



Applying a behavioral lens to the water sector

The SDGs for water are a greater challenge than the MDGs before them. The move from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs) for water, brought into focus the importance of quality of service, and safe, clean water, in addition to just access to an improved source. By 2017, 663 million people still lack access to improved water supply (Independent Evaluation Group, 2017) but over 2 billion people lack access to safely managed drinking water services (UNICEF and WHO, 2019). The SDG targets have also underlined the scale of investment needed, which is estimated at \$1.7 trillion, three times more than has been invested in the sector to date (Nagpal, Malik, Eldridge, Kim, & Hauenstein, 2018).

In addition to addressing the funding gap, existing investments need to be more efficient. According to IBNET data, around 37% of water utilities are regularly making losses and not covering operational costs, with another 17% having at least 50% Non-Revenue Water. Some of these inefficiencies can be attributed to behavioral regularities and thus behavioral interventions can play a role in addressing them.

Furthermore, in rural parts of the developing world, access is hampered not just by the lack of near water points, but by the fact that new constructions regularly fall into disrepair due to poor maintenance. For example, 38% and 29% of water points in Nigeria (Andres, Chellaraj, Gupta, Grabinsky, & Joseph, 2018) and Tanzania (Joseph, et al., 2019) respectively are non-functional, with 27% and 20% respectively failing within the first year of construction.

When it comes to water quality, water sources in both rich and poor countries alike are experiencing high levels of contamination in various forms – from chemicals and plas-

tics, to sewage, nitrogen and even salt. In Bangladesh, where saline water is widespread, it is responsible for up to 20% of infant mortality across the most affected coastal areas (Damania, Desbureaux, Rodella, & Russ, 2019).

What all these challenges – utility inefficiencies, non-functional water points and water contamination – have in common is that they are a direct result of human behavior. For example, a lack of monitoring, motivation, enforcement or capacity from the policymaker or service provider, or a lack of adaptation from the consumer. As a result, behavioral economics offer an opportunity to address them. This brief presents behaviorally motivated interventions that have been used in the water sector, their results, and highlights further areas where these approaches could be useful to meet SDG 6.

WHAT ARE THE MAIN BEHAVIORAL CHALLENGES IN THE WATER SECTOR?

There are behavioral challenges at all levels of the water sector where decisions are taken. Below we illustrate this from the policymaker, to the service provider and finally the consumer level:

POLICYMAKERS have the primary role in making decisions on: (i) what projects to invest in from across several alternatives and how to finance them, (ii) setting up the contractual arrangements to build, maintain and manage the infrastructure, and (iii) regulating the market.

SERVICE PROVIDERS of the water sector – whether in utilities, rural water committees or even informal providers – require motivated employees with adequate capacity and training to

operate and maintain a good quality service. Opportunities for behavioral interventions to address these include: thinking through pro-social, non-monetary incentives (Belsey & Ghatak, 2018), and understanding what aspects of capacity buildings may be related to improvements in quality outcomes.

CUSTOMERS are those making the final decisions on adoption and consumption of the services. When facing the adoption decision of water services, potential users ponder cost and benefits of the new service or good. The framing, type of message provided, identity, and their beliefs could play a crucial role in adoption decisions. Evidence has shown that factors such as wording in informational brochures, non-monetary cost, and attitudes towards ambiguity and governments affect the adoption decision. Regarding the consumption or use of the service, challenges can be addressed using social norms approaches, plan principles or paying attention to message framing. Moreover, overconsumption has been addressed with behavioral approaches showing promising results.

Experiments have been conducted to test the efficacy of such behavioral approaches, including nimble and traditional evaluations. Nimble evaluations are primarily low cost, rapid and often use administrative data, while traditional evaluations are more focused on longer term outcomes.

FOUR BEHAVIORAL APPROACHES AND EVALUATIONS IN THE WATER SECTOR

Though not necessarily explicit, behavioral approaches and evaluations have been a component of a few projects in the Water Global Practice (GP) and beyond. Here are four case studies to show their effectiveness.

1. NICARAGUA:

Capacity building to encourage rural maintenance

CHALLENGE: A common challenge in water provision for urban and rural water is ensuring the ongoing proper maintenance of water systems for piped and non-piped infrastructure. Even if they are structural issues underlying the reasons for such failings, there may also be collective action and individual behavioral barriers that are inhibiting utilities and communities from taking the needed maintenance responsibilities. The available evidence suggest that good support and maintenance are key if water distribution systems are to operate reliably for the long term (Borja-Vega, Luengas Sierra, & Grabinsky Zabludovsky, 2020).

INTERVENTION: Considering this issue, the World Bank and the Government of Nicaragua implemented an intervention to provide technical assistance to Water and Sanitation Committees (CAPS), informal institutions that manage, maintain, and repair water distribution systems in the rural communities. The intervention worked through training provided to teams from the local utilities on how to improve CAPS at community level. Participants were required to develop, implement, and update action plans with specific goals and deadlines. These plans pursued to strengthen the institutional capacity of CAPS and to improve environmental, sanitary and hygiene conditions in rural communities.

RESULTS: The results of the interventions were assessed with an RCT. The impact evaluation showed how capacity building of local rural water committees could show a significant impact on rural maintenance. The intermediate outcomes related to strengthening institutional and management capabilities showed a success. The intervention significantly improved water committees' capabilities in formal operation (+0.36-point improvement), financial sustainability (+0.42-point improvement) and system operation and maintenance (+0.30-point improvement). Regarding long-term outcomes related to quality and sustained service enhancement, the intervention seems to impact an uptake of improved sanitation in treatment communities, with an 8% increase in improved sanitation. The results support the idea that capacity building at the institutional level can help strengthen capabilities of local communities' water committees to provide adequate operation and maintenance to their water systems, which can in turn improve service delivery to communities.

2. INDIA, TANZANIA AND ETHIOPIA:

Field- Level Leadership to improve maintenance

CHALLENGE: There is growing recognition that the problems underlying the poor performance of a water utility in a developing country are complex and multidimensional. This situation calls for the need of techniques that go further than the application of standard technical and managerial techniques. Many World Bank operations have supported institutional reform in the water sector, yet there are no interventions aimed at systematically transforming the internal culture of public service delivery organizations and building constituencies of support for positive change. This has motivated the implementation of a human motivation-based approach as a complement to achieve results and sustainability.

INTERVENTION: To address this gap, the World Bank Water GP piloted the implementation of Field-Level Leadership (FLL) to improve performance and service delivery outcomes of public agencies in the water sector in Ethiopia. This innovative approach aims to improve maintenance at an organizational level identifying and supporting field-level public official whose internal values are strongly aligned with the underlying values of development projects. The FLL training consist in different phases to change employees motivation to address customer complaints and ultimately improve service delivery to the customers.

RESULTS: For evaluating the impact of the FLL training in Ethiopia an impact evaluation is taking place across four branches of the Addis Ababa's water utility, for which results are pending. However, evidence on FLL training has showed promising results in different contexts. This was first implemented as a pilot in India and Tanzania in 2017 and displayed some promising results. In India, it seemed to result in 2-4 times better project performance in treatment areas of the Tamil Nadu Irrigated Agriculture Modernization and Water-Bodies Restoration and Management Project, in terms of year-on-year change in project performance indicators. Meanwhile, in Tanzania, it resulted in a reduction of 10 percentage points in Non-Revenue Water in 18 months, in the Dar-es-Salaam Water and Sanitation Company. Its applicability to a broad variety of

FIGURE 1.
WATER SERVICE DELIVERY
TRIAD BEHAVIORAL
CHALLENGES



BOX 2. MEASURING IMPACT

Behavioral interventions need to be tested to see if they can produce the desired impacts and changes. Impact evaluations have been widely used to generate this kind of knowledge in economics. To put it simply, impact evaluations usually take the form of Randomized Control Trials (RCTs) which allocate comparable populations to treatment vs. control groups to estimate whether the intervention had a significant impact. As a

result, the difference in outcome after intervention between the treatment and control group can be directly attributed to the program (Gertler, Martinez, Rawlings, & Vermeersch, 2016).

They are broadly two types of impact evaluations, that were used in the studies presented in this brief, nimble evaluations or A/B trials and traditional impact evaluations:

	Nimble evaluations	Traditional impact evaluations
Intervention	Useful for: <ul style="list-style-type: none">operational questions such as measuring uptakeprocess questionsnudges e.g. Why does the intervention actually work? Among a set of alternatives, which one will work better?	Useful for: <ul style="list-style-type: none">packages of interventionsmore complex interventions e.g. What was the impact of a large program/multi-year intervention?
Data sources	Largely administrative (internal databases, information already available)	Administrative and survey data (including household survey data collection)
Time frames	Most often they take between 3 months and a year	12 months (when there is not primary data collection), otherwise 18 or more
Costs	Between 0 to 80,000 USD, in some cases even overall cost savings may occur	On average 500,000 USD
Outcomes	Limited to first-order outcomes like take-up and usage of the intervention in question. Short-term outcomes.	Welfare outcomes such as income or consumption, as well as usage of complementary and substitute products. Long-term outcomes.

cultural settings shows promise for the use of behavioral approaches in this space.

3. COSTA RICA:

Descriptive social norms and planning principles for water conservation

CHALLENGES: A six-fold increase in global water use over the 20th century has prompted many to identify the availability of fresh water as one of the most critical issues confronting policy makers. Currently, many low- and middle-income countries are facing growing concerns about water scarcity coupled with limited impact from traditional price or information interventions. Demand management of water consumption is a key component of any initiative to manage water resources.

Taking into account the limitations that governments face to manage this issue, behavioral approaches result extremely relevant for demand management.

INTERVENTION: These has motivated policy makers into exploring and evaluating innovative ways, including behavioral nudges, of reducing water consumption. In Costa Rica, Miranda, Datta, & Zoratto (2020) conducted a behavioral intervention to test the impact of three different forms of social norms on water consumption. The authors conducted a set of focus groups that lead to the following three nudges:

NEIGHBORHOOD COMPARISON TREATMENT: invoking a descriptive social norm it took the form of a colored sticker pasted onto the monthly water bill, whose design leveraged social comparison, smiley/frowny faces, and water-saving tips.

CITY COMPARISON: to present a descriptive social norm it used similar stickers, with the key difference being the use of city-wide, rather than neighborhood wide, average water consumption as the reference point for the social comparison element.

PLANNING POSTCARD: consisted of a postcard leveraging salience, goal-setting, and implementation intentions.

RESULTS: Using the three nudges, an RCT was conducted in all residential households in Belen, Costa Rica with active connections. Results showed that the neighborhood comparisons reduce average water consumption in the first two postintervention months by 4.9 percent relative to the control group, while a planning postcard intervention reduces consumption by 4.8 percent. A descriptive social norm intervention using a town-level comparison (city comparison) also reduces water consumption by 3.2 percent, but this effect is not statistically significant. Finally, the study's onetime interventions continue to generate statistically significant reductions in water use for up to four months after they are implemented.

4. SOUTH AFRICA:

Providing information to increase bill payment among water utility customers

CHALLENGE: Improving people's access to basic utilities is viewed as a key challenge in many developing countries. However, consumers' ability or willingness to pay for ser-

vices can be an important constraint to investment in water sector. In consequence, nonpayment for public utilities is an important constraint to expand service access. One of the policies to address nonpayment is punishment in the form of denied service, which may work well in developed countries, but this may not be the case in developing countries. In these, the incentive of denying the service is limited when consumers do not have enough income to pay for the bill. Jointly, aggressive enforcement could go against social perception or fairness, eroding trust in local governments and even resulting in more nonpayment or even civil unrest.

INTERVENTION: To address the policies that might be effective to address nonpayment in developing countries, Szabó & Ujhelyi (2015) implement a water education campaign in low-income peri-urban areas in South Africa. Providing information about different aspects of water consumption may improve the households' water management and consequently lower nonpayment. Education officers visited a treatment group of 500 households to give them accessible information about various aspects of the water consumption process, including the water meter, the bill, and the amount of water used by everyday activities. To evaluate the program the authors combined administrative billing data on the full population of consumers with survey information on the treatment and control group.

RESULTS: The results from the randomized water campaign showed it was successful in reducing nonpayment in the short run. Compared to a control group, treated households were more likely to pay their bill and make larger payments. On average, treatment group increased total payment by approximately 25% in the first quarter following the treatment. The treatment increased the fraction of households making at least one payment in the three months following the intervention by about 4 percentage points relative to a mean of 54%. While temporary, these are large effects, and provide evidence that strategies other than increased enforcement can lower nonpayment. Moreover, evidence is not consistent with the treatment operating solely by increasing information. Rather, authors support the idea that payments are an expression of reciprocity for the providers education efforts. If consumers appreciated the provider's effort in reaching out to the community, they may have felt guilt about not paying more. This explanation is consistent with the patterns observed in the data.

WHERE ELSE CAN THEY BE APPLIED?

Despite the recent efforts in applying behavioral insights to address challenge in the water sector, several questions remain that could benefit from the approaches presented here. Some of them are presented below.

PROVIDER LEVEL CHALLENGES

ENCOURAGING GOOD QUALITY LAST MILE COLLECTIONS

The financial constraints that utilities face put an additional burden on their ability to ensure good quality last mile connections. To provide this service, utilities require that willingness-to-pay is high enough to justify the expansion, or a subsidy to finance the operation. However, willingness-to-pay often depends on the quality of the service. For example, Koehler, Thomson, & Hope

(2015) monitor handpump usage in rural Kenya and determine that dramatic improvements in maintenance services influence payment preferences. These findings reveal how utilities can communicate in a better way improvements to enhance payment and customers willingness to acquire these services. This study relates with the intervention presented in Nicaragua, on different mechanisms to improve maintenance, where behavioral mechanisms can be valuable tools.

ENCOURAGING TRUST IN UTILITIES

Trust between the customers and water utilities affects customers choices to acquire new services, pay for the ones they already have and collaborate with the utilities. Trust is crucial for utilities wishing to have community support for upgrades to water treatment facilities, promote water tap consumption and reduce household reliance on bottled water (Weisner, Root, Harris, Mitsova, & Liu, 2020). Three points results relevant in the importance of trust in water utilities:

1. Consumers judgements on tap water: customers perception of drinking water is usually based on an individual's subjective judgment to the aesthetic and non-aesthetic qualities of water. When the public perceive risk in the tap water and raise complaints about it, effective communication and strategies that can build confidence must come into place from the utilities (Weisner, Root, Harris, Mitsova, & Liu, 2020) (Goetz, 2018).

2. Impact of trust on ownership model: Birchall (2002) states that consumer ownership model of water has advantages and would be less costly than investor-ownership. Advantages emerge due to trust relation in these model that promote social goals and ethical practices into the business strategy giving a cooperative advantage.

3. Trust in private sector participation contracts: lack of trust in outsourcing activities of water services resulted in partnerships based in the management of mistrust, leading to inefficacy, weaking cooperation, and limiting innovation.

INCENTIVIZING PROVIDERS TO DELIVER SAFE WATER

Studies have found a set of approaches that can be helpful to incentivize providers to deliver safe water if they are further implemented. An example is benchmarking utilities not just based on their monetary performance but also on their improvements in reaching the poorest populations. This can motivate utilities to incorporate strategies that ensure access to safe water (Nagpal, Malik, Eldridge, Kim, & Hauenstein, 2018). One of these can be bottom-up approaches, characterized by

a strong involvement of alternate service providers, that have shown effectiveness in improving access to safe water supply (Narayanan, Rajan, Jebaraj, & Elayaraja, 2017). The question still remains on how to engage the community. Other example can be for the utilities to promote new technologies as the implementation of rainwater harvesting methods (Tran, et al., 2020); where the adoption of these technologies faces several behavioral barriers.

ENCOURAGING COLLECTION RATES FOR WATER SERVICES

The need to encourage collection rates is imminent to ensure the sustainability of water service delivery. For utilities and municipalities serving the poorest populations, there is insufficient local revenue from tariffs or transfers to fund the necessary operational and maintenance expenditures (Nagpal et al., 2018). Usually, nonpayment is explained by the lack of financial resources, but behavioral insights have shown the existence of more factors. In Guatemala, nonpayment was a demonstration of consumer dissatisfaction with current water services (Vásquez & Alicea-Planas, 2015); and in Mexico the lack of penalties enforced were associated with nonpayment of water bills (Aguilar-Benítez & Saphores, 2008). Nimble evaluations may be especially relevant to address these issues as they can help to understand further the behavioral barriers behind nonpayment, and they can serve as the starting point to larger evaluations. An example of the potential of these approaches is presented by Szabó & Ujhelyi,(2015) who found that water education campaign in low-income areas of South Africa increased total payment by 25%. Jointly, there is evidence that increasing service quality is associated with consumer satisfaction (Vásquez & Alicea-Planas, 2015), time and monetary savings (Burt, Ercümen, Billava, & Ray, 2018); which can translate into higher payment rates.

HOUSEHOLD LEVEL BEHAVIORAL CHALLENGES

ENCOURAGING WATER TREATMENT AT HOUSEHOLD LEVEL

There are several obstacles for water utilities to ensure sustainable improvements in water supply at the moment, and there is a need to encourage water treatment when quality cannot be guaranteed at household level.

However, household water treatment is still low. In Andhra Pradesh, India only 36% of the responders of a survey conducted by Poulos, et al., (2012) reported treating water at home at some point during the year. This has given a great importance of household water treatment and storage product. Despite this situation, the adoption and continued use of these products remains low. Understanding household preferences for

BOX 2. HOW DOES FIELD-LEVEL LEADERSHIP (FLL) TRAINING PHASES WORK?

The FLL training consists of 3 different phases aimed to change employees motivation. The first is a core workshop which comprises of a series of intensive group-work sessions conducted over a period of 3-4 days where participants will be able to fully express themselves as well as their sentiments at work in a safe space to identify areas of work where they can commit to improving. In the second field applications where employees are back to their work and can reflect on the work-

shop experience. Finally, a follow-up self- reflection workshop is conducted. All in all, the three phases of the training program take about 6 to 9 months to complete. These interventions were aimed at changing motivation for employees to address customer complaints and ultimately improve service delivery to the customer through shorter response times to complaints, connection requests, and reduction in the frequency of service error and non-revenue water.

these products can be used to create demand through product positioning and social marketing (Poulos et al., 2012).

WATER CONSERVATION UNDER SOCIAL NORMS INFORMATION TREATMENT

Resource conservation has been one of the areas where behavioral economics have been applied the most through Social Norms Information Treatments (SNIT). However, there is still a lot of space for research in this matter as SNIT can take many forms and they have shown positive results when applied. In fact, these type of conservation programs are easy and low-cost to implement and can result in short-term reduction in energy and water used of about 2-5 percentage (Nauges & Whittington, 2019). Examples of nudges that haven't been studied widely are evoking perception of peer rank -how we perform relative to our peers- (Bhanot, 2017) and social comparisons present as a percentage rather than in levels of consumption (Brent, et al., 2017). Both interventions resulted in reductions in water consumption. These behavioral approaches result relevant for water conservation also under free basic water policy, as is the case of an intervention conducted in South Africa (Scheihing, Tanner, Weaver, & Schöniger, 2020) for which results are pending.

The promising results of these type of interventions require further study as the changes in customers consumption levels may have further consequences, both positive and negative, on the objectives the utilities wan to achieve. Positive consequences are seen in the experiment conducted by López-Rivas (n.d) in Colombia where accounting for spillover effects of norm-based messages resulted in even more effective reductions in consumption than traditional estimations. Negative consequences were identified by Brent & Ward (2019), were providing more information to households customers increased consumption levels in Australia.

ENVIRONMENTAL AND AGRICULTURAL ISSUES

ENCOURAGING WATER CONSERVATION BY FARMERS

Promoting water conservation behavior among farmers requires novel strategies which have recently been explored. Currently, the agricultural sector consumes 70% of the global water supply and is among the most water-intensive activities (Ouvrard, Préget, Reynaud, & Tuffery, 2020). As a consequence, farmers water consumption is a public priority which can be addressed using behavioral tools. The main body of literature on behavioral tools has focused on consumers. However, the decision-making process of farmers is different from that of consumers and nudges must respond to these specific motivations. Regarding these differences behavioral interventions have been tested in the context of farmers in France, as the case of Chabe-Ferret et al (2019) that used social compar-

isons nudges, or Ouvrard et al (2020) that promote voluntary adoption of smart water meters using conditional subsidies and green nudges.

ENCOURAGING WATER REUSE AND RAINWATER HARVESTING SYSTEMS

The water scarcity many regions are already facing- and much more will be faced- calls for more options to sustainable water supply. Examples of these options include water reuse on water-stressed regions and rainwater harvesting systems. The adoption of these by water utilities and households may be further addressed through behavioral insights. In fact, Goodwin, Raffin, Jeffrey, & Smith (2018) conducted a behavior-oriented intervention that consisted in providing information to the public about reuse options. Through different forms and mechanisms of communication shown to the public around reuse, compliance messages and general messages about water reuse had statistically significant improvement for some attitudes. Regarding rainwater harvesting systems (RHS) several studies have investigated the viability of them (Ali, Zhang, & Yue, 2020), their crucial impact on relieving pressure to groundwater extraction (Krishna, Mishra, & Ighalo, 2020), their viability to supply human consumption water in certain contexts (Saidu, Dabi, Ezashi, & Bose, 2021); and their benefits using benefit-cost analysis (Dallman, Chaudhry, Muleta, & Lee, 2016). The potential of RHS to alleviate water challenges has been recently studied, however it still lacks literature about methods to implement them both in households and water utilities.

DISCOURAGING OVERUSE OF GROUNDWATER BY SMALL FARMERS

Groundwater is one of the main and safest sources of water. Nonetheless, the intensive use of these resource, in particular by the agricultural sector, has created an urgent need to design governance mechanisms at local and national level (Faysse, 2001) and evaluate hard evidence on the responses that work. The literature on these types of resources has proposed measures at different levels:

- 1. Government regulation:** in some countries, as Mexico and India, the government has implemented subsidies for energy used to pump groundwater which has artificially reduced the cost of pumping water fostering overexploitation. Lab experiments that explore the impact of changing the structure of subsidies found that farmers may reduce water pumping when eliminating, reducing, or decoupling subsidies, but the most feasible option would be decoupling (Foster, Rapoport, & Dinar, 2017) (Foster, Dinar, & Rapoport, 2018). These results are valuable; however, they haven't been tested in farmers. Therefore, it is imperative to conduct further studies in the population of interest as behavioral barriers can differ substantially.

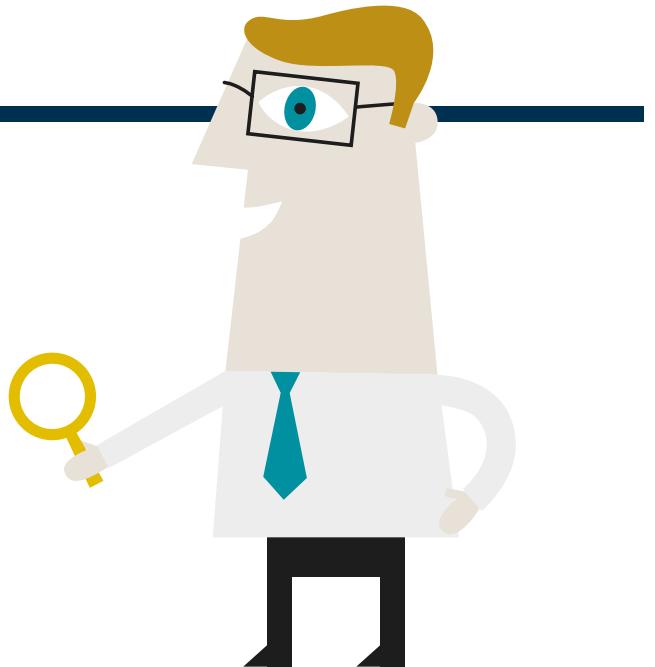
BOX 3. BEHAVIORAL BARRIERS BEHIND NONPAYMENT

eMBeD (n.d) has identified three factors present in the decision environment that explain nonpayment from a behavioral perspective: reciprocity, unperceived threat of punishment and negative descriptive norms. Reciprocity is a type of social norm in which the most likely response to a social exchange is similar to the one received, either positive or neg-

ative. In this case, when households receive a poor service delivery, they tend to respond similarly, providing justification to their nonpayment. Finally, households may perceive the default behavior as "the norm" rather than the exception, which discourages bill payment. When households act like this, they may be subject to inertia and a default bias.

2. Collective action: literature argues that created and agreed rules within the community, along with tools that ensure the enforcement of those rules, can be effective in the provision of resources as groundwater. Group heterogeneity, characteristics of the group, and the diversity of ecological conditions, call for specific rules in each context (Kurian & Dietz, 2004). These call for methods that are able to test tools in a faster and less costly way, as nimble evaluations

3. Providing information and changing social norms: Resource management should be considered a socio-economic issue with a profound technical component (FAO, 2003). In that sense, the dissemination of information to impact farmers decisions becomes key. In fact, high quality economic and scientific research is one of the main issues in establishing groundwater markets (Wheeler, Schoengold, & Bjornlund, 2016).



DISCUSSION

This brief has presented a fraction of questions in the water sector that could gain insights from behavioral interventions and nimble evaluations. The interventions that were presented can be applied in different country contexts, contributing to improve operational outcomes elsewhere.

The examples mostly focused on addressing behavioral barriers at the customer level and to a lesser extend at service provider level, but there is a need for more research on how to address behavioral issues at all levels. Customers can be encouraged to take up a service, but if the utility shows a history of poor service quality, encouraging connection or service uptake may only backfire. Also, several nudges remain to be untested at customer level and policymakers' challenges have not been studied.

In conclusion, it is important to stress that behavioral interventions are not a catch-all solution. What they can be is a low-cost way to make impactful gains when placed within the context of broader institutional reform and investment in the

water sector. The combination of behavioral interventions, nimble evaluations, and the development and implementation of a World Bank investment is therefore a perfect opportunity to improve the quality of project rollout.

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