Breaking the culture of non-payment: A qualitative analysis of utility intervention Project Sarbulandi in Karachi Electric, Pakistan

Husnain Fateh Ahmad (Sewanee: The University of the South)
Ayesha Ali (Lahore University of Management Sciences)
Robyn C. Meeks (Duke University)
Victoria Plutshack (Duke University)
Zhenxuan Wang (Duke University)
Javed Younas (American University of Sharjah)*

Abstract

Reliable electricity access is vital to economic growth, but the financial challenges of electricity utilities in low- and middle-income countries can undermine service quality. In Karachi, Pakistan, the local utility undertook an intervention aimed at reducing losses and improving bill recovery. The intervention increased budgets of underperforming areas to build upon ongoing efforts to improve infrastructure by also providing staff incentives and increasing customer engagement activities. We employ qualitative techniques to study managers' and customers' perceptions of both the intervention and the mechanisms driving its effects. We find that while managers credit the multipronged nature of the intervention for increasing trust and allowing the utility to weather the pandemic, customers focused primarily on visible infrastructure improvements.

Keywords: electric utilities, Pakistan, cost recovery, service quality, COVID-19, customer trust

Acknowledgments: This project was funded with UK Aid from the UK government under the Applied Research Programme on Energy and Economic Growth (EEG), managed by Oxford Policy Management. The views expressed in this paper do not necessarily reflect the UK government's official policies. We also acknowledge the grant number BU0092 by American University of Sharjah. We would like to share our deep appreciation to the management and staff of Karachi Electric for their support and cooperation in conducting this study. Our sincere thanks also go to Ramsha Sajid and Suhaib Imtiaz for their excellent research assistance and comments by the participants at New York Conference on Asian Studies 2022 at Syracuse University. Finally, we are grateful to Thomas Klug for graphic design assistance.

Role of the funding source: EEG provided financial support, but was not involved in study design, data collection, analysis or interpretation, writing or the submission of this article.

***Corresponding author:** Javed Younas, Department of Economics, American University of Sharjah, Sharjah, United Arab Emirates. E-mail: jyounas@aus.edu. Ph: +971 6 515 2612

1. Introduction

Economic prosperity and development are hindered if a country is unable to meet infrastructure needs. In particular, access to reliable electricity is an important component of economic growth in the long run (Fried and Lagakos, 2023). In many low- and middle-income countries, however, financial challenges pervade the electricity sector and threaten to dampen economic growth (Trimble et al., 2016; Zhang, 2019). Non-technical losses, which cost electricity utilities approximately $25 billion per year worldwide (Depuru et al., 2011), are a major contributor to these financial burdens. Furthermore, losses disproportionately affect utilities in low- and middle-income countries.[1]

Such financial challenges are a severe problem in Pakistan, leading to electricity generation constraints and subsequent load shedding. In an effort to reduce losses, Karachi Electric (KE), Pakistan's only private and vertically integrated utility provider, began to invest in theft resistant cables starting in 2015 (Ahmad et al., 2023). To build upon the effects of those infrastructure improvements, KE implemented Project Sarbulandi (henceforth, "the project") in November 2019. This project was a multi-pronged intervention that, in an effort to also improve bill payment rates, added staff incentives and community engagement activities to infrastructure improvements. Soon thereafter, in February 2020, the first cases of COVID-19 were identified in Karachi and the city was on lockdown from March 22 until May 9 of that year. During that time, in-person business operations were interrupted with severe local economic effects. While COVID-19 affected all of KE operations, the utility's administrative data suggest that the sub-

[1] According to the calculations based on IEA data (OECD/IEA, 2018), transmission and distribution (T&D) losses account for 18% and 16% of total output in low and middle-income countries, respectively, which is approximately 3 times the rate these losses for high-income countries.

divisions within their territory, known as Integrated Business Centers (or IBCs), that had implemented the project rebounded more quickly after the COVID-19 lockdown relative to other similar IBCs.

Motivated by this suggestive evidence on utility finances post-pandemic, we leverage Project Sarbulandi as a unique case study to analyze the perceived strengths and weaknesses of programs that combine technical and non-technical interventions in effort to increase cost recovery in the energy sector. In particular, we use qualitative methods to elicit and understand KE's theory of change, as a first step in identifying possible mechanisms for reducing theft and improving cost recovery. Furthermore, we contrast the perception of KE managers, with the views of its customers, vis-à-vis the project's effectiveness.

Our research design and findings inform a growing literature on electricity quality (see e.g., Carranza and Meeks, 2021; Meeks et al., 2023) and cost recovery (e.g., McRae, 2015; Jack and Smith, 2020; Ahmad et al., 2023) in low- and middle-income countries. Developing countries often subsidize their utilities and/or the services that they provide, with the goal of making those services accessible to the poorest customers. Yet, because they fail to recover the full cost of electricity service provision, the electricity generation and distribution systems of such utilities are often underfunded. In some settings, the government may bail out utilities, but that is infeasible in countries with more limited financial resources (Huenteler et al., 2017).

The complexity of this relationship between cost recovery and electricity service quality makes improving public service provision a challenging problem to tackle. Interventions to improve consumer bill payment and cost recovery, such as purely technological approaches or reforms to tariff structure and prices commonly undertaken by utilities and regulators, have been

tested in the past.[2] This paper details an intervention that – in an effort to address this obstacle to the provision of public services – employed a unique decentralized implementation approach and a combination of both technical and non-technical interventions.

In this paper, we report the subjective views of KE managers and customers. Therefore, our task is not to determine the objective effects of the intervention. Rather, we seek to provide insights into three questions: 1) What was the stated approach utilized by the project, as it was envisaged and implemented by those on the ground? 2) What impacts do the project's architects and administrators believe the project had and do they believe it mitigated the negative effects of the COVID-19 pandemic on utility functioning? 3) Do the perceptions of those implementing the project align with the experiences of their customers?

We vary our approaches and the data employed to shed light on each of these questions. To answer the first two questions, we leverage data from interviews with the general managers ("managers") of the six sub-divisions that implemented the project. In contrast, to address the last question we report findings from focus groups with customers in areas where the project was implemented.

Our results indicate very different perceptions of the project across the types of stakeholders. We find that managers perceive the multi-pronged approach as a major strength of the project. They credit improved performance not just to infrastructural upgrades, but also to their ability to leverage community engagement and build trust among their customers. This is in stark contrast to customer perceptions, which are indicative of near universal distrust of KE and -

[2] See Asantewaa et. al., (2022) for a comprehensive review of electricity sector reforms.

aside from an awareness of visible changes in the distribution infrastructure – little knowledge of the project's interventions.

These results present important insights as to how a project's intended goals and mechanisms may diverge from realities and perceptions on the ground. Our findings that customers focused on the infrastructure improvements is aligned with quantitative analyses on the utility's performance by Ahmad et al. (2023). Ahmad et al. (2023) study a purely technical intervention that preceded Project Sarbulandi and replaced bare distribution wires with theft-resistant aerial bundled cables (ABCs). Their quantitative analyses, which utilize both data preceding the project and control for other interventions, show that the major driver of improvements in KE's financials was the conversion to ABCs (ibid). Taken together, the current paper highlights the need to not just articulate a theory of change, but to test its validity.

The remainder of the paper proceeds as follows. Section 2 covers background information, by reviewing related literature from multiple countries discusses the connections to this paper and then providing information on the utility's operations, the challenges it faces, and the conceptualization of Project Sarbulandi. Section 3 addresses our data collection efforts and the qualitative methodology used. Section 4 presents and discusses results on the perceived effects of the program from the perspectives of both the utility and its customers. Finally, Section 5 concludes.

2. Background

2.1 Related Literature

Low bill payment and high theft mean that an electricity distribution company has low cost recovery, which is problematic for multiple reasons. First, it makes it difficult for the utility

to purchase the imported fossil fuels needed to generate electricity. Low cost recovery also means less money to invest in infrastructure maintenance, modernization, and technical upgrades (Carranza and Meeks, 2021). Poor quality electricity services, including load shedding, outages, and voltage fluctuations, can result from underinvestment in infrastructure as well insufficient electricity generation (Burgess et al., 2020). Moreover, the unpredictable additional load from informal connections may induce brownouts and blackouts during periods of peak consumption (Depuru et al., 2011).

Low-quality electricity services are known to decrease the economic benefits from connections to the electrical grid (Pargal and Ghosh Banerjee, 2014; Zhang, 2019). Consumers that pay for their electricity consumption bear the greatest cost of these high non-technical losses in the form of higher electricity tariffs to cover losses, while enduring inferior quality services (Yakubu et al., 2018).

Electricity theft and bill non-payment may be reduced by various interventions, including technical or engineering methods that include modernizing metering systems and power lines, managerial methods such as inspections and customer engagement, and system changes including deregulation and privatization (Smith, 2004). A growing, yet limited body of evidence exists on the impacts of such interventions. Recent studies document efforts to reduce losses through various technologies, such as smart meters (Ahmad, 2017; Depuru et al., 2011) and prepaid meters (Jack and Smith, 2020; Mwaura, 2012). An investigation conducted by Ahmad et al. (2023) finds that replacing bare electricity distribution wires with aerial bundle cables (ABCs) between 2018 and 2020 decreased theft and increased revenue recovery in the city of Karachi.

These theft-resistant cables led to financial gains by increasing the number of formal electricity customers and increasing consumption among the formal consumers.[3]

Others note a limited role for technology-only interventions in loss reduction and argue for complementary non-technical interventions. There is a call for a better understanding of the role of a broader suite of interventions – particularly non-technological interventions -- in reducing electricity losses (Bhatt and Singh, 2020; Smith, 2004; Winther, 2012). Using monthly feeder-level electricity data from mid-2012 to mid-2018 for Karachi, Pakistan, Ali et al. (2023) evaluate the effect of a reward and reprimand load shedding policy on reducing electricity theft, where hours of load shedding were tied to loss levels at each feeder level. Their findings suggest that an additional hour of outages reduced non-technical losses by an estimated 5.4 percentage points, which is equivalent to a saving of 3.3% of total electricity supplied into the distribution system.

This paper complements existing studies on technical (Ahmad et al., 2023) and non-technical interventions within electricity distribution in Pakistan (Ali et al., 2023). Project Sarbulandi added a mix of technical and non-technical interventions to the ongoing existing efforts (loss-based load shedding and theft resistant cable installation), making this case study a unique opportunity to shed light on an intervention that provides a combination of multiple efforts.

[3] Also, see Younas and Ali (2022 & 2021) for a detailed discussion on the electricity theft, non-payment of bills and distorting nature of electricity subsidies in Pakistan.

Finally, given the project leverages different types of interventions, the paper aims to understand and pin down KE's *implicit* theory of change.[4] By doing so, we contribute to the literature on theories of change, which are viewed as a crucial first step in evaluating any type of intervention. A theory of change helps describe how an intervention is *supposed* to work (Weiss, 1995). It requires the researcher to create a blueprint of the project, identify inputs (i.e., the multiple activities and actions the project would undertake), and link them to measurable outputs and results by explicitly stating the assumed mechanisms through which inputs are expected to yield outputs (Gertler et. al., 2016; Morra-Imas et. al., 2009). Constructing a theory of change requires the evaluator to not just identify the relevant output measures, but also the stakeholders and mechanisms through which inputs are assumed to enact change, allowing them to causally establish the effects of the intervention. By making Project Sarbulandi's theory of change explicit, the paper not only paves the way for future research to evaluate it, but also provides novel insights into how corporations envisage, plan for, implement and finally evaluate their projects.

2.2 Electricity Utility Challenges in Pakistan

We focus on Karachi Electric (KE), which serves Karachi, Pakistan, a sprawling mega city of over 20 million people. KE's distribution business is organized into 30 local offices known as Integrated Business Centers (IBCs), which are responsible for electricity distribution, billing, and collection in the areas that they serve. KE has a large and diverse customer base ranging from

[4] While it is possible that KE had an internal explicit theory of change, it has not been shared publicly or with the research team.

those located in prosperous residential, commercial, and industrial areas to those in informal settlements. Karachi's high settlement density and high percentage of informal settlements come with significant non-technical losses, largely caused by illegal wire hooking (*kundas*) onto the nearby service cables.

Since 2009, the company's management has focused on reducing losses through the allocation of outages (load shedding) according to past losses, infrastructure improvement programs, and customer facilitation initiatives. According to the utility's reports, the average transmission and distribution (T&D) losses, which arise due to technical inefficiency, unmetered consumption, and theft, declined from 35.9% to 19.1%.[5] Over the same period, planned load shedding ceased in 70% of the city (Karachi Electric, 2019).

The losses suffered by KE are comparable to those experienced in the rest of the country. The national average T&D losses were 18% in 2018-19, with certain distribution companies reporting losses upwards of 30% (NEPRA, 2019). Like other utilities, KE faces challenges with both technical and non-technical losses. Non-technical losses include electricity theft (which typically occurs through meter tampering and illegal connections to bypass meters), bill non-payment, and billing irregularities.

[5] Engineering estimates by Abdollahi and co-authors (2020) show that technical losses, attributed to heat dissipation during distribution are at most 6%. Further, one infrastructure upgrade KE undertook was the conversion of some distribution lines to Aerial Bundled Cables, which may have lower line losses, but the decline in a similar setting (Iran) is shown to be about 1.5% (ibid.). We therefore interpret the remainder of losses, and majority of the fall in losses to be due to non-technical losses or theft.

2.3 Project Sarbulandi

In July 2019, KE's central management began planning Phase 1 of the project, for which six high-loss IBCs were selected. The managers of the selected IBCs were directed to form a four-person team to prepare, present and defend a detailed operational and financial plan for reducing losses and improving recoveries. IBCs could customize their multipronged strategies by assigning priorities to various technical, managerial, and customer-facing interventions. Phase 1 of Project Sarbulandi was launched in November 2019 and was designed to complement the ongoing efforts (i.e., installing theft-resistant cables and loss-based load shedding) that started earlier. The installation of ABCs, started in 2015 and documented by Ahmad et al. (2023), continues in the background as Project Sarbulandi was introduced. Project Sarbulandi was only implemented in a subset of six IBCs with Karachi and began at the very end of 2019.

The project provided resources for a range of intervention types – human capacity building, technical solutions, and community outreach – all of which have the potential to achieve the objectives of reducing losses and improving cost recovery. The multiple intervention approach, mixed with increased funding and autonomy, aimed to be an additional push beyond those ongoing interventions and break the cycle of high losses and poor-quality electricity services.

COVID-19 affected all KE operations. However, administrative data shared by the utility suggests that the Phase 1 Project Sarbulandi IBCs rebounded more quickly following the COVID-19 lockdown, relative to other similar IBCs (Table 1). Given the project's first phase began shortly before the COVID-19 pandemic, the timing allowed us to study whether KE managers perceived that the project mitigated the effect of negative exogenous shocks.

Table 1: Average Losses and Revenue Recovery, by Sarbulandi Phase 1 and 2 IBCs.

	Pre- Sarbulandi		Post- Sarbulandi	
	Nov 2018-Feb 2019	Mar 2019-Oct 2019	Nov 2019-Feb 2020	Mar 2020-Oct 2020
Panel A: Losses				
Phase 1 IBCs	0.17	0.30	0.14	0.28
Phase 2 IBCs	0.19	0.33	0.18	0.39
Panel B: Revenue Recovery				
Phase 1 IBCs	0.88	0.85	1.02	0.75
Phase 2 IBCs	0.76	0.76	0.80	0.70

Notes: Author calculations made using KE administrative data. Losses are measured as (Units Sent Out - Units Billed)/ (Units Sent Out) and Revenue Recovery is measured as (Net Credit/Gross Billing). Phase 1 IBCs are Korangi, Landhi, Liaqatabad, Nazimabad, Orangi II and Surjani I. Phase 2 IBCs are Baldia, Gadap, Lyari II, Malir, Organi I and Surhani II.

We view the current paper's task of pinning down the theory of change as an important first step in evaluating the project. In what follows, we report how those implementing the program perceived it would take effect (i.e., their internal theory of change). Since the managers of the IBCs were given significant autonomy in implementing the project, we explore if there was a stated consensus on the theory of change and what managers believed were the outcomes of various initiatives. Finally, based on the data from our focus group discussions with the customers, we compare the managers' perceptions with those whom they serve.

3. Methodology

3.1 Research Objectives and Analytical Approach

The objective of this study was to determine KE management's theory of change, which is vital to understand the utility's goals for this intervention. Qualitative methods are the most appropriate for such an exercise, as they allow us to identify policies and activities that are

perceived as inputs and help identify potential variables as measures of outputs. Qualitative methods are particularly valuable for their insights into causal mechanisms (Yin 1981; Eisenhardt 1989; Corbin & Strauss 2008; Ridder et al. 2014); however, this paper is meant to be descriptive in nature, as we are not identifying any causal effects. Our methods, detailed below, allow us to identify and even visualize manager perceived theory of change (see Figure 1). Finally, we also elicit manager and customer perceptions of the effects of the project to lay the groundwork for future research.

Although the research asked specific questions of the interview data, we did not apply a top-down analytical framework, opting instead to allow the interview subjects to speak for themselves. This necessarily means that the study's findings reflect the perceptions of the informants (Andrews, 2012; Berger and Luckmann, 1990; Eriksson and Kovalainen, 2016). Preliminary numbers suggest that these IBCs did experience an increase in bill payments and a decrease in losses (see Table 1). This paper explores the managers' perceptions of the mechanisms by which the project may affect these outcomes and compares them with customers' experience of potential impacts. We hope that the results from this qualitative work will help motivate future quantitative research, allowing further examination of the project.

We utilize an interview-based approach as it can be effective for unpacking the mechanisms through which change may occur. Unlike structured surveys, this approach does not make assumptions about how policies work– it simply asks the respondent for their subjective perception of the pathways to change. Qualitative studies can provide insight into such mechanisms by allowing the researcher to explore the rich contextual information shared in an interview without making assumptions regarding how these interventions are working (Yin 1981). Exploring these mechanisms first through interviews gives the researcher material for

forming hypotheses (Hair et al. 2007; Corbin & Strauss 2008; Barr 2004). The obvious limitation of such a study is its inability to determine the true effect of a policy or determine the relative significance (if any) of each mechanism.

3.2 Data Collection

To answer our research questions, we interviewed the managers of all six IBCs that had already begun implementation of Project Sarbulandi (i.e., IBCs in Phase 1) plus two additional IBCs that had yet to begin implementation (i.e. IBCs in Phase 2). These IBCS are listed in Table 2. Questions covered the perceived impacts of each intervention, implementation challenges, and issues surrounding electricity theft and bill payment. The interviews with 2 IBCs in Phase 2 enabled us to also ask questions about the perception of the project's impacts as they compared to an IBC that had not yet implemented it. Interviews took place in-person between 20th October and 17th December 2020. We note that, as with any perception-based study, our results will rely on opinions of participants who may have systematic biases. Also, the selection of IBCs into two

Table 2: Characteristics of General Managers Interviewed and Focus Group Discussions.

Interview Code	Project Sarbulandi Phase
GM1	Phase 1
GM2	Phase 1
GM3	Phase 1
GM4	Phase 1
GM5	Phase 1
GM6	Phase 1
GM7	Phase 2
GM8	Phase 2

Focus Group Code	Gender
FGD1	Female
FGD2	Male
FGD3	Female
FGD4	Male

different phases implies that there are likely some differences between the characteristics of phase 1 and phase 2 IBCs and their general managers (GMs).

In Fall 2021, we conducted four focus groups with the utility's residential customers – two with female respondents and the other two with male respondents – to better understand their perspectives on the project and the utility's efforts to reduce losses. In total, 24 customers from high-loss areas participated in the focus groups. Focus group enumerators asked questions on topics such as the quality of electricity service, billing and payment issues, *kunda* practices and other ways of meter tampering, as well as their perceptions about the utility programs in their communities. Protocols and questions for both GM interviews and focus groups are provided in the appendix.

Manager interviews and focus groups discussions were transcribed and translated from Urdu into English. Manager transcripts were coded with the aid of the qualitative data analysis software NVIVO, looking for IBC characteristics, key actors, key interventions, the impact of COVID-19, and key themes. Focus group discussions were summarized and used as another means to corroborate the narratives in the manager transcripts. We recruited participants for the focus group interviews who were residential consumers of electricity from the high-loss IBCs of Liaquatabad, Lyari 2, Surjani 1 and Korangi. Within these IBCs, participants were recruited from residential areas or nearby commercial areas, where illegal usage was high (i.e., there are visible "kundas"). A map of IBCs and a list of feeder names with high and very high losses was provided. Furthermore, we avoided particularly unique areas of greater Karachi (e.g., outlying areas, hilly areas). Before launching the full-scale focus group interviews, the survey firm pilot tested the protocols by interviewing a few randomly selected households, which allowed them to test how some terms were perceived (e.g., "fair/accurate/reliable/reasonable" and "expensive").

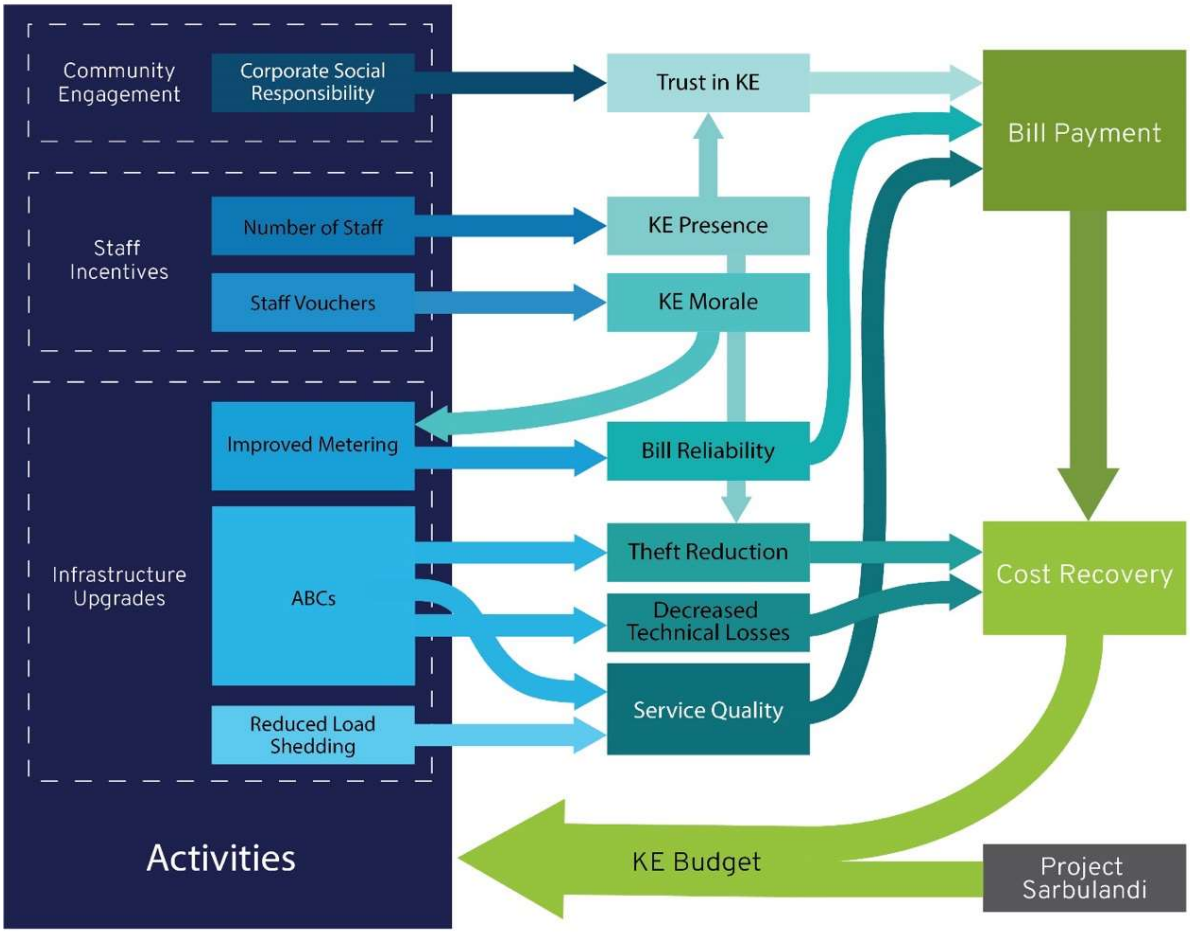
Throughout our study, we utilized inductive thematic analysis. Inductive analysis takes a "bottom-up" approach, where themes are generated from the data itself with no assumptions imposed by the researcher (Patton, 1990). Given our research objective was to identify our subjects' perceived theory of change, the inductive methodology is preferred as it minimizes any biases that may arise from the research team's own knowledge and interests in the area, as it is driven by the data and not by pre-specified themes (Braun & Clarke, 2006).

In addition to thematic coding, the codes for key interventions and the impact of COVID-19 were referenced to answer the key research questions. Answers to those questions were broken down by the activities that took place, how the intervention worked, what managers believed was the impact of the intervention, and finally, how (and whether) customers perceived these changes.

4. Results and Discussion

The project is not a single intervention, but rather provides a set of targets, a bottom-up decision-making structure that gives IBCs autonomy, and additional resources to implement their ideas. First, we detail and visualize the manager's perceived theory of change for the project, and then report what they perceived were its impacts. Given the timing of the project, we also leverage our data to understand how managers perceived COVID-19 affected their operations, and if Sarbulandi helped them mitigate some of these effects. Finally, we analyze how customers experienced these initiatives.

Figure 1: Manager's perception of the project's mechanisms for change and their cyclical nature.



4.1 Mapping the Theory of Change: An Ecosystem of Interventions

In general, managers in phase 1 IBCs utilized the financial resources from Project Sarbulandi for three types of interventions: infrastructure improvements, customer engagement and staff incentives. Our analysis shows that managers perceive these multiple intervention types as symbiotically working together. As illustrated in Figure 1, managers believe that infrastructure interventions reduce theft and improve service, which, in turn, increases consumer trust in and support for KE. Staff incentives (e.g., vouchers for groceries) increase morale, but they also

speed up the rollout of these projects, as staff compete to reach targets, such as the number of meters installed. Meanwhile, customer engagement initiatives such as medical camps, education, and outreach help to strengthen KE's support while also ensuring that consumers know who to contact if they have a problem, which helps to improve bill payment.

4.2 Manager Perceptions of the Project's Impact

As mentioned above, managers engaged in three types of interventions: infrastructure upgrades, customer engagement, and staff incentives. In general, managers found that infrastructure upgrades not only reduced losses and improved bill collection, but also helped improve KE's rapport with its customers thereby changing the nature of electricity theft. The most frequently mentioned infrastructural change was upgrading bare distribution wires to Aerial Bundled Cables (ABCs), followed by the installation of new meters. Based on the interviews, our understanding is that managers could use their resources to install additional ABCs (i.e., if their territory was not fully covered already by these theft-resistant cables). Project Sarbulandi built upon those ABC installations and the efforts were expanded under the project (GM5), because: (i) ABCs made attaching illegal connections more difficult; and (ii) the coating on the ABCs reduced the risk of electrocution (GM2).

Managers report that these interventions could be augmented with greater effort to expand the number of formal electrical grid connections. This was achieved in certain IBCs by expanding infrastructure to informal settlements (GM4) and lowering the number of documents required for a new connection (GM3).

Table 3: Summary of managers' perceptions of intervention impacts.

Intervention Type	Impact	Number of IBCs Cited
Infrastructure	Improving Billing	3
	Improving Bill Collection	2
	Improving Support	3
	Improving financials	3
	Changing Patterns of Theft	4
	ABC wires helped mitigate effect of COVID-19	2
Staff Incentives	Improving Morale	4
	Improving KE end results	1
Customer Engagement	Improved Customer Education	3
	Improved support for KE	3
	Improved accessibility of KE	3
	Improved customer engagement mitigated effects of COVID 19	2

Managers perceived that these interventions impacted both KE's financial situation (GM5) and chipped away at the "culture" of non-payment in their areas, thus functioning together to improve service quality and cost recovery. Table 3 summarizes the types of perceived impacts and the number of IBC interviews.

Due to new infrastructure, the managers believe the use of illegal connections decreased (GM2, GM5, GM6). They further believe that these changes helped increase both service quality and customer trust in KE (GM2, GM5, GM6). The changes in financials reported by some managers are substantial. For example, GM3 reports a decrease in losses from over 50% to 15% and an increase in cost recovery from 30% to over 90% following the installation of ABCs.

Some challenges to cost recovery remain, however. For example, in some cases, the realization that *kundas* were not effective with ABC wiring, led to resistance in the form of physical confrontations with and criticism of KE staff who were involved in infrastructure upgrades (GM1, GM3, GM5).

GMs' experiences with ABCs are consistent with utilities in other low- and middle-income countries. While not a new technology, ABC's resistance to puncturing has led to their deployment more recently as a tool to combat theft/unauthorized connections to the utility in Brazil, India, Iran, and Mexico (La Salvia, 2006; Agarwal, Mukherjee and Barna, 2013; Abdollahi et al., 2020). While their use as a theft deterrent is not new, we note that outside of engineering estimates (Abdollahi et al., 2020), to our knowledge, we join Ahmad, et. al (2023) as the first to find evidence of their efficacy on the ground.

The second pillar of the project's interventions was customer engagement. Managers reported undertaking these efforts in multiple forms, most frequently describing Corporate Social Responsibility (CSR) projects. According to GM1, these activities were run specifically by the IBC's CSR team. CSR projects included medical camps (GM1, GM4, GM5), eye camps (GM1, GM4, GM5), and sports or events for children (GM4, GM5).

According to managers, these events were largely intended to strengthen KE's public relations and profile within these communities. One manager described purposefully timing the events so that they ran two days before bills were due (GM3). Managers also reported collaborating with community leaders and appointing a "focal person" within the community in an effort to improve communication between customers and KE. Elsewhere, support from the head of the neighborhood mosque was important, in part because mosques could be used to spread information on KE updates and the message that stealing electricity is wrong (GM1, GM5). Community spaces, other than mosques, were also used for customer education. For example, informational notices we posted at street intersections (GM2) and in shops (GM1). Managers claim these efforts were due to their intentional attempt to show people the results of their program initiatives. An additional method to build customer trust in KE was to ensure

regular electric supplies for particular public services, such as government water pumping stations, hospitals, social service centers (GM2), and industrial consumers (GM5).

KE staff worked closely with customers, in an effort to mitigate the "resistance" demonstrated by consumers now having to pay for electricity (GM1, GM2, GM3, GM4, GM5, GM6). Sometimes staff would "face backlash and verbal abuse" (GM1). However, managers considered face-to-face interactions to be critical in sharing messages on the importance of bill payment and the connection between increased payment and reduced load shedding (GM1, GM5). A major component of customer outreach that built upon this was the IBC on Wheels (IoW) initiative, in which KE staff would travel around the IBC to handle common customer concerns. This was a "one window" solution to the consumers where you are catered for new connections, billing complaints, and concerns regarding delayed bills" (GM1). IoW was made possible in all the project IBCs (GM1, GM6). One manager reported this was a particularly effective way to reach customers "who have a weak banking network in the locality and where the majority of the population is living in *katchi abadis*" (informal settlements) (GM1).

As shown in Figure 1, managers believed that customer engagement actions, from CSR projects to door-to-door problem resolution, increased customer trust in KE. Furthermore, updating the billing process to a smartphone-based system also helped increase trust as it provides proof of the meter reading (GM1, GM2, GM3, GM4, GM5, GM6). Managers believe that these initiatives made customers' attitude towards KE staff friendlier – from handshakes to greeting managers in the street – and they responded to new IBC customer service locations by bringing their questions about bill payment.

Once again, GM expectations and experiences are consistent with those of other utilities. For example, Ntengwe (2004) finds that customer engagement had a positive effect on

customers' willingness to pay for water services, but also found the effect to be limited by consumers ability to pay, and their perception of service quality. More closely related, Winther (2012) highlight how electricity theft in low-income settings can be viewed and explained through the lens of customer-corporation trust, in both Tanzania and India.

The last pillar of the project was an increase in human resources. These were allocated towards meter reading and the introduction of a staff incentive program that provided vouchers for grocery purchases. These vouchers were paid when IBCs reached their monthly targets. However, continuing to promote IBC autonomy, they differed as to how they distributed their vouchers. Some IBCs distributed them through their line managers because IBC success was considered to be a "team effort" (GM1). In contrast, other IBCs distributed vouchers directly to team members that reached or surpassed their particular targets (GM3, GM6). This focus on governance within KE is perhaps unsurprising, as weak governance is a well-established driver of theft and inefficiencies (Smith, 2004).

Managers felt that incentives had a major impact on staff morale and motivation. As the selected IBCs for the project were the lowest-ranked IBCs, they were rarely eligible for incentives (GM1). Before these incentives were put in place, managers felt there was a lack of motivation and high levels of corruption among KE field staff (GM1, GM5). They believed that the introduction of vouchers "inculcated a sense of healthy competition," provided "motivation," "instant gratification," and "built trust" (GM6, GM5, GM4, GM5), which helped catalyze their other initiatives.

4.3 Managers' perception about the effects of COVID-19

Given the timing of the project, we are able to study the effects of the COVID-19 pandemic on the operations of municipal utilities in low- and middle-income countries. By doing so, we add to the growing literature on the effect of the pandemic on essential services (see, for example, Switzer et. al., 2020). We find that GM experiences were similar to those in other parts of the world, and that additionally, GMs believe that Project Sarbulandi tempered some of the effects of the pandemic.

As expected, managers reported that the COVID-19 pandemic had far-reaching consequences for the operations of KE. It directly affected the ability of its customers to pay their bills and its staff to continue normal operations (Table 4). Most managers agreed that the project's initiatives allowed them to reduce losses, both due to the improved infrastructure and the building consumer goodwill that prevented them from 'falling off the wagon' (Table 2).

All managers noted the economic downturn, particularly job losses, as a reason for the low recovery rates during the beginning of the pandemic. Some managers estimated that 30% of non-paying customers during COVID-19 were those who lost work (GM5, GM1). This was particularly an issue in areas with a high percentage of daily wage workers (GM3, GM7). Paying electricity bills was a lower priority for such customers, resulting in the pilling up of unpaid bills (GM4, GM1). Although one IBC manager felt that "COVID kind of did not happen here" (GM2), the quantitative data suggest that it had a similar experience during COVID-19 to that of other IBCs.

Table 4: Impact of COVID-19.

Topic	Impact	Number of IBCs Cited
Effects of COVID-19 on KE Operations	Changes in Operations	6
	Changes in Load Shedding	4
	Changes in Community Engagement	2
	Financial Impact on KE	8

Lockdown restrictions imposed hurdles for KE operations. These challenges, which included requirements to work from home (GM5), positive COVID tests within KE teams (GM4, GM5) and contract workers leaving the city (GM1), all resulted in inefficiencies in IBCs' operations. COVID-19's most substantial effect on utility operations came was through limitations on meter reading and reduced presence in its service territory during the first months of the pandemic. As a result, KE billed customers based on their past average readings (GM1, GM3, GM6, GM7). After a few months meter readers were allowed back into the field (GM1, GM3), yet GMs felt that insufficient staffing reduced their ability to meet the project's timelines and recover costs (GM5, GM4).

The pandemic hindered IBCs' ability to apply load shedding as a punishment mechanism. As mentioned earlier and studied by Ali et al., (2023), KE allocated more hours of loadshedding to areas with higher losses. During the pandemic, however, KE decided to eliminate load shedding throughout the city during lockdown (GM3, GM4, GM6). One manager reported that theft increased during this time because "people knew that they had a free hand" (GM4). After lockdown restrictions were eliminated, IBCs returned to their normal load shedding schedule (GM4).

Finally, lockdown and social distancing rules directly affected CSR activities. To address community needs while considering health and safety during, KE staff wore full PPE when they

resumed meeting with customers. Managers believed that resuming customer outreach was important to prevent the perception that KE had abandoned them during the pandemic (GM1). Other managers shared information from vans with loudspeakers during the lockdown (GM2). CSR activities like medical camps and sports events, which initially shut down completely (GM1, GM3), also resumed but at a lower frequency (GM1, GM3).

Furthermore, managers believed that the government's pandemic response caused confusion and increased the rate of bill defaults. For example, the Government of Pakistan offered a relief package in response to the economic impacts of COVID-19. This included provisions for electricity access. From April through August, KE staff were not allowed to disconnect customers for bill non-payment (GM1, GM5). Installment plans were implemented to facilitate bill repayment and to "ease out hardships for customers" (GM1, GM4) and one IBC described waiving consumers' bills for the first three months of lockdown (GM5). Managers felt that these safeguards caused confusion among customers, who believed that they no longer needed to pay their electricity bills at all. The bills were required to be paid in full, but these payments were allowed to occur in installments over time (GM4, GM6). When KE staff tried to collect payments, local community representatives resisted, claiming that consumers were eligible for government relief programs (GM1). Indeed, pandemic consumer safeguards negatively impacted IBC revenues, with one manager describing them as a monthly "dent" of between 10 to13% (GM1).

Like all IBCs, phase 1 Project Sarbulandi IBCs experienced high losses at the start of the pandemic, but project managers stressed that they were able to return to normal recovery rates quickly. "COVID-19 had a negative impact on our performance but still overall, the positive

impact continued" and operations are now back to normal (GM4). Pre-pandemic customer engagement and improved billing were cited as reasons why billing could continue as usual, and consumers understood that KE would be expecting regular payments (GM2, GM5). GM2 also cited that "attitudes towards KE [had] changed" and that people now wanted to pay for electricity. Phase II IBCs continued to face issues of low trust (GM8), as managers had not had the same amount of time to engage with their customers before the pandemic hit.

4.4 Customer perceptions

Customer focus groups provide insights into the project's impacts and highlight discrepancies between manager perceptions and customer experiences. Although the focus groups were separated by gender, there was surprising consistency across all of them. With this in mind, we report the results collectively here.

First, we found that customers were unaware of Project Sarbulandi by and large. When prompted more specifically, some focus group participants cited changes in KE operations over the project period. The participants most frequently mentioned the visible interventions - the infrastructure upgrades - though their perception of these contrasted with those reported by managers.

Across all groups, infrastructure changes such as ABCs were described as the utility's most visible changes implemented in recent years. There was a general sense that these changes reduced theft by making the practice of attaching a *kunda* more difficult; this theft-resistant property of ABCs was similarly identified by IBC managers. However, customers reported no perceivable decrease in load shedding and consistently mentioned load shedding as a major problem. Worryingly, multiple customers reported distrusting any new meters, reporting their

beliefs that new meters overcharged them. These reports underscore the level of distrust towards KE; meters were only changed during the project period when faulty and there were no technological differences or additional features between the old meters and their replacements (i.e., the new meters were not "smart" or prepaid meters).

The distrust extends to KE staff and contrasts with IBC manager perceptions. Customers report KE being increasingly inflexible in billing disputes. This indicates that although billing may have become more accurate, customers' trust in and understanding of the system did not improve. Coupled with customers' perception of overcharging and their inability to pay due to a lack of resources, this may explain why, while losses have gone down (lower theft and better billing infrastructure), revenue recovery remains an issue.

Given the importance managers placed on customer outreach and awareness, this discrepancy in perceptions is concerning. None of the focus group participants were aware of any customer engagement activities, despite multiple efforts to prompt them. This suggests that these activities had limited scope and impact. Furthermore, although managers expressed an increase in accessibility and customer-friendly payment plans, our focus group participants reported that the utility became less amenable to requests for bill concessions and late payment.

In general, customers exhibited a lack of trust in the billing procedure and overall performance of KE, with a general perception that KE overcharged customers to profit as a private corporation. Some distrust may be attributed to the confusion over the increasing block tariff structure. Other respondents claimed that KE strategically changes the meter reading and bill dispatch date to increase their bills unjustly (given the increasingly block tariff). These reports suggest that the project's community engagement and educational interventions were either limited, or at the very least, not as impactful as managers perceived them to be. Worse, the

lack of trust in KE led customers to also distrust infrastructure improvements, questioning the efficacy of newer meters that "keep counting units even when they turn off all appliances." Similarly, customers did not report any differences caused by COVID-19 in relation to their interactions with KE, reporting that it was business as usual, and KE continued to show no flexibility.

This difference in perceptions of managers and customers is consistent with experiences of water utilities detailed in the literature, with perhaps one major novel aspect. The literature highlights differences in customer perceptions of water quality and objective water quality (see Dorio, 2010 for a review). It is important to note, however, that in the case of Project Sarbulandi, the "reality" is likely more aligned with the customer experience, and the discrepancy is driven by managers' over-estimations of the project's effects. This discrepancy is important to understand as increased customer trust was a major mechanism that managers identified in the theory of change (Figure 1).

5. Conclusion and Policy Implications

As implemented to date, Project Sarbulandi was a comprehensive reform package that built on KE's prior interventions – the installation of ABCs and the reward/reprimand-based system of allocating load shedding -- and aimed to further reduce distribution losses and increase revenue recovery. To achieve these objectives, KE's management provided significant administrative and operational autonomy to the local managers under the project. According to our interviews with GMs, there is a perception that the project has been a success, a view also shared by the IBCs outside the project's first phase. Consistently, managers report that the marriage of both technical and non-technical interventions is what allowed them to raise customer trust. Yet, input from customer focus groups suggests that these internal impressions are not aligned with customers'

opinions. The project, according to managers, not only met its major objectives of lowering losses and increasing revenue recovery, but it also enabled IBCs to effectively respond to the pandemic by fostering trust between KE and its customers. While the former may be true owing to improved infrastructure, particularly the continued installation of theft-resistant cables, a rise in consumer bills and irregularities in procedures may in fact be causing a decline in customers' trust in KE.

Our analyses and results highlight three policy implications. First, there is a need to evaluate the validity of any theory of change. While managers, both within and outside the project, nearly unanimously appreciated the project's multiple interventions and their interconnectedness, customers were only aware of the technical upgrades, and the limited, if any, effects of non-technical interventions line up with quantitative studies (Ahmad et al 2023).

Second, the perceived success of the bottom-up approach recognizes the need to devolve decision-making. Although the IBCs employed many of the same interventions, there were significant differences in their implementation across IBCs. While it may be true that the main effect was driven by infrastructure upgrades, the bottom-up approach appears to have increased buy-in from KE staff on the ground.

Finally, although customer engagement was considered a major project pillar, customers emphasized KE's need to engage more with them. What the utility's administration may view as "better billing" and customer-friendly procedures, may result in greater customer dissatisfaction when implemented in the absence of their trust. For example, a technical improvement in infrastructure may be perceived as an unfair and manipulative mechanism for billing.

All our interviewees also repeatedly brought up the issue of "culture" around bill-paying and "fair price" for electricity, highlighting a broader question for utilities: is electricity a private

or public good? This has already been the subject of some debate in the existing literature. Where electricity is viewed as a right, this attitude can lead to high losses and low supply (Burgess et al., 2020). However, our findings show that a culture of non-payment may also be reflective of high barriers to payment, such as inaccessible customer service or backlogged payments.

The lessons learned from this research may apply to many electric utilities in low- and middle-income countries facing the similar challenge of breaking out of a negative infrastructure trap (Burgess et al., 2020; McRae, 2015). Although KE is a private utility, public sector utilities may also benefit from research on this project and similar initiatives. The only caveat is that customers may perceive activities conducted by a public entity differently than those of a private for-profit firm. While this study has focused on the perceptions of managers and their customers, the differences in their experiences call for future research to test some of the pathways by which different interventions influence customers' behavior and perceptions and confirm the extent of their effectiveness.

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Appendices

A. GM Interview Protocol and Questions

Interview Protocol:

- Interview appointment will be sought with the General Manager (GM) of the IBC. If unavailable, appointment with the next appropriate member of the management will be sought.
- Interviews will be conducted in person by members of the research team at IBC office in Karachi.
- Some research team members will participate remotely using Zoom.
- Interview will be recorded on Zoom.
- The following set of questions serves as a guide for the topics that will be discussed during the interview.
- Interview may be followed up with request for specific data, which is protected by a Non-Disclosure Agreement which has been signed between Karachi Electric and Research Team.

Interview Guide:

1. Questions on the interviewee
   - What is your current role at IBC?
   - How long have you worked at this IBC?
   - How long have you worked for KE in total?
   - What was your role/position when you started off at K-Electric?

2. Questions on the basic characteristics of the IBC
   - IBC organogram? Number of employees for each position?
   - Which category does your IBC fall under High Loss? – High Bleeding, Medium Bleeding and Low Bleeding
   - How many feeder lines are covered by your IBC's territory?
   - Are any of these lines ABCs?
   - In which year/month was ABC implemented at your IBC? (Feeder Level)
     - Can you provide a month wise break-up of the number of Feeders covered under ABC for that specific year?
   - How many PMTs are covered by your IBC's territory?
   - Do any of these PMTs have smart meters installed?
   - In which year/month was ABC implemented at your IBC? (PMT Level)
     - Can you provide a month wise break-up of the number of PMTs covered under ABC for that specific year?

- How many meter readers work within this IBC?
    - What is the organization of the meter readers (e.g., do they rotate or always cover the same territory)?
    - How many consumers are metered under a single meter reader?

- How many total customers, as measured by metered connections, are covered by your IBC's territory?
    - How many are residential customers? Do any have smart meters installed?
    - How many are commercial customers? Do any have smart meters installed?
    - How many are industrial customers? Do any have smart meters installed?
    - How many consumers are covered under each Feeder at your IBC territory?
    - Is the meter reading manual or through a smart phone app?
    - In which year/month was the smartphone app initiated?
    - On average how many consumer's complaints does the IBC deal with each day? (Those raised through the ticket system at the IBC)
    - Approximately what percentage of units consumed are used under theft?
    - Can you provide a breakup of the nature of the complaints filed for each month? How many were raised for billing, new meter connections, connection/disconnection? (2018 till the current month of 2020)

- Do you resort to load shedding in your area?
    - If yes, how do you decide which areas should undergo load shedding and how much (hours per day)?
    - Is load shedding as per the announced hours/time by the KE? If yes, how many announced hours one day.
    - Do you also do unannounced load shedding? If yes, how many unannounced hours per day.
    - Do people resent unannounced load shedding more? What is their common reaction?

3. Questions on the IBC Pre-Sarbulandi
    - What was the financial status of this IBC before the start of Sarbulandi?
        - T&D Loss
        - RR (Recovery Ratio)
    - What efforts, in general, were made to improve the IBC's finances before Sarbulandi?
    - What infrastructure improvements/investments were made, if any, before Project Sarbulandi? (thinking ABCs, smart meters, other physical improvements)
    - What human resources investments were made, if any, before Project Sarbulandi? (thinking additional hires, trainings for staff)
    - Did the IBC employ the Scorecard Program? What did this program include?
    - Has your team ever won the Scorecard? If yes then how many times – mention the months if possible
    - Can you list down the exact programs that were implemented at your IBC before the implementation of Sarbulandi? (Qadam Barhao, Operation Burq etc.- Amnesty Schemes)

- Exact month/year of the program's initiation and the program's duration

4. Project Sarbulandi
   - When did Project Sarbulandi begin in this IBC?
   - Mention the exact month of 2019 at which Sarbulandi got fully rolled out at your IBC? In terms of budget allocation and hiring of the required human resources.
   - What Sarbulandi targets were appointed to your IBC? (IBC Specific Numbers)
     - T&D Loss
     - RR (Recovery Ratio)
     - Number of installed Meters
     - Number of consumers covered under metered reading
   - Were you ever able to achieve your Sarbulandi targets? If yes, then for which month?
   - If no, then how far are you from the target? (% terms from the target and the current month performance)
   - What key outcomes/performance indicators are being monitored for this IBC?
   - Who makes decisions related to Project Sarbulandi for this IBC?
   - Can you mention the exact team members who were behind the direct implementation of the project? (no. of people in the team and their exact designations)
   - What activities has the IBC implemented under Project Sarbulandi?
     - Enforcement example: Any change in the time shifts after Sarbulandi?
     - Incentives example: Do you have a specific mechanism for distributing the vouchers?
     - Community rewards example: which of the community rewards, you believe had the highest positive impact? And why?
   - What HR efforts has this IBC implemented under Project Sarbulandi?
     - Hiring? Approximately how many? In which positions?
     - Training? For which types of employees?
   - Do you share ideas with other IBCs participating in Project Sarbulandi?
   - How do you plan on sustaining the results and performances after the completion of the Sarbulandi Project?
   - Was your IBC ever selected for the Monthly Sarbulandi Meeting with the upper Management? If yes then exactly how many times?
   - In your opinion what are the main reasons why Project Sarbulandi was successful in your IBC?

5. COVID
   - How has the pandemic impacted the functioning of this IBC?
   - How was the work shift affected? To what extent were the working hours reduced? Was there any downsizing done at the IBC level?
   - How has the pandemic affected the finances of this IBC?
   - Impact of COVID on the following KPIs:
     - T&D Loss

- RR (Recovery Ratio)
- Number of installed Meters
- Number of consumers covered under metered reading

- How has the pandemic affected the implementation of Project Sarbulandi?

6. Coping with other negative shocks (e.g., recent flooding in Karachi)
   - Did the recent flooding affect the functioning of this IBC? If yes, how?
   - How many *disconnections* happened during the recent floods?
   - How was the internal capacity managed or adjusted to meet the unforeseen increase in complaints during these flooding?
   - Did the recent flooding affect the finances of this IBC? If yes, how?
   - Effect on CAPEX and REVEX; How was it adjusted to account for emergency situations like recent urban flooding?
   - Did the recent flooding impact the implementation of Project Sarbulandi? If yes, how?

B. Focus Group Questions

1. Thinking about the last 1-2 years, are you satisfied with the quality of electricity service delivery in your area?

2. Please tell us about the main problems as well as any positive changes that your area experienced.

3. Do you think your electricity bill is fair/accurate/reliable/reasonable?

4. In your opinion, what are the main reasons why some people in your area use electricity without paying for it e.g., using a "kunda", meter tampering, or through some other illegal means. What methods do you know people use for stealing electricity in your area? (potentially prompt about line man/readers)

5. In your opinion, what are the main reasons why people with meters (who do not engage in illegal practices) find it difficult to pay their bills? Push respondents to elaborate if they respond re: financial constraints (e.g., what exactly are the financial constraints?).

6. What are the effects of stealing/not paying on everyone else? Do nonpayment of bills and theft of electricity also make electricity more expensive for everyone? Lead to more loadshedding?

7. If you were to recommend one way to reduce electricity theft and improve bill payment, what would you suggest?