reminders, format of bill, timing of the bill, framing of words in the bill, language of the bill, and related factors influence payment rate

Proposition: Higher moral cost, costly alternative sources of water, and salient monetary costs increase payment likelihood, while high political cost discourages disconnection.

Specific Null Research Hypotheses

H1: A lower moral aversion to non-payment increases the probability of utility disconnection.

H2: Higher alternative water costs increase the likelihood of household bill payment.

H3: More salient monetary costs of non-payment increase the likelihood of household bill payment

H4: Higher political cost to the utility reduces its likelihood of disconnecting non-paying households.

From the two levels of possible intervention highlighted in Figure 1, what we seek in this study is to determine what can the utility do to ensure a higher payment rate at the first decision node, and how to improve bill payment once the client has defaulted. We conduct a diagnostics scoping review with the aim of developing protocol for behavioural change intervention. We first present some background information to provide an understanding of the South African water sector, then outline the methodology for carrying out the scoping review. Lastly, we present the protocol and key success factors for such protocol.

2. Study focus and rationale

2.1. Problem statement

Municipal water services revenue collection in South Africa is poor, with many water authorities financially constrained due to widespread non-payment of water bills (Motsoeneng, 2022; Sualihu, Rahman & Tofik-Abu, 2017; Zaied et al., 2020). This is compounded by non-revenue water (caused by illegal connections, leaks, and unpaid metered usage) further undermines local authorities' ability to operate and maintain infrastructure (World Bank, 2021). Growing numbers of indigent users and increasing bill defaults exacerbate these

financial challenges (DGLP, 2005; Ruiters, 2018; Pillay & Mutereko, 2022; Sualihu et al., 2022). For instance, Merafong Local Municipality was unable to collect over 70% of its debt, incurring losses over R600 million (Motsoeneng, 2022). Key reasons for non-payment include economic hardship, billing errors, dissatisfaction with municipal services, and perceptions of high-water costs (Zaied et al., 2020; Sualihu et al., 2022; National Treasury, 2011; Medwid & Mack, 2022; Enqvist & van Oyen, 2022). Studies show that poor service quality often leads customers in developing economies to withhold payment for multiple municipal services, creating a self-reinforcing cycle of reduced revenue and declining service quality (Ben Zaied et al., 2020; Kayaga et al., 2004; Sualihu & Rahman, 2014; Singh et al., 1993). This creates a low equilibrium trap that is not addressed by traditional enforcements strategies, which are considered heavy handedness and critiqued to be implemented selectively or are abused due to weak institutions[4].

Current enforcement strategies such as meter blocking and debt collection impose significant costs on already constrained water authorities (Motsoeneng, 2022; Masungini, Maseko & Robbetze, 2023). Despite these efforts, non-payment remains high, threatening water security and compromising quality of life in cities (World Bank, 2021; Hutete & Sibanda, 2022). Access to water is a fundamental human right, yet increasing delinquency in bill payment reduces revenue and jeopardizes future water access (National Treasury, 2011).

Many users feel justified in not paying, particularly when municipalities struggle to enforce credit control policies. For instance, in Buffalo City, a public call for payment compliance was met with backlash, reflecting broader distrust in local service delivery.

2.2. Aims

The primary aim of the project was to conduct a scoping review on nudging for improved bill payment, contextualise identified nudges to South African municipalities and design a behavioural intervention plan to encourage water bill payment.

Additionally, the project sought to develop capacity for Behavioural Insights application in the water sector.

2.3. Objectives

The study's specific objectives being to:

[4] https://gga.org/poor-governance-exacerbates-south-africas-water-crisis/

a) conduct a scoping review on the application of behavioural insights to utility bill payment challenges
b) establish the context in which consumers default or fail to pay their bills on time by assessing existing interventions to promote compliant behaviours.
c) investigate consumer behavioural responsiveness at decision making points within the water access and payment processes.

2.4. Review questions

The critical questions to guide the scoping review are:

1. What does the empirical evidence reveal about behavioural intervention strategies implemented to improve utility bill payment?
2. What contextual factors contribute to consumers failing to pay on time or defaulting, and how effective are behavioural interventions in promoting compliant payment behaviour?
3. How does consumer behaviour manifest at decision making points within water access and payment processes?

2.5. Rationale

Considering this problematic cycle, there is a pressing need for cost-effective strategies that complement traditional enforcement. The current approaches, such as meter disconnections, legal recovery processes, and credit control policies, are not only costly but have also proven insufficient in improving payment compliance. Moreover, with public mistrust in service delivery and a growing perception that non-payment is justified, especially in contexts of poor service quality, there is a risk of further entrenching a low-revenue–low-service cycle.

This study is therefore necessary to explore alternative approaches that can positively influence user behaviour. Behavioural insights and nudges offer a promising, low-cost means of encouraging payment compliance without relying solely on punitive methods. By better understanding the behavioural drivers behind non-payment, municipalities can design interventions that align with how people make decisions- offering potential for lasting, scalable impact on revenue collection and, ultimately, service sustainability.

2.6. Background of the study

Water is one of the key trading services provided by municipalities in South Africa. There has been increasing emphasis on ensuring that trading services must operate as ring-fenced units with a single point of accountability to improve revenue collection and promote financial

sustainability (World Bank, 2025). Given that the local government fiscal framework comprises both own revenues (such as service charges) and transfers from national government, municipalities are expected to implement cost-reflective tariffs for service delivery, while also taking affordability into account. The South African society is characterised by three major ills- poverty, inequality, and unemployment- which calls for greater funding support from the national government to enable services to be delivered even to poor households (Department of Welfare, Republic of South Africa, 1997; Ledger, 2021; Ngubane, Mndebele & Kaseeram, 2023). To fully appreciate the financial dynamics of municipal service delivery, it is essential to first understand the structure of the government fiscal framework. Illustrated in Figure 4 below is the basic revenue sourcing for a local municipality.

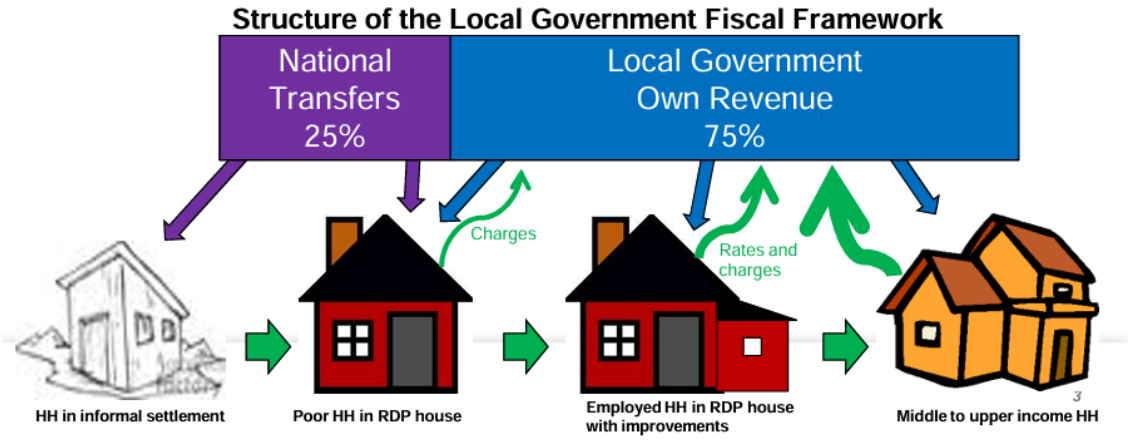


Figure 4: Sources of local authorities' revenue
Source: *Mokgabodi (2013)*

Despite this potential revenue generation that is targeted to provide seventy-five percent of required revenue, World Bank (2024) asserts that South Africa's municipalities are facing a crisis in the provision of basic services. This is due to several factors including: i) low collection rates resulting in loss of revenues; ii) trading services departments not having full control of the revenue cycle (governance failures); iii) lack of proper asset management; and iv) underinvestment in infrastructure operations and maintenance, which has led to capacity constraints and unreliable services, resulting in a cycle of diminishing revenues and decreased investment.

The green up-ward pointing arrows in Figure 4 reflect revenue from tradable services (such as water) and other sources like levies, fines, among other cost recovery measures. Paying consumers contribute directly through water tariffs, where they are charged more for higher

usage. Indigent consumers typically do not pay for water; instead, they receive free basic water supported by government transfers (Department of Water Affairs & Forestry, 2001; 2002). Additional revenue comes from property rates and levies, and this ensures water service sustainability while maintaining affordability for vulnerable groups. This balanced approach aims to secure financial viability for the water authority while promoting equitable access to essential services (Department of Water Affairs & Forestry, 2001; 2002; Statistics, South Africa, 2025).

Municipalities aim to generate a surplus from trading services by charging for consumption, with water being one such service billed according to meter readings. This surplus serves as a primary funding for local authorities, making revenue collection efficiency crucial (Statistics, South Africa, 2025). Generating a surplus is important because it enables municipalities to qualify for grants such as the Urban Settlement Development Grant (USDG), and the Municipal Infrastructure Grant (MIG). These grants were designed to fund municipal infrastructure development, particularly for basic services like water, sanitation, roads, electricity, and housing support. The MIG funds infrastructure in all municipalities, mostly rural or smaller ones while the USDG is specifically for metropolitan municipalities, supporting infrastructure aligned with urban housing and settlement development (Palmer, Paladh, Kaplan & Walsh, 2017).

Water authorities face various challenges in water supply and management, including difficulties related to grant systems. For instance, the Metro Trading Services Programme (MTSP) under which MIG is implemented, targeting metropolitan municipalities, has highlighted issues such as insufficient incentives and stringent performance requirements that affect funding and service delivery. Further, World Bank (2024) bemoans South Africa's local government infrastructure grant system which lacks effective incentives that focus on results, and in response, proposed MTSP to reduce Non-revenue Water (NRW) and increase revenue collection ratios. A municipality need to show efficiency in running trading services to be able to receive a grant to further support service delivery in that line.

Overall efficiency in government is increasingly getting attention (Monkam, 2024; Mishi, Mbaleki & Mushonga, 2022; Amusa & Fadiran, 2024), with cost recovery and revenue generation through tradable services in local municipalities poised to drive own revenue generation in the face of dwindling fiscal space (World Bank, 2024). One notable area of efficiency concern is the increase in NRW (Cassidy, Barbosa, Damião, Ramalho, Ganhao,

Santos & Feliciano, 2021; Farouk, Rahman & Romali, 2023; Mojanaga, 2023), more so amid the water crisis driven by climate changes, aging infrastructure and other leakages within the system.

Sustainable provision of universal water access to essential services is critical for socio-economic development of the people, businesses, and communities (Statistics South Africa, 2025; World Bank, 2025). However, a major challenge on the demand side is that an increasing number of consumers are not paying their water bills, which undermines the financial sustainability of water service provision (Walsh, et al., 2019). There is no doubt that strategies enabling municipalities to improve revenue collection at minimal cost are highly desirable. However, influencing consumer behaviour remains a complex challenge for local authorities worldwide and requires a combination of targeted, multifaceted approaches (Brent & Ward, 2019; Migchelbrink & Raymaekers, 2023).

2.7 Legal policy framework

Section 227 of the Constitution states that: "*Local government and each province is entitled to an equitable share of revenue raised nationally to enable it to provide basic services and perform the functions allocated to it*". Such services include water, to which access is guaranteed as a basic human right. Water and sanitation services provisioning is a legislated matter, starting from the constitution. There is also changing legislation, such as outlined in the Division of Revenue Bill 2024 the introduction of a performance-based incentive grant component for trading services (water and sanitation, electricity, and waste management), which is envisaged to start in 2025/26 from the water and sanitation services as part of the USDG. The aim is to improve efficiency of urban utility services as per Explanatory Memorandum, Annexure W1 of the Bill.

The requirement for residents to pay for municipal services, enforced through credit control policies, is grounded in South Africa's legal and policy framework. The Constitution (Sections 152(1)(b), 153(a), and 195(1)) mandates municipalities to ensure sustainable service delivery, prioritise community needs, and promote accountable and efficient administration. The Municipal Systems Act 32 of 2000 further outlines residents' responsibilities to pay for services (Sections 4, 5, and 6) and provides a framework for customer care, billing, and credit control through Chapter 9 (Sections 95–100). In addition, the Water Services Act (108 of 1997), the Municipal Finance Management Act (56 of 2003), and the Public Finance Management Act (1

of 1999) collectively support financial sustainability, sound revenue management, and accountability in the delivery of water and other essential municipal services.

The default approach, at policy, for recovering debt is a penalty, in the form of charging interest, disconnecting services, attaching assets and/ or handing over to debt collectors. Given these penalties, it could be reasonable to assume that consumers avoid such scenarios and thus pay timeously, at least from a Homo Economicus point of view where rationality is assumed. However, a key behavioural insight is the 'pain of paying' (Brent & Ward, 2019), where consumers experience an inherent psychological cost when spending money, framing it as a loss. This often leads to payment procrastination. This tendency is exacerbated when the future, more abstract penalties for non-payment are less salient than the immediate, painful loss of making the payment. The pain of paying is experienced because individuals are loss averse (Zellermayer, 1996)[5]. The pain of paying plays an important role in consumer self-regulation to keep spending in check (Prelec & Loewenstein, 1998). This pain is thought to be reduced when movement of money is less visible or tangible such as when spending on credit card which will be paid up in the future. The same applies to water consumption where consumption takes place, and payment is done later, compared to the now favoured pre-paid water meters.

Water Services Authorities (WSAs) in South Africa demonstrate significant structural and performance disparities across metropolitan, district, and local levels due to differences in scale, resource allocation, and institutional capacity. From Table 2, it is evident that water authorities in different municipalities serve different populations, and some have higher revenue collection efficiency than others, among many other characteristics.

[5] Smith (1759, p. 176–177) noted that "Pain … is, in almost all cases, a more pungent sensation than the opposite and correspondent pleasure."

Table 2: Water service authority classification

Category	Water Services Authorities (WSAs)	Population Served (avg.)	Water Source Type	Service Coverage (avg.)	Revenue Collection Efficiency (avg.)	Technical Capacity (avg.)	Monitoring & Data Systems (avg.)	Water Infrastructure Budget (avg.)
Metropolitan Municipalities	City of Johannesburg; City of Tshwane (Pretoria); eThekwini Municipality (Durban); Nelson Mandela Bay MM; (Gqeberha); Buffalo City MM; Mangaung MM.	>2.5 million	Surface water (dams, rivers)	Very high (~90-95%)	High (~85-95%)	High (well-staffed & skilled)	Advanced (digital, GIS-based)	High (R1 billion + annually)
District Municipalities (WSA)	OR Tambo DM; Vhembe DM; Zululand DM; Capricorn DM; Amajuba DM; Sedibeng DM; Amathole DM; Mopani DM; Bojanala DM; Waterberg DM: Ehlanzeni DM; Xhariep DM; Fezile Dabi DM; West Coast DM; Frances Baard DM.	~850,000	Mixed (surface + groundwater)	Moderate (~60-75%)	Moderate (~50-70%)	Medium (some skill gaps)	Developing (partial digitisation)	Moderate (~R300 million annually)
Local Municipalities (WSA)	Ngquza Hill LM; Bushbuckridge-Jozini LM; Nquthu LM; Makhuduthamaga LM; Umzimvubu-Maluti-a-Phofung LM; Umhlabuyalingana LM; uMshwathi LM; Matatiele LM; Greater Kokstad LM.	~150,000	Mainly groundwater	Low to moderate (~40-60%)	Low (~30-50%)	Low (under-resourced)	Basic/manual or none	Low (under R100 million annually)

Source: Department of Water and Sanitation (DWS), (2023). South African Local Government Association (SALGA), (2022); Department of Cooperative Governance and Traditional Affairs (CoGTA). (2022); Water Research Commission (WRC),(2021).

The increasing proportion of water bill non-payment is coupled with other challenges like day-zero risk due to climate change and infrastructure decay. Severely hit municipalities include Buffalo City, Nelson Mandela Bay and Cape Town. The doomsday prediction of when these municipalities would have zero water running from their taps and water demand was restricted jeopardised the water supply systems and management thereof (Gelund, 2020). Below is a comparison of how these three metro municipalities treat water bill non-payment.

Table 3: Treatment of Water Bill Non-Payment Across Selected South African Metros

Municipality	Initial Response to Non-Payment	Enforcement Actions	Special Measures / Notes
Buffalo City	Interest charged on overdue accounts- Payment due by 15th of each month- 30-day grace period after due date	Electricity disconnection (including prepaid)- Water flow restriction/disconnection (especially for businesses)- Legal action: handover to debt collectors, salary garnishment, property attachment	Withholds: grants-in-aid, contract payments, building plan approvals, clearance certificates- Recovery costs charged to account holder
Nelson Mandela Bay	Bills expected to be paid by due date	Water flow restrictor devices installed on overdue accounts- Applies to both subsidised (ATTP) and non-subsidised customers	Restriction remains until payment or arrangement is made
City of Cape Town	30-day formal notice issued under Section 115 of the Systems Act	Water restricted to basic flow (6 kL/month; up to 15 kL for indigents)- Non-domestic users may be fully disconnected- Legal action: court order to sell property if unpaid	Residents may apply for indigent relief or payment plans- Active anti-fraud campaigns warn against scam disconnection threats

Source: Author compilation

As shown in Table 3 above, metros such as Buffalo City, Nelson Mandela Bay, and Cape Town, have formal mechanisms to recover unpaid water bills. Building on these existing systems, this project seeks to find low-cost but high-impact strategies to improve revenue

collection from water and sanitation tradeable services. Behavioural Economics stands to benefit this inquiry through the establishment of behavioural insights from nudges. The trading services need to be resilient within difficult contexts, even from the socio-economic domain, given the demographics of water consumers. This requires improvement in billing and collections in terms of how (process), when (timing) and what (actions) of credit management. The next section outlines the methodology that was followed.

3. Methodology framework

The project applied scoping review techniques to identify and map strategies that have been implemented to improve bill payments in general, and municipal water (utility) bill payment specifically, from within South Africa and beyond. The study extracted both grey and academic literature through a comprehensive review. The data extracted evidence is analysed to understand which strategies worked, the enabling factors, and the barriers leading to failure. The intended outcome is a developed, contextually informed and behaviourally informed intervention plan (BIIP), designed to nudge water customers to pay the bill on time and in full. The scoping protocol is outlined below.

3.1. Scoping review protocol

The review is guided by the methodological framework of Arksey and O'Malley (2005) and the enhancements proposed by Peters, Godfrey and McInerney (2020). Reporting will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) guidelines (Moher, Shamseer, Clarke et al. 2015). This protocol ensured a structured and standardised approach to sourcing and reviewing literature.

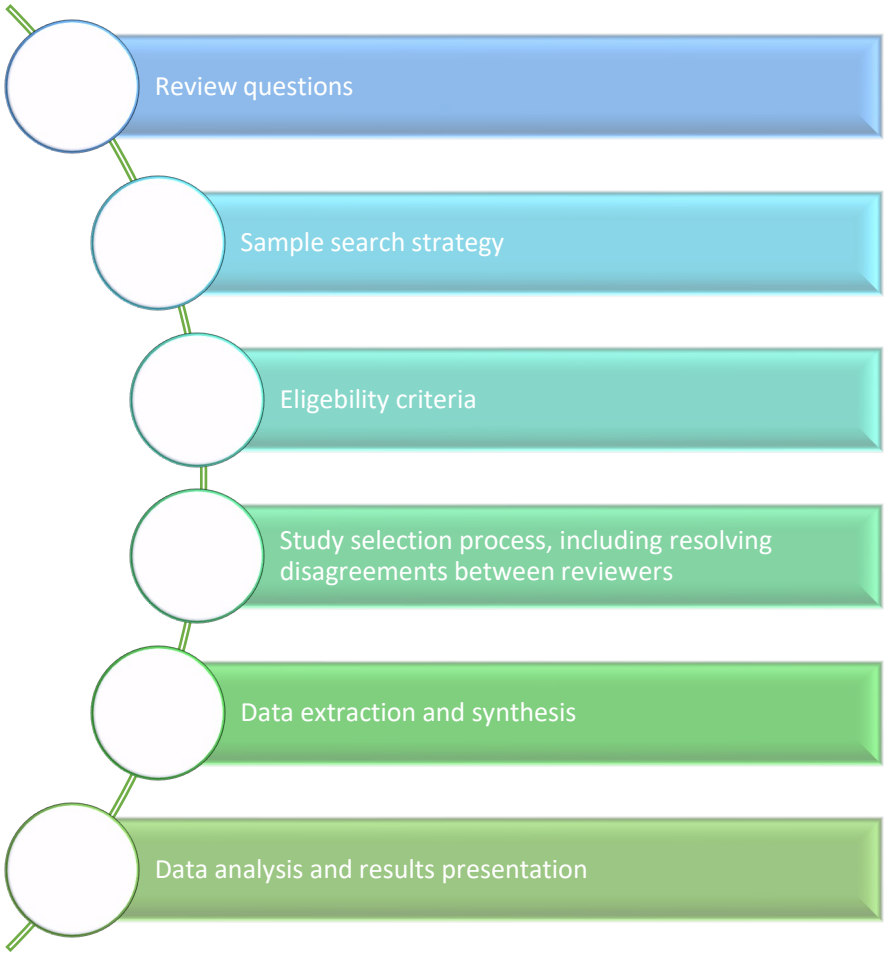


Figure 5: Steps of the scoping review
Source: Authors' Illustration

3.1.1. Review questions

This scoping review is in line with diagnostic study by the World Bank, (2021), and is aimed at understanding the behavioural interventions reported in literature, conducting an in-depth literature review to understand the water bill non-payment problem.

3.1.2. Sample search strategy

Based on the review questions, a search strategy was developed by identifying the key concepts using the PICOC (Problem or Population /Intervention/Comparator/Outcome/ Context) approach (Ghislaine et al., 2016; Schiavenato & Chu, 2021; Hosseini, et al., 2023). The PICOC is illustrated in Table 4.

Table 4: PICOC Framework applied to this Scoping Review

PICOC Element	**Guiding question**	**Description in relation to this review**	**Operational Definition / Search Terms (Examples)**
Population	What population or subgroup of the population is under the influence of the intervention?	Water consumers, households, and account holders who are billed for municipal water services.	"water consumer*", household*, "account holder*", resident*, customer*
Intervention	What intervention is under study on the population?	Behavioural change targeted actions or nudges designed to influence payment behaviour. This includes strategies like messaging, framing, social norms, reminders, and choice architecture.	nudge*, "behavioural intervention*", "behavioural intervention*", "social norm*", messaging, framing, reminder*, "choice architecture", "default option", “experiment”
Comparator	What is the primary comparison intervention (if present)?	Traditional enforcement and credit control measures, or a situation with no intervention (status quo). This includes disconnections, penalties, fines, and legal action (such as handing over to debt collectors or attaching assets).	enforcement, disconnection*, penalty*, fine*,"credit control”, “legal action”, “traditional approach"`
Outcome	Which outcomes are being assessed? On what scale is the effectiveness evaluated?	Improvements in bill payment behaviour, revenue collection, or compliance. This includes outcomes such as increased on-time payment, reduction in arrears, and higher collection rates.	"bill payment", "payment compliance", "revenue collection", "on-time payment", arrears, "collection rate", "payment behaviour*"
Context	In what background settings is the intervention studied?	Municipal water services, particularly in settings similar to South Africa (e.g., the Global South, developing countries, or specific	municipal*, "water service*", "water utility", "local government", "Global South", "developing country*", South Africa

		municipal utility contexts).	

The search strategy utilised controlled vocabulary or subject headings (descriptors, index terms) based on the business and economics sciences thesaurus to ensure an exhaustive search (Chapman, 2021). On the other hand, the Peer Review of Electronic Search Strategies (PRESS) checklist was applied to refine the search strategy. The databases searched included Google, Google Scholar, Ebscohost, Scopus, Jstor, and the WRC research portal to build on from past works as a foundation for this project.

3.1.3. Eligibility criteria

For material to be included in the review, it had to meet a specified inclusion criterion.

Inclusion criteria: Studies presenting evidence on behavioural or other interventions in utility bill payment; no limits applied on publication date; all study designs were considered; both scientific and grey (non-scientific material).

Exclusion criteria: Studies that do not focus on utility bill payment, as well as those written in languages other than English were excluded.

3.1.4. Study selection

The study selection followed the PRSIMA flow diagram (Page et al, 2020). Each team member independently searched and screened titles and abstracts against the eligibility criteria. Duplicates were removed, and so were those of questionable quality (as per the assessment described below). Any disagreements at any stage were resolved through discussion and consensus within the team meetings, which were held regularly. Meetings were held within four-six weeks intervals. This approach was designed to minimise any search and review bias. The meetings addressed any disagreements and debated any insights emerging, which then guided the next round of search and review.

3.1.5. Quality control and assessment

The quality of included studies was assessed using the Shea et al (2017)'s AMSTAR 2 tool, which is suitable for assessing systematic reviews (see Bojcic, Todoric & Puljak, 2022 for the tool). The overall rigor of the scoping review process was ensured through team discussions and formal peer review by academic experts.

The certainty of evidence in the included studies was assessed using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach (see

Guyatt et al., 2008, for template). The criteria are on three levels: high, moderate, or low. In that context, high quality means that any further research is unlikely to alter the confidence in the estimate of the effect; moderate quality, on the other hand, points to the possibility of further research impacting confidence and altering the estimates. Lastly, low quality entails that any further study has a high probability of impacting confidence in the effect of the estimate and the estimates may substantially differ as a result.

The quality approved studies were used as a data source, with data extraction carried out as discussed in the next section.

3.1.6. Data extraction and synthesis

A data extraction sheet was used to systematically extract information from the included studies (Annexure A2). The research team independently tested the data extraction sheet using a preliminary sample of at least three articles/reports and compared the level of extracted information from the literature during the first team meeting.

3.1.7. Data analysis

Once data was extracted, the analysis started by grouping studies according to the behavioural change techniques used, drawing on existing typologies as proposed by Aikpitanyi, Yacin and Tubeuf (2024). A narrative synthesis was then conducted, with data synthesised and interpreted using sifting, concept mapping and sorting to identify key themes and patterns.

3.2. Methodology implementation strategy summary: A phased approach

The project followed a three-phased approach:

Phase 1: Baseline analysis - scoping review as per above protocol

This stage involves the exploration of the context and characterization of the defaulting water users' behaviour, and the strategies employed globally, as well as their effectiveness. We analysed the extent of delinquency and identified behavioural mechanisms that have been implemented and their outcomes.

Phase 2: Contextualisation: Understanding the process, what works, and what does not work

This phase focused on understanding the local context through:

1) analysing the magnitude of water revenue loses among water authorities.
2) characterising of water users and alignment with behavioural traits identified in literature

3) analysing the experience with legislation governing water services, billing and credit management

Phase 3: Designing an intervention protocol

Based on the findings from Phases 1 and 2, we then proposed a step-by-step Behaviourally Informed Intervention Plan (BIIP) and toolkit for future implementation, which we are identifying as NuWRev. The toolkit is easy to implement but requires practical testing in partnership with water authorities. We note that two student projects supported under this study have their protocols approved for implementation with two water authorities in the Eastern Cape, namely, OR Tambo District Municipality (nudging water-saving behaviour) and Nelson Mandela Bay Metro (assessing willingness to pay for water quality improvement), demonstrating the willingness of water authorities to partner. A protocol for intervention and analysis of impact is developed. A diagnostic approach and systems thinking are used in designing the intervention.

4. Results from the scoping review

4.1. Baseline analysis- scoping review

Defaulting on bills is rampant globally (Fowlie, Wolfram, Baylis, Spurlock, Todd-Blick & Cappers, 2021; Skerker, Verma, Edwards, Rachunok & Fletcher, 2024), very much pronounced in developing countries (Al Kez, Foley, Lowans & Del Rio, 2024; Fowlie & Meeks, 2021; Cleaver, Whaley & Mwathunga, 2021), and driven by many factors from high total value of the bill (Moita, Rodrigues, Rodrigues, Lucinda, Lopes, Stefanello & Chaves, 2024), limited incomes (Sarango, Senier & Harlan, 2023), as a mere form of protest for bad service (Carr & Thomson, 2022), or just attitudinal or habitual factors that are not yet fully understood (Datta & Mullainathan, 2014; Goel & Rastogi, 2023). Although it varies by nature of the bill (Old Mutual, Savings and Investment Monitor, 2024), public services bill, such as water and energy bills, have registered significant defaulting of worrying proportions (Murwirapachena, Kabange & Ifeacho, 2023). These studies have shown that a multiplicity of communication nudges can help local governments to increase consumers' timely payment of administrative fines more effectively than a single type of nudge.

4.1.1. Bill payment challenges in South Africa

South Africa faces a widespread culture of non-payment that extends beyond municipal services to various forms of consumer debt. While this study focuses on water bill payment, it is important to situate the problem within a broader context of low compliance in bill

settlement, including household credit, electricity, and loan repayments (Burgess et al., 2020; Klege, et al., 2022). High levels of indebtedness, weak enforcement, and a perceived lack of consequences (seemingly reluctance to disconnect, which may be due to political pressure as alluded earlier) contribute to this challenge. The tendency to delay or avoid payment is often driven by a combination of financial constraints, unhappiness with service providers, and behavioural factors such as procrastination, optimism bias, pluralistic ignorance, among others. These patterns are evident in both public and private sectors, suggesting a deeper behavioural and systemic issue that impacts the sustainability of services and institutions alike. Table 5 shows the trends in household bill payment behaviour.

Non-payment of water bills is part of a wider trend of financial strain and selective bill payment, which must be considered when designing strategies to improve municipal revenue collection

Table 5: Household bill payment behaviour

Saving and credit								
Households that have fallen behind bills and card payments [a], 2021-24								
Category	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**Change 2018-24**
Fallen behind on store card payments	39%	20%	30%	28,0%	25,0%	25,0%	23,0%	-41%
Fallen behind on any household bills	27%	24%	37%	34,0%	35,0%	31,0%	30,0%	11%
Fallen behind on credit card payments	15%	5%	28%	27,0%	26,0%	25,0%	23,0%	53,3%
Fallen behind on rent or home loan payments	8%	7%	26%	19,0%	18,0%	18,0%	15,0%	86,5%
[a]The annual monitor is a survey of 1 508 working people in South Africa's major metropolitan areas. It examines levels of savings and investment, as well as people's attitudes to their finances in general. Respondents were asked about household rather than personal income.								

Source: Source: Old Mutual, Savings and Investment Monitor, July 2024

The data on Table 5 shows that South African households have become more selective in managing their debts between 2018 and 2024. Of note is the Covid-19 impact, with payment levels never returning to their prior levels, except for store cards. While arrears on store card payments have significantly decreased (–41%), defaults on credit cards (+53%), rent, and home loans (+87%) have increased, alongside a moderate rise in falling behind on household bills (+11%). This can suggest that under financial pressure, households show trends of prioritising certain debts over others, likely focusing on short-term, high-interest, or easily punishable accounts (like store cards which may also provide everyday sustenance for clothing and food), while falling behind on essential obligations (such as rent, utilities, or credit cards) that may have fewer immediate consequences or enforcement mechanisms(but where strong political pressure to penalise defaulters exist). This shifting payment behaviour reflects broader

economic challenges and highlights that non-payment of water bills is part of a wider trend of financial strain and selective bill payment, which must be considered when designing strategies to improve municipal revenue collection. It is important to note that the non-payment of a utility bill, in most cases, leads to blockage of electricity not water itself; with investment in alternative energy sources such as solar and gas (to avoid load shedding), the effectiveness of such measures is weakened.

Poverty remains a significant driver of household defaulting on bills. According to Stats SA (2024), nearly a quarter (24.9%) of households across South Africa's metropolitan areas are classified as poor (monthly expenditure below R2 500). Table 6 shows that Buffalo City had the highest proportion of poor households at 29.3% in 2023, followed closely by Mangaung (29.1%) and Johannesburg (27.6%). In contrast, Nelson Mandela Bay has the lowest share at 14.9%. These disparities highlight the deep inequality across metros, particularly in the Eastern Cape, where both Buffalo City and Nelson Mandela Bay are located. All local municipalities have indigent concessions in place, which in some cases are considered too generous and porous to be abused, putting further burden on very few households (Fuo, 2020).

Table 6: Households classified as poor[a] by metropolitan municipality, 2023

Metropolitan area	Total households	Poor households	As a proportion of total households
Buffalo City	256 000	75 000	29,3%
Cape Town	1 400 000	335 000	23,9%
Ekurhuleni	1 459 000	366 000	25,1%
eThekwini	1 308 000	328 000	25,1%
Johannesburg	2 280 000	629 000	27,6%
Mangaung	306 000	89 000	29,1%
Nelson Mandela Bay	377 000	56 000	14,9%
Tshwane	1 332 000	297 000	22,3%
All metros	**8 718 000**	**2 175 000**	**24,9%**

[a]Those with a monthly expenditure below R2 500.

Source: Stats SA, Selected Development Indicators, Metros 2022, Statistical release P03-18-20, 23 May 2024, Table 2.6, p11

Despite understanding the plight of poverty, the impact of defaulting on bills on the authorities expecting the payment is significant. Specifically, defaulting on the municipal/utility bill rendered some local authorities dysfunctional (Patji & Selepe, 2022). It is of concern for authorities and policymakers when there is defaulting on bills, but the poverty argument is often put forward to discourage authorities from enforcing the mechanisms. Nonetheless, the population group needs to be understood in detail to guide intervention as prescribed by the PICOC approach.

Different measures to promote timely and full payment of the municipal services bill have been reported in literature ranging from the traditional punitive (cutting the service or other related

services), to the more modern ones (such as behavioural insights as encouragement to do good by appealing to the inner being). The traditional methods have faced criticisms, firstly on humanitarian grounds as water or any other public service is considered a basic need and right of citizens (Heleba, 2011; Dugard, 2021); and from a cost effectiveness angle (the techniques are costly and may further worsen relations between citizens and the authorities). Imperative to note that the Supreme Court of Appeal in South Africa has affirmed the utility's right to disconnect services when there is non-payment[6].

4.1.2. Strategies for Improving Bill Payment from literature

Table A3 in appendix summarises the literature aligned to different strategies.

4.1.2.1. Nudging as an intervention

Nudging is a concept from Behavioural Economics that refers to the use of small, subtle interventions to influence people's choices and behaviour (Espinosa, Wang & Huerta De Soto, 2022). The idea is to "nudge" people in the direction of making better choices, without forcing them to do so. This ranges from changing how information is presented (sequencing without changing the words) or framing (using specific wording), to colouring as a way of highlighting what needs to be noted as important (such as having statements of accounts in different colours depending on whether there is a debt or not). It is critical to underscore from the onset that not every nudge works; some may even backfire (Holzmeister, et al., 2022). Understanding the problem and population characteristics will help limit this downside, hence this scoping review.

Literature has attended to the question of improving compliance at low costs- one notable strategy is behavioural insights (Migchelbrink and Raymaekers, 2023; Visser et al. 2021; Datta, et al, 2015). This is applicable in both the private and public sectors, with opportunities for learning from each other (Caldwell, 2018).

Behavioural insights are context specific (Holzmeister, et al., 2022), sometimes only entailing a word or sentence framed specifically (Visser et al., 2019; Kettle, Hernandez, Ruda & Sanders, 2016), and their application in South Africa, particularly bill payment, remains limited (see, for example, Szabó & Ujhelyi, 2015). Elsewhere (see, for example, Brent & Ward, 2019; Dheepanchakkravarthy, et al., 2021; Manaloto & Castillo, 2022), innovative water billing

[6] https://dullahomarinstitute.org.za/multilevel-govt/local-government-bulletin/archives/volume-19-issue-2-june-2024/the-supreme-court-reaffirms-municipalities-power-to-cut-electricity-supply-to-combat-non-payment

systems have been developed, including targeting and appreciating the heterogeneity among customers (Boyle, et al., 2011).

The following themes emerged under behavioural change interventions: (1) Messaging and Framing nudges, (2) Timing and Frequency of Communication, (3) Simplification of the message (4) Social norms and social comparison of behaviour, (5) Institutional and Service Quality Nudges, (6) Structural and Market-Based Nudge; and are discussed in turn below.

a) Messaging and Framing Nudges

Messaging and framing strategies often shape how households perceive and respond to utility obligations. In Kenya, Coville et al. (2020) conducted field experiments among tenants and landlords in Nairobi's slums, comparing engagement strategies with enforcement mechanisms such as disconnection notices. The study found that engagement messages failed to shift behaviour, while framing substantially improved compliance, showing that framing nonpayment as a tangible risk can act as a strong behavioural nudge. Similarly, in Guatemala, Vásquez (2015) studied households in San Lorenzo and found that nonpayment was linked primarily to dissatisfaction with service reliability rather than income constraints. Improved communication and framing messages around reliability and trust were identified as potential nudges to reduce nonpayment. In Mexico, Aguilar-Benitez and Saphores (2008) examined households in Nuevo Laredo and found widespread nonpayment across both poor and affluent groups, attributing the issue to weak enforcement and opaque systems. They concluded that transparent enforcement and trust-building messages could serve as effective nudges. Framing affects behaviour around payment of the service, Burgess et al. (2020) used electricity as an example and found that framing access as a right is counter-productive, as it reduced payment. On the other hand, Karlan et al. (2016) proved the effectiveness of reminders in improving savings and bill payment behaviour.

b) Timing and Frequency of Communication

The timing and frequency of nudges also play a critical role. Ghaffari, Kaniewicz and Stricker (2021) found that messages delivered at 8 p.m. elicited stronger responses among a "willing-but-chaotic" debtor group, underscoring the role of daily routines. In Armenia, Antinyan and Asatryan (2021) demonstrated that even a rightly timed single reminder about overdue property taxes increased the likelihood of payment by 25 percentage points compared to a control group. These findings suggest that well-timed and infrequent but salient reminders can yield significant improvements in compliance without incurring high costs.

c) Simplification of Message

Simplifying complex or opaque billing systems has been shown to reduce cognitive barriers to compliance. The Behavioural Insights Team (2023) redesigned water bills in the United Kingdom, making consumption clearer and incorporating water-saving tips. This led to an overall reduction of 0.5% in water consumption, with reductions of 0.7–0.9% among households receiving paper bills. In Mexico, Aguilar-Benitez and Saphores (2008) highlighted how nonpayment was perpetuated by opaque enforcement practices, further reinforcing the importance of simplifying and clarifying billing processes to promote compliance. Slabert et. al. (2010) argued for standardisation of utility bills- that could be done in effort to simplify and provide pertinent information. It points to the need to revise current utility bill wording and presentation format.

d) Social Norms and Social Comparison

Social norms and comparative feedback have been effective behavioural tools in utilities. The Behavioural Insights Team (2023) embedded social comparison messages into redesigned bills, encouraging customers to reduce water usage by benchmarking against peers. In South Africa, Smith and Visser (2013, 2014) and Bhagwan (2018) reported large-scale trials showing that comparative feedback and conservation tips reduced water use by 2–3.5%. Brick, De Martino and Visser (2023) further showed that wealthier households were more responsive to recognition and public appeals, while poorer households were less influenced, highlighting the need to tailor social norm nudges to income inequality contexts.

Allcott (2011) conducted a randomised field experiment in the United States to test the impact of social norms on energy bill payment and conservation. The study found that social norm messages increased compliance with energy-saving behaviours and timely bill payments. Applying social norm messaging is especially relevant in the South African water context, where promoting a sense of collective responsibility with social expectations may help normalise payment behaviour. This aligns with the Prospect theory which maintains that value judgments of decision-makers are associated with reference point (Kahneman & Tversky, 1979).

e) Institutional and Service Quality Nudges

Several studies underscore the role of institutional practices and service quality as indirect nudges. In Uganda, Kayaga, Franceys and Sansom (2004) surveyed 11 towns and found that customer satisfaction with service quality was strongly linked to payment compliance, making

service improvements an effective indirect nudge. In Ghana, Sualihu, Rahman, and Tofik-Abu (2017) studied 150 households in Accra East, showing that service quality, monitoring, and billing time significantly influenced payment behaviour, suggesting that efficient institutional practices themselves can act as nudges. In Nicaragua, Vásquez and Alicea-Planas (2017) analysed households using regression models and found that low income and poor service quality were the primary drivers of nonpayment, reinforcing the importance of service quality as a behavioural lever for compliance.

f) Structural and Market-Based Nudges

Structural interventions that alter the way households interact with utilities can also serve as nudges. In South Africa, Jack and Smith (2015) analysed the impact of prepaid metering among households and found that prepaid systems reduced electricity use and supported budgeting by making costs more salient. This demonstrates the potential of structural nudges to promote disciplined payment. In Nigeria, Whittington, Lauria, and Mu (1991) surveyed households in Onitsha and found that households willingly paid higher amounts to private water vendors than to utilities, and vendors were more effective in revenue collection. This highlights the salience of willingness to pay in informal markets and points to the need for nudges that redirect payment behaviour toward formal utility systems.

Important to note, however, Saultis, (2023) argued that, simply nudging defaulting individuals does not work. Although every next reminder that debtors receive increases the payment rate, the effect is rather small. Moreover, sending reminders when the promise to make a payment on a debt has already been made can trigger a repeated default. This highlights the need for targeting communication rather than generalising or 'shooting in the rubble' when communicating with customers. Personalised messaging is effective, considering the specific bill characteristics such as trends in payment (past behaviours) and framing the message accordingly.

Whether the threat of disconnection, as current practice, is needed to compel on-time payment remains an important and unanswered question. Coville, Galiani, Gertler and Yoshida (2020) found that a randomized threat of disconnection was effective in spurring payment among landlords in Nairobi, Kenya. However, disconnection is banned in other jurisdictions, such as France, Ireland, and Estonia (WAREG, 2017), yet service levels have not spiralled downwards. Through moral suasion and patriotism, customers in these settings may perceive it as a moral

obligation to pay their utility bills, such that non-payment is akin to a moral tax. Understanding what is required to establish and sustain such norms is essential to guide authorities.

Little attention has been paid to nudging bill payment, specifically municipal water services bill; yet nudging has proved to modify behaviours in all spaces, including payment of other public goods like electricity. This study sought to explore the strategies that have worked and help contextualise these for South Africa, with the aim of developing an intervention plan to assist municipalities in increasing revenue collection at limited costs. This will go a long way to supporting the sustainability of cities and enabling metros to tap into the infrastructure incentive grant.

While enforcement through levying penalties or disconnecting services often pushes clients to act, behavioural nudges are highly effective and can even be more impactful when combined with complementary elements of the system, such as timed reminders or simplified payment processes to address multiple barriers to compliance simultaneously. These interventions work when combined with better service delivery and transparent communication by the municipality. This emphasises the fact that how to communicate (timing, message contents, framing, emphasis, among others) is as important as what to (Esmark, 2018). People care about reciprocity or how they are viewed or treated in relation to any reference group. There is therefore a need to put context to the discussion, so that the developed intervention strategies is acceptable to utilities and impactful.

4.2 Contextualisation: Understanding the process, what works, what does not work

Figure 6 shows a call to attend to outstanding payment via social media by one municipality in the Eastern Cape, which received mixed reactions from customers (residents broadly). It confirms that punishment is not always the best way to handle such matters (Becker, 1968). The magnitude of the problem, and how its implications are overlooked, is summarised by Mndla Mchunu[7], who wrote "*Only rebuilding a sense of national pride and citizenship can unblock the financial supply chain leading from the Soweto electricity meter where currently only 12% of customers pay their bills.*" Adding "*By not paying their bills, South Africans are cutting off their noses to spite their faces*."

[7] https://mg.co.za/article/2019-11-09-00-nudge-a-nation-of-non-payers-to-cough-up-for-their-bills/

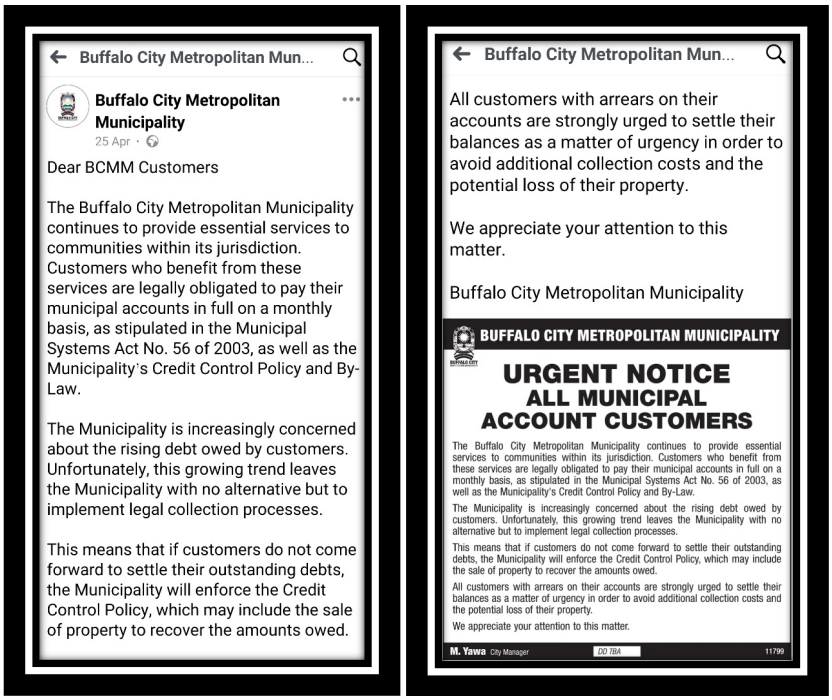


Figure 6: Public notice for bill payment

Source: Facebook Post emphasising the Print media notice

The message contains the following key elements outlined in Table 7.

Table 7: Behavioural elements from the social media interaction of utility and residents

Message domain/focus	Key reactions	Comment form BI
Commitment to provide services to all→ enabled by bill payment	• Delivering services we pay for... you know the BASICS • What services … they non existent, • what services do you render? i will gladly pay for a well kept city but nothing is done… from what you wrote, i don't have to pay a cent rates	• This is framed from a **public goods perspective,** for customers to know why it is important to pay their bills timeously. • However, when there is perceived inaction from the other party even though customers feel they have been honouring their side of the bargain; payment may be withheld • Mchunu arqued: *They think that their money will not go to the right place*
Legal obligation of customers to pay→ with clear legislation cited	• "Customers who benefit from these services " Who are they?	• **Reciprocity emphasised,** but questioned by customers as they feel the services are being rendered
The concern → the problem being experienced	• We will only pay in December when you give the discount to those with outstanding debt. We missed out last year because we thought it's a good thing to pay and be up to date, then you rewarded those who don't pay with a discount. So you shouldn't complain now	• There is a different understanding of the problem→ problem identification not agreed upon • **Pluralistic ignorance**
Threat of action, highlighting the extent and gravity of this-legal action in the absence of alternative strategies	• Practically it's impossible because of the legalities involved	• **Enforcement is challenged; if not possible to carry it out, more customers may end up defaulting** • **Availability / confirmation bias because there is no such experience**
Call to action → extending an opportunity to customers, to correct the problem	• What is that R432 for in our statements • Maybe focus on getting your billing right • What about all the unresolved account queries....??? • MAYBE GET YOUR BILLING CORRECT FIRST • People problems don't get sorted out • BCMM includes the following - Duncan Village Ziphunzane Feris scenary park Egoli Amalinda forest etc. Please start there and inform us with the progress then you can go to those you see as your easy targets • Get your house in order and stop over charging your customers and maybe they will pay their accounts!!	• Appealing to the inner being reversed-**reciprocity demanded** • Distance to reference group highlighted • Fairness questioned • tragedy of the commons ("Why should I pay if my neighbour doesn't?").

Source: Own tabulation based on reactions to public notice

The application of behavioural insights to municipal revenue collection offers a wide range of tools aimed at shifting citizen behaviour in contexts where traditional enforcement and punitive measures have limited reach. Evidence from the literature demonstrates that nudges can address bottlenecks in payment compliance, but their effectiveness is strongly dependent on design, context, and implementation dependability (see Table A4 in the Appendix). The following discussion synthesises five common intervention categories.

a) Reminders and Communication Strategies

Reminders- through SMS alerts, letters, or annotated bills- are among the most widely tested nudges in behavioural economics. Studies show that timing and framing of the message matter (Karlan et al., 2016; Sloboda et al., 2022). In South Africa, utilities issue SMS alerts when statements are generated, but often omit positive reinforcement such as thanking those who have already paid. Evidence indicates that such acknowledgement can enhance compliance by tapping into reciprocity. Moreover, the timing of statement issuance (e.g., mid-month versus month-end) may interact with household cash-flow cycles, as illustrated by Buffalo City's decision to change its bill issuing schedule from the 15th to the 30th of each month. Importantly, the correctness and clarity of the bill itself remain critical: errors or poor wording can undermine trust, negating the effect of the reminder, as vividly demonstrated by the public reactions captured in Table 7.

Utilities issue SMS alerts when statements are generated but often omit positive reinforcement such as thanking those who have already

b) Simplifying Payment Processes

Barriers to payment are often procedural rather than motivational. Simplifying payment processes through multiple, recognised platforms including banks, retail outlets, electronic funds transfer (EFT), and mobile money alters the "choice architecture" and reduces friction costs (Datta & Mullainathan, 2014). In Kenya, the integration of M-Pesa (mobile money) drastically lowered transaction costs and improved compliance in utility bill payment. In South Africa, payment options exist in supermarkets and municipal offices, but barriers such

***Use of M-Pesa** mobile money drastically lowered transaction costs and improved compliance in utility bill payment*

as low digital literacy in rural areas (Murwirapachena, 2021) constrain uptake. Simplification must therefore be tailored: urban users may benefit from digital options, while rural households require accessible physical payment points and assisted digital literacy initiatives.

c) Social Norm Messaging

Drawing on descriptive norms (Cialdini, 2007), social norm messaging leverages the fact that people align their behaviour with what peers are perceived to be doing. International evidence demonstrates effectiveness in tax compliance (Hallsworth et al., 2017), energy conservation (Allcott, 2011), and water usage (Ferraro & Price, 2013). In South Africa, this approach remains under-utilised, with limited trials in the City of Cape Town during the drought crisis (Brick et al., 2023). The literature warns of potential boomerang (backfiring) effects if norms are poorly designed: highlighting high non-payment can legitimise free riding (Brent et al., 2020). This risk is clearly visible in the public comments showing 'pluralistic ignorance' and 'tragedy of the commons' thinking (Table 7). Norm messages must therefore be carefully targeted, with stronger effects expected in middle-income areas where baseline compliance is moderate. Bicchieri and Dimant (2022) caution that norm nudges succeed only when the reference group is trusted and salient.

d) Educational Campaigns

Educational outreach targets knowledge gaps by explaining the importance of payments and the services funded in return (Szabo & Ujhelyi, 2015; Sualihu et al., 2017). In South Africa, campaigns via community radio have been used to reach rural audiences with lower literacy levels. Such efforts contribute to the inclusive economy vision of the National Development Plan 2030, but their standalone effectiveness is limited: evidence shows that knowledge provision alone rarely changes entrenched non-payment habits. The public reactions, which focused on service delivery failures rather than a lack of understanding about why payment is important, underscore this limitation. Campaigns must therefore be combined with simplified billing (for example, icon-based statements) and contextualised messages that resonate differently in rural versus urban settings. While educational campaigns may raise awareness, they are weak levers for habitual defaulters who are more responsive to enforcement, incentives, or peer-norm cues.

e) Incentives and Reciprocity Appeals

Incentive-based nudges such as early-payment discounts, acknowledgement of civic duty, or linking payment to community benefit draw on the principle of reciprocity (Fehr & Gächter, 2000). However, their effectiveness in South Africa has been mixed. Discounts and subsidies may encourage compliance in middle-income groups, but low-income residents face affordability constraints, while distrust in service quality and perceptions of corruption (Motsoeneng, 2022) undermine the moral reciprocity logic. The public sentiment, such as "I will gladly pay for a well-kept city, but nothing is done," highlights that the perceived lack of reciprocity from the municipality is a fundamental barrier. Literature further suggests that incentives alone have limited long-term effect; they require coupling with transparent communication and visible improvements in service delivery. Rogers and Frey (2015) highlight the role of feedback designs, where households are given transparent, frequent updates linking payments to outcomes, thereby reinforcing the sense of reciprocity.

Overall, the evidence indicates that behavioural nudges can complement but not substitute structural reforms in municipal finance. Reminders, simplification, and norm messages work best when bills are accurate, services are reliable, and enforcement remains credible. Educational campaigns and incentives play important supporting roles, particularly when tailored to socio-economic and spatial differences (urban vs rural, income levels, digital access). Importantly, behavioural nudges are not "one-size-fits-all": they must be carefully designed to the context, piloted, and evaluated with attention to possible backfire or distributional effects. These lessons are critical for guide designing of an intervention protocol to improve revenue payment in South Africa.

4.3 Designing an intervention protocol

Based on the scoping review, we propose a Behavioural Change (BC) intervention protocol that integrates several evidence-based strategies: personalised, timed reminders, social norm messaging, a simplified payment option. This approach is measurable and scalable, and relatively low-cost. There is evidence from literature that such behavioural nudges can significantly improve bill payment. As the focus of the protocol is to nudge (Nu) Water (W) bill payment to increase revenue (Rev) collection, we name the protocol NuWRev.

The suggested BC intervention will help measure the following outcomes:

- **Payment completion rate:** The percentage of customers who pay their bills by the due date. This indicator can help determine if the intervention led to a change in behaviour

- **Time to payment**: the number of days it takes for a customer to pay the bill from the date they receive the reminder. Interventions that reduce time to payment are seen as more effective.
- **Engagement rate**: (if SMS is used to send the reminder) – Monitoring the SMS open rates, payment link clicks or logins to the bill payment portal. This can also help in determining the drop-off points.
- **Rate of incomplete or partial payments:** This metric helps assess the user-friendliness of the payment process and identify points of friction.

Literature is clear that "educating" people often does not change their attitudes or behaviours (Arlinghaus, & Johnston, 2017; Bar-Tal & Hameiri, 2020). We might be more successful by just targeting behaviour without worrying about what people believe. It is argued, generally, that authorities cannot go wrong by harnessing the power of human nature. The need for behavioural insights as soft measures to improve compliance to policy, or effective tools to help change behaviour or promote good practices has seen Behavioural Insight Teams/Nudging Units spreading across the world (Afif, October 2017;). From the literature, it is apparent that some assumptions about human behaviour need to be made, to better modify it through interventions (Albarracín, et al, 2005; Franco, et al., 2021). Figure 7 below illustrates the assumptions held about human behaviour, based on insights derived from the review.

Reinforcement: there is need to reinforce the understanding of desire behaviours and aligning behaviours, attitudes and emotions. This means there is need to act for good behaviour to be activated or sustained, it does not automatically happen in all people. Not to forget that others, based on various systems they come from (social networks, beliefs), already display good behaviours always. Such behaviours need to be reinforced so that they do not get 'corrupted' by those displaying deviant behaviours (boomerang effect). Several utilities run campaigns on social media, electronic media and via bill statements inserts to educate people; what is important to note is that educating people does not necessary translate to behaviour change, there is need to understand fundamental motives.

Fundamental motives: human beings do care, they fear, they have preferences which differ from one person to the other and shape their behaviours. We are interested in knowing whether the motive/desire is to honour the bill, but failing due to other forces or whether the motive is not to pay, then modify behaviour accordingly. Appreciation is that a human being is not a 'blank canvas' to imprint any ideas, they have priors. For example, non-price interventions,

that appeal to doing good for the better of society at large, can have effects that are comparable to large price changes or monetary penalties. This means, societal pressure (explicit or implicit) can encourage to do good, especially if there are some benefits through reputational standing (Batson et al., 2003) or motive to avoid moral cost. This is the element of moral price that can be made salient to make non-payment costlier.

Decision triggers: the right decisions need to be triggered or ignited. From the human mind system explained earlier, most decisions are made in system 1 which is based on subconscious actions; there is need to switch to system 2 for more rational decisions. That switching needs to be activated, and can be done by various means, including re-arranging how information is displayed (choice architecture), its timing or saying certain words/phrases (framing), to make certain choice much easier or preferably by the individual. Through comparing own behaviour (bill payment to that of others) people adjust accordingly (Schultz et al., 2007; Nolan et al., 2008) to reduce the moral cost.

Reinforcement

Behaviours, emotions, and thoughts don't necessarily correspond.

"Educating" people often does not change either their attitudes or behaviours.

Even when attitudes change, behaviours don't necessarily follow.

- Delayed reinforcement!

Fundamental motives

There is **a human nature** consisting of evolved abilities, behavioural tendencies, preferences, and fears.

Opposite of "The blank slate

- Self-protection e.g, from legal battles
- Care for family- not wanting service disrupted

Seeking friends and allies

- Seeking status

Decision Triggers

Many behaviours that are predictable are not economically "rational"

We often don't know why we do what we do

We can't always tell when we're being influenced

- Many things that influence us do so below the threshold of consciousness

Figure 7: Assumptions about human behaviour
Source: Own Computation

4.3.1. Unpacking decision triggers

At the centre of decision triggers is organisation of the context in which people make decisions to influence their choices. The organisation triggers activate something within the mind of the decision maker as a reminder or additional information structure towards a specific 'preferred behaviour'. In the context of a utility bill, this can be changing the date that the bill is issued to align with income receipt for most customers, or to have Snap Scan codes or clickable links for easy payment. This is known as choice architecture (Thaler & Sunstein, 2008). The organisation can be visual, interactive or language use (Thaler, Sunstein & Balz, 2013) as illustrated in Figure 8. It has been reported that individuals often rely on the option that has already been selected for them - for example by issuing a utility bill on the 30th of the month, the option is for one to pay the bill on that date (Allcott and Mullainathan, 2010).

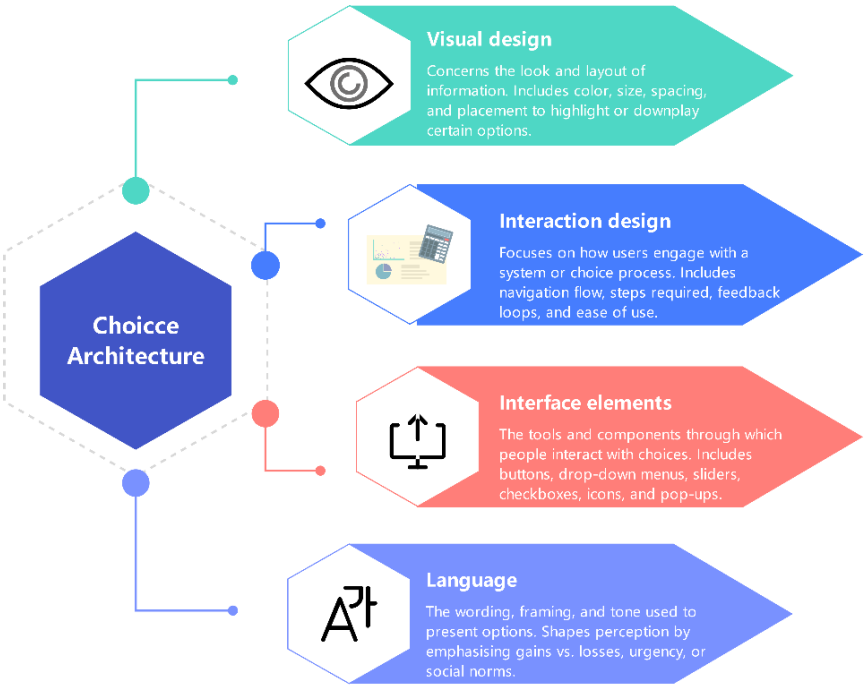


Figure 8: Choice architecture design elements
Source: Authors own drawing

Earlier, it was argued that human beings suffer from cognitive limitations, which push them to make automatic choices based on System 1 of the brain. It is, therefore, bounded rationality leading to satisficing outcomes rather than optimal. Information that comes to mind easily and quickly is used to make decisions, implying that if one desires certain pieces of information and characteristics to be considered at the time of decision, it must be made salient. Salience is a significant element in behavioural economics and psychology (see Kahneman, 2003).

Besides re-arranging the context, there can be a shared commitment to a path of action within a community. Often easier when there is a common bond, as in the case of group lending, where there is social commitment to repaying the loans, with the threat of isolation for any defaulters. Similarly, when residents boycott paying for municipal rates, they usually form a

Rate Payers Association (RPA) with resultant consistent contributions due to stakeholder commitment and social contract (Powell, May & Ntliziywana, 2010; Masungini, et al, 2023). This means peer influence is possible in bill payment, the stronger the interaction or socialisation that already exists. In summary, individuals are influenced by the way in which their external environment is structured, as well as the information shared.

Language as a way for communicating needs to be simple and clear to make information accessible (Gaudin, 2006). In addition, wording, often referred to as framing, does matter. There are many words that can be used; the choice and combination of words and phrases do matter as it determines the tone and rapport being established in the interaction.

Social norms are critical in modifying behaviours. Establishing and sustaining certain norms matters in respect of how the group guards each other towards a common action and helps the decision maker understand the true value of moral cost. Social norms are essential in public policy to safeguard against free riding and improve overall efficiency. There are certain considerations for norms to be effective, which were identified in this review:

a) **Size of the reference group:** In general, one is more likely to do something (utility bill payment in this regard) if more people do it, versus something done by fewer people (Milgram, Bickman & Berkowitz,1969). This is the reality of human behaviour, where individuals make decisions based on the actions of others. Identifying and educating or influencing the 'leader' in the group may help influence decisions for the whole group.
b) **Social Distance (**representativeness heuristic**):** this is how close or distant one feels one is to the norm or norm-representative individual or group. Due to perceived similarity and relevance, customers aim to align with those they consider to have similar characteristics to them. This justifies comparing bill payment behaviour with the average of the neighbourhood.
c) **Pluralistic ignorance and social norms** – sometimes groups exist, and decision-making takes place shaped by the grouping, yet most or all members of the group are ignorant about what others in the group do or think. For example, one may think that most people in the group (neighbourhood) are not paying their bills and, on that basis, choose not to pay their bills. This thinking may be false and never get corrected. As more and more people think that way, the more the utility announces the problem of

non-payment, which will confirm the behaviours and make more think that the majority are not paying.

Reporting social norms in communication promotes learning efficient behaviours. It is often difficult and costly to source and process information, especially in the presence of bounded rationality. Communicating norms helps signal (make salient) the desired path of action, which decision makers can then follow. Often the biases to be corrected include status-quo bias: default options; attitude-behaviour gap [cognitive dissonance] and framing effects: framing of choices. It is important to acknowledge improvements in the presentation of bills over time. However, it is also important to note that feedback via bills is infrequent and lacks detail, such as the average payment rate within the neighbourhood.

With the understanding of behaviours and assumptions of how to change behaviour, the following steps are envisaged to guide the process of implementing behavioural interventions to improve bill payment behaviour. First is to acknowledge the system boundary and map stakeholders as outlined in Dewies et al (2022), shown in Figure 9.

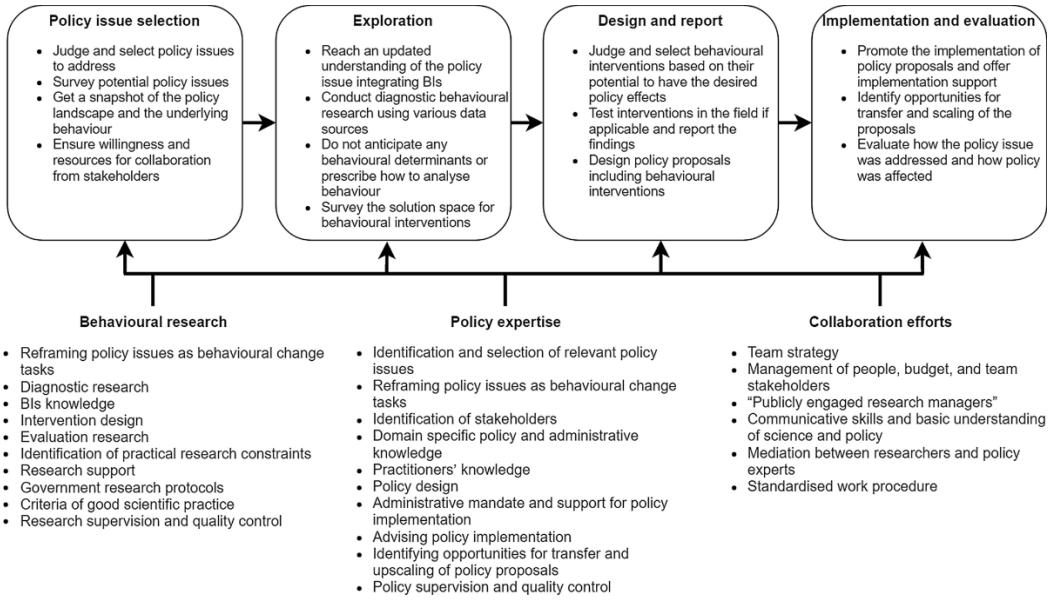


Figure 9: Behavioural Intervention Systems boundary and necessary steps
Source: Dewies, Denktaş, Giel, et al. (2022).

BC requires strong partnerships between researchers, practitioners and policy makers; the collaboration is to be long-term from identifying and delineating the policy issue, conducting an appropriate diagnostic, designing the intervention, implementation, evaluation and scaling up. A clear logical sequence, as outlined in Figure 10, is necessary. This report is part of behavioural research, conducting diagnostic research and designing the necessary intervention as a starting point of a series of steps, namely (1) policy issue selection; (2) efforts to understand

the underlying behaviour; (3) design of policy proposals, and (4) implementation and evaluation.

Without full cooperation of the organisations (key stakeholders) effective intervention is not possible. Intervention is best when it is implemented in full partnership with the relevant entity (water authority in this case), in the everyday business activity of the entity, to avoid contamination or Hathorne effect (Vannan, 2021). The partnership is easy to establish if there is a good appreciation of the problem as described by researchers, thus policy issue selection (water bill payment, in this case) and exploration (scoping review) are done and findings shared by the relevant stakeholders for co-creation of intervention strategies. This enables interventions that align with operational procedures, legislation and minimise indirect cost to the utility (water authority). Figure 10 outlines the steps that need to be carried out in partnership with the stakeholders, as a more elaborate expression (application) of Figure 9.

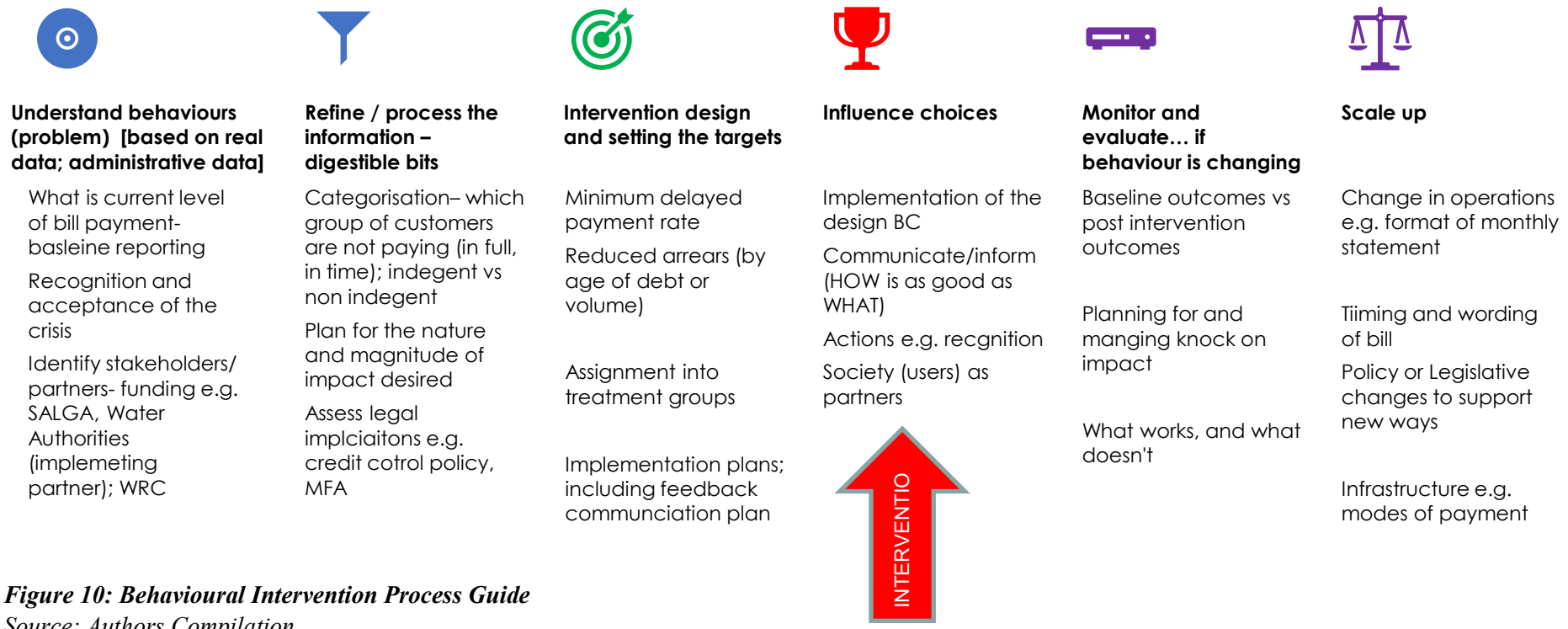


Figure 10: Behavioural Intervention Process Guide
Source: Authors Compilation

The illustration aligns with ideas42 four-part process of define (understand the behaviours), diagnose (process the information), design (intervention design, influence choices), test (monitor and evaluate, scale-up), which also align to Duflo, Kremer and Robinson (2011) as presented in UNDP (2016) where they proposed the SIMPLER nudging options.

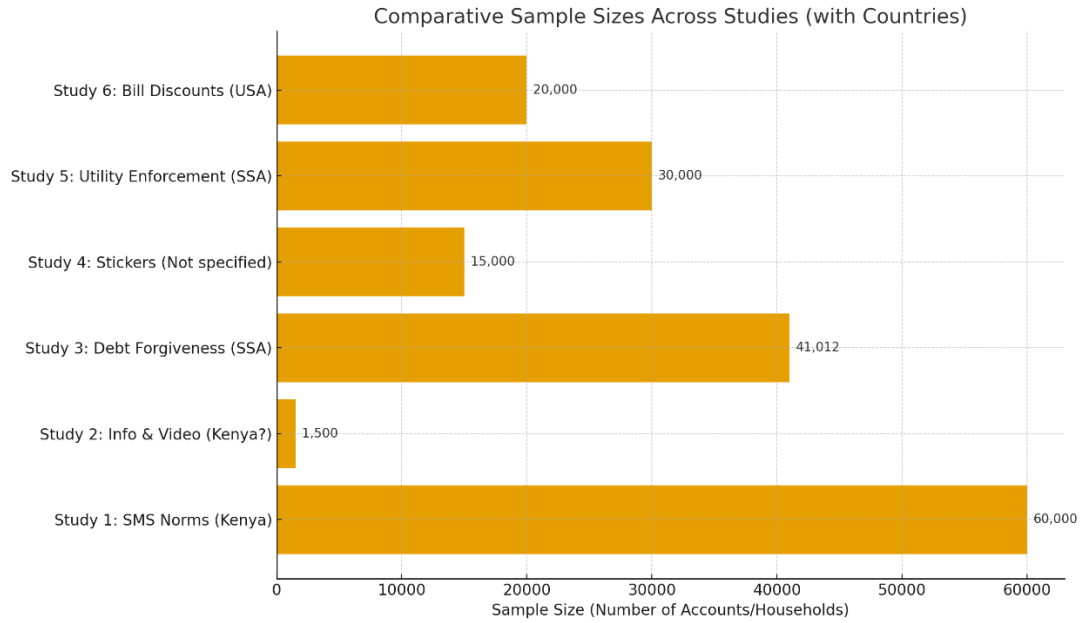
Before designing our intervention, we considered registered protocols related to water bill payment improvement, as summarised below in Table 8. Protocol registration is an essential quality assurance step, which was also done for the developed protocol in this study.

Table 8: Registered protocols summary

Study Title	Country of Study	Treatments	Target Outcomes	Experimental Design	Experiment Characteristics
Study 1: SMS Norms & Messaging (NCWSC) Registry: https://www.socialscienceregistry.org/trials/7477	Kenya (Nairobi)	T1a. Descriptive norm – 'Most customers in Nairobi make a payment towards their water bills on time. Please pay the bill before the due date.' T1b. Descriptive norm + penalty – Adds '…to avoid service interruption.' T2. Injunctive norm – 'Most people in Nairobi think it is important to pay your water bill on time…' T3. Service quality appeal – 'NCWSC requires regular revenue to continue providing water services… Example: Sh 350m spent on Sasumua pipeline repairs.' T4. COVID-19 appeal – Links timely bill payment to stopping the spread of COVID-19 and sustaining water services. T5a. Phone survey (basic) – Perceptions of reasonable water bills and arrears. T5b. Phone survey + infrastructure info – Includes information about Nairobi's water & sanitation infrastructure.	Primary outcomes: • Total arrears (amount of unpaid balances) • Probability of on-time bill payment Secondary outcomes: • Probability of making any payment • Percent of total billed amount paid	Population: All NCWSC customers who had arrears at least once in the previous 50 months (excluding those with continuous arrears for 50 months). Randomization: Done in MS Office by computer. Randomization unit: Customer account. Stratification: By water use decile. No clustering.	Sample size: 60,000 customers. Treatment arms: 10,000 customers per arm. Power: 80%. Minimum Detectable Effect (MDE): On-time payment: 1.92 percentage points; Arrears: KSh 425.
Study 2: Information on Subsidies & Video (GWL) Registry: https://www.socialscienceregistry.org/trials/16040	Not specified (likely Kenya)	T1. Information treatment – Customers receive information on how much their water service is subsidized and the financial cost of procuring non-network water. T2. Information + video – Customers receive the same information as T1, plus a short video highlighting the hidden nature of water infrastructure. Control: Households who received neither information treatment for perceptions of fair bills; other residential customers in the same meter reading route (CCA) for bill payment behaviours.	Primary outcomes: • Perceptions of 'fair' water bills (survey-based) • Bill payment behaviour (timeliness and arrears) using GWL billing data. Secondary outcomes: Not specified.	Population: Residential GWL customers within the CCA meter reading route. Randomization: Customers not randomly selected to be interviewed. Randomization unit: Customer accounts. No clustering.	Sample size: 1,500 customers. Treatment arms: 500 control, 500 T1, 500 T2. Minimum Detectable Effect: Not reported.
Study 3: One-time Debt Forgiveness (SSA utility) Registry: https://www.socialscienceregistry.org/trials/9598	Sub-Saharan Africa (unspecified country)	T1. Debt forgiveness – One-time arrears forgiveness for residential customers with arrears between 500 and 5000 local currency. Customers receive an SMS and follow-up call	Primary outcomes: • Arrears accumulated over six months • Number of positive	Population: Residential water utility customers in Sub-Saharan Africa with arrears between 500 and 5000 local currency.	Sample size: ~1,012 customers in treatment group; control group ~40,000 eligible customers. Treatment arms: One treatment arm (debt

		confirming their eligibility and the one-time nature of the program. Control: Eligible customers not selected for arrears forgiveness (~40,000).	monthly payments • Number of full payments Secondary outcomes: Not specified.	Randomization: Conducted in office via Stata 16.1. Randomization unit: Customer accounts. No clustering.	forgiveness). Power: 80%. MDEs: Arrears = 565 local currency; Positive payments = 0.2; Full payments = 0.15.
Study 4: Sticker Treatments (3x2 framing) Registry: https://www.socialscienceregistry.org/trials/2281	Not specified	Sticker treatments in 3x2 design: • Positive frame – Reminder • Positive frame – Reminder + Self-concept persuasion ('Please be a responsible citizen') • Positive frame – Reminder + Self-concept attribution ('You are a responsible citizen') • Negative frame – Reminder • Negative frame – Reminder + Self-concept persuasion • Negative frame – Reminder + Self-concept attribution Control: Untreated baseline condition.	Primary outcomes: • Payment behaviour • Water consumption behaviour Research interest: treatment differences among customer types, past payment behaviour, and long-term effects. Secondary outcomes: Not specified.	Population: Private residential customers billed by eight readers over ~15,000 customers per month. Randomization: Computer program, balanced by day and reader. Randomization unit: Individual customers. No clustering. Implementation: Stickers attached to bills by staff during meter reading and bill delivery.	Sample size: Nominally ~15,000 customers per month, but effective treated number is smaller due to inactive accounts, unreadable meters, commercial accounts, etc. Treatment arms: 6 sticker treatments + 1 control group. Final distribution may vary due to field conditions (staff availability, device issues, etc.). MDE: Not specified.
Study 5: Utility Enforcement Treatments for Electricity Bills Registry: https://www.socialscienceregistry.org/trials/8742	Sub-Saharan Africa (unspecified)	Treatment arms: • Pure control (no action) • Business-as-usual control • SMS reminder • SMS social comparison (with neighbour averages) • Mailed disconnection notice • In-person notice without disconnection • In-person notice with subsequent disconnection	Primary outcomes: • Electricity consumption • Bill payment • Arrears • Re-connection to the grid (if applicable) • Endline survey outcomes (household finances, consumption, mental health) Secondary outcomes: Not specified.	Population: 30,000 households with unpaid electricity bills. Randomization: Stratified randomization in Stata. Randomization unit: Household. No clustering. Data sources: Administrative utility data, baseline and endline surveys.	Sample size: 30,000 households. Treatment arms: 7 groups. Allocation: 7,500 pure control; 2,500 BAU control; 5,000 SMS reminder; 5,000 SMS social comparison; 5,000 mailed disconnection notice; 2,500 in-person notice (no follow-up); 2,500 in-person notice with disconnection. MDE: Not specified.
Study 6: Randomized Water Bill Discounts Registry: https://www.socialscienceregistry.org/trials/14214	United States	Treatment arms: • Full price (control) • Discounts: 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% • For current Tier 2 financial assistance recipients: restricted to 50%, 60%, 70%, or 80% Cells remain active for 3 months, between Aug 21, 2024 and Nov 20, 2024. All other financial aid suspended to isolate the price effect.	Primary outcomes: • Water usage • Bill payment behaviour • Water debt accumulation behaviour Secondary outcomes: Not specified.	Population: Single-family home water accounts on quarterly billing cycle. Randomization: Conducted by computer in office. Randomization unit: Individual household account. No clustering.	Sample size: 20,000 accounts. Treatment arms: 9 discount levels (including control). Design ensures Tier 2 recipients only randomized within 50–80% discount group. MDE: Not specified.

From the registered protocols reviewed as summarised in Table 8 above, the study with the smallest sample size included 1 500 customers, while the largest included 60 000 customers, with considerable variation across other studies.



Sample sizes vary widely; in setting a target sample for own intervention, it is important to calculate it based on effect size computation. As more experimental designs are published, it may be necessary to conduct a meta-analysis in the immediate future.

4.3.2. Nudging Water Revenue Collection improvement (NuWRev): An illustrative protocol

Experimental Economics requires registration of a protocol, the process that entails submitting for review on the system and receiving feedback. Taking into account the scoping review, as well as lessons learned from students' projects, a protocol is proposed here.

1. **Policy issue of interest:** Utility bill payment is a confirmed challenge for water authorities, as established in various scholarly works

2. **Baseline analysis on administrative data: analysis of** payment behaviour/patterns by different sub-groups. Administrative data received from OR Tambo Municipality shows great variation in bill payment, confirming the existence of the problem.

3. **Assign to treatments:** From the literature, it is clear that multiple treatment arms should be created to establish the most effective one for future implementation. We will understand the different scenarios and devise wording to go with each bill outcome [through analysis of administrative data].

4. **System Update by Billing Division:** The billing division will update their systems as follows: tag for each consumer and the treatment group they fall under; update macros – wording that appears on the bill, depending on the outcome at next bill issue- e.g in arrears vs not in arrears

5. **Implement interventions** as follows:

    i. **BAU** (Business as Usual) Control Group receives the messaging as it currently is the case

    ii. **Patriotism Nudge**: A subtle, non-coercive influence aimed at encouraging or reinforcing patriotic behaviours, for example, 'proudly South African' or 'Proudly Metro x citizen', appealing to consumers to be patriotic and pay their bills [revise the current message of 'Please attend to the arrears as services will be terminated shortly' to *'In the spirit of Ubuntu, and to ensure we have resources to provide quallity services to all, please pay this bill by due date'*

    iii. **Loss Aversion Framing:** Personalised bill providing key information (own historic bill payment and the interest accrued framed from a loss perspective)- '*Please pay the bill in full. Any arrears attract an interest of …##, and you owe R… in interest equivalent to X weeks of tuck money for a primary school child.*'

    iv. **Social Norm and Comparison Nudge:** Personalised bill + comparing bill payment behaviour with own household's historic behaviour + information on the average bill payment within the neighbourhood

        - Your bill payment is X months behind schedule
        - 90 % of your neighblours are paying their bills by the due date
        - You are among the very few (less than 10%) who are behind on bill payment
        - Be a good neighbour and pay your bill in full, on time

    v. **Payment Request Message:** Enroll consumers for the payment request message for the total bill amount e.g. via Ozow; they would need to click the link to be directed to the payment platform; otherwise, they will pay via traditional ways.

        Message: "Mr/Miss/Ms/Mrs/Dr/Prof _____, for your convenience, you can pay R####.00 due on your XXXXXXXMunicipality account ###### by clicking on https://pay.ozow.io/z/PvqrSTk or via Easypay using ref no ##########. If already paid, please ignore."

    vi. **Reinforcement of good behaviour (reward/reciprocity):** Every household in each of the above treatments (a-v) who pays on time and in

full receives a 'Congratulatory' message / sticker, which will be considered a rare status for those with timely payments for 3 consecutive months. This aims to neutralise a possible 'boomerang' effect.

Table 9: NuWRev registered protocol summary

Study Title	Country of Study	Treatments	Target Outcomes	Experimental Design	Experiment Characteristics
NuWRev: Nudging for municipal water services revenue collection improvement	South Africa- Eastern Cape- OR Tambo District Municipality (pilot water authority)	The control group is considered a BAU case The treatments design is 4 x 2 1. Patriotism (P) 2. Loss aversion framing (LA) 3. Social norm and comparison nudge(SN) 4. Payment request SMS with link (SMS) 5. Reinforcement of good behaviour (reward/reciprocity) embedded in each of the 4 designs (not with control/ BAU) [P + R] [LA +R] [SN +R] [SMS + R]	Primary outcomes: • Total arrears (value of unpaid balances) • Probability of on-time bill payment Secondary outcomes: • Probability of making payment of any amount • Percent of total billed amount paid	Population: All customers who had arrears at least once in the previous 30 months (excluding those with continuous arrears for 30 months). Randomization: by computer using Stata Randomization unit: Customer account number. Stratification: By water use decile Clustering: by socio-economic class (low income, middle income, high income)	Sample size: 17 395 customers. Treatment arms: 3 479 customers per arm. Power: 80%. Minimum Detectable Effect (MDE): On-time payment: 1.92 percentage points; Arrears: ZA1 000.

6. Monitoring and Evaluation

Observation will occur before intervention (at least 3 months) and post intervention (at least 6 months) to assess any changes in behaviour. The analysis attempts to isolate the treatment effects through the use of difference-in-difference, as well as difference-in-difference of the differences (see Table 10).

Table 10:Analysis plan

Intervention	Data Analysis	Comment
Baseline	Descriptive analsysis, categorising and analsysis of target outcome variables	To understand the sample, and enable randomisation into treatments Analysis of treatments groups to confirm similarity before intervention
Treatment vs the control group	Difference-in-Difference and Differenc-in-Difference of the Differences approaches- comparing the average otucome sof controlled group versus the control, and between different treatments	This will be extended to treatment vs teatment as well, to determine the differences between treatments

7. **Scaling up –** successful interventions in terms of effectiveness from impact (increasing bill payment indicators) or cost (at minimal cost per impact achieved), are then prepared for large-scale implementation.

4.3.3. Critical success factors

The successful implementation of the proposed intervention protocol depends on several critical factors:

- Water Authority (Municipality) buy-in:
  - i. A strong partnership with researchers, including access to administrative data for analysis and a commitment to monitor implementation and outcomes over time..
  - ii. An information technology system that is amenable to adjustment primarily the wording on bills or inserts based on each treatment assignment.

The theory of change that underpins the intervention is outlined in Figure 11 below.

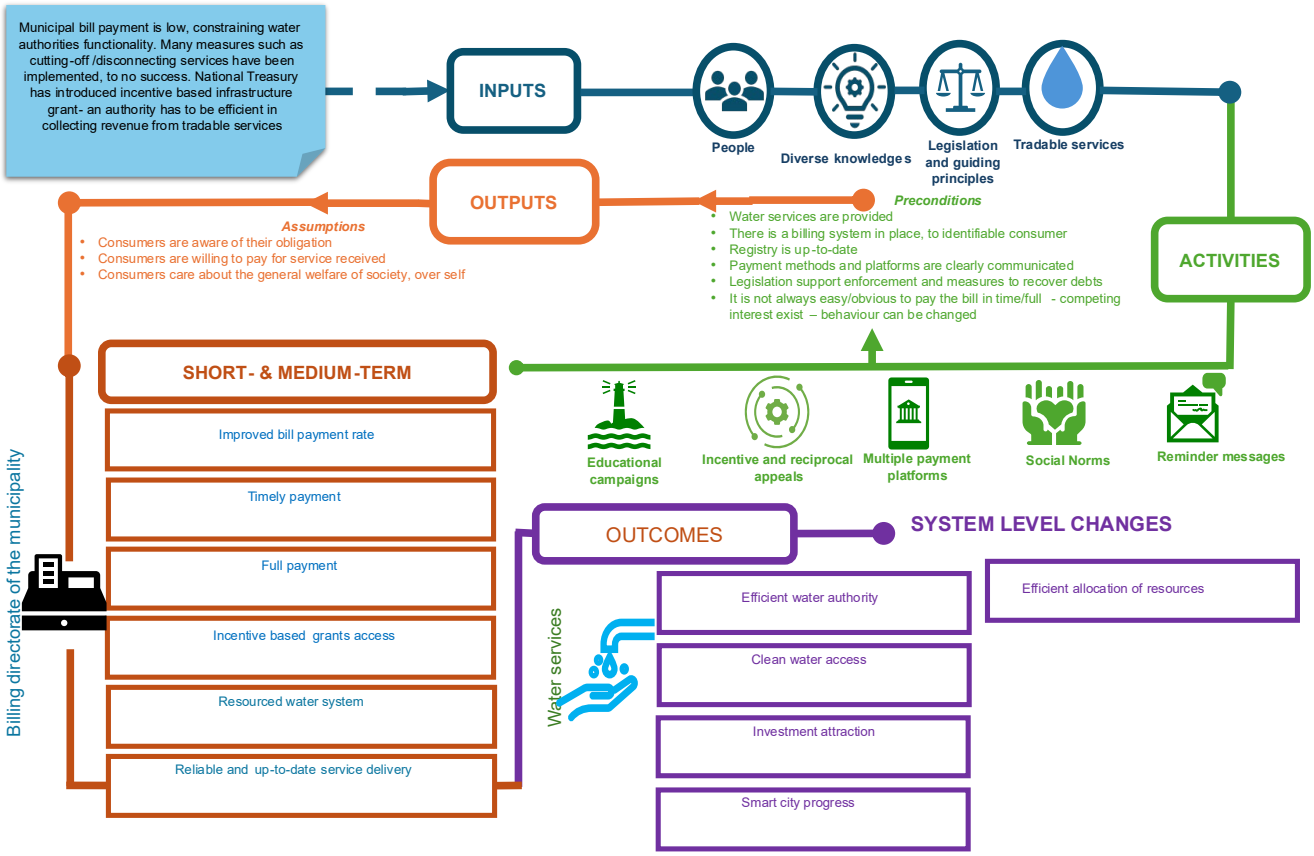


Figure 11: Theory of change for the proposed intervention
Source: Own Compilation

From this theory of change, we propose a protocol for intervention to improve revenue collection by increased bill payment compliance. The research activities by students on the project provide further insights into the possible ways to work with municipalities

Systems boundary and stakeholder consultations: *Lessons from Postgraduate students' projects*

To date, two studies have received gatekeepers' permission from local municipalities to carry out studies that are related to this project. The lessons from the projects are summarised here.

Table 11: Capacity building activities supported

Student	Study level	Study title/focus	Supported activities	Data requirements	Progress to date
Florence Katsande	Masters	Consumer Preferences and Willingness to Pay for Water Quality Improvement: Case of Nelson Mandela Bay Municipality	Data collection – fieldwork	using choice experiment data	Data collection completed Analysis done and draft ready for examination
Vikela Sithole	Doctorate	Behavioural Interventions on Water Demand: Applications to Eastern Cape, South Africa	Data collection-sourcing of administrative data and visiting supervisor	using administrative data and an experiment to help reduce water consumption in OR Tambo District Water Service Authority	Delays in getting permission and access to administrative data The approval took several months with multi-layer discussions.
Nomusa Jiyane	Honours		Tuition and living expenses	Water scarcity focus, using secondary data	Draft completed for examination
Nomonde Tshablala	Doctorate		Visit to national lab	National Treasure Secure Data Facility – Tax compliance data	Proposal to request access submitted, revisions received. Awaiting appointment
Makgantse Mmereki	Doctorate		Data collection-fieldwork	Primary data on smart city measurement, to which improved revenue collection has a bearing	Currently collecting data

5. Conclusion

This project aimed to ascertain strategies that can be used to improve municipal bill payment, specifically the possible role of behavioural insights. There is growing utility bill debt that is threatening the ability of water authorities to provide reliable and quality water. It has become even more important to improve efficiency in water revenue collection as the National Treasury of South Africa has introduced an incentive-based grant system, where the release of such grants is based on proving efficiency in own revenue collection by the local authority (especially metros).

The study serves as a necessary dip stick ahead of recommending to local authorities. Literature reviewed the application of behavioural insights to improve bill payment across the world, albeit with great limited studies applying in local authorities' type of bills. The justification for such kind of interventions is provided, based on how human mind works and decisions are made. It is possible to influence human behaviour in a sustainable way, and the proposed protocol will assist water authorities to modify behaviour of consumers for good.

The following takeaways are noted:

- Short-cut (unconscious) decision-making is common, accounting for at least 80% of choices
- The way information is presented, or the decision-making environment is structured, matters, as it serves as a guide to decision-making. What is communicated is as important as how it is communicated.
- Salience is key
- Service delivery is considered a sincere way to reciprocate bill payment
- Customers are inclined to withhold payments in protest of bad service
- Municipalities are currently addressing the low bill payment problem primarily through educational campaigns and reminders that focus on penalties or potential punishment. Reforms are needed.

A protocol for intervention is developed, where a control group (business-as-usual case) is compared to interventions based on the following treatments:

- Patriotism
- Loss aversion framing
- Social norms
- Reward/ incentive for good behaviour, which is embedded within each of the above treatments.

There are several RCTs that have been registered in the past nine years to assess behavioural change with respect to utility bill payment. While their results are not yet reported in the public domain, the need to intervene is demonstrated and motivated. The study outlines the sequential decision-making from a game theory perspective on how the water authority and the consumer interact repeatedly, with resulting payoffs at each stage. There are two specific points at which intervention is possible – at the onset when a bill is issued (regardless of the payment history

of the customer) or at a point when some payment has been missed. The latter is the popular intervention reported in literature, including in the registered RCTs reviewed.

The broad outcomes of the project are:

a) Scoping review was done, which gave insights into works within this focus area, and lessons have been drawn by the team and for the public.
b) Partnerships established with municipalities, which were enabled by scholarship funding to students.
c) Capacity building: training of postgraduate students in behavioural change interventions was embedded in all activities of the project, and interest in behavioural economics has been grown.
d) Design of a protocol that will guide future interventions – this is a guide for utilities that seek to improve revenue collection from tradeable services, specifically water, as outlined in this review.

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7. Appendices

A1. Extract from Guiding principles in BCM credit control policy

(8) Customers must receive regular and accurate accounts that indicate the basis for calculating the amounts due.

(9) Customers must pay their accounts regularly by the due date.

(10) Customers are entitled to reasonable access to pay points and to a variety of reliable payment methods.

(11) Customers are entitled to an efficient, effective and reasonable response to appeals, and should not suffer any disadvantage during the processing of a reasonable appeal.

(12) Debt collection action will be instituted promptly, consistently, and effectively without exception and with the intention of proceeding until the debt is collected

A2: Selected key studies

Author	Year	Title	Problem	Primary Aim	Geography	Methodology	Key Finding(s)	Relevance	Partners in Project	Comment/ source
Anneke Kosse	2021	An Empirical Analysis of Bill Payment Choices	Consumers' bill payment behaviours are not well understood, especially compared to POS (point-of-sale) payments.	Understanding the drivers of bill payment choices is essential for shaping efficient payment systems (point-of-sale) payments. Understanding the drivers of bill payment choices is essential for shaping efficient payment systems.	Canada	Survey-based study using 2019 data from over 4,000 Canadians. Binomial and multinomial regressions were used to analyze the factors affecting bill payment choices	Allcott, H	2011	Social Norms and Energy Conservation	The study highlights the importance of digital payment adoption and how demographics influence bill payment behaviour. Policymakers should consider tailored strategies for different consumer groups when promoting electronic payments.
Simeon Schächtele, Huáscar Eguino, Soraya Roman	2020	Fiscal Exchange and Tax Compliance: Evidence From a Field Experiment	Low tax compliance is a significant issue, especially in areas with weak institutional capacities and low public trust. Non-deterrent nudges have shown mixed results in improving compliance	Low tax compliance is a significant issue, especially in areas with weak institutional capacity and low public trust. Non-deterrent nudges have shown mixed results in improving compliance.	Mendoza, Argentina	A randomized controlled trial (RCT) involving 20,000+ taxpayers. The study compared tax bill designs, including one emphasizing public services benefiting children, to assess its impact on tax payments	The fiscal exchange nudge increased tax compliance by 20%, with stronger effects (almost 40%) when bills were delivered in person. - Compliance improvements persisted for two years after the intervention. - The cost-benefit ratio of the intervention was 18:1, indicating high cost-effectiveness. - Personal interaction during tax bill delivery amplified compliance	This study provides strong empirical support for using nudging techniques in municipal revenue collection	Conducted with the municipal government of Mendoza, Argentina	The study suggests that affective responses (such as appealing to reciprocity and social responsibility) are key to increasing compliance. This insight can be leveraged in water billing strategies to improve collection rates.
Allcott, H	2011	Social Norms and Energy Conservation	Low compliance with energy-saving behaviours	To test the impact of social norms on energy bill payment and conservation.	United States	Randomized field experiment.	Social norm messages (e.g., "your neighbours are saving energy") increased compliance with energy-saving behaviours and timely bill payments.	Highlights the role of social norms in influencing payment behaviour.	Opower (energy company)	Social norms can be a cost-effective tool for behaviour change. https://doi.org/10.1016/j.jpubeco.2011.03.003
Karlan, D., et al.	2016	Getting to the Top of Mind: How Reminders Increase Saving	Low savings and bill payment compliance among low-income individuals.	To test the effectiveness of reminders in improving savings and bill payment behaviour.	Peru	Randomized controlled trial.	SMS reminders significantly increased savings and bill payment compliance, especially when combined with goal-setting.	Demonstrates the power of reminders in improving financial behaviour.	Innovations for Poverty Action (IPA)	Reminders are a low-cost, scalable intervention. https://doi.org/10.1287/mnsc.2015.2296
Hallsworth, M., et al.	2017	The Behaviouralist as Tax Collector: Using Natural Field Experiments to Enhance Tax Compliance	Low tax compliance rates	To test the effectiveness of behaviourally informed letters in improving tax compliance.	United Kingdom	Randomized field experiment	Letters emphasizing social norms (e.g., "9 out of 10 people pay their taxes on time") and moral appeals significantly increased tax compliance.	Demonstrates the effectiveness of behavioural insights in improving compliance.	UK Tax Authority	Social norms and moral appeals are effective in improving compliance. https://doi.org/10.1016/j.jpubeco.2017.02.003
Datta, S., & Mullainathan, S	2014	Behavioural Design: A New Approach to Development Policy	Low compliance with bill payments and savings behaviour	To explore how behavioural design can improve compliance and financial behaviour.	India	Field experiments and behavioural diagnostics	Simplifying payment processes, providing reminders, and leveraging social norms significantly improved compliance with bill payments and savings behaviour.	Highlights the role of behavioural design in addressing barriers to compliance	Multiple NGOs and government agencies	Behavioural design can be applied across various contexts to improve compliance. https://doi.org/10.1111/roiw.12093
Sloboda, M., Pavlovsky, P., & Sicakova-Beblavá, E	2022	The effectiveness of behavioural interventions on increasing revenue from local fee	High levels of unpaid municipal waste disposal fees leading to revenue losses	To evaluate the effectiveness of behavioural interventions (reminders and social norm framing) in increasing municipal fee payments	Prievidza, Slovakia	Quasi-experiment involving 712 waste disposal fee debtors; tested different communication strategies (reminders and social norm framing)	The combination of a reminder with an injunctive social norm leaflet increased the probability of debt repayment by 1.7 times. Debtors with only one missed payment were three times more likely to pay after receiving a reminder.	Demonstrates the potential of behavioural nudges to improve compliance with municipal service payments, which can be applied to water bill payments	Local municipal authorities	The study contributes to understanding the role of communication strategies in public finance management. https://doi.org/10.1108/RBF-06-2020-0126
Céline Nauges & Dale Whittington	2019	Social Norms Information Treatments in the Municipal Water Supply Sector: Some New Insights on Benefits and Costs	Non-payment and under pricing of water in municipalities, leading to underfunding and inefficiencies in the water sector.	Various municipalities	Various municipalities	Field experiment testing the effect of social norm information treatments (e.g., information about the average customer's payment behaviour) on bill payment behaviour	Social norms information treatments improved water bill payment behaviour. Customers who received information about other customers' payment behaviour were more likely to pay their bills on time and in full, especially when the information was framed positively	Provides evidence that social norms can be used to influence payment behaviour in municipal water sectors, supporting the application of social norm-based interventions for improving compliance with water utility payments	Environment for Development (EfD) initiative	The study highlights the importance of leveraging social norms to improve payment behaviour, particularly in the context of municipalities with persistent nonpayment issues. https://doi.org/10.1142/S2382624X18500261
Andrea Szabo & Gergely Ujhelyi	2015	Reducing Nonpayment for Public Utilities: Experimental Evidence from South Africa	High rates of nonpayment for public utilities, hindering the expansion of service access in developing countries	To investigate the causes of nonpayment and evaluate the effectiveness of a water education campaign in reducing nonpayment.	South Africa	Implemented a randomized water education campaign in a low-income	The information campaign led to a 25% increase in payments over a three-month period, after which the effect dissipated. The treatment did not work by merely increasing information, serving as a reminder, or threatening	Demonstrates that non-enforcement strategies, such as educational	Center for Economic Growth and	The study highlights the potential of customer engagement and education in enhancing payment

						peri-urban area, involving 500 households in the treatment group. Evaluated the program using administrative billing data and in-depth surveys of both treatment and control groups.	enforcement. Instead, households may have reciprocated the provider's outreach efforts by paying more.	outreach, can effectively reduce nonpayment for public utilities, offering insights into alternative approaches for improving revenue collection.	Opportunity (CEGO) at the University of Houston	compliance, suggesting that fostering a reciprocal relationship between providers and consumers can be beneficial. https://doi.org/10.1016/j.jdeveco.2015.06.002
Lilian, & Barigayomwe.	2024	Method(s) of Paying the Water Bills and the Performance of NWSC		Investigate the methods of paying water bills and their impact on the performance of the National Water and Sewerage Corporation (NWSC)	Iganga Municipality, Uganda	Descriptive Survey Method	Delays in bill delivery, lack of follow-ups, and inadequate feedback mechanisms significantly hinder prompt payment	The study focused on assessing various factors that influence timely bill payments. This included examining issues such as delays in bill delivery, lack of follow-ups, and inadequate feedback mechanisms, which were identified as significant barriers to prompt payment	National Water and Sewerage Corporation	
Gration, Pastory, & Ndunguru	2023	Using Information and Communication Technology to Enforce Non-Payment of Water Bills: The Case of Water Supply and Sanitation Authorities in Tanzania	Enforcing the payment of overdue water bills is difficult in both developed and developing nations. Many water supply and sanitation organizations in Tanzania and other countries use water service termination as a last resort for non-payment. Since providers are legally forbidden from cutting off service because of unpaid bills, this enforcement tactic frequently contravenes government regulations.		Tanzania	Design Science Research (DSR) methodology	The findings indicate that people who owe unpaid water bills are automatically denied access to electricity services			Water Supply and Sanitation Authorities (WSSAs), Tanzania Electricity Supply Company (TANESCO), and Dodoma Urban Water Supply and Sanitary Authority (DUWASA)
Antinyan & Asatryan	2021	Does the Frequency of Reminders Matter for Their Effectiveness? A Randomized Controlled Trial	The study addresses the issue of tax payment delays and examines the effectiveness of different reminder frequencies in motivating taxpayers to pay on time. The challenge is determining how reminder timing and frequency influence payment behaviours.	The study aims to assess the impact of varying the timing and frequency of reminder communications on the likelihood of taxpayers making prompt payments	Australia (business taxpayers)	Randomised controlled trial	Sending a single reminder letter significantly increases the prob ability of payment, with an approximate 25 percentage point rise compared to the control group. The timing of reminders within a three-week window did not notably affect the overall payment rate. Early reminders led to faster payment but did not change the total payment rate.	This study provides valuable insights for improving timely water bill payments	Nonementioned	https://doi.org/10.1016/j.jebo.2021.09.023

A3: Identified strategies

Behavioural Nudges/Intervention activities	**Examples (Find an appropriate description) -Application of the nudge/ (Column 3)**	**Theory of change basis (Column 2)**	**Current application (to South African context)**	**Comments/ Observations from the literature**
1. Reminders and Communication Strategies	SMS reminders or personalized letters to encourage timely payments. Studies: Karlan et al. (2016), Sloboda et al. (2022).	Timing of message matter Framing of message matter	Issuing of the bill/statement every month Nelson Mandela Bay Metro sends SMS alerting of statement issuing, reminding about payment but not thanking payers Statements acknowledge timely payment and thank you message is included	Timing of the statement issuing is critical- e.g on the 15th vs 30th. Buffalo City municipality changed in the recent past. Which one is better Correctness of the bill matters Wording/framing on the bill matters
2. Simplifying Payment Processes	Streamlining payment methods to make them more accessible and convenient for users. Studies: Datta & Mullainathan (2014), Anneke Kosse (2021	Change of social architecture	Linked to multiple banks recognised entity Different forms of payment- in supermarkets, at municipal offices, EFT	Barrier: Low digital literacy in rural areas (Murwirapachena, 2021). Success: M-Pesa integration in Kenya reduced
3. Social norm messaging	significantly improve compliance rates across various contexts, including tax compliance (Hallsworth et al., 2017), water bills (Nauges & Whittington, 2019), and energy conservation (Allcott, 2011). Example: Social norm messaging (e.g., "your neighbours pay their bills on time") to encourage compliance.	Descriptive norms: People conform to perceived group behaviour (Cialdini, 2007).	Social norm messaging (not explored) Limited in SA; tested in Cape Town water conservation (Brick et al., 2023).	Risk: Backfire if norms highlight high non-payment (Brent et al., 2020). Norm-nudges can be powerful interventions, but they can easily fail to be effective and can even backfire unless they are designed with care (Bicchieri and Dimant, 2022).

		Studies: Allcott (2011), Karlan et al. (2016), Hallsworth et al. (2017), Nauges & Whittington (2019). Ferraro and Price (2013) sent behavioural messages to water consumers in Atlanta, USA,			Best for: Middle-income areas with moderate compliance. Strong vs Weak vs Informative norm messages
4.	Educational Campaigns	• Example: Outreach programs providing information about the importance of payments and services provided in return. Szabo & Ujhelyi 2- 015), Sualihu et al. (2017).	Knowledge deficit model: Information gaps drive non-payment.	Rural campaigns via local radio (e.g., Ukhozi FM).	Community engagement; targeting rural communities, low literacy → towards inclusive economy (NDP 2030)→ campaigns through Radio station Classification of households and message they receive or type of nudge--- e.g. role of educational campaigns --- rurality vs urban context … emphasising statistical facts Effectiveness: Low for habitual non-payers. Combine with: Simplified bills (e.g., icons for low literacy).
5.	Incentives and Reciprocity Appeals	Example: Highlighting the benefits of timely payments or fostering a sense of reciprocity between service providers and customers- Simeon Schächtele et al. (2020), Szabo & Ujhelyi (2015). - Pay on time to support community services. - Small discounts for early payment.	Reciprocity: Moral obligation to reciprocate fair service (Fehr & Gächter, 2000).	- Indigent subsidies for consistent payers.	Payment incentives (e.g. discounts, civic-duty messages) have limited success in South Africa. They work better for middle-class households than for low-income residents. Affordability issues and distrust in poor service undermine effectiveness. Perceived corruption undermines trust (Motsoeneng, 2022). For real impact, combine incentives with better service delivery and transparent communication. Behavioural changes can be incentivised through feedback designs. In order to map behaviour to outcomes, individuals need transparent and frequent feedback information- (Rogers and Frey, 2015).