

Implementing Water and Sanitation Systems in Rural India: The Role of NGOs

By

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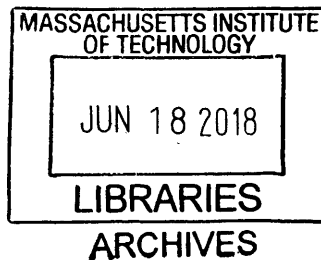
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Abstract

NGOs are an important actor in rural India, and are increasingly important in implementing water and sanitation infrastructure. This thesis first systematically investigates physical conditions that lead to good bacteriological water quality in rural India, and then investigates how NGOs are inserting themselves into this space. Ultimately, this work examines under what conditions NGOs are effective in advancing water and sanitation systems, with a focus on how they build up, empower, and utilize local community organizations to do so. Thus, the strategies of two NGOs working in rural India that have facilitated the implementation of water and sanitation infrastructure are analyzed using an extension of Field Theory by Asad & Kay (2014). The way these NGOs create alliances, use resources, and change frames to advance water and sanitation infrastructure are similar in some ways, while distinct in others. This analysis demonstrates that these organizations are able to harmonize and negotiate their development agenda with that of the state in order to make progress in water and sanitation systems. Combining a systems analysis of rural communities' water quality with an analysis of strategies of NGOs illuminates practical implications for how policymakers can expect these organizations to incorporate new technologies and policies.

Thesis Supervisor: Chintan Vaishnav, Sloan School of Management

Thesis Supervisor: Gabriella Carolini, Department of Urban Studies and Planning

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Motivation

I was selected as a Tata Fellow in the fall of 2015 to work on a project to improve the water-testing paradigm in rural India. Tata Fellows are graduate students at MIT selected to do research for The Tata Center for Technology and Design, a center funded by the Tata Trusts. These Tata fellows are graduate students pursuing research on projects in the Indian context, in the areas of water, agriculture, health, housing, and energy. My colleague Dr. Michael Bono was tasked with the water test design, and I was tasked with policy research surrounding the water test implementation. Though the Tata Center is largely focused on technological innovation for India, they understand that technology cannot be successful in the absence of thoughtful policy or in a system where the technology isn't beneficial. Thus, my focus was to explore the "system" the water quality test could be implemented in rural India. To further bound my ultimate research questions, I was a graduate student in two programs; the department of urban studies and planning as well the Technology and Policy Program. I had to ensure my research could contribute something to discourses in both fields.

After working with my colleague, we determined that we should focus on improving the existing field microbial water quality test. Poor microbial water quality is pervasive throughout India, the current field tests take up to two days for incubation, and people actually have the power to easily improve their microbial water quality. If there is a chemical contaminant; the water requires an expensive treatment process for purification. Meanwhile if the water is bacteriologically contaminated, it can be purified through filtering, boiling, or the addition of chlorine tablets. Thus, the incorporation of a microbial test would allow people to actually make a change in their water quality without having to rely on external governments or institutional support.

Though my team had narrowed down the scope of our research from "improving the water testing paradigm" to "improving the microbial water testing paradigm", it was still quite a vast area to explore. To begin to understand where microbial water quality testing could be useful, we wanted a holistic view of water systems in rural India. Thus we began by investigating what physical conditions actually led to poor microbial water quality in rural India. We investigated these parameters by visiting NGOs working in water and sanitation and developing an understanding of the microbial water quality in each area. However, during this process we realized that while it is incredibly important to have an understanding of the physical system, it was also important to investigate the institutions working on "water quality" projects in rural India. This

realization led to an analysis of how two NGOs are engaging in the space of water and sanitation. Thus, this thesis addresses two sub-questions, related to the larger Tata inquiry on improving water testing, synthesizing these discussions in the conclusion.

My thesis' guiding research questions are thus as follows:

1. *What are the core dynamics of microbial water management in rural India?*
2. *Under what conditions are community organizations effective in advancing water and sanitation systems in rural India, and what is the role of NGOs therein?*

These questions are discussed at length in this thesis, and their analysis contributes to the discourse about infrastructure development and the integration of technology in both planning and policy studies.

Chapter 1: NGO's Role in Water and Sanitation Service Delivery

The Sustainable Development Goals highlight that the world is still far from reaching universal access to improved water and sanitation services. Despite having the technical capability, water and sanitation services haven't been adequately delivered to several communities around the world due to underlying systemic issues. In theory, local government is tasked with service delivery for all communities; but due to political pressures and social influences, the state does not or cannot prioritize this water and sanitation infrastructure delivery. Thus, a network of stakeholders often steps up where the government doesn't; individual actors, businesses, community based organizations, and non-governmental organizations are able to find ways to increase access to water and sanitation. NGOs in particular have a variety of strategies for engaging with this issue. In this thesis I examine one NGO that uses "water and sanitation service delivery" as the end goal, using community empowerment as a tool. I also examine an NGO that uses community empowerment as the end goal, and water and sanitation efforts have developed out of these efforts. The reliance that NGOs have on local community organizations is discussed in depth in this thesis.

1.1 NGOs Role in Development

The playing field in development has been constantly shifting regarding country status, donors and alliances. India, Brazil, and China have appeared as emerging powers (Banks, Hulme, & Edwards, 2015). Additionally, there are new philanthrocapitalists and private donors (Herzer & Nunnenkamp, 2013), and there are new actors and alliances for development (Richey & Ponte, 2014). NGOs in particular are a key stakeholder in influencing policy, delivering services, mobilizing communities, and play a key role in development. These organizations have had varying roles in development throughout history; and today have a different role than ever before. A tide of technocracy has re-emerged in foreign aid over the last 10 years, which has driven NGOs as "clients" to work on a limited set of agendas biased toward service-delivery and "democracy-promotion" (Banks et al., 2015). They can have a great impact in a rapidly globalizing and changing world: "Rapid globalization and the spread of market liberalizing reforms across the Global South have led to the increasing influence of non-state actors on development policy and practice" (Banks et al., 2015). NGOs are bigger, more complex, and receive a larger slice of foreign aid than they have

previously. Overall, NGOs are playing an important and ever-changing role in development initiatives today.

It is important to define what exactly is considered to be a development organization. Overall, Development NGOs are concerned with transformative missions of empowerment and social justice, not just service delivery (Banks et al., 2015). According to Sanyal, NGOs can often have a role more expansive than service delivery; “Community-based NGOs are assumed to be able to empower these groups and to be trusted more than government agents by local communities, therefore serving as a necessary intermediary between the state and its citizens” (Sanyal, 1998). While development NGOs or development organizations can mean several things, Sanjiv Phansalkar, program director of the Tata Trusts, defines a Development Organization as: “an organization whose primary mission as well as intent of all actual action is to bring about positive, salutary changes in the lives of the disenfranchised, neglected, and the poor whether in rural or urban areas” (Phansalkar, 2015). This definition is along the same lines as the definition of development NGOs, given by Patrick Kilby, an NGO scholar: “Development NGOs work with poor and marginalized communities, and they aspire to alleviate poverty, address marginalization, achieve social justice, and promote respect for human rights” (Kilby, 2011). Overall, Development NGOs are concerned with deeper social transformation, but will often develop one focus area they invest in; for instance microfinance, agriculture, or water access.

It is these development organizations that are the subject of this research. Thus, it is important to distinguish Development NGOs from Membership-based organizations, which are also growing in size and influence. Membership-based organizations are often microfinance collections, or as they are known in India, Self Help Groups. “Development organizations” are distinct from these membership-based organizations, and have different challenges and limitations. However, there is a complex interplay in the way these organizations interact that can contribute to the overall performance of the NGO. In order to tackle complex issues that society faces, inter-organizational cooperation is seen as desirable or necessary (Ramanath, 2009). This cooperation for development is often seen between NGOs and Self Help Groups in different ways, and will be discussed later.

1.2 Local Community Organizations Role in Development

As an important backdrop, it is important to explain the organizational structure in India. At the most local level there are groups of people arranged in groups of hamlets, similar to a neighborhoods. There is a small group of hamlets that make up a village, a small group of villages

that make up a Gram Panchayat, and a number of Gram Panchayats that make up a block. These categories are official government classifications that have accompanying levels of community organizations at each stage.

In addition to the formal government systems, a parallel system has formed for women's self help groups. Self Help Groups are essentially collectives of women that build up savings and loans for themselves. This type of organization has a long and varied history that is decades old. Today, the formation of Self Help Groups is strongly promoted by the National Rural Livelihoods Mission, a mission that was launched by the Ministry of Rural Development in 2011 (*Welcome to DEENDAYAL ANTYODAYA YOJANA - NRLM, 2018*). This mission is partly aided by the World Bank.

Self Help Groups begin as a way for women to build up savings and loans, but has since taken on different roles depending on the state and context they are in. Often, both NGOs and governments can use these Self Help Groups as entry points to the community. To bring clarity to this organizational structure, see the figure below. Each hamlet has a Self Help Group. A group of Self Help groups will thus make up a Village Organization. A group of village organizations will make up cluster level federations, which in turn will make up block level federations. The table below shows how many members are in each level of "SHG", as informed by field interviews.

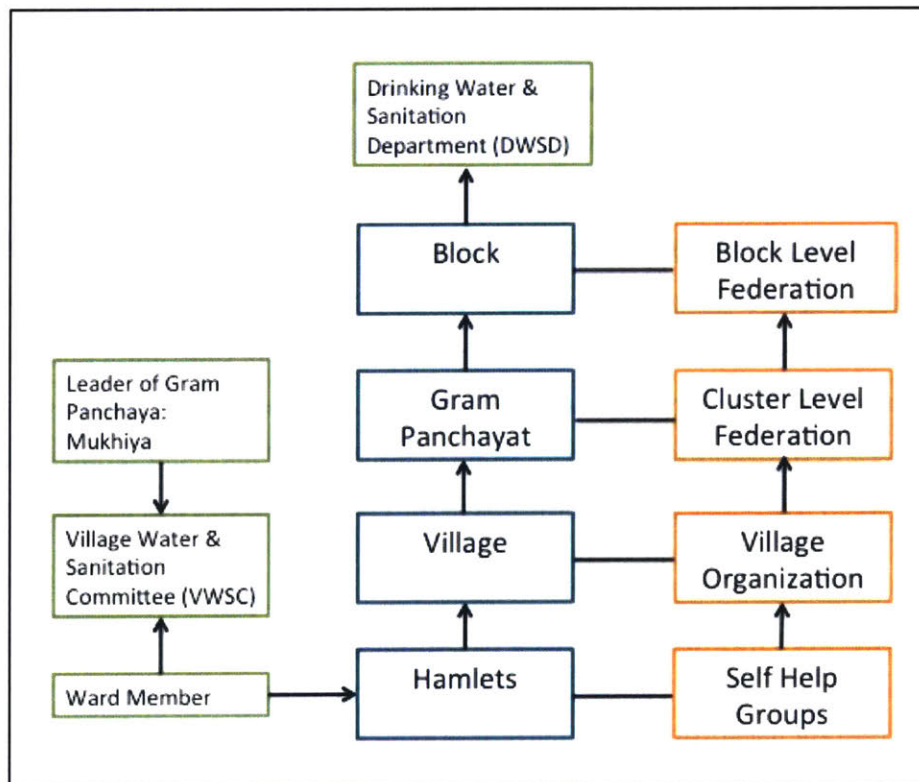


Figure 1 - Structure of Government and Self-Help Groups

	Himmotthan (Himmotthan Staff member)	PRADAN, Jharkhand (PRADAN staff member)
Members in SHG	10 - 20	15
SHGs in VO	5 - 8	8 - 12
VOs in CLF	10 - 15	20 - 30
Number of SHG in hamlet	2 - 3 (approx.)	
Number of families in Hamlet	10 - 50	30 - 40
Number of Hamlets in Village	1 to 4	
Number of families in Block	15,000 - 20,000	17,000

Table 1 - Approximate members in each category

Concerning local government organizations, in the states of Uttarakhand and Jharkhand, each hamlet has a designated ward member. There are also generally village water and sanitation committees. The concepts of “jal sahiyas” or “jal surakshaks”, who are supposed to be people in the community dedicated to water testing, did not seem to be pervasive however even though there is a designated role for them in local governments (Project Associate, Himmotthan). Thus, even if these positions exist they are not that well known. Overall, these Self Help Groups and local government organizations can be a powerful agent of development, especially when working in collaboration with an NGO.

1.3 NGOs Role in Water & Sanitation Globally

Both the Millennium Development Goals (MDGs) and the more recent Sustainable Development Goals (SDGs) have a concentrated focus on improving access to water and sanitation (United Nations, 2015). One reason for this is because poor hygiene and sanitation practices can result in numerous fatal diseases each year. An estimated 801,000 children younger than 5 years of age die from diarrhea each year, mostly in developing countries; this means about 2200 children are dying every day as a result of diarrheal diseases (Liu et al., 2012). What makes these statistics so remarkable is that the vast majority of deaths from diarrhea are easily preventable: “Unsafe drinking water, inadequate availability of water for hygiene, and lack of access to sanitation together contribute to about 88% of deaths from diarrheal diseases” (Prüss-Üstün, Bos, Gore, &

Bartram, 2008). To tackle this pressing health problem; organizations often use a combination of 'hardware' and 'software' implementation. In addition to implementing a latrine or a water pump (the 'hardware'), organizations have also begun to implement behavior change campaigns and trainings (the 'software'). This 'software' focus has been a focus at a national scale in India, especially through the use of behavior change campaigns regarding toilet usage.

Often times, because of the nature of engagement required to implement both hardware and software project elements, NGOs often step up and take on this multi-faceted role; "Working with households and communities, they are well placed to add value to sanitation initiatives at the project, program, and policy levels" (Carrard, Pedi, Willets, & Powell, 2009). Development NGOs, especially those based locally, often have a comparative advantage over the state when working with communities, on behavior change efforts in particular.

They are able to access people at the ground level and thus have a greater social reach. In some cases, the development NGOs are so effective that the government will actually seek cooperation with them (Phansalkar, 2015). NGOs have played numerous roles in the sanitation sector. Carrard et. al. have grouped these roles into 6 categories: Facilitation and service delivery, community education, building partnerships and networks, capacity building for local governments and organizations, research and innovation, and engaging in policy dialogue (Carrard et al., 2009). These same categories translate well to NGOs working to implement water projects. NGOs are typically able to adapt to the context they are in and fill a gap that is left by the public sector.

The important role these NGOs play in the water and sanitation is demonstrated by the large amount of water and sanitation NGOs active today. Several NGOs are based locally and only work in their respective locations; while others are international NGOs that can contribute to work on the ground through extensive partnerships. It is important to consider the origins of the organizations because it can impact the reach and efficacy of these NGOs. Some of organizations that work on water and sanitation initiatives among several countries include UN-Water, WaterAid, Water for People, World Vision, Water.org, and Charity:Water ("7 Water Organizations You Should Know," 2013). Other organizations focused on water and sanitation that are focused domestically include the Indian NGOs Arghyam and Action for Community Empowerment (ACE). Overall, NGOs have proven to be an important player in facilitating the installation of water and sanitation infrastructure around the world.

1.4 The Role of NGOs in Water & Sanitation Services in India

Water and Sanitation Situation in India

India struggles with water and sanitation access, especially in rural areas. This leads to a high amount of preventable, waterborne diseases. In India, diarrheal disease is an enormous problem, and diarrhea is responsible for 13% of all deaths per year in children under 5 years of age (Lakshminarayanan & Jayalakshmy, 2015). Additionally, diarrhea is the third leading cause of child mortality in India (Lakshminarayanan & Jayalakshmy, 2015). Thus, there are several efforts to increase access water and sanitation infrastructure and improve water and sanitation behaviors. For instance, there are now a number of government initiatives allocating funding for this improved infrastructure; the government has allocated 4,000 rupees to every household for them to construct a toilet (Pareek, 2015). The work to carry out such initiatives takes place at all levels; national, state, & local, as described below. Additionally, much of the work is taken on by development organizations.

Water and Sanitation Situation in India – National Level

Water governance and policy in India is not straightforward; “There is a lack of comprehensive legislation called water law in India, and therefore legal regulation is made up of several components that include both formal and informal rules of engagement with water” (Asthana & Shukla, 2014). Thus, water is controlled in part at the National Level, the State Level, and local level. At the top of the system is the *Union Ministry of Water Resources, River Development, & Ganga Rejuvenation*, which conserves, coordinates, and develops the water as a national resource. A number of agencies support this ministry: the *Central Water Commission*, the *Central Ground Water Board*, and the *National Water Development Agency*. The Central Pollution Control Board and State Pollution Control Boards are authorized to act on behalf the ministry to curb pollution (Asthana & Shukla, 2014).

More relevant to sanitation regulations is the *Ministry of Drinking Water and Sanitation*, which implemented the *National Rural Drinking Water and Sanitation Program* (Asthana & Shukla, 2014). This ministry also manages Swachh Bharat, or clean India. It is divided into Swachh Bharat Mission Gramin, and Swachh Bharat Mission Urban. Swachh Bharat Kosh is dedicated to attracting resources from corporate social responsibility for Swachh Bharat Water Security Pilot Projects.

Overall, this initiative aims to increase access to latrines and decrease open defecation. Other ministries that intersect with the mission of the *Ministry of Drinking Water and Sanitation* and the *Ministry of Water Resources* include the *Ministry of Rural Development* and the *Ministry of Health & Family Welfare*.

Swachh Bharat India has been a national push that has received a lot of attention. Despite the fact that this is a national push for a Clean India, the central government encourages adoption of these goals to the local contexts of states and districts. Several organizations of all types have become involved in pushing forward the mission of the organization; organizations that have worked to carry out the mission of Swachh Bharat include the Tata Trusts, and numerous NGOs such as PRADAN and Himmotthan.

Water and Sanitation in India – State Level

Though there are national policies governing water, state and local levels have more sway in governing water and sanitation projects. Water control is given ultimately to the states, and thus they control most of the water supply (Asthana & Shukla, 2014). However the state mainly focuses on planning and investment, and local groups operate and maintain the water services. In urban areas, these groups have been designated as *urban local bodies (ULB)*. Furthermore, under the Jawaharlal Nehru National Urban Renewal Mission (JMMURM), *municipal corporations* can provide water supply to the sectors through other agencies, provided that the ULBs are ultimately accountable. In rural areas, responsibility for water management has been delegated to the *panchayats*. These local governing boards have the power to regulate the use of water and issue taxes for regular water supply among other things (Asthana & Shukla, 2014).

Water and Sanitation in India – Local Civic Societies and NGOs

Given the fragmented nature of water policy in India, several stakeholders including government organizations and NGOs must come together to take on the various responsibilities regarding water management. The National Rural Water Drinking Program (NRWDP) is the current program overseeing rural water governance. According to the NRWDP, there are important responsibilities at all levels, including local, district, state, and national. For instance, Village Water and Sanitation Committees (VWSCs) are in charge of planning, implementing, operating, maintaining, and managing all in-village water schemes. Their responsibilities include developing a

Village Water Security Plan. At the district level, there should be a Water and Sanitation Mission (DWSM). This organization should monitor all water projects of villages within its district. The Zilla Panchayat or district government often takes on this role. As suggested by Asad and Kay (2014), the state and NGOs in various contexts can be mutually dependent. States depend on the NGOs to deliver services, and NGOs depend on states to provide resources to facilitate their delivery. This is often the case in various Indian contexts.

There are an enormous amount of NGOs in India; most of which are not officially registered. According to the Central Bureau for Investigation (CBI), in September of 2016, there were nearly 3,100,000 NGOs, and only 8 – 10% had filed their accounts with the registrar of societies (Tandon, 2017). Missions of NGOs include improving healthcare, livelihood opportunities, agricultural production, and more; and can tackle issues in both urban and rural areas. It is hard to say what number of these NGOs addresses water and sanitation issues in rural India, but there are certainly numerous organizations. NGOs working on water and/or sanitation in rural India include Water Aid India, Arghyam, Water for People, World Vision India, India Wash Forum, PRAVAH, UNICEF, Peer Water Exchange and more (sabitakaushal, 2017). It is hard to generalize these NGOs working in rural India because they each take a different approach and theory of change to tackling water and sanitation issues in their community.

Water and Sanitation in India with Tata Trusts

It is important to consider the effect that the Tata Trusts have had in India, especially in regard to their water and sanitation efforts. The Tata Trusts is essentially the philanthropic branch of the group of Tata companies. These companies include Tata Motors, Tata Chemicals, and Tata Steel. The Tata Trusts have been a mechanism to give the profits of the Tata Companies back to communities for over 100 years. In line with the mission of their founder, Jamsetji Tata, this organization attempts to catalyze social development while ensuring that initiatives and interventions are relevant to the nation. The Tata trusts have engaged with themes of natural resource management, education, and more. The trusts help in a variety of ways; by mobilizing funds and offering on-ground support (*About Tata Trusts*, 2018).

The Tata Trusts have mobilized resources to develop and support various research centers based on campus; the MIT Tata Center for Technology & Design, the Tata Centre for Technology & Design at IIT Bombay, and others including the Tata Center for Development at the University of

Chicago, and the Tata Innovation Center at Cornell. These centers support a variety of projects, some of which support research on improving water and sanitation services.

The Tata Trusts support several NGOs that include work on water and sanitation, two of which are discussed in great detail in this thesis. However, they even have a specific mission called the Tata Water Mission dedicated to focusing efforts on creating rapid and scalable impacts on water and sanitation.

There is one recent example that highlights the ability of the Tata Trusts as an organization to shape national discourse on water and sanitation. In 2015, The Tata Trusts partnered with the Swachh Bharat Mission to appoint 600 Zila Preraks. These “Zila Swachh Bharat Preraks”, or ZSBPs, were selected as “Swachh Bharat Fellows” and were dedicated to strengthen capacities at the district level to continue making strides towards being Open Defecation Free (Tata Trusts, 2016). This dedication of 600 ZSBPs were a way to expand the Tata Water Mission’s work as described above (Tata Trusts, 2016). The ZSBPs are responsible for supporting district level officials in implementing the mission of Swachh Bharat. This partnership between the Tata Trusts and the Government of India is an interesting backdrop when investigating how smaller Development NGOs navigate fields of influence among government levels and major donors like the Tata Trusts.

Chapter 2: Discussion of Theoretical Framework

To determine what factors led to the most successful water and sanitation system implementations in communities, it is important to choose a framework that can analyze all dominant areas of NGOs' strategies in a comprehensive and insightful way. Asad and Kay (2014) use a comprehensive theoretical framework to theorize the relationship between NGOs and the State in medical humanitarian development projects. This thesis uses this same framework, but in the context of water & sanitation initiatives. Overall, Asad and Kay look at NGO state interaction through the lens of *interest harmonization* and *negotiation*. They use *Field Overlap Theory* to illuminate how successful outcomes depend on NGO's ability to leverage resources. Field Overlap Theory has the following three components: Alliance Brokerage, Resource Brokerage, and Frame adaptation. These elements are described below. When examining state-NGO relationships, it is important to keep in mind that states can be categorized differently in how they work together with NGOs; 1) willing & capable 2) willing and incapable 3) unwilling and capable and 4) unwilling and incapable (Asad & Kay, 2014). Using this theoretical framework, this thesis examines ways NGOs utilize leverage and resources as form relationships with the state and try to ensure project success.

2.1 Alliance Brokerage

Alliance brokerage is the term that signifies NGOs ability to gain access to, increase their legitimacy with, and/or influence the decision-making calculus of the state by brokering valuable alliances across fields (Asad & Kay, 2014). For instance, this could mean cooperating with advocacy, civil rights, and/or civil society organizations. Alliance brokerage can also point to the partnerships and relationships developed with individual *politicians*. One Oxfam America member in the study by Asad and Kay succinctly explained the importance of relationships with the state; "If you want to achieve some kind of scale and impact, you probably better consider working with the government" (Asad & Kay, 2014). Alliance brokerage should also be considered in how NGO's partner with local government officials. To bring in additional talent, NGOs also brokerage alliances with universities or experts. This relationship was especially relevant when implementing water and sanitation projects in India.

In the context of rural India, a particularly important group to include in the analysis of alliance brokerage of NGOs is Self Help Groups, which are usually small groups of women's

collectives. What makes this relationship interesting is that these SHGs are often formed by NGOs themselves as their tool for working in a community.

Going forward, this element of the framework is very relevant for organizations in rural India; where often rural government is fragmented, corrupt, or difficult to work with; “Our data suggest that alliance brokerage is particularly important for NGOs dealing with less capable and willing states” (Asad & Kay, 2014). Where a state is “unwilling” NGOs can still find a way to advance their mission; “NGOs build alliances to resist state’s heavy handed restrictions on their work” (Asad & Kay, 2014). In the case of rural India; NGOs are often creating “partner collectives” themselves as a way to advance their mission.

2.2 Resource Brokerage

According to Asad and Kay, “Resource brokerage depends on the extent to which financial, political, and/or cultural resources from one field can be useful or necessary for the effective functioning of another field” (Asad & Kay, 2014). Often times NGOs will rally resources to obtain support from the state for projects or initiatives. Resource brokerage is particularly important when an NGO is partnered with a state that is willing, but incapable (Asad & Kay, 2014). In this way, the NGOs are using resources to *negotiate* with the state. Though it is a common idea that NGOs are able to adapt their program to local needs, they often do not have the resources to do so; “Contrary to popular perceptions, NGOs face significant difficulties in tailoring programs to local needs” (Banks et al., 2015). This element of the framework is very useful in highlighting how NGOs leverage resources to accomplish their goals.

2.3 Frame adaptation

NGOs are also able to adapt what are known as “frames” across fields to earn state support. Changing a frame involves actors “mobilizing a new consensus around a modified or broader understanding of policy concerns and possible outcomes (Klandermans, 1988, Snow and Benford 1992 – Asad). Skilled actors are able to “translate conceptual understandings from one field to another” (Asad & Kay, 2014). One prominent example of this is Oxfam America and Partners in Health; they are able to change conceptions of what rights should mean in various contexts. Naturally, frame adaptation proves more difficult when states are unwilling and incapable, though

it can be difficult in any situation. This will be interesting to analyze in the case of NGOs in rural India; as they rely on different “theories of change”, which are similar to “frames”. For instance, NGOs analyzed in this thesis frame their work as empowerment of women and of communities, and often frame their work through pushing behavior change campaigns.

2.4 Discussion & Summary of Theoretical Framework

Overall, this framework based on field theory is particularly useful because it illuminates how NGOs can leverage resources across fields to create social and organizational change. There are other frameworks that have been used in the past to analyze the dynamics between NGOs and other stakeholders. For instance, Brinkerhoff puts forth measures of *mutuality & organizational independence* (Brinkerhoff, 2002). Additionally, Coston defines 8 possible relationship types between governments and NGOs that vary on several dimensions including the relative balance of power in the relationship and the degree of formality. These relationships include repression, rivalry, competition, contracting, third-party government, cooperation, and complementarity (Coston, 1998).

This framework is suitable because it gives a way to systematically analyze the main ways NGOs in rural India differ in their strategies; through their relationships with the state/donors/networks, what resources they are using to accomplish their goals (professional personnel, engineers/technical experts), and how they “frame” their missions. Additionally, in interviews with NGOs, the theme of how they work or partner with the state was a recurring theme, and will have a very important impact on how projects play out.

In the study performed by Asad & Kay concerning medical humanitarian projects, they saw more success of projects where NGOs adjust how they interact with different types of states through processes of *interest harmonization* and *negotiation*. As a general rule, “NGOs harmonize their interests with “*developmental states*,” or those run by competent coherent bureaucrats committed to designing and delivering public services” (Evans 2010; Evans and Heller, 2013 – Asad). Meanwhile, “NGOs try to negotiate with “*predatory states*,” or those that undercut development at the expense of the society and are generally unwilling to participate in humanitarian projects (Asad & Kay, 2014). Thus, my *hypothesis* for how PRADAN and Himmoththan carry out the most successful water and sanitation infrastructure projects is when they negotiate and harmonize their organizational strategies and development objectives with those of the state.

2.5 Unit of Study – Two NGOs

In order to study factors leading to microbial water quality in rural India, NGOs working in two geographically diverse contexts were chosen as units of analysis. By choosing one NGO that works in the mountainous region, Himmotthan, and one NGO that works in a predominantly plains region, PRADAN, my team has chosen organizations that represent a variety of hydro-geological contexts with different water management strategies. Himmotthan and PRADAN have ongoing and completed projects throughout rural regions in different Indian states, and thus prove to be good NGOs for evaluating how state-NGO relationships can vary, and under what conditions water and sanitation infrastructure is implemented successfully.

Learning about these two NGOs has been very insightful, but it is important to acknowledge that they were selected as units of study not only because of their geographical diversity, but in part because of their connection to the Tata Trusts, the same organization funding the Tata Center for Technology & Design at MIT. Because of this mutual connection to an overarching organization, my team was incentivized to facilitate an open line of communication between the Tata Center at MIT and the NGOs, in order to encourage a lasting relationship between these organizations. Focusing on this connection may have caused us to miss out on studying other NGOs that may have brought a different perspective to what is going on in the world of water and sanitation of rural India, especially when these organizations have no backing from a major funding organization like the Tata Trusts.

2.6 Himmotthan

The Himmotthan Society was registered in 2007 and works among rural mountain communities in the Central Himalayan region. Himmotthan focuses on developing sustainable livelihoods related to livestock and agriculture, and focuses on intervening in communities to improve their access to education, water, sanitation, and energy. It is primarily funded by the Sir Rata Tata Trust, one of the oldest philanthropic institutions in India and under the umbrella of the Tata Trusts (*Himmotthan.in*, 2014). While Himmotthan has made progress in a variety of areas, their accomplishments in water and sanitation infrastructure are notable. Their water and sanitation program, ongoing since 2004 under the broader organization “Himmotthan Pariyojana”

has assisted 176 villages to have access to drinking water delivered to their doorstep. They have assisted with the implementation of sanitation facilities for over 4,160 households. (*Himmotthan Annual Report 2014-2015*, 2015) Currently, Himmotthan is working with 313 villages. There are 53 people in total working for Himmotthan, 17 of which work specifically in an office dedicated specifically to water. Himmotthan works in Uttarakhand and Himachal Pradesh, but for the purpose of this thesis only their experience working in Uttarakhand is considered.

Uttarakhand was carved out of northern Uttar Pradesh in 2000 to form the 27th state of India (*Uttarakhand: State Profile*). Uttarakhand is a very hilly state as it lies at the foothills of the Himalayas. It has a population of approximately 10,086,000 people, of which 7,037,000 live in rural areas, or approximately 70% (Government of Uttarakhand, 2014). Himmotthan works in 26 blocks across 9 districts in Uttarakhand (*Himmotthan Annual Report 2014-2015*, 2015). According to a member of Himmotthan, 94% of drinking water comes through the springs. Because of the mountainous terrain in this state, well maintained and sufficient infrastructure is problematic.

2.7 PRADAN

PRADAN was founded in 1983 with the mentality that educated professionals could work in communities to help poor people improve their lives. PRADAN stands for Professional Assistance for Development Action and is inspired by the mentality that removing poverty necessitates empathy and a helping motivation (“The Origin: PRADAN,” 2016). PRADAN is funded by numerous organizations including the Bill and Melinda Gates Foundation, Tata Trusts, and various banks. Their mission statement is “to enable the most marginalized people, especially rural women, to earn a decent living and take charge of their own lives” (*PRADAN: Building a World Where Everyone Can Live With Dignity*, 2017). In order to accomplish this, they focus on developing women’s collectives, more commonly known as self help groups, that in turn are able to develop their own skills and initiatives. As of March 2015, PRADAN worked with 28,592 Self Help Groups across 7 states, which represents a total membership of 367,871 rural poor women (*PROMOTION OF SHG’S*, n.d.). They work in states across the central region of India; Rajasthan, Madhya Pradesh, Chhattisgarh, Bihar, Orissa, West Bengal and Jharkhand. PRADAN has made notable advances on installing piped water systems for villages, though across the country water is a newer portfolio for them.

Jharkhand became the 28th state of India in November of 2000 (Government of Jharkhand, 2013). Most of the state lies on the Chota Nagpur Plateau, and approximately 29% of the state is covered in woodlands. (Government of Jharkhand, 2013) Jharkhand has a population of approximately 32,988,000 people, of which 25,055,000 live in rural areas, or approximately 75%. (*Jharkhand Population Census data 2011, 2015*). In Jharkhand, PRADAN works in 11% of the villages (“The Origin: PRADAN,” 2016). The state has had a recent history of political instability, which certainly effects development outcomes throughout the state.

Chapter 3: Methods

While all interviews and experiences ultimately shaped overarching analysis and conclusions, some methods were specifically applicable to each research question investigated in this thesis. My first research question is thus as follows; *What are the core dynamics of microbial water management in rural India?* This has led to the overarching question, *Under what conditions are community organizations effective in advancing water and sanitation systems in rural India, and what is the role of NGOs therein?*

This chapter discusses methods used to analyze both research questions. The below figure is a summary of the research design for each part.

RESEARCH DESIGN
<i>What are the core dynamics of water management in rural India?</i>
Sampling
NGO Group Model Building Sessions
Focus Group Sessions with Communities
Unstructured Interviews with Water Team
Causal Loop Formation Through Content Analysis
<i>Under what conditions are NGOs able to advance water and sanitation systems in Rural India?</i>
Selection of Extension of Field Theory Framework
Re-examination of previous interviews with new lens
Unstructured Interviews with NGO management staff
Content Analysis of Interviews Using an Extension of Field Theory
Synthesis with Causal Loop Diagram Analysis

Figure 2 - Summary of Research Design

3.1 Methods: Core Dynamics of Water Management in Rural India

3.1.1 Design

My research team consisted of myself, my colleague in Mechanical Engineering, Dr. Michael Bono, and my research advisor Dr. Chintan Vaisnav. Because we were interested in understanding the factors of microbial water quality in various contexts, we visited geographically diverse locations to do *field research*; one in a mountainous region and one in a plains region. These locations represent two diverse hydrogeological systems of rural India. NGOs facilitated our visit in each location. This was possible in part because of the existing relationships they have with Tata Center at MIT. Thus, we were able to visit the offices of the NGOs PRADAN and Himmotthan in rural India in January of 2017.

We were able to talk to these NGOs about their work and strategies, and hold a simple group model building session. Additionally, while meeting with the NGOs we talked about the communities they worked in, and communicated we would like to visit communities with “advanced” water systems and also some with “less advanced” water systems. Thus, after meeting with NGOs, they were able to facilitate field visits to both types of communities. The communities that had “advanced water systems” had had extensive NGO contact, while the communities we visited that had “less advanced water systems” had had limited NGO contact. These less advanced water systems were treated as the “control villages” that were relatively untouched. We met with local community members there and held focus groups. At least one member of the NGO that works directly with communities was present with me at all times to help with introductions, trust building, and translations. Additionally, we took time to visit the different types of water infrastructures present, ranging from solar powered pumped piped water, to hand pumps, to wells.

3.1.2 Subjects

We used *purposive sampling* based on the geography. We studied water systems in Uttarakhand, with a mountainous terrain, as well as an NGO in Jharkhand, that works in primarily in the plains. In total, we conducted 20 semi-structured interviews in January of 2017 and August of 2017. These interviews ranged from approximately 30 minutes to 1 hour and 15 minutes. We performed 8 focus group sessions with members of rural communities, which ranged between 1

hour to 1 hour and a half hours. The attendees at these focus groups were primarily women in Self Help Groups, and anywhere from 7 participants to 30 participants attended. We also performed 2 Group Model Building Sessions, one with each NGO, which ranged from 2 – 3 hours. All interviews and focus group sessions have been audio recorded with consent of the subjects. The overall study design has been approved by MIT’s Review Board; The Committee on the Use Human Subjects (COUHES).

The tables below have the breakdown of subjects. “Advanced” Water Systems indicates that the community had installed piped water (either from a Spring Catchment system or borewell), and “Basic” Water Systems indicates that the community was primarily using a hand pump to meet their domestic water needs. See Appendix A for field research materials and Appendix B for field work photos.

	PRADAN	Himnotthan
Participants in Group Model Building Session with NGO water team	6	6
Semi Structured Interviews with members of Water Team	3	3
Focus Group Sessions with Communities with “Advanced” Water Systems	3	3
Focus Group Sessions with Communities with Basic Water Systems	1	1

Table 2 - Summary of Participants Interviewed

Uttarakhand	Advanced Water System	Basic Water System
	Kudiyal Gaon Day 1, 12 attendees	
	Kudiyal Gaon Day 2, 18 attendees	
		Chureddhar, 20 attendees
	Jadipani, 7 attendees	
Jharkhand		
	Ronhe, ~30 attendees	
	Gopla Parkharatoli, ~30 attendees	
		Belkhara, 30 attendees
	Jolha Karma, 16 attendees	

Table 3 - Sampling of Community Water Systems

3.1.3 Procedures

Based on the interviews and focus group session, we created causal loop diagrams to reflect the causal relationships expressed. We elicited variables from the conversations that came up repeatedly, and linked them together. As described above, we used a three-fold research approach; Group Model Building Sessions with 2 NGOs, semi-structured interviews with 6 NGO employees, and 8 focus group sessions with members of Self Help Groups in the communities NGOs work in to craft the causal loop diagrams. Typically these Self Help Groups were either created or continually supported by the NGOs. Below each activity is described in more detail. Chapter 4 will discuss the results of the Causal Loop Diagram Analysis, and Appendix C provides additional documentation for the diagrams.

Group Model Building

We conducted group model building sessions with members from each NGO who were involved in water and sanitation work in some capacity. We adapted a common script for Group Model Building processes known as the Hines method. We started the conversation by explaining the basics of what stocks and flows are. Stocks are accumulations of an object, and flows are the rate at which an accumulation builds up or leaves. We presented a skeleton diagram of Stocks that showed accumulations of contamination in 3 stages; water in community public storage, water in local homes, and water that is ultimately digested. We elicited variables that contributed to contamination in each stage, worked with the group to choose the most important variables, and then charted reference modes (or behaviors over time) for each of these variables. When developing causal loop diagrams to best describe the system, we tried to base it around these anchoring variables.

Semi-Structured Interviews with NGO staff

We conducted semi-structured interviews with members of NGO water teams. Our question topics included what impacted water and sanitation infrastructure adoption and how NGOs worked with each community. We then typically focused the conversation on their particular expertise and how they individually contributed to the mission of the organization. The questionnaires used for semi-structured interviews are included in Appendix A.

Focus Groups with Community Members

For focus groups in communities, we began each session with an introduction from the NGO facilitating our visit. We obtained verbal consent from the community members for the session to be recorded and pictures to be taken. We then introduced ourselves and asked an “ice-breaker” question; typically what everyone’s favorite food was. The topics we covered in each session included the water systems they used, their perceptions of water quality, the presence of waterborne diseases, the daily routine of community members including their role as Self Help Group members, and how they interacted with the NGO. We often discussed where community members would consider a water sensor to be most useful.

Observations

In addition to all of the above, we visited various sources of water and sanitation infrastructure. We learned about the construction process, the power source for water transportation (usually solar in this case), and where the pipes were laid for greatest community access.

3.1.4 Measurements

These interviews, focus groups, and group model building sessions were translated to causal loop diagrams through an iterative process derived from system dynamics modeling methodologies. First, we identified important variables that impacted water quality through the Group Model Building Sessions with the NGOs. We tried to make sure these variables were including in the diagrams we created. Using the field observations, focus groups, and interview data, we ensured that each linkage created in the causal loop diagrams could be supported. See Chapter 4 for an explanation of the Causal Loop Diagrams and Appendix C for documentation.

3.2 Methods: NGOs Advancing Water and Sanitation Systems

After examining physical parameters of water quality in rural India, our investigation shifted to an institutional analysis of how NGOs were engaging in the space of water and sanitation.

We selected the NGOs that had facilitated our visits to the field as our units of study for this overarching question. Our research approach is explained below.

3.2.1 Design

In August of 2017, I returned to India to share with NGO leadership our understanding of water systems and then performed semi-structured interviews with NGO leadership. I interviewed six members of PRADAN's strategy leaders in their main office in Delhi, rather than their office in Jharkhand where I had visited earlier. I interviewed 8 members of Himmotthan's strategy leaders, in their office in Dehradun, where I had visited earlier with my team for the previous group model building exercises. This purpose of this visit was to share our earlier understandings of factors leading to microbial water quality and develop a broader understanding of the context the NGOs work in.

3.2.2 Subjects

I conducted semi-structured interviews with 6 NGO staff members associated with PRADAN, and 8 staff members associated with Himmotthan. At PRADAN, the individuals I spoke to included staff focused on resource mobilization, youth engagement, partnerships & communication, and monitoring & evaluation. At Himmotthan the individuals I spoke to included the natural resource management coordinator and project associates at Himmotthan. I also spoke to individuals from partner organizations like the Himalayan Institute Hospital Trust and the Tata Trusts, who work very closely with Himmotthan. In these interviews, I often focused on their expertise area and how their work fit within the broader work of other organizations, especially those focused on water and sanitation.

3.2.3 Procedures

Interviews

The interviews focused on overarching NGO strategy, and their relationship with other organizations. The interviews also focused on gaining feedback on the causal loop diagram structures that were created. My interviews also delved back into the original motivation for this

project. For instance, I would discuss what are the barriers to implementing water sensors? Who would be the best users?

Focus Group Session with PRADAN

I conducted one focus group session with PRADAN to introduce myself to several members of the NGO I had not yet met, and receive feedback on the causal loop diagrams we had constructed. This meeting allowed for logistical planning of the rest of the interviews. I was not able have the same format with Himmotthan because of scheduling constraints.

3.2.4 Measurements

I recorded and transcribed all interviews. I then manually coded the interviews for instances of “alliance brokerage”, “resource brokerage”, and “framing”. This highlighted the relationships with other organizations and the state that was not otherwise apparent. I also coded for “barriers to implementing water quality testing”, which will help tie this line of question back to the overall motivation of the project. Chapter 5 discusses the results of this analysis. I then synthesized my findings with that of Chapter 4 in the concluding Chapter.

Chapter 4: Systems Analysis of Core Dynamics Underlying Drinking Water Management

This chapter examines systematically what factors lead to water quality in rural communities in India. Using a combination of Focus Groups with NGOs and communities, we identified key aspects that are important for a community to have good water quality. In general, we find that good microbial water quality is ultimately dependent on community organizations, water availability, sanitation infrastructure, water infrastructure, and personal water practices. These insights were drawn mainly from interviews with the water members of the NGO water team and from women's self help groups themselves. In January of 2017 we visited NGOs and attempted to formulate a unified diagram that encompasses the strategies of both NGOs in both locations.

4.1 Dynamics of Community Organizations

A theme present throughout our research was the importance of community organizations in various forms. The below figure shows the dynamics that lead to the maturing of community institutions, focused on the development of women's self help groups. Based on our fieldwork, we found that the maturity of community institutions shapes the demand for sufficient and safe water. Self Help Groups, a form of women's collectives, became a powerful force in moving the community forward in areas of livelihood creation, financial stability, and water management. Self Help Groups exist in Uttarakhand, Jharkhand, and other states throughout India, and can serve slightly different purposes depending on the context of the community. However, the common thread seen throughout these Self Help Groups is that they are able to highlight the needs the community and catalyze taking action to tackle problems.

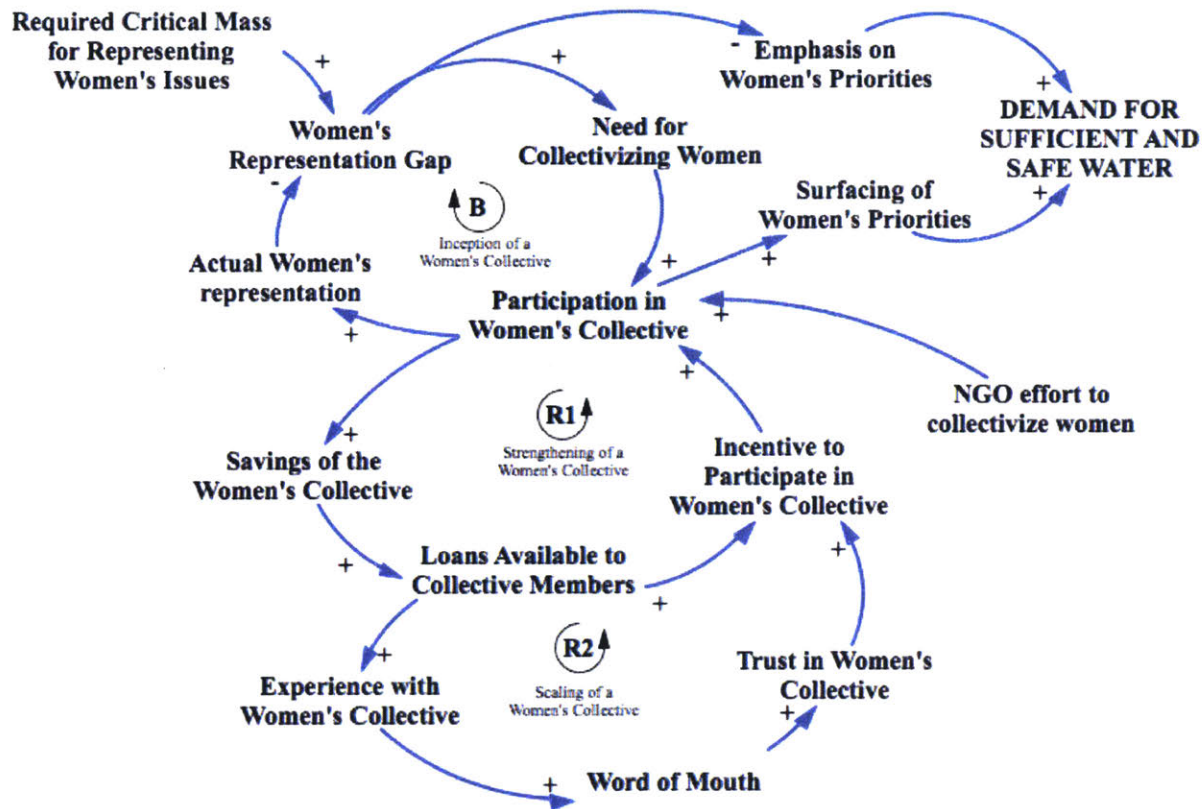


Figure 3 - Dynamics Underlying Community Organizations

In order for a Self Help Group (SHG) or women’s collective to begin emphasizing their needs, there must be enough people involved. Thus, there is a gap that needs to be overcome between the “required critical mass for representing women’s issues” and “actual women’s representation”. When an NGO like PRADAN interacts with a village, women in the village are able to visualize their problems more clearly. This can be inequality between genders, insufficient income, or the difficulty of collecting water. In order to address their needs adequately, the “need for collectivizing women” increases. As this need for creating a SHG grows, the incentive also grows to join. More women are attracted to the group, realizing that the organization can help them tackle obstacles in the community. Thus, participation in the women’s collective goes up, actual women’s representation goes up, and the women’s representation gap narrows.

A women’s Self Help Group has several benefits. As participation goes up, financial savings go up. As the savings go up, more loans are made available, and thus the incentive to participate in the women’s collective increases, furthering the actual participation in the women’s collective. Furthermore, as more loans are made available, people have a more positive experience with the

Self Help Group, and positive Word of Mouth (WOM) will increase surrounding membership. Trust grows, and incentive to participate grows, thus again increasing participation. NGOs also play an important role in incentivizing women to participate in SHGs. A female employee working with the Tata Trusts and Himmotthan says that women's participation in the collectives is driven mainly from the desire to have savings and loans... "The mindset is all about the money" (Senior Executive, Tata Trusts). She says that they will sit for one and a half hours for money management, but wouldn't want to sit their that long for a training. Women are generally overburdened; but if they can make some money out of meeting, they will do the extra bit.

As self help groups become stronger and have more women participants, the women begin to get a voice in the community governance. They are able to bring attention to their needs and emphasize taking action. Water management is typically a task women are expected to handle; they collect water for their families from far away sources. However, the male dominated community governance did not recognize the hardship women faced in gathering water; men themselves had no issue. According to PRADAN, it was the women in the Self Help Group that actually brought to their attention the need for closer and safer water. It was only then that PRADAN was able to begin investigating ways to assist the community. This was a common pattern we found in PRADAN villages where water was present; as women gained more of a voice, the demand for sufficient and safe water increased. PRADAN shared this concept with us in their interviews, and my team got to visit the water infrastructure sites ourselves to see the end result.

While the above narrative drew on narratives from on PRADAN, Himmotthan also has a strong element of women's empowerment. A Himmotthan employee says regarding the gap of women's representation; "yes exactly that's the situation, and that I believe is a gap... and that is why the Swajal program that we had, so the whole criteria of planning phase and making sure that 30% participation is from women's side, as decision-makers... was to fill that gap" (Staff member, HIHT). The Swajal Program used to run for 4 to 5 years; in which a whole year was dedicated to the planning phase and it was ensured that the organization talked with women.

Takeaway: The above causal loop diagram discusses the growth of women's self help groups as a form of community organizations leading to demand for water quality. However, any form of community institution can lead to the demand for water quality, such as village community water and sanitation committees or local councils.

For instance, in the cases we examined of PRADAN, women's voices seemed to be intentionally highlighted as their form of development, and seemed to mostly align with the above diagram. One PRADAN member emphasized it's important that individual demands be taken into account, but there was general agreement that several women needed to be expressing their voices to be heard. However, as members of Himmotthan pointed out; generally women are very involved in collecting water, but do not currently have much say in the management of water.

Additionally, one Himmotthan employee pushed back on the idea that the demand for water infrastructure comes from the community itself. He would say that most of these schemes are based on the NGOs observations and their own experience (Staff Member, HIHT). They of course will speak with village pradhans and the village panchayat system, but the selection of these organizations is more from the organization side rather than the village side. However, as discussed in other interviews; the NGO's do make sure that there is a 2-way "demand". If the community institutions are not strong enough to "demand" their presence, then they will not work there and water infrastructure ultimately will not be installed.

4.2 Dynamics of Water Infrastructure Installation

The below figure shows the dynamics we uncovered that leads to water sufficiency in rural areas. Several communities throughout rural India face challenges of water quantity. However, there is often a lot of untapped potential of water quantity (i.e. groundwater that has not been extracted, rainwater that has not been collected, natural springs that have not been managed).

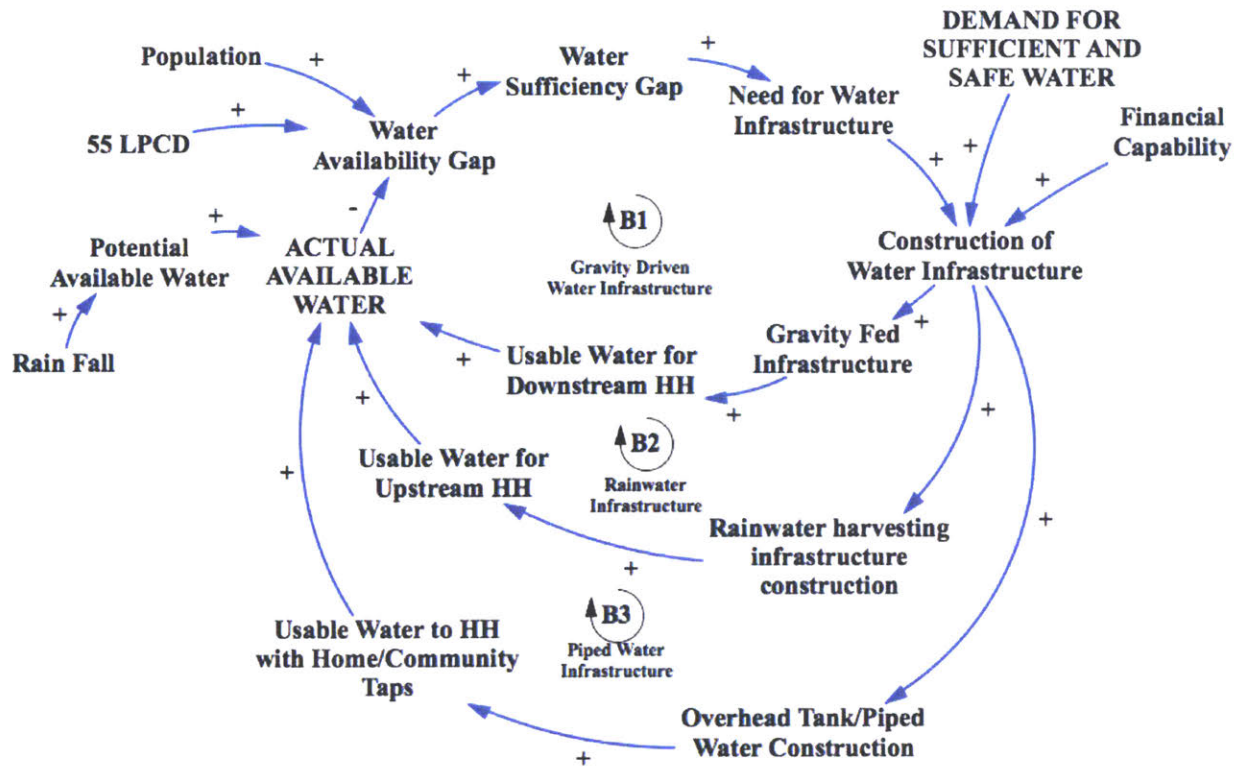


Figure 4 - Dynamics of Water Infrastructure Installation

One can consider that there is a gap between the potential water available in a community (if water was managed correctly) and actual available water in a community. Additionally, there is a gap between this available amount of water and the desired amount of water to meet the minimum need that communities have. This can be referred to as the water sufficiency gap. If the water sufficiency gap is large enough, the need for water infrastructure naturally goes up. However, what catalyzes the development of actual water infrastructure is the demand for water infrastructure, which is often influenced by the involvement of an NGO. Based on the context that Himmotthan works in in Uttarakhand, a common strategy was gravity-driven water infrastructure, meaning the management of natural springs, or Rainwater harvesting infrastructure. In Jharkhand, piped water infrastructure using groundwater was a popular mechanism. Each type of infrastructure serves different types of households (HH) as can be seen in the causal loop diagram below. Due to the water management structures, the actual available water increases, and the water availability gap decreases, and the water sufficiency gap also decreases, thus creating a balancing loop.

It is important to place this in the broader context of climate change and the depleting water table; according to a Himmotthan employee “Because the groundwater is depleting there is no

water eventually. So then they dig further. So that is in turn not allowing the natural process of groundwater to happen, which is what effects the water quality” (Associate, Himmotthan).

Takeaway: There are several types of “infrastructure”; that may not include physical installations.

Himmotthan also works on “conservation-activity infrastructure”, which means contours and trenches, building recharge areas, aquifer work, and more. If we include this type of infrastructure, this formulation makes sense.

Additionally, according to a PRADAN Group meeting, it is important to keep in mind that this water infrastructure is only in a very few villages, and is not ubiquitous throughout India. It is more common in the mountainous region where they can take advantage of gravity-driven infrastructure. Also, rainwater is often not used for drinking, but for irrigation, which is important to keep in mind when analyzing the system holistically.

Takeaway: The role of the government is really important in financial capability.

What we mean by the above “financial capability” in the above loops is essentially the ability of community members to pay for it. A member of Himmotthan expressed one example in which they proposed a water scheme, but the community members decided only chose to implement certain parts of the water scheme because of their financial limitations. As suggested in several interviews, it is important to consider that the government really influences this. If there is government funding or support that communities can leverage, they are more likely to push through with water infrastructure installation.

4.3 Dynamics of Operation and Maintenance

The below figure demonstrates the operations and maintenance dynamics our fieldwork revealed. Once a water structure system is up and running, operation and maintenance are key to keep it going to prevent slip back. Successful operation and maintenance will result in the chlorination and cleaning of the community water source; whether this is an overhead tank. In the case of PRADAN, or a tank collecting spring water, in the case of Himmotthan. To understand this system we can think of there being a “gap” between the needed operation and maintenance, and the amount of operation and maintenance that is occurring. The more operation and maintenance there

is, the more usable water infrastructure there is. Pipes won't be leaking, hand pumps won't be rusting, chlorine will be added regularly to the storage, and the quantity of water will remain at a good level. The amount of water that the system produces has a direct impact on the incentive of the community to keep maintaining their system; if it is producing enough water then they will want to keep it going.

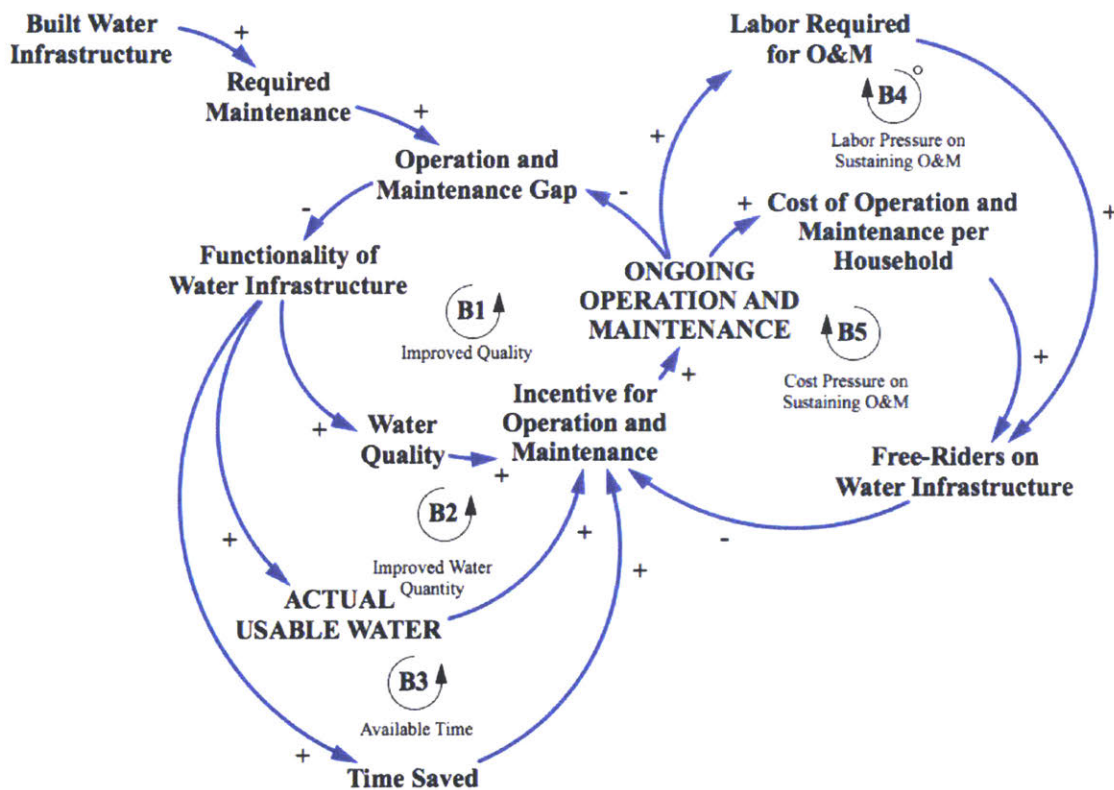


Figure 5 - Dynamics of Operation and Maintenance

However, as reflected in the about loops, typically the more operation and maintenance that is required, the more labor is required, and the more the system costs to upkeep. As the costs rise to maintain the system, the greater chance there is for “free-riders”, individuals who take advantage of the common access to water without paying their fair share or helping clean the tank when needed. This problem of the commons, or increasing free riders, actually decreases the incentive to continue operation and maintenance practices; people don't want to pay or work for others unfairly.

This insight was based off of actual examinations of advanced pipe systems. To keep in mind the communities that don't have advanced piped water systems; In the PRADAN group meeting there were comments that in the operation and maintenance of hand pumps, there is external dependence; someone must come and repair it. (However, in the case of wells, they can repair their own).

4.4 Dynamics of Sanitation Infrastructure

The below figure shows the process by which sanitation infrastructure gets adopted. The quality of water and health is closely linked to good hygiene and sanitation practices. Thus we feel it is important to capture the nature of the sanitation dynamics in a village in order to get a complete picture of water quality. In rural India, a common practice has been open defecation. However, the effort to install sanitation units has been growing; a Swachh Bharat Abiyan ("Clean India") has set aside funding for the implementation of millions of toilets in the coming years. Given this push for sanitation by the government, both Himmatan and PRADAN have had extensive involvement in working with communities to address their sanitation needs. Using their experiences, elicited some important factors that lead to increased toilet construction. From an NGO perspective, we determined that there is a connection between the amount of toilets and the source water quality; the more toilets there are, the less amount of fecal contamination there is that can end up in the source water.

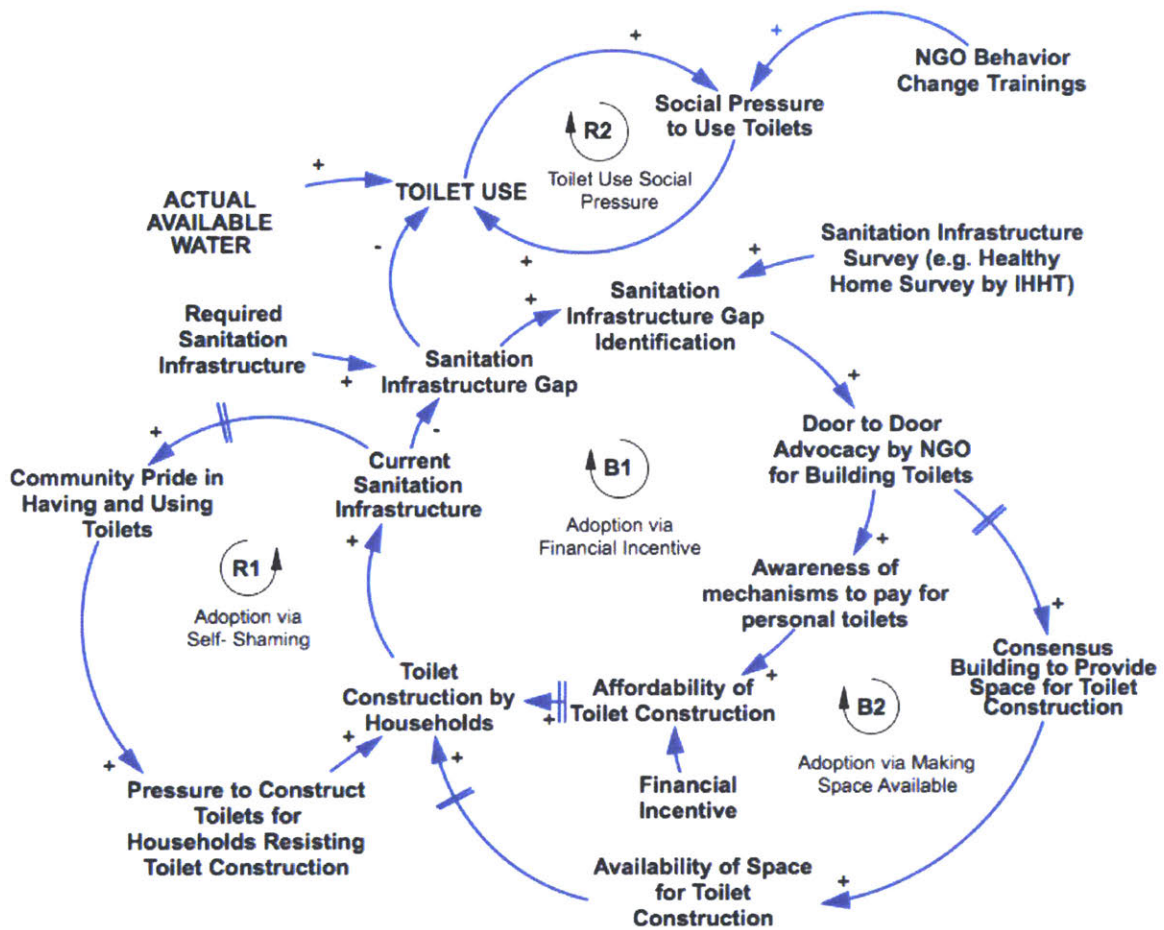


Figure 6 - Dynamics of Sanitation Infrastructure

We consider that every village has a gap between the required sanitation infrastructure and the current sanitation infrastructure; the “Sanitation Infrastructure Gap”. The larger the gap is, the easier it is to be identified by NGOs like those in Uttarakhand, who survey communities through use of a “Healthy Home Survey”. If there are a lot of people who need sanitation units, door-to-door advocacy for toilets increases. As this door-to-door advocacy by NGOs increases, the awareness of the need for toilets increases as well, and affordability of toilets becomes more manageable. The door-to-door advocacy also eventually results in consensus from community members to provide space for toilet construction. Often times, people do not own enough land to create a toilet; they must rely on the generosity and understanding of those around them to allocate them space for a unit. NGOs often take an intermediary role in this, facilitating discussions between community members to find space for installation. Ultimately, this heightened awareness combined with increased consensus can increase availability of space for toilet construction. All of these factors

increase the amount of toilets constructed by households, increase the current infrastructure, and reduce the sanitation gap. As there are more and more toilets; the sanitation infrastructure in a community eventually reaches its saturation point and less and less toilets are constructed.

There are also other important dynamics to consider that impact people's desire for toilets. As more and more toilets are installed, people begin to see toilets as a status symbol and they take pride in having their own. The more pride there is associated with having a toilet, the more people feel pressured into constructing a toilet of their own. This reinforcing structure helps to increase the number of toilets installed in a community. For those who are late adopters of the technology, there is another dynamic that encourages them to adopt. People in the village actively begin to look down upon those who do not have toilets of their own. Thus, as pride in toilets goes up, shaming of others also goes up, and people will ultimately construct more toilets. Overall we feel that these are important characteristics of the system to capture for a couple reasons; for one, sanitation has a direct impact on water quality and health. Additionally, understanding how a community reacts to and adopts new technologies is crucial in understanding how to design potential interventions for communities.

Takeaway: The above causal loop demonstrates what we observed the NGO's strategies to be, and doesn't take into account all of the situations of sanitation installation by the government.

A Himmotthan associate (a previous AQWADAM employee), suggested the addition of the government to these diagrams because NGOs are very small; "They're very small, their footprint is very small". This is important to keep in mind in this thesis especially as its focus is NGOs and community organizations. Additionally, he adds we should have more intervening factors to make the relationships between the arrows more understandable; for instance an intermediary diarrhea step for sanitation gap to turn to door-to-door advocacy of NGOs. Or, he says there should be an intervening variable between the sanitation infrastructure gap and the gap identification; "This lack of infrastructure, it may lead to some kind of disease, epidemic,..."

Takeaway: The loop above focuses on sanitation installation factors, and less on usage factors. Factors contributing to usage should include water availability.

This same Himmotthan associate commented, like many people we interviewed, that water availability is a very big factor in toilet usage. Many people constructed a toilet in the house, but

they don't have water supply so no one is going to fetch water in a bucket and use this toilet; "It is better to out in the open and just take your bottle of water". An HIHT staff member points out that if you have a sanitation unit, but do not have water, it will difficult to use toilets effectively.

Additionally, while the above loops hint at the behavioral factors that go into toilet usage, they are very nuanced, and they way they are carried out will be discussed in more detail in the following sections. Members of a PRADAN group meeting agreed that the availability of Water should be included in this. There were also comments on the fact that inappropriate design of toilets could impede correct usage of toilets. There was agreement that behavior change was an important issue.

4.5 Dynamics of Water Quality

The below figure shows the water quality and health dynamics our fieldwork revealed. All of the dynamics described thus far contribute to the ingested water quality, and resulting health. Ultimately, ingested water quality is affected by a combination of factors; water quality in community storage, water practices in the home (here represented as "compliance with hygiene practices"), and ingestion from uncontrolled sources. A dynamic to consider here is people continuing good practices due to good results; if compliance with hygiene practices goes up, ingested drinking water quality goes up, and incidents of waterborne disease go down. According to a PRADAN team coordinator, people in the villages have been able to recognize the connection between their good practices and reduced waterborne diseases. He says that that due to this positive change, people are likely to continue their good practices.

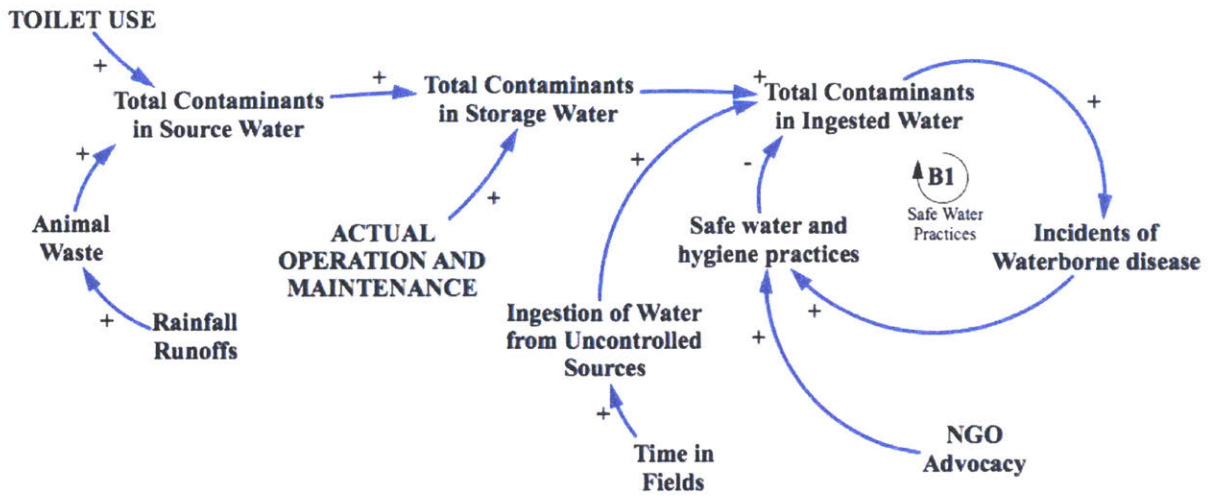


Figure 7 - Dynamics of Water Quality

Here hygiene practices include not just personal hygiene such as hand washing, but hygiene of water storage. According to Himmoth and PRADAN, examples of good hygiene practices include; covering stored water, preventing livestock and children from accessing water, not putting fingers inside the glass of water, boiling water, and more. Unfortunately, villagers are under a lot of time pressure and do not often comply with water practices that are time intensive. One especially notable instance of this is boiling water; most people in villages knew that boiling water helps keep water safe. However, according to women in Jadipani, they often don't boil because it requires a lot of time and has a high energy cost. Women in other villages echoed this sentiment as well, including those of Kudiyal Gaon. Often, people only boil water if someone is sick, because they see that they are able to accomplish more housework and fieldwork if they do not have to take time out to boil. Essentially, the more time the practice takes to do, the less likely an individual is to comply with hygiene practices. Additionally, people usually only boil when they get sick. The relationship often goes; The more waterborne disease there is, the more they boil the water, and then the water gets cleaner. When the water is cleaner, disease is lower, and they stop boiling, and then disease gets higher. This is captured in the balancing loop above.

Working in the farm also makes it difficult to comply with hygiene practices. People often go to work in the farm when it is raining. An important linkage to consider is that the more time individuals spend on the farm, the less access they have to reliable water sources, and the more

they drink from unknown or uncontrolled sources. Villagers in Rohne for instance say that their sickness rises when they are drinking water from everywhere.

As mentioned earlier, a big factor that influences ingested drinking water quality is the chlorination and cleaning, which results from good operation and maintenance practices. This could be a common well, water tower, or spring catchment area. The water in community storage is also impacted by other influences; if there is more rainfall, then more contamination can get into the community source. Additionally, the closer the community storage and water access point is to people, the more likely it is to get contaminated. History has shown that the closer the water access point is to people, the more contaminated it gets. For instance, in the village of Kudiyal Gaon, villagers said that drinking water problems are not major there because there is no settlement above the spring where they are.

Takeaway: The relationships listed above can be problematized.

At times, incidents of waterborne disease does not go clearly to “compliance with hygiene practices” (Associate, Himotthan). There are so many things happening in between. Perhaps diarrhea should be an intermediary step in here. A Himmothan assocaite brings up again that they have acclimated to this problem; and they will probably not switch unless something big happens or if there is sufficient advocacy from NGOs and government.

Takeaway: Populations in Communities are not homogenous, and communities across a region are not homogenous, and should be categorized differently, often by age and gender.

From the PRADAN meeting they expressed the importance of disaggregating people in the community. For instance; “When it comes to children it’s easier to do this practice of washing your hands, habit formation is easier..” People will form different habits according to whether they are women or men, elderly or young, etc.

Someone in the PRADAN group meeting comments that the stage of a community could really change the perception of water quality; another seems to clarify; “the concept; it may be quire remote for some people, to have that in their world view”. Most SHGs would not identify “quality” as a need. A staff member from HIHT says the diagram is okay, but water quality is something that we communities don’t consider. I think the diagram I showed him had 3 things to incentivize because of better water quality, more water, and more time saved. He says the taste of

the water is rarely an issue. However, there was general agreement of this diagram from a senior executive of the Tata Trusts In general Lara and a staff member of HIHT.

4.6 Evolving Community Maturity

Based on the narratives from these NGOs, we propose the following schematic as a way to visualize a community’s “maturity” on their way to safe microbial water quality. Each causal loop diagram as discussed above is roughly correlated to a “slice” of a pyramid.

Takeaway: Though the NGOs are different in their approaches; they have a similar perspective on the physical factors that lead to safe microbial water quality. Water Quality rests upon sanitation infrastructure, which rests upon water availability, which rests upon water infrastructure, which rests upon community institutions. This is seen in the diagram below.



Figure 8 - Evolutionary Dynamics of Stages of Community Water Maturity

Mature community organizations are the underpinning required for demanding and sustaining water system in a rural area. It is the seasoned community organization that helps

achieve the operation and maintenance of water infrastructure and the regular availability of water supply. While Water sufficiency rests upon both endogenous factors such as operations and maintenance and exogenous factors such as rainfall that makes water available in the first place; it is the functional infrastructure that plays an important role in reaching the water to its end user. This water supply effectively contributes to the successful use of toilets. Use of toilets, along with safe water management and hygiene practices contributes to safe microbial water conditions. These relationships can be traced through the causal loops just expressed.

Takeaway: Community maturity does not necessarily always evolve in this clean sequence on their path to safer water quality.

For instance, a partnership engagement staff member of PRADAN says that; “If you see how it’s currently happening it’s not really going in that neat sequence, because sanitation infrastructure you see are coming up, but without the earlier steps of water infrastructure and water availability”. Regardless, while the community does not need to progress in these neat steps, these layers must be present for ultimate water quality.

Takeaway: From this systemic analysis, we see that water and sanitation systems are keys to advancing water quality. This conclusion informs are subsequent analysis of the ways NGOs are actually involved in the advancing water and sanitation systems.

Chapter 5: Analysis of NGO Strategies

The analysis on NGO strategies is primarily drawn from a range of interviews with NGO employees. These interviews were assessed using an extension of Field Theory Framework; the transcripts were analyzed for instances of resources, alliances, and framing. Examining the interviews in this way allowed visualization of connections and comparisons not otherwise obvious. Overall, these NGOs acted in similar ways in many cases, but also acted accordingly to adapt to their individual contexts. Overall, because these NGOs are in very different stages of experience with water and sanitation planning, their strategies play out in different ways. This chapter begins with an examination of Himmotthan's work, followed by an examination of PRADAN's, with a follow-up comparative discussion. For each NGO, the general flow of water work that is done in their respective communities is explained, and this narrative is used as a basis to delve into a deeper examination of field theory parameters. This narrative helps expand on how they are leveraging their strengths to achieve water and sanitation infrastructure.

5.1 HIMMOTTHAN ANALYSIS

5.1.1 Himmotthan's Water and Sanitation Work in a Community

While Himmotthan works in a variety of areas including livestock and agriculture, they have refined a process for working with communities to implement water and sanitation projects. There is a 6-month planning phase, a 12-month implementation phase, and a final 6-month operation and maintenance phase (Junior Engineer, HIHT) .

As a way to focus their efforts, Himmotthan surveys villages to determine where they should work. For instance, If Himmotthan has money to work on issues in 5 villages; they will visit 10 to 15 villages in person to analyze whether a scheme should be built there (Staff Member, HIHT). After Himmotthan's visit, the village itself will have to apply for Himmotthan's services. Himmotthan would then select which 5 villages they will work with. Thus there is an application from both sides. For Himmotthan to agree to work in a community, they require 5 – 10% community contribution, which can come in the form of cash or labor (Staff Member, HIHT).

It is for this reason that Himmotthan could be considered to be a demand-based program; generally they have more people that want their services than they are able to provide (Community Mobilizer, HIHT). An employee of a partner agency of Himmotthan, echoes this sentiment as well. He emphasizes that with NGO's it is a 2-way request to work with each other. At times, a community will want Himmotthan's water services, but will not be willing to make any investments, and thus will stay with their existing scheme (Staff Member, HIHT). Government work seems to be more one-sided. The government will receive requests for help with water availability from people in districts like Bageshwar, the Swajal department, and from villages themselves.

In the first 6 month planning phase, representatives from Himmotthan or a partner of theirs like the Himalayan Institute Hospital Trust (HIHT) perform a baseline survey of the village (Junior Engineer, HIHT). These representatives perform a Healthy Home Survey, which documents several individual practices. It has 3 sections; individual health, household health, and environmental health. There are 21 components among these sections that document elements such as personal hygiene and toilet practices (Junior Engineer, HIHT). The healthy home survey has multiple uses; to collect information, but also to share information about best practices. While completing the survey, Himmotthan also uses behavior change posters and something called a SARAR kit (Junior Engineer, HIHT). The SARAR kit is essentially a toolbox of ways to communicate how people can change their behavior to have better water and sanitation practices.¹ Going forward, HIHT will work with the community over the course of a year to make sure their sanitation habits are good. This can mean making sure that people not only use toilets, but install them if they don't have them. According to a community mobilizer; "If we do all this water work, but people keep defecating near the source and all that, it will defeat the purpose" (Community Mobilizer, HIHT).

While surveying the condition of the community, and who is most in need, Himmotthan and its partners try to identify viable water sources for the community (Community Mobilizer, HIHT). The water available in a community is sampled and tested by a government lab (Junior Engineer, HIHT). Himmotthan also makes sure detailed technical report is prepared, which commonly known as a DTR (Junior Engineer, HIHT). However, the DTR is a also tool for the community to decide collectively where water lines will run and how many taps to install (Community Mobilizer, HIHT). He says that at the end of the planning phase, the community is presented with choices including budget options (Community Mobilizer, HIHT). An important aspect of this process is that at the end of the 6 months, the village and Himmotthan have the option to "drop each other" (Community

¹ SARAR stands for; Self Esteem, Associative Strength, Resourcefulness, Action Planning, and Responsibility.

Mobilizer, HIHT). Finally, the DTR is submitted to Himmotthan management for approval and progress begins (Junior Engineer, HIHT).

Once Himmotthan approves the report, they will transfer funds according to costs laid out in the DTR. Work will then go according to what was planned in the DTR (Junior Engineer, HIHT). Once the material arrives in the village, labor tasks are distributed, monthly targets are established, and their evaluation criteria is put forth (Junior Engineer, HIHT). HIHT will also have behavior change efforts in parallel with construction and planning work (Junior Engineer, HIHT). Initially, there are 2 meetings per month in this community; one with the User Water Sanitation Committee and one with the Gram Sabah (Junior Engineer, HIHT).² While Himmotthan interacts with Self Help Groups, they do not rely heavily on them for development projects.

In a village they are working with, HIHT appoints two people; a Community Development Specialist and a Junior Engineer, who oversees the construction (Junior Engineer, HIHT) Additionally, the work is overseen by a committee in the village which is headed by the Gram Pradhan (Junior Engineer, HIHT) The committee that is formed to oversee the project must be representative of the village; there should be about 25% women participation in this committee, and there must be members of scheduled castes and scheduled tribes, if applicable (Community Mobilizer, HIHT). The committee has a president, vice president, secretary, treasurer, and then about 3 – 8 members. There is a public election of these different members of the committee (Community Mobilizer, HIHT).

After construction of water and sanitation units, Himmotthan makes sure to evaluate the progress of the project and hand it over to the community. For instance, during this operation and maintenance phase, the water is tested again (Junior Engineer, HIHT). This community mobilizer is an HIHT member who works to supervise compliance with the plan that has been laid out for the village; if there is any difficulties they encounter, he will work with them to overcome those challenges (Community Mobilizer, HIHT). Concerning operation and maintenance, one person is selected in each village and is trained on how to run the chlorinator and overall system (Engineer, HIHT).

Each household will give a minimum of 10 rupees a month to cover these ongoing operation and maintenance costs (Engineer, HIHT). Additionally, Himmotthan ensures that there is a mechanism for continued progress after Himmotthan withdraws, which are called Self Reliant Cooperatives (SRCs) (Associate, Himmotthan). Amit summarizes this as follows; “These SRCs will take care of the work in the long run, after Himmotthan and the project will withdraw. So this SRC

² The Gram Sabah is an organized meeting of all the adults in a village.

is a local institution that will take forward the work we have started” (Associate, Himmotthan). Himmotthan ensures the creation of these local organizations to continue the work, speaking to the overarching theme of strong community organizations underpinning sustainable water and sanitation systems.

5.1.2 Himmotthan Alliance Brokerage

Takeaway: Himmotthan is building relationships with existing politicians and councils at the local level to enter into the community for water and sanitation work.

From the above narrative, it is evident that Himmotthan is utilizing existing networks of local government to ensure sustained water and sanitation efforts. As described above, Himmotthan only operates in a village when they receive an application to work there; which usually comes from an existing village council

Takeaway: Himmotthan is creating and working with local government institutions to ensure their water and sanitation work is implemented and sustained.

Once they begin intervening in the village, they help to build necessary organizations that are necessary for successful water management. For instance, they create a committee to oversee the installation of a water project in the village. They also ensure there is a self-reliant cooperative to take over the water work once they leave. The ability of Himmotthan to create alliances with these institutions that are locally rooted in the community means they are able to increase their legitimacy within that field.

Takeaway: Himmotthan cooperates with civil society organizations, notably the organization Himalayan Institute Hospital Trust, to successfully intervene in communities for holistic water and sanitation implementation.

Perhaps one of the biggest ways that Himmotthan uses partnerships is to directly intervene in communities and implement projects. As mentioned earlier the Himalayan Institute Hospital Trust (HIHT) is a critical partnership for project implementation. HIHT is an actual hospital working in the Himalayas, but they have several sub-programs that revolve around bringing better health to

communities. For them, water work is a somewhat of a smaller portfolio compared to the hospital and health work they are otherwise focused on. However Himmotthan relies on them extensively to be the implementing arm for their water and sanitation projects. Himmotthan has HIHT work on water projects where the government is not working (Junior Engineer, HIHT)

In addition to HIHT, Himmotthan works with other NGOs like the Himalaya Trust, also known as THT (Project Associate, Himmotthan) The Himalaya Trust works on similar issues; water, sanitation, and hygiene of women in the mountain regions. THT is working in a few areas of Uttarakhand on themes of water and sanitation, and make sure it is a mix of hardware and software activities. They are building water schemes but at the same time, they are “also talking about the awareness, hygiene activities, and how they can also learn a bit about water quality, talking about... things related to women issues” (Staff Member, HIHT).

Himmotthan’s ability to partner and form alliances with a variety other organizations is financially key to their projects, including their water and sanitation work. For instance, they work with the National Bank for Agriculture and Rural Development (NABARD), a semi-government organization (Project Associate, Himmotthan). Another organization to be aware of in this area is the ILSP; the Integrated Livelihood Support Project.

Himmotthan works not only with NGO’s and government’s, but has found a way to work with businesses as well. For instance, many private companies and government institutions came together to recover after a severe flood disaster in Uttarakhand in 2013 (Associate, Himmotthan). The media company *Star TV* began working with two partners in Uttarakhand; Himmotthan Society and People Science Institute. The focus of this post disaster effort was on long-term rehabilitation and livelihood restoration of the effected people.

Overall Takeaway: Again, Alliances & Networks allow NGOs to increase their legitimacy with the state, because they have been able to broker alliances across fields (Asad & Kay, 2014). Also recall, According to Evans and Kay, a field can be defined as “local social order of actors who take one another into account as they carry out interrelated activities and *that is characterized by an orienting principle or goal*”. Overall, Himmotthan is able to build relationships upward with the state, and downward with the community. This increases Himmotthan’s legitimacy with the state because it ensures an indirect connection for them with the community.

5.1.3 Himmotthan Resource Brokerage

NGOs are able to influence the state's participation in water and sanitation work by leveraging resources that states find valuable. These could be financial, political or cultural resources (Asad & Kay, 2014). Himmotthan is able to get funds from the state to carry out work, and it can do this leveraging its environmental expertise and donor funding.

Takeaway: Himmotthan has negotiated its role in the state by signing a Memorandum of Understanding to operate in different areas than the government for integrated water and sanitation projects, in a way that still allows them to access government funds for pieces of the project.

There are a variety of ways Himmotthan can work and has worked with the government. For some specific programs like livestock development, Himmotthan collaborates with the government. However, for drinking water schemes they have something called a "no objection certificate" that they take from the government and they present in a state level committee meetings (Natural Resource Management Coordinator, Himmotthan). This certificate seems to allow them to work with different hamlets; often the hamlets that are difficult to supply drinking water for.

Himmotthan is considered a long term partner of the state government; they have had a 10 year long agreement with the state government (Associate, Himmotthan). Tata Trust, who funds Himmotthan also has a MOU with the state government, which essentially means there are several levels of collaboration with the state government.

Takeaway: Himmotthan uses a variety of funding sources including major donors to ensure holistic projects.

Perhaps the most important funding agency to know that backs the work of Himmotthan is the Tata Trusts. The Tata Trusts gets about 600 crores in a year which goes into development work, which is distributed about 28 states and different verticals, and distributed to other partners also (Project Associate, Himmotthan). The Hens Foundation is an important stakeholder, as well as Titan, which is a Tata Associate Company (Natural Resource Management Coordinator, Himmotthan). Other funders include the Confederation of Indian Industries (CII) as well as HDFC,

the bank. The Mount Valley Development Association and the Himalaya Trust are also important stakeholders in Himmotthan's work (Project Associate, Himmotthan).

With any of Himmotthan's projects there is a component of convergence; meaning they use a variety of sources that funds their projects (Associate, Himmotthan). The money also doesn't just go directly to Himmotthan, but to the beneficiaries directly. For instance, there is an employment guarantee scheme of the central government of India, which can help support the construction of rural infrastructure (Associate, Himmotthan). Himmotthan would be able to support a government scheme to build a water shed by bringing in the goods necessary to build it; though the watershed is ultimately built by the government scheme (Associate, Himmotthan). In this way they are able to collaborate with the government.

Takeaway: Himmotthan has an expertise in water management that allows them to work in communities that might otherwise be ignored.

NGOs will usually work on water management in communities where there is a minimum of 9 liters per minute coming out of the perennial source (Staff Member, HIHT). However in some villages, only 5 liters per minute are coming out of the perennial source. If the discharge is low like this and the population is high, many organizations will consider working in the village a waste of money (Staff Member, HIHT) However, when Himmotthan encounters this situation, they know that something can still be done. They are able to begin catchment treat work area to revitalize watersheds.

Additionally, core members of the Himmotthan team have PhDs in fields related to natural resource management or ecology. This foundation in scientific rigor is present throughout their work and helps secure their favored position with the government and donors.

Overall Takeaway: Himmotthan is able to help communities take advantage of government funding by serving as project support. Himmotthan is able to maintain their legitimacy as a self-sufficient organization because they can take advantage of donor funding and their scientific expertise.

5.1.4 Himmotthan Framing

Framing essentially means taking actions to facilitate the adoption of a strategy in another field. In this case, this may mean the transfer of strategies from a “non-state” field to a state field. It may also manifest itself by the reconceptualization of a political idea, the linkage of new issues, or the transformation of available political options. Himmotthan’s strategies encompass several of these components.

Takeaway: Himmotthan positions itself as an organization that can “pilot” projects to be scaled up by the government; in this way they are expanding available political options.

Perhaps the clearest example of Himmotthan’s strategy to facilitate the adoption of strategies in another field is their intent to inform governmental policy. Himmotthan has had an MOU with the government for 10 years (Project Associate, Himmotthan). During this time, they have collaborated with different departments of the government based on what their focus of their project is. When Himmotthan began, Tata Trusts were funding all of the projects. However, over the last 10 years of operation, more groups have been giving Himmotthan money for their projects. According to a project associate at Himmotthan, “We try to involve the government, so that the structure which we’ve created can be sustained with the government”.

Himmotthan has worked with a variety of departments of the government for their overall work; it is not just departments related to water and sanitation. For instance they have interacted with the department of agriculture and the department of horticulture, as well as organizations involving animal husbandry, women and child development, and forestry (Project Associate, Himmotthan). Himmotthan is expanding its work at a good pace, but their goal is not to work in every village; “The idea is to create successful examples. It is not that we will replace government and we will start running the state” (Associate, Himmotthan). Thus this person considers that expansion at Himmotthan should happen through a limited extent, and the government should continue working through the existing structure. He lists the examples of running a dairy and creating a successful drinking water scheme as strategies that the government should adopt and then scale up.

Takeaway: Himmotthan has re-conceptualized the dominant political framing of water and sanitation service delivery by ensuring there is sufficient community buy-in and mobilization.

The way organizations approach installing water systems in communities can vary very different. There is a distinct difference between the way the government approaches water and sanitation infrastructure, and the way NGOs like Himmotthan have approached installing infrastructure services. A senior executive at the Tata Trusts summarizes the difference succinctly; the government focuses on quantity and Himmotthan focuses on quality.

According to a Junior Engineer for HIHT, the main differences between the government and Himmotthan is that the government just does the provisioning of water and leaves; the government is not concerned with community building and consensus building. Additionally, when the government installs projects they do not charge the community. In the case of Himmotthan, Himmotthan makes sure the community pays 10% of the total scheme so there is a greater “buy-in” (Junior Engineer, HIHT). According to a Himmotthan Associate, there are different ways of working with a community. The government uses one scheme “Peyjal”, which is very different from the scheme used by Swajal; one which engages the community intensely. The natural resource management coordinator from Himmotthan says that Himmotthan’s work mainly focuses on water scarce villages; “so for those villages we make a separate committee that we call water management village committee, and we tell them we contribute 10% in cash from villagers, to increase their ownership”.

An HIHT community mobilizer gives the following example for how the government scheme can be inefficient. A contractor for the village may go to a water board in the government with a proposal for a water scheme in a village. The officer who sanctions the scheme will look for his own cut; and in reality the scheme was proposed so that the contractor could make money himself. So, the water scheme can get passed without an in depth analysis of what will serve the whole village or how sustainable it will be. Also, contractors often work during rainy season, meaning that there is enough water to make the line usable for a while; but in the summer the line can dry up (Community Mobilizer, HIHT)

In contrast, the engineers that work for Himmotthan only give technical advice to communities; all of the decisions the community makes are decisions for themselves (Community Mobilizer, HIHT). For example, this mobilizer gives the example that one village wanted a pumping scheme in 2003, but when they learned the exact monthly costs of what this would entail; the village opted for a less expensive water management strategy; rainwater harvesting.

It is important to acknowledge the role of women's Self Help Groups. While these have become really important tools of development, from the interviews conducted, their role in advancing water and sanitation in Uttarakhand didn't seem to be emphasized.

A staff member says the role of government is really important in the financial capability. He adds that the government has a more important role in providing water infrastructure; people can afford installing their own toilets but can not afford building their own toilets; "Sanitation is something that can be taken care of, but it's more about the mindset change, it's more about the community work". In general, communities perceive that water work and maintenance should be done by the government and do not see themselves as being the major responsible party.

Takeaway: Himmotthan is able to push forward the discourse on integrated water and sanitation planning, creating a way to link two separately governed domains.

Himmotthan must decide how they will interact with the disjointed government priorities on water and sanitation. In general, the government has managed the installation of several piped water sources, but not in conjunction with toilet services as well. The government, not NGOs, installed the majority of water systems; the government has installed approximately 90% of the piped water systems in the state (Associate, Himmotthan). In the hills these systems are usually 20 or 30 years old maximum, "but in the plains there are places also where pipelines are 50 or 60 years old" (Associate, Himmotthan). The addition of toilets has been a much more recent development in the state; they have been around for the last 10 years.

In general, Himmotthan handles this by actively pushing a streamlined water and sanitation community intervention. As described above, in the first six months of a project, also known as the preplanning phase, Himmotthan focuses on building toilets (Engineer, HIHT). Community members are told that if they build the toilets they will get the water. To get people to construct toilets, Himmotthan will often provide an additional financial incentive. In the hills constructing a toilet costs about 25,000 rupees, and the government has a fixed incentive of 12,000 rupees (Senior Executive, Tata Trusts). In order to encourage toilet adoption, Himmotthan will often add an additional incentive such as 3,000 or 5,000 rupees (Senior Executive, Tata Trusts).

Additionally, at times Himmotthan does make sure to validate the use of toilets. They will measure for fecal contamination after repeated interventions and validate the usage of the toilets with the water testing (Engineer, HIHT). If the water still shows fecal contamination, they assume

people are still defecating, providing them of some amount of understanding of how effective toilet adoption is.

This push for integrated planning is reflected in other elements of the organization; Himmotthan thinks that a holistic intervention is critical. According to monitoring and evaluation coordinator at Himmotthan, “When you are working in a village it is important to work on various aspects”. These include agriculture, livestock, livelihoods, and more.

Takeaway: Even though Himmotthan pushes the narrative on integrated planning, they still feel that sanitation is an individual responsibility.

In regards to why sanitation is a priority in the federal government, an HIHT staff member says that “it depends on the individual of the government people that are sitting there, what are the priorities for them”. He goes on to say “I’m not saying that the water is a bigger crisis or that sanitation is not a bigger crisis, nothing like that, it’s equal”. In general he adds says that people can provide their own toilets (with government assistance) but the cost for a water system is extremely high and is what communities truly need help with.

A senior executive at the Tata Trusts thinks that it’s a person’s responsibility to provide a toilet, “If you can build a house, why can’t you build a toilet. It’s as important as that”. This is an interesting perception of NGO employees of who the responsibility for basic services rests with. This executive also says that Swachh Bharat has just been highlighted, but “equal work” is happening in water. She also shares the perception commonly held among NGO employees: “Even if you work on water, water and sanitation are so closely linked that if this is not increasing simultaneously, nothing is going to happen. So if people are defecating in the open, the water is going to get contaminated. It’s just a regular cycle”. She agrees that perhaps the work of ODF is disjointed in the field; however she doesn’t know what exactly the government is doing in the field; “I’m not sure, I haven’t seen it happening personally. But they must be just forcing units for now. Because ODF has to happen and there are deadlines”.

Takeaway: There are state-led incentives to provide toilets

The government will give everyone 12,000 rupees to install a toilet (Senior Executive, Tata Trusts). However, when and if people actually get that money can vary tremendously. Sometimes Himmotthan will provide an additional incentive for toilet construction. One toilet costs

approximate 25,000 rupees. Government gives 12,000, sometimes Himmotthan will give a little more. For at least one project they gave an extra 5,000 to the government's 12,000, which means that community members were only paying 8,000. Sometimes this incentive is 3,000, or sometimes it can be nothing.

Takeaway: Himmotthan is pushing forward the efforts on behavior change campaigns; this combination of "hardware" and "software" interventions is an emerging linkage of ideas that comes into play in 1. Holistic Water & Sanitation Schemes in Communities 2. Work with Anganwadi Centers and 3. Work through E-wash.

In general, it seems that the dominant narrative is that people can and should install their own toilets; the burden is on them. "We must convince them to use toilets, but not completely pay for their toilet installation"

Holistic Water & Sanitation Schemes in Communities

Behavior Change Efforts have become a critical piece to Himmotthan's interventions. More and more organizations are recognizing the need for both "hardware" and "software" interventions. As described above, Himmotthan is incorporating behavior change communication into their holistic water and sanitation schemes. This section expands on the initial explanation of Himmotthan's behavior change efforts in a community.

Himmotthan modifies behavior change campaigns based on characteristics of the community; "they start with the same format, but then they end up modifying it according to the need of that community" (Junior Engineer, HIHT). For example, if they find that people in the survey have toilets but are not using them, then they will emphasize toilets in their communication activities. Himmotthan usually hires someone local in the village to disseminate messages; this person will go door to door to get the message across; people generally trust locals more than outsiders (Junior Engineer, HIHT) .

A community mobilizer describes the behavior change communication convincing people to use toilets as follows; After HIHT has identified what families are not using toilets, they will meet with each family to understand the barriers to toilet usage. They then start working with people who have manageable barriers to construction; they do not start trying to convince people that are adamant they don't want a toilet (Community Mobilizer, HIHT). These barriers could be financial

costs or space constraints. HIHT works to make toilet installation and use possible; for example they communicate the financial aid they can provide, or they mediate between neighbors to make sure someone has space to install the toilet. He says that essentially once there is a critical mass of people with toilets, it becomes a matter of pride, and people will start feeling that they need a toilet as well.

There are multiple means for behavior change communication; street plays and use of behavior change kits among them. An example of a skit is that skits for example tend to be formulated such that there are 2 almost identical families; the main difference being that one has good water and sanitation habits, while the other doesn't. Overtime one family is able to bring in more resources.

This community mobilizer describes the behavior change components; there is the message, how the message gets delivered, the frequency of that message, and the whole evolution of how much support that message has in a community. He also considers the delivery of that message to be most important. Also, if 90% of the community becomes convinced, there is no need to deliver that message again, because eventually those 10% will be convinced by the 90%. Otherwise, there is somewhat of an evolution of acceptance in a village as more and more people come to accept the message.

Work with Anganwadi Centers & Generational Change

Another example of how Himmatan is bringing hardware and software elements together is through what happens at the Anganwadi Centers, which are day care centers for the community. One of the projects worked on by a Himmatan associate involves working with twenty Anganwadi Centers in Chamoli. These centers are where children younger than 4 years old get basic education. He primarily works on delivering sessions on behavior change but he also checks that the drinking water supply to the center is of good quality. For this, they do use water quality testing where they have to await a report for results. In general, working with the Anganwadi center can mean a lot of things including connecting pipelines, providing a water storage space, ensuring functionality of the toilets, and promoting a water filtration product called life straw.

Work through E-wash to Effect Generational Behavior Change

Another project Himmotthan is working on that involves software interventions is their “E-Wash Program”. Manish is involved in Himmotthan’s educational initiative as well as the E-wash program. He explains that Himmotthan generally works on the “hardware” piece of educational technologies, but for water and sanitation, they are actually more focused on information education communication and behavior change communication activities. He also says that they do perform hardware work on the water-side as well; though there is generally enough water in the mountains, sometimes schools don’t have proper taps or pipelines. Thus this group will work to implement water stations or even water filters. However, the e-wash program has just finished it’s first year. There are 10 – 25 members working in this team; including members of Himmotthan’s water team but also Himmotthan’s partners. A member of the E-wash team comments that the e-wash work is going on in 85 villages; so for every 10 villages there is approximately 1 community mobilizer or community motivator.

For initial reactions, an E-wash team members says he is able to see changes after their behavior change efforts, particularly in the behavior of children. They are washing their hands and drinking from filtered water only. However, data they are currently relying on observations only, not necessarily on data. They have the data on how many toilets and water taps there are, but not any on hand washing practices. In general, this initiative is in an early stage (E-Wash team member, Himmotthan).

Tools that this team has used to work on behavior change communication include puppet shows, children’s books, and pictures. The goal is to ensure children understand the importance of health and hygiene, and how to properly use water. The member of the team echoes what has been said earlier about the importance of educating children; “We should treat this generation as a change agent so that they can go to their home... and they can display to their parents”. He hopes that children will learn for themselves, but also be able to pass along this message to their parents.

He also says that they use the work of other organizations in determining what materials to use for behavior change communication. For instance, there is an organization called Upward Spiral that provides a certain “consultancy” for these tools and techniques. Additionally the UNICEF manual is a very important tool that they follow in schools. They also keep in mind that RTI (Right to Education) has defined that health and hygiene is a component of any educational institution, and follow the guidelines from that manual as well. The RTI is not only about education, but about the holistic development of children, including health, hygiene, and nutrition.

He agrees that the government is an important stakeholder in the work with Ewash. In particular they are working with SSA: Sarva Shiksha Abhiyan, which is the nodal body of education

in India. They also work with ICDS; the Integrated Child Development Services. They must work with these departments to get the necessary permission to work in schools (for example repair or maintenance of toilets). Overall he echoes that changing people's mindsets around e-wash is incredibly challenging.

5.1.5 Discussion

Overall, the NGO relationship with the state is impacted because of how recently Uttarakhand became an official state. Thus, in the last few years NGOs have started to work with the "State of Uttarakhand" (Associate, Himmotthan). The "newness" of this relationship implies that the state and Himmotthan may still have a lot of work to do finalizing their strategies in a way that is mutually beneficial. Below are some ways Himmotthan is currently adapting their strategies to their context.

Takeaway: Himmotthan has successfully developed strategies to adapt to various challenges while working in communities. These challenges may be supported with a planning tool that can be used as an interface between communities and the NGO.

One challenge that Himmotthan may face deciding where to spend time and resources. This challenge is applicable to more than just their water projects. In order to prioritize needs and decide where to focus their limited resources, they use "participatory identification" (Associate, Himmotthan). Essentially they organize communities into small Self Help Groups, and are then able to identify the most-affected people, and thus whom they should work with directly.

A project associate at Himmotthan says that the a big challenge Himmotthan faces when intervening in the community is that some people think Himmotthan itself has a lot of money to bring into the community. This misconception means that it is difficult to make the community aware of Himmotthan's capability and expertise; they have to convey what exactly their program can bring them.

Additionally, the natural resource management coordinator says that changing community dynamics have been challenging for the organization. People have become dependent on the government for many things, which effects their aspirations. Finally, several families have migrated for better employment, which leaves only poor and resource-less people in the village;

“empowering those people, that is the challenge” (Natural Resource Management Coordinator, Himmotthan).

5.2 PRADAN ANALYSIS

Following the pattern above, this section begins with an explanation of water work in a Community that PRADAN works with. PRADAN has many similar elements of working in a community to Himmotthan, while some are distinctly different. In this section, I will give an overview of how PRADAN work's in a community particularly Ronhe. I focus especially on how the water work started in areas that it did, and then explain further using the elements of field theory what made their work successful.

It is important to keep in mind that while PRADAN is a huge organization working in a variety of areas across numerous states; their work on water and sanitation is relatively new. According Resource mobilizer for PRADAN; “PRADAN has been doing this water and sanitation work in 100 odd villages. So among 7000 villages, it's just a pilot”.

5.2.1 PRADAN's Process of Working with a Community

In 2003, PRADAN entered the village of Ronhe, which was one out of 52 villages in the Torpa block. PRADAN worked in the community to form self help groups. They worked with them on sustainable livelihood options, like the development of SRI paddies. Later in 2009, PRADAN helped the village by leveraging the government programs for employment guarantees and asset creation for families. They focused particularly on catching rainwater in their farm pond for easier irrigation, developing mango plantations, and well creation. Ramesh explained that gradually, SHG members were able to raise their concerns including food sufficiency and problems specific to women. For instance, they were able to bring to attention the fact that a girl child was raped 5 years earlier; and the policy were able to catch the culprit; “So in this way, we reflected that the SHG members have become very aware and are active participants; they want to move forward in developing their villages” (Community Mobilizer, PRADAN). In the meantime there was a huge issue of drinking water. Up until this point PRADAN “had only been concerned with livelihood and women empowerment, but we never thought around this drinking water issue” (Community

Mobilizer, PRADAN). He adds that the water scarcity issue was so bad that people would steal water from each other in the middle of the night.

The way that water came about in the agenda was through a discussion in the Gram Sabah in 2013, where male and female members were in attendance. The issue was raised in this meeting, and they decided to learn more about what had happened in Koderma, where the Damwell Valley Corporation had funded a water tank. (The DVC was a hydropower public utility company). Ramesh said they visited Koderma with some SKG members itself to learn about the scheme and its operation and maintenance. The team then returned to the Gram Sabah where they discussed what they could do regarding the scarcity of drinking water.

This community mobilizer then said PRADAN realized that many villages were also in the same situation; facing scarcity of water in the summer season; “So we have to work on this, we have to mobilize the government officials around this.... Without any support of money we cannot do anything, that is why we went to state officials”. They went specifically to the Drinking Water and Sanitation Department. (Initially they had gone to the district levels department, but then went to the State Department where they agreed to have a meeting with PRADAN). PRADAN went alone to talk to the government, but had the support of the community. They asked for 20 – 25 water pumping units across Jharkhand. 3 have been made in this block; Ronhe Gufu, and Japud. The government agreed to send money directly to the community for the construction of the structure; they deposited it directly into the Village Water and Sanitation Committee’s account. The VWSC is formed by the government in every village. PRADAN is considered to be facilitators of the project; “we were here only for their technical and managerial support” (Community Mobilizer, PRADAN)

This organizer says that there were a lot of trainings in the community to make sure the community was mobilized and engaged. An engineer was hired for technical assistance for the actual water tower. Eventually the VWSC had to engage with the households to make sure they would commit to pay a both the fixed cost for the system and also a monthly recurring cost for continued operation and maintenance of the system. Overall a 27,000 liter tank was installed for Ronhe, a village that had 113 families, but 102 families getting tapped water. Some families live in a lower part of the village and are getting well water.

However, not all households in Ronhe have toilets. Out of 113 families that live in the village, only 70 sanitation units have been made. Ramesh says that the rest are waiting on more funds. However, he does say that of the families that have constructed a toilet, approximately 90 – 95% are actually using them, in great part due to the fact there is sufficient water. This community

mobilzier was involved in toilet installation by training the mason, mobilizing the group, and training group members to identify material needed for construction.

He says that his interactions with the village are part of a well-designed training program. Sometime SHG members are invited to the PRADAN office for trainings. Other times there is an exposure program in which community members are taken to another village to learn from them. These trainings can include working with the SHG members to identify the challenges they are facing and develop an action plan. Ramesh seems to think the training works well; he says he helped make 4 to 5 sanitation units, but after that the community was able to take charge themselves.

There is also a behavioral component of trainings also, in which all the SHG members are called to sit together. There he explains that they are asked engage with themes of water and sanitation; considering how it will be helpful for them. Sometimes, they use a pico projector to display materials. The video they use is helpful to describe how they can manage hygiene and sanitation; there are 8 ways to wash your hands. They are just starting to approach larger behavior change efforts in the WASH space, and so far Ronhe and Gufu are the only villages were these activities have been implemented.

Concerning the women in Ronhe, “All the women members are willing to listen to PRADAN, and they understand that this is a group that is trying to build our capacity” (Community Mobilizer, PRADAN). Every intervention that PRADAN does is through women only. They then expect women to share with their husbands and children about what they have learned.

The effectiveness of working in a community largely depends on whether people have the same needs (This was reflected by a community mobilizer in Himmotthan as well); “Gufu is a non tribal and Ronhe is a tribal village, the need of water was more in this village, Ronhe. So the people from the village were very much connected with us, and very much supportive, but in the village of Gufu, that kind of need was not there of drinking water, as their own thought. So there was some issues to connect with the people and to execute this kind of project in that village”. In general, he says connecting with tribals in difficult because of language barriers and perception of needs. However, “I think drinking water is a subject to connect with each other easily, that is why they connect with us”. He emphasizes that Ronhe is the first place that they have worked directly on drinking water; and he expresses that he hopes that PRADAN will engage more with WASH themes

5.2.2 PRADAN Alliance Brokerage

Takeaway: PRADAN is first develops Self Help Groups in a community, and then uses them as their primary tool for development.

Alliances and partnerships are critical to advance the mission of PRADAN. They have alliances and partnerships at every level of governance, but also with universities, NGOs, and perhaps most importantly, women in the villages they work in. PRADAN's partners include people at the national level of government, but women in the Self Help Groups are the real way things get done.

A PRADAN associate working in Koderma district shared that SHGs were originally started by NGOs in different parts of the country 30 years ago. However, he says that since 2011, it has been a national program under the government of India under the National Rural Livelihood Mission. All households are required to join a SHG program. This associate says that he thinks the roles of SHGs are slightly different in different states. For instance, in Andhra it is more of a microfinance model, but in this part of Jharkhand it is a social and inclusion platform.

As described in the above narrative, Self Help groups were extremely critical in bringing attention to the need for more water.

Takeaway: PRADAN functions by connecting these SHGs to existing government funds; acting as a bridge or a facilitator between the community and the government.

As described in the above narrative, PRADAN mobilized the community to learn what their demands were, and then found ways to connect them to available resources.

Takeaway: PRADAN has a comprehensive organizational structure that works across the poorest regions of India where government structure is often lacking.

When asked about the presence of water quality testing, a PRADAN resource mobilizer replied that it's not really present in areas he has worked in; "There's hardly a government presence in those areas, PRADAN is one of the biggest key actors, and new ideas are fortunately or unfortunately brought into PRADAN".

PRADAN has its central management in Delhi, but its development arms reach across India. PRADAN works in organizational clusters. In each cluster there are 2 integrators who are the lead of the “team coordinators”. There are usually 4 team coordinators that each lead a team (Executive Director, PRADAN). The integrators will report to the executive director. Above the executive director is only the board of governors. This management structure is uniform across all states they work in (Executive Director, PRADAN). A resource mobilizer & partnership coordinator says PRADAN has 60 teams and 12 regional offices. In a development cluster she says there are 6 or 7 teams. Development clusters are all regional and of a similar kind of “agroclimatic” and socioeconomic political background,

The executive director of PRADAN refers to PRADAN’s organization as a flatter structure; there are several senior management, known as integrators; “almost peer level senior people are there, handling multiple units and departments”. One of these senior level people will become the executive director for 5 years and then return to a senior management position.

In PRADAN’s central office, they have intentional departments to help them spread their influence. For instance, in PRADAN’s overarching management team, there is a section dedicated for “Resource Mobilization, Communication & Partnerships”. A resource mobilizer at PRADAN describes the mission of this organization as follows: “The basic idea is to position PRADAN in these different stakeholder groups as a go-to partner”. This office is responsible for getting human talent, financial resources, and managing social media communication.

The executive director says that they have a lot of professional capabilities in the organization; they make sure to plan, implement, and monitor projects in a professional and rigorous manner. However, they also take care to hire professionals with advanced degrees or specialists. He seems to take pride in the organization that is bringing in a range of professionals that can understand all facets of issues; they can move forward from empathizing with problems to offering concrete solutions; “PRADAN is one of the original organizations, and one of the first NGOs in the country who actually brought professionals into development. Otherwise development is being done by all kinds of people, but they are not really able to go contribute to the enhancement of quality of lives of people.”

The main PRADAN office has numerous departments that function as “resources”. In addition to the Resource Mobilization, Communication & Partnerships department, as discussed above, the organization is adding an Advocacy Group. The previous executive director of PRADAN describes that the purpose of this group is to obtain knowledge from their experience by doing research, and then go on to influence policy.

A resource mobilizer & partnership coordinator at PRADAN used to coordinate the apprenticeship program, which is a 1 year program in which students from various disciplines go to the field to understand if they want to make development work their career. In 2014, PRADAN went through a restructuring, and now this person works with resource mobilization, communications, and partnerships unit. Resources can mean physical resources or human resources. She is interested in communicating with university campuses to share the importance of development by intervening in curriculums or workshops.

There is a resource mobilizer & youth engagement representative at PRADAN that helps build networks and relationships with a variety of campuses and higher education institutions, thus highlighting the focus on generational change of PRADAN's work. The goal is to talk to young people about development, poverty, and inequality, and to create opportunities for them to be engaged with development work. PRADAN's outreach in this area mainly focuses on graduate and undergraduate students, but they hope to begin working with younger groups of the population before students begin feeling career pressure. She says she would add educated privileged people in India and various educational institutes to the stakeholder map. PRADAN will also talk to heads of institutions (Resource Mobilizer & Youth Engagement, PRADAN). For example, she explains that they just worked with the graduating class of the Indian Institute of Technology in Delhi through a curriculum on inequality and poverty. She says that the primary reason of this outreach is not just recruitment; it is to make sure that these graduates working in the world will have a better understanding of the majority of the population in their own country.

Takeaway: The state is also using SHGs as a tool for development to advance their sanitation agenda, perhaps lessening the pressure they have to do their own work. This heightens the role that PRADAN can play as an effective intermediary.

Overall PRADAN has been engaging with the department of drinking water and public health engineering at the state level and committees at local levels (Partner Engagement Staff, PRADAN). Concerning water and sanitation, they have been engaging with governments at the state level, not the central government level. She points out that the Village Health and Sanitation Committee are important stakeholders to know. She also comments that the State Rural Livelihood Missions are also increasingly becoming stakeholders; "especially you know in this toilet construction; reaching out to the women's collectives and through the women's collectives the entire construction of toilets, that's becoming a major program of the SLRNs also." She says that this

stakeholder is increasingly important in Jharkhand, where the *entre agenda of toilet construction is being made the mandate of women's collectives, which are being promoted by SLRN.*" In many states they are engaging with Civil Society Organizations (CSOs). Toilet construction through women's collectives has been a huge area of debate; she says that constructing good quality toilets should be the government's mandate, but has often been put as a responsibility on the women's collectives (Partner Engagement Staff, PRADAN).

They do try to differentiate the role of SHGs; "mostly these SHGs are not liable for service delivery; they are mostly acting as a civic body, there is civil representation" (Koderma Associate, PRADAN). This associate says that they visualize panchayats or other government functionaries to be responsible for the service delivery.

Additionally, the government can create water bodies through the Mahatma Ghandi National Rural Employment Guarantee Act (Partner Engagement Staff, PRADAN). Villages can supposedly make development plans for their villages, and can get private bonds from this act to make water bodies; "So that's also very significant in influencing the community to demand water for creating their own private water bodies" (Partner Engagement Staff, PRADAN).

Takeaway: There is minimal water and sanitation planning done by the state.

The government does take some minimal action with regard to waterborne diseases; "All I know what happens is that if there's an outbreak in a village, then the development officer would send his staff with a bag of chlorine, bleaching, and he would only do that in those villages" (Resource Mobilizer, PRADAN).

With regard to water and sanitation, a previous executive director of PRADAN points out that the secretary can influence the agenda for water and sanitation. A change of secretary can in effect negate whatever has been agreed upon in a Memorandum of Understanding, if the secretary doesn't agree with it. PRADAN has an MoU with the Ministry of Rural Development, and also engages with various states in different capacities.

At the local level of governance PRADAN doesn't seem to be too involved; they are more involved with members of the Self Help Group. There are local bodies related to water and sanitation, but they are mostly dormant, according to the executive director. He says that perhaps in some areas these local government bodies are active, but that is not the experience he has in the villages that they work with. A PRADAN resource mobilizer also echoes that the government is not active in water and sanitation, despite the fact there are existing frameworks for the government to

engage in water and sanitation. When asked about a water testing program supposedly implemented by the government, this resource mobilizer replied “The jal sahiya is part of the concepts of the government program, but the government hasn’t worked with the communities to find them actors, to find those actors activated in the system”. Someone on the partner engagement staff echoes the common sentiment that the government is not doing much on the water front because it is so much more expensive than toilet installation.

Takeaway: The presence of PRADAN and other NGOs has made the state more efficient in numerous ways.

Perhaps the biggest stakeholder relationship to understand is their relationship with the government. In many cases, PRADAN sees itself as the facilitator between the government and the communities. According to the previous executive director: “Most of the program funds, we help people to access from government”.

He also says that *having a network of NGOs helps to influence the government better. Additionally, he says that where the government is open to working with NGOs, their situation is better.* This has been their experience in Jharkhand; where the government officially seeks the support of the organization. However, he says that in Orissa it is the opposite situation. The Orissa government is apprehensive of forming partnerships with NGOs, even though they see the NGOs are doing good work. Often times, the government will take the advantage of the NGOs expertise for their own use, but will not acknowledge the contribution of the NGO (Previous Executive Director, PRADAN). In Jharkhand, PRADAN has worked with the state to monitor community programs. PRADAN helps the community make plans, and then through components of government schemes, works to implement those plans (Previous Executive Director, PRADAN).

He also adds, “The government wants to be accountable, at least at the senior level”. However he points out that criticizing the government doesn’t help them. What the government wants is ways to improve, and ways to address the gaps that have been pointed out to them. When PRADAN has gone to the government with ideas, the government actually involves them to input new systems and do better. PRADAN is essentially an organization that tries out ideas and the government is able to see what is working, and not working so that it can be replicated on a greater scale; “If we work with government, it improves. Things improve” (Previous Executive Director, PRADAN).

Takeaways: PRADAN is able to leverage relationships with other NGOs to improve their work output and retain their credibility as a source of knowledge with the state.

Some of the NGOs PRADAN works with includes Gram Vikas. According to a member of the partner engagement staff, “this is an organization which creates this infrastructure for bathing space and toilet, and they also help us provide water when there is funding availability”. She also mentions that they have had partnerships with ACIAR, an Australian Research Project, and Aqwadam.

Overall Takeaway: PRADAN has worked with the government in a variety of capacities. In some cases their interests do align with the state, and at other times it seems their ability to make progress is determined by the state’s priorities themselves.

5.2.3 PRADAN Resource Brokerage

PRADAN has a unique set of resources that they use to advance their mission, including a variety of funding sources, selected domains of expertise, and a professional work force with strategic departments.

Takeaway: PRADAN has been able to gain legitimacy with the state because of it’s expertise in livelihoods.

National Agencies that PRADAN interacts with include the Ministry of Rural Development, National Rural Livelihood Mission, and the National Rural Employment Guarantee Act (Partner Engagement and Monitoring Evaluation Staff). In essence PRADAN is concerned with livelihoods; their work with water and sanitation seems to be a newer portfolio that is encouraged because they view holistic development as very important.

The government has found that they must partner with PRADAN to make progress in the area of livelihoods, naming PRADAN the only National Support Organization. This partnership revolves around building livelihoods; the government gave PRADAN this special status of National Support Organization because of their expertise and success on livelihoods work (Executive Director, PRADAN). They have been a national support organization since 2013 (Previous Executive Director, PRADAN). The way that PRADAN is currently supporting the government is by training

their staff and supervising their projects; they are not implementing programs on behalf of the government (Executive Director, PRADAN). The government has tried to promote rural livelihood programs, but has not been very successfully; “so, now, they are more, not necessarily proactively, but gradually out of no choice they are more partnering with NGOs” (Executive Director, PRADAN).

The way their executive director describes their interaction with the government is as follows; “In the livelihoods area they have sought our assistance in training their people. Obviously we can’t go implement programs on their behalf, so what we said, we don’t have the staff, we don’t have the strength, we are already full with our own work, but we can laterally extend support to your government staff by training them, and then they can come and see our work and then we can go back with them, and supervise.” He goes on to describe the difference between a memorandum of understanding concerning support and an MOU concerning implementation. He says that in places like Khunti and Koderma, the PRADAN team is only supporting; it is the government that is implementing the livelihoods programs.

PRADAN is well respected for their livelihood work, among other things; “In our scheme of things we have managed to combine everything, so livelihoods work versus drinking water, and gender and violence, we have kind of managed to create a package of it, so that’s our work. Our interventions are very integrated, and holistic in a village” (Executive Director, PRADAN).

Takeaway: PRADAN has been able to secure a standing relationship with the state because of their expertise in facilitating resources for a variety of projects, often based on livelihood generation.

In addition to their expertise in livelihoods, they have somewhat of an expertise in “facilitation”. PRADAN’s main advantage is being able to translate funding of the government to infrastructure and projects on the ground. In this way they are actually expanding the reach of the state as well.

Takeaway: PRADAN uses a variety of funding sources including major donors to ensure holistic projects.

PRADAN is funded by the Tata Trusts, but also gets money from the Bill and Melinda Gates Foundation. Though this funding is a resource, it can also be thought of as a “partnership”, because these organizations don’t just give them money, but in a sense shapes their agenda and priorities.

In addition to money from large organizations, PRADAN relies heavily on mobilizing funds from the government. The piped water systems we saw in Jolha Karma and Belkara were actually created with money from a power corporation (Executive Director, PRADAN). However, normally, piped water systems cost such a substantial amount of money, that the only viable funder is the government. Each community water scheme costs around 30 lakhs 3,000,000 rupees (46,630 USD)

According to the previous executive director, for most of the program funds, they help people access the funds from the government. For training costs and the costs of the employees, PRADAN mostly mobilizes it from the donors.

PRADAN has a department to ensure they continue to access grants. They have an engagement support unit, a unit that supports major institutional grants. Staff within this department also work on development methodologies for new areas of work like gender, governance, nutrition, and water and sanitation, and are also engaged in coming up with monitoring and evaluation strategies of these new methodologies.

5.2.4 PRADAN Framing

Examples of Framing include “reconceptualization of a political idea of concept”, “linking two or more issues in a new way”. PRADAN uses several framing strategies to advance ideas between fields. They focus on women empowerment, community empowerment and ownership, and are beginning to delve into the importance of behavior change as a solution.

Takeaway: PRADAN is focusing on linking water and sanitation where it can, expanding the ideas for future political options.

PRADAN really emphasized the discrepancy that exists in water and sanitation planning in India. Toilets are often installed without sufficient water. Toilets are also installed without sufficient training or behavior change campaigns to ensure their use. According to the executive director “The politicians have their own ways of thinking. They think toilets built [are] toilets used.... So with a very little investment they want to say that whole of India has become open defecation free”. The government is also shying away from huge investment drinking water schemes.

The executive director argues that toilets without water is more dangerous, not less dangerous. It’s better that they would defecate in the open; because they will dry in a few days and then it is gone. He expresses concern that government priorities will never shift as far as they need

to; “how to get them to invest, 20 to 30 lakh rupees in every village. And we have 600,000 villages, imagine the cost of this.” In all of PRADAN we work in about 60 districts. Of all the 60 districts, we there are only a few in Jharkhand where PRADAN is engaged with drinking water. The executive director shares that people are realizing that piped water may be able to come in their lifetime in certain villages for instance villages around Koderma; “But now the big wall is the investment, where will the money come”. He points out that he wishes there were different investment options where you would only have to pay for purification of a small amount of water; not a water tower that will purify all your domestic water as well.

The previous executive director says a barrier for communities to remediate their own water quality is that they must work within the constraints of a divided community; When you are divided it is difficult to come together and get strength to raise voice(s)”. He also says that the government is not under pressure to address all of these issues. To make progress in this area he also contends that the government must make water treatment a priority; “Even though we have schemes, they are so far inadequate for all the state governments to make safe water available”. He adds that dealing with water contamination is a distinct challenge; he remarks that the chlorine dosage must be accurate. He also remarks that Aga Khan Rural Support Program has in fact installed RO systems).

The previous executive director says this regarding water and toilets; “We believe that both the things should be done simultaneously, water supply and toilets. Other wise toilets will not be used, and it will increase the load on women to carry water to home”. Overall, he believes that if they are to achieve open defecation free villages like the government desires, they must achieve water and sanitation together. He goes on to describe the difference in the way that PRADAN interacts with the water and sanitation scheme in the context of government policies; “Wherever we have been able to mobilize resources we have done both”. He remarks that the government’s priority is that toilets are available, and there is a general assumption that people will be able to use any water available for their toilets. However, that is not what they see in the field. He also describes that the effect of installing toilets on health is not that apparent or quite understood; it’s main advantage seems to be from the convenience of it.

According to the executive director, around Koderma there are 4 or 5 more teams who are now talking about drinking water and sanitation, but it has not spread across PRADAN yet. He emphasizes that the only way he can get the money for such large scale drinking projects is through the government. He also points out that large corporations can also give money; like the hydropower company that has implemented water towers in Belkhara and Jolha Karma. However,

the reason this power company supported these projects is because they have displaced people (Executive Director, PRADAN).

A member of the partner engagement staff at PRADAN says the WASH space is across India with PRADAN with regard to the Swacch Bharat Missions. However she says that the projects they have taken up have been in Jharkhand (and possibly Orissa), and they have partnered with Gram Vikas, who is specialized in creating toilets and bathing spaces and piped water. PRADAN collaborates with them, and also activate the villages committees on water and sanitation.

Takeaway: PRADAN positions itself as an organization to help bring government programs to scale.

The government has signed an MOU with PRADAN at the national level to secure systematic support with livelihood generation, but it seems there is variability at the state level of what agreements with governments accomplish; “Some states want us to deliver things, rather than building their capability to do it; but we want to take up that route, we want to build their capacity so they can do it in a large scale. Otherwise if we have to do it here, scale will remain low.” The previous executive director says, “We are trying our best to work with government to increase the scale of the program”. Regarding water and sanitation, PRADAN’s work has not yet been on the national level. A member of partnership engagement and monitoring evaluation staff comments that they have been engaging with state and local levels regarding sanitation. She also comments that State Rural Livelihood Missions are increasingly becoming stakeholders especially in this toilet construction.

Takeaway: PRADAN’s Theory of Change Involves around empowering women, which is changing the dominant development discourse.

PRADAN has a unique “framing” component of their work. For this framing component, they focus on women empowerment, especially those in marginalized communities, and believe that change is driven from the bottom; not the top. The SHG is their main agent of change. Enhancing the agency of women’s collectives is one of the major objectives of PRADAN, as well as enjoying well-being (Partnership Engagement & Monitoring Evaluation Staff).

According to the executive director, they have been focusing more on drinking water in the past; “This graduation to drinking water has been a big change in the past.. And this has come out of

our women's groups". This empowerment of women manifests itself in the form of SHGs, which have been discussed above in the context of "alliances".

A PRADAN team coordinator in Koderma says the first challenge is being able to mobilize the community and empower them; "Now you have to tell them, your journey has started, now you have to raise your own voice and demand it... show your own responsibility". He says that the local government institutions are at a very nascent stage; where the age of a panchayat is only 3 or 4 years old. Meanwhile, SHG are more than 25 years old in some areas. A PRADAN associate in Koderma adds that Jharkhand is a new state. Jharkhand was founded in 2001. In other states like Bihar, Bengal, and Orissa they have a panchayat system of more than 30 years.

Takeaway: PRADAN's goal is to empower entire communities, and use women's mobilization as a tool to do that.

A PRADAN resource mobilizer says "PRADAN stokes needs in the community, that is the primary responsibility". *He thinks that in our change theory, interested people must work on the issue for change to happen.* When discussing evidence of community maturity, he says "The water tower implies the fact that there's already an SHG in that village, working in that village". The primary purpose of their organization is working with women. PRADAN believes that the poverty in India is because of power differentials in society at the intersection of class and gender. They focus on the poorest regions; the tribal women in central India.

5.2.5 Discussion

Takeaway: PRADAN is reliant on the government's agenda to make progress.

A team coordinator in PRADAN says there are different barriers for expanding every program; "Suppose if you think about this type of water infrastructure and toilet infrastructure, the program fund has to come from the government... But government is not willing to pay (lots of) expenses because their mandate is a little bit different than what we are trying to do. So we have to stop".

Takeaway: PRADAN experiences challenges in villages but is able to adapt to their contexts with thoughtful strategies.

A member of the partner engagement staff says that for projects to be successfully completed, it is important for the community to feel the need for the project as well; it is best that the project is a joint venture of the community and PRADAN coming together to work on a certain purpose.

Takeaway: PRADAN has several metrics of success reflecting the various dimensions of their work.

The previous executive director says the indicators of success they use to determine how their project went include: how many families are integrated into SHGs, the number of livelihood activities that have been taken up, what kind of income they have, and their participation in public forums.

One way they measure metrics of success is “village saturation”; meaning how much of the community or households in a village are group members (Partner Engagement and Monitoring Evaluation Staff, PRADAN). They will also look at the quality of groups being formed; what kind of actions are being taken and what institutions are the groups in touch with. They will also monitor the stages of the livelihood programs that they do; and will examine two a year how many families have been involved in various livelihood projects. They can monitor what the nature of PRADAN support was in each of these activities, and they will also try to get an estimate of gross annual households incomes. They can monitor how many groups are talking about various topics like self-governance issues, and what they are talking about at Gram Sabah meetings. PRADAN looks at coverage of toilets, amount of households with a water supply, and how many households have access to a piped water supply system within the household. One way they collect all this data is through trained community data collectors; they have tablets and go to the field to collect information on different modules; livelihoods, local governance, institutions, practice and knowledge adoption, and more. There are approximately 1200 Community Data Collectors (Partner Engagement and Monitoring Evaluation Staff Member, PRADAN).

The data that is collected is usually about the Self Help Group meeting frequencies and what they do with the loan money. Indicators that PRADAN also looks for to measure overall community health include whether women have confidence to report abuse or how frequently have groups been able to influence local government or local authorities. They are partnered with almost all the state governments that they are working in; the rural livelihoods mission intervention is a state

level intervention. Something interesting pointed out by a resource mobilizer and youth engagement representative is that as more students go to college for the first time there is even more pressure from their families to choose conventional or traditional career options; there has been an enormous contribution by families to send you to school and you have to choose a career that makes a return on their investment. This overall makes it hard to recruit students to work for PRADAN. In a sense, the more development there is, the more attached people are to conventional career options because they have “achieved” the status of a university.

5.3 Comparative Discussion

We see that Himmotthan uses community empowerment as a tool to achieve safe water and sanitation planning, and we see that PRADAN has thus far used water and sanitation planning as a way to achieve water and sanitation planning. They both align their interests with the state in certain aspects, but Himmotthan often creates MOUs to operate separately from the state, and makes sure to introduce integrated water and sanitation planning. Meanwhile, the limited water and sanitation success that PRADAN has achieved has come about through community dialogue and an “empowered community”. Helping the community attain water systems was one mechanism that PRADAN employed to make sure that the community gains confidence and independence.

The original question asked was under what conditions are NGOs able to advance water and sanitation infrastructure. Based on the previous examples and analysis, it seems NGOs are able to advance water and sanitation infrastructure in different ways, as summarized in the table below.

All of the above speaks to the fact that NGOs were able to harmonize their interests with the state in some capacity when they accomplished water and sanitation work. Himmotthan has been granted an MOU to work separately from the state on water and sanitation cases, while PRADAN acts as a bridge between the state and the community to give them access to already existing water and sanitation infrastructure funding. PRADAN in general acts as a bridge between state funding and the people. This is particularly true for sanitation infrastructure, but for water infrastructure, they pulled in private actors and universities to accomplish the installation of the water towers

	Alliances	Resources	Framing
Himmotthan	<p>Builds local councils to support their water and sanitation intervention work</p> <p>Relies extensively on another NGO partner for implementation of water and sanitation projects</p>	<p>Signed an MOU with the state in a manner that still allows them to leverage government funding in villages they work in</p> <p>Developed an expertise in water management that grants them legitimacy</p> <p>Leverages Multiple Funding Sources to Complete Projects</p>	<p>Positions itself as a way to inform government programs</p> <p>Ensures Sufficient Community Buy-In and Mobilization</p> <p>Focuses on Integrated Water and Sanitation Planning, finding a way to link two separately governed domains</p> <p>Ensures the presence of both “hardware” and “software” interventions in water and sanitation projects</p>
PRADAN	<p>Builds Self Help Groups, which then allow them to prioritize needs in the community</p> <p>Using the SHG structure allows PRADAN to help communities leverage existing government funds.</p> <p>Collaborates with other NGOs to ensure state’s resources are allocated to community</p>	<p>Gained legitimacy with the state by leveraging their expertise in livelihood creation</p> <p>Has extended the reach of the state because of their expertise in facilitation</p> <p>Leverages Multiple Funding Sources to Complete Projects</p>	<p>Positions itself as a way to inform government programs</p> <p>Mobilizes women as a way to empower the community</p>

Table 4 - Summary Table of Extension of Field Theory Analysis

Alliance Brokerage Comparisons

PRADAN relies on alliance brokerage; they create Self Help groups that become development tools. Himmotthan creates water management committees, which are in a sense alliances for them to progress work. However, in a sense these organizations are both relieving

pressure on the state to get every single region; they both work in areas that are less easy to manage (PRADAN the poorest, tribal areas, and Himmatthan works with communities that don't have enough water; their water strategy is useful in revitalizing communities). In general, both of these NGOs are able to build alliances to strengthen their legitimacy.

Resource Brokerage Comparisons

Both NGOs were only able to advance water and sanitation infrastructure because they interacted with the government and a network of stakeholders; they were not acting separately. Resource Brokerage is especially important for interactions with states that are willing, but incapable. Because of the newness of the states Uttarakhand and Jharkhand, they both have elements of "incapability", making resource brokerage an important parameter for NGOs to leverage if they are working with these states.

Framing Comparisons

The reason they are able to interact with the state is because the state is able to learn from them & benefit from them. They are both positioning themselves as ways to pilot policies for the government to bring to scale, expanding the available political options. They both also engage with Behavior Change as a framing device, though to different extends. This can a slippery slope; they are using rhetoric that conveys that they must convince and empower people to make the change; and in a sense it could let the government off the hook for much needed infrastructure installation. Finally, while both engage in community empowerment, PRADAN has a much greater focus on women mobilization.

CHAPTER 6: Conclusion and Discussion

6.1 Limitations

While this study delved deeply into overall strategies of NGOs and how they engage with the water, sanitation, and hygiene space, it lacked an examination of the state-NGO relationship through the lens of the state itself. A perspective from the government would be useful to better address the strengths of the state and shortcomings of NGOs, which would give a more holistic picture of how NGOs work with community organizations to implement water and sanitation systems.

Additionally, there was a bias in village selection sites; NGOs took us to project sites where they had learned the most about water and sanitation, and showed us communities that had done well in that regard. Because of our status as foreign researchers, communities we visited likely gave us the answers they thought we were looking for, and perhaps they were not comfortable describing any intimate problems regarding water and sanitation. For instance, a Himmotthan associate says that it is hard to get people to talk about diseases; “They say no, we have never been sick of water” (Staff Member, HIHT).

Again, as mentioned earlier, the NGOs we investigated were not “typical” NGOs; they have funding, a great reputation, and extensive connections. As we share the same overarching funding organization, there was a special effort put into maintaining a relationship with these NGOs that may not have been present with other organizations.

Finally, the “Causal Loop Diagram Analysis” and “Field Theory Analysis” are defensible and methodological, but some assumptions can be problematized. The relationships uncovered through this analysis should be used to gain insights into systemic issues underlying the advancement of water and sanitation systems in rural India, but should be considered in the context of a complex economic, political, social, and physical environment.

Overall, the relationships highlighted through these analyses are useful in reflecting on the different ways both NGOs and community organizations are integral to water and sanitation systems in the rural context. It also provides a background for evidence-based hypotheses for placement of water sensors with NGOs, which brings this investigation back to the original research motivation. Finally, this work analyzing NGO and community relationships has implications to consider for different stakeholder groups interacting in this space.

6.2 Discussion

6.2.1 Process of Intervening in Community

These examples demonstrate that NGOs can work and have worked in different ways with community organizations that have led to water and sanitation “success” in a community. As mentioned earlier, Himmotthan has used streamlined water programs to build community institutions. Meanwhile, PRADAN is focused on mobilizing community institutions, which is how water and sanitation planning came about in the first place.

This concept of how NGOs work with villages and community organizations can best be visualized by placing it in the context of the pyramid developed in Chapter 4. The below figure demonstrates that there are different ways for NGOs to develop both improved “water quality” and “community organizations”.



Figure 9 - Evolutionary Stages for Maturation of Rural Water Systems in India

With regards to water and sanitation, Himmotthan enters communities and makes sure sanitation is installed, and complements installation of sanitation infrastructure with behavior change trainings. It is only after sanitation and behavior change trainings that they provide water through water infrastructure. As mentioned before, at times this requires watershed rejuvenation work, and then accompanying water infrastructure is built. Throughout this process, Himmotthan is establishing community organizations to ensure the continuation of water and sanitation service maintenance. These community organizations will then takeover completely for Himmotthan. **In this manner, Himmotthan is using community organizations as a means to achieve water and sanitation infrastructure**, which results in an overall increase in water quality. Generally, Himmotthan is working from the top of the pyramid to the bottom of the pyramid.

Meanwhile, in the state of Jharkhand where water work is beginning to take off, PRADAN entered the communities with the intent to build up community organizations. It is through these Self Help Group Federations that PRADAN discovered communities wanted more water availability; and thus they worked with various stakeholders to install water infrastructure. They are still complementing the water work with sanitation infrastructure, and occasional behavior change trainings as they can. **In this sense, PRADAN is using the water and sanitation infrastructure as a way to strengthen the autonomy of community organizations.** In this way, they are essentially working from the bottom of they pyramid to the top of the pyramid.

In both cases, ultimate water quality rests on the presence of sanitation infrastructure, water availability, and community organizations to maintain these systems. However, these two case studies demonstrate that there are different “directionalities” to achieve this hierarchy in a village. This core finding motivates the concluding discussions, takeaways, and evidence-based hypotheses.

6.2.2 Theories of Change

To complement the discussion of how and why NGOs can intervene in a community in the way they do, it is useful to highlight their theories of change. According to recent UNICEF report, a ‘theory of change’ “explains how activities are understood to produce a series of results that contribute to achieving the final intended impacts (Rogers, 2014). Regarding water and sanitation projects, PRADAN’s intended impact is “Community Ownership and Empowerment”, while Himmotthan’s intended long-term impact is “Improved Health & Efficiency is Harvesting Water”. As

seen in the pyramid above, they each recognize the importance of all of the “layers”, but they take different steps to reach their goals.

An ‘input’ is “the financial, human and material resources used in a programme or policy” (Rogers, 2014). For PRADAN, this is often the time of staff spent mobilizing and communicating with self-help groups. An ‘output’ is “the immediate effects of programme/policy activities, or the direct products or deliverables of programme/policy activities” (Rogers, 2014). PRADAN’s output can thus be seen as the Self Help Groups themselves. Finally, An ‘outcome’ is “the likely or achieved short term and medium-term effects of a programme or policy’s outputs, such as a change in vaccination levels or key behaviors” (Rogers, 2014). The outcome that we have observed here is water and sanitation infrastructure due to demand from Self Help Groups. Developing and implementing their own projects ultimately leads to PRADAN’s desired “impact”; community mobilization and empowerment.

Himotthan’s ‘inputs’ to the project can be seen as a comprehensive site selection process and baseline community surveys. This process helps prepare them for the short-term ‘outputs’ of their work; community trainings on water & sanitation management, and the installation of toilets. The ‘outcome’ of their work is a functioning water system, which leads to the long-term ‘impact’ of their work; improved health and efficiency harvesting water. This discussion is summarized in the figure below.

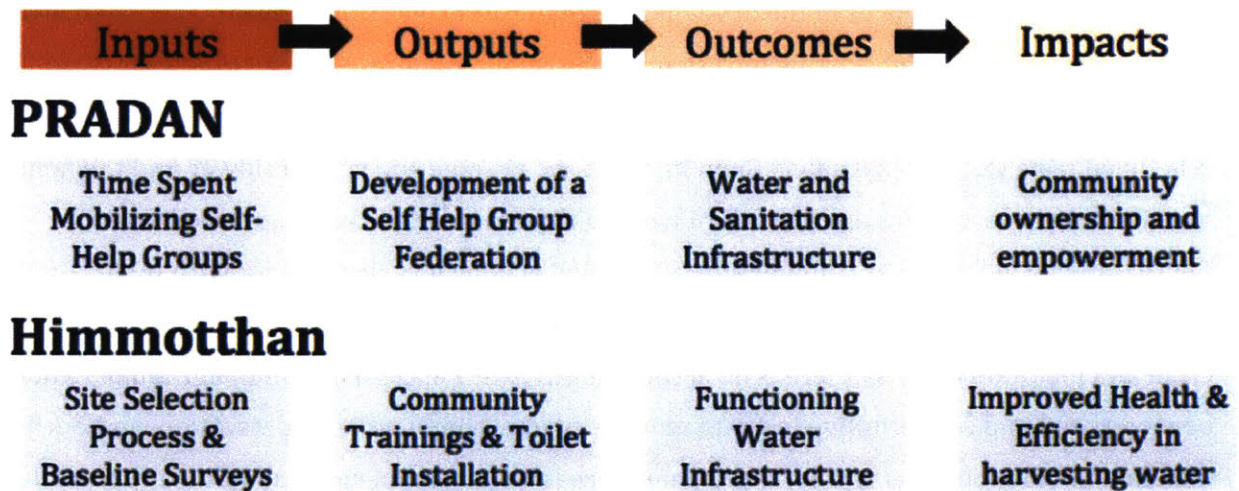


Figure 10 - Theories of Change

There are similarities in the way they use alliances, resources, and framing, as discussed above. Though they are multidisciplinary organizations relying on community mobilization and donor support, they do have distinct differences. For instance, Himmotthan signed an MOU to work in areas separate from the government, while PRADAN seems to work exclusively as a bridge for the government. Additionally, PRADAN has a huge alliance that they develop themselves as their main goal: the Self Help Group. In regards to water work, Himmotthan relies less on the Self Help Group and more on another institution they create, water and sanitation committees.

6.2.3 Community Characteristics

While this thesis has discussed mainly the characteristics of NGOs and community organizations, it is important to reflect on how outcomes in communities do not just simply depend on the “input” of an NGO. A community’s demographics, connectedness to infrastructure, and environmental conditions can influence how effective an NGO may be in working with local organizations to advance water and sanitation systems.

For instance, Himmotthan has worked with the villages of Jadipani and Kudiyal Gaon in Uttarakhand, but they seem to have progressed at different rates; with Jadipani being more “developed”. The differences in the development of these villages can be due to education level, homogeneity of need, and existing infrastructure.

According to an HIHT community mobilizer, there are several scheduled caste and scheduled tribe families in Kudiyal Gaon in which the average education is lower and the families larger. Thus these families are difficult to work with because their challenges are harder. Comparatively Jadipani has a higher education level making it easier to work with them.

Additionally, in Kudiyal Gaon, there is a fair amount common space; which is hard to keep clean and maintain because there is no accountability. The village relies on the Pradhan (leader) being forceful and authoritative to try to manage spaces, eliminate open defecation, and encourage installment of toilets. Meanwhile, in Jadipani there is less common space and thus everyone has their own area to keep clean, making for easier management. According to the HIHT community mobilizer, there is a homogenous need in Jadipani; “There’s greater cooperation here because everyone’s need is the same... .If there is no common need along with which people can coalesce, then cooperation becomes hard” (Community Mobilizer, HIHT).

Finally, the existing infrastructure plays a large role in development outcomes. For instance, if Kudiyal Gaon was given a 10,000 rupee grant for materials, half of the money would be used up in transporting the materials to the village because adequate infrastructure doesn't exist.

Unfortunately, government support mechanisms don't take that into account when allocating funding to projects. Jadipani is relatively easier to access than Kudiyal Gaon, and as a result the development level of these two villages are different.

PRADAN's experience is also impacted because of characteristics of the community; for instance, some demographics are harder to work with than others. According to a PRADAN team coordinator, PRADAN must take into account whether the community is Muslim, and whether the community has members of backward castes or tribes. Muslims for instance, often do not agree with the idea of collecting interest, which makes savings and credit groups very challenging. This team coordinator says that of the 7000 SHG members they are working with, more than 70% are from the backward caste community, and around 20% are from the Scheduled Caste Community. Working with these communities in particular is difficult because they all believe the government should come in and give them what they need. Overall, these examples are just some of many of how water and sanitation success depend on more than just NGO intervention strategies, and are largely impacted by numerous other factors.

6.2.4 Incorporation of Water Sensors

Current Technology Use

The analysis of NGO and community organizational strategies relates well to the initial research motivation; and can inform evidence-based hypotheses of where "insertion" of improved water sensors could be most effective. There has been a dominant paradigm that in order to fix problems of development, it can be addressed with problems of technology. However, often better and faster technology cannot "fix" a problem unless applied correctly or in the appropriate context. Thus it is important to consider the characteristics of NGOs and their theories of change when considering how, or if, the incorporation of a faster microbial test would be useful.

Technology is a crucial part of these NGOs' work; they help install water purification systems and scale up technological innovation in agriculture, health, and more. However, Himmatan and PRADAN are using and incorporating technology and technical experts in different ways, and are often not incorporating various technologies efficiently. For instance, in

Himmothan; much of the expertise is “in house”. They often can rely on the expertise of their staff to guide technical projects. In PRADAN, most of the expertise is “out of house”; PRADAN contracts assignments to the people best for the job; as their own core competencies include being able connect people with resources. Additionally, several (higher level) staff members of both Himmothan and PRADAN did not even know about the existence of current field microbial water quality tests. This speaks to the fact that perhaps technology itself isn’t the problem, but the way in which the technology is marketed and utilized. Overall, these differences in the way these NGOs treat technologies is important to consider when hypothesizing how and if faster microbial tests could be of use.

Potential User Groups of Water Testing

In our research, we discussed with Self Help Groups and NGO staff members whom could be the best users of this technology. There were a variety of responses, some of which are highlighted here. An Associate of the Himalaya Trust, affiliated with Himmothan shared the following; “I think it will take us a lot of time to reach that goal where we can actually talk with the people about the quality”. Thus, he considers that currently water tests would best be used by upper-level management to test if water is potable. However, an engineer associated affiliated with Himmothan believes that the test should go through NGOs, but if the NGO is capable of training community members to use a test, it could be much more useful with them.

According to a PRADAN resource mobilizer and corporate communicator, water testing and concerns with water quality seem to be an issue to address in the future, as right now they are focused simply on water availability. This echoes the sentiment of the Associate from the Himalaya Trust above; water testing is very advanced for the level these communities are at. However, he continues on to say that; “So if water testing is a tool to bring about change... then it has to be done to a group which can act on that information knowledge”. In this way, a water quality test could be used for more than monitoring water, but could be a successful behavior change tool for use in trainings for women or in a school setting. A resource mobilizer and partnership manager from PRADAN shares that she sees potential for water testing to be used in women’s Self Help Groups, but it depends on how much the test costs and how easy they are to use; she has seen a similar concept work successfully when women were able to test their milk in a dairy in Rajasthan.

Concerning the opinions of Self Help Groups themselves, several were eager to incorporate a water test. The SHGs that PRADAN had extensively interacted with seemed generally positive

about the concept of incorporating a water test into the responsibilities of their SHG; women from Jolha Karma, Belkhara, and Ronhe suggested ways for their organization to utilize water quality information. It is interesting to note that women of Gopla Pakharatoli, who had had less intensive interaction with PRADAN, suggested local government bodies as ways incorporate the water test. These suggestions speak to the potential of PRADAN to empower Self Help Groups to take on projects and responsibilities for themselves.

Technology Amplifies Intent

Given the various ways technology can be incorporated into an organization and the various opinions of the utility of water quality testing, it is important to anchor hypotheses about the insertion of water quality testing with a supported theory. In his book *Geek Heresy*, Kentaro Toyoma argues for the “Law of Amplification”; which means that “Technology’s primary effect is to amplify human forces” (Toyoma, 2015). Using this theory alongside the NGO analysis lends itself to supportable hypotheses about where improved sensors may be useful.

Top-Down Organizations

In a “top-down” organization like Himmotthan they hope to create community organizations for the purpose of sustaining streamlined water and sanitation practices. Thus, the following are hypotheses for ways in which faster water sensors could be inserted.

H1: Use of an improved water sensor will ensure community trainings on water infrastructure maintenance are focused, which will lead to effective and sustainable water infrastructure management.

H2: Use of an improved water sensor will improve monitoring and evaluation efforts of water quality, which will improve compliance with safe water and sanitation practices.

H3: Use of an improved water sensor would allow community organizations to feel a sense of ownership of their water systems, leading to sustainable water system management

H4: Use of an improved water sensor would allow NGOs to pinpoint the best locations to implement their streamlined water and sanitation process, which could increase the efficiency and scope of their organizations.

Bottom-Up Organization

In a “bottom-up” organization like PRADAN, they hope to use water and sanitation infrastructure development as demanded by the community as a way to sustain community autonomy. The following hypotheses take this characteristic of the organization into account.

H1: The distribution of improved water sensors would stoke interest in the community, which would help NGOs mobilize the community faster around an actionable issue.

H2: The use of an improved water sensor will lead to more engaging behavior sessions and community trainings, which will increase compliance with sanitation and safe water practices.

H3: The use of an improved water sensor would be useful in quantifying the need for improved water systems, which would allow an organization like PRADAN to be a more effective bridge between the community and the government and other donors.

H4: Distributing improved water sensors to local community organizations like Self Help Groups would empower them to feel in control over the issue of water, leading to greater demand for water infrastructure.

6.2.5 Implications for Stakeholder Groups

This analysis of determinants of microbial water quality, ways NGOs work with community organizations to advance water and sanitation systems, and the resulting evidence-based hypotheses of technology-insertion have implications for various stakeholder groups.

Primarily, it is important for water and sanitation policymakers to understand that there are a variety of ways that the policies they create are actually carried out. At times government representatives will be able to coordinate the installation of basic services. However, as seen in the cases described in this thesis, the government is often inadequate at extending water and sanitation services to communities, even when there is funding allocated for projects. Thus, NGOs often focus their work in areas where government services are especially lacking. However NGOs do not have a homogenous strategy for how they approach problems, as demonstrated by the two NGOs studied here. Policymakers should take into account the variety of organizations that will help carry out the policy, and adjust parameters of the policy to ensure efficient implementation of the policy in multiple cases. (i.e. ensuring streamlined/simple process of requesting funding for different groups).

Additionally, donors (Companies, trusts, individuals, or otherwise) should consider the long-term “impacts” they are seeking to align their funding with. While both Himmotthan and PRADAN build community institutions and installed water systems, they had very different theories of change while doing so. Himmotthan as an organization tackles several issues, but in the case of water and sanitation, they demonstrated a streamlined process with the end goal being sustainable water and sanitation systems. PRADAN also tackles several issues, but typically promotes community mobilization and empowerment, and then supports the community-demanded projects after mobilization. In this case, it has organically spread to water infrastructure. While there is no “wrong” answer when choosing to align with streamlined targets or community empowerment, it is a distinction a donor should be aware of. In addition, a donor should consider whether the actions of the NGO are enhancing the capability of the state, or relieving pressure from the state to take action. An ideal situation is where the relationship between the state and an NGO are mutually beneficial. (This is different than mutually dependent, as is the case with several NGO-State relationships)

For the NGOs themselves, it is important to consider how their relationship with the state is impacting their own work and mission. As mentioned earlier, states can be categorized in the way they work with NGOs as 1) willing & capable 2) willing and incapable 3) unwilling and capable and 4) unwilling and incapable (Asad & Kay, 2014). Himmotthan and PRADAN had working relationships with the state, indicating that both states of Uttarakhand and Jharkhand are “willing”. The degree of the capability of the states is hard to categorize, but the state of Jharkhand is often “incapable” of handling several of its own issues because of political instability. Uttarakhand is also a new state, causing it to be incapable in some areas as well, especially due to the unique (lack of) infrastructure situation they must contend with in mountainous regions. NGOs themselves should be aware of their standing with the state, and find a balance of complementing states where they are “incapable”, but building up the state’s capability to handle problems sustainably and at a large scale. As highlighted earlier, the intensity with which the NGOs engage with communities (either “top-down” or “bottom-up”) can impact the way states view a NGOs legitimacy and utility.

Implications of this analysis also apply to organizations like the Tata Center, and other groups developing technologies they hope will address all aspects of life in India. Centers like these should consider what the characteristics of the organizations are that they hope to partner with. Will the organization be able to implement successfully a technology that is being developed? Have the organizations successfully leveraged alliances, resources, and framing to negotiate or harmonize their interests with that of the state? For instance, how does an organization engage

with a community? Do they build local organizations or leverage existing ones? Do they work 'bottom-up' or 'top-down'? All of these questions are important to consider when selecting partners to develop a project with.

In conclusion, this analysis demonstrates that PRADAN and Himmotthan are able to harmonize and negotiate their interests with that of the state. However, the resulting inquiries beg the question; "Which method is most effective in the long run for NGOs to advance sustainable water and sanitation systems; 'top-down' or 'bottom-up'? Government systems are notorious for going into a community, installing a system, and pulling back out, leading to unsustainable infrastructure. Thus, this is a very 'top-down' system but includes no element of capacity building for communities. Meanwhile, both Himmotthan and PRADAN engage extensively with communities, working completely differently than the government. Given Himmotthan's relatively larger success with water and sanitation implementation than PRADAN, it may seem initially that they have the better method for success. However, as PRADAN continues to expand its' work with water and sanitation, it could become apparent that their 'bottom-up' approach is slower, but more robust. Regardless, I argue that as long as both elements of community organizations and water systems are supported (as seen in the hierarchical pyramid on which water quality rests), a step has been made in the right direction.

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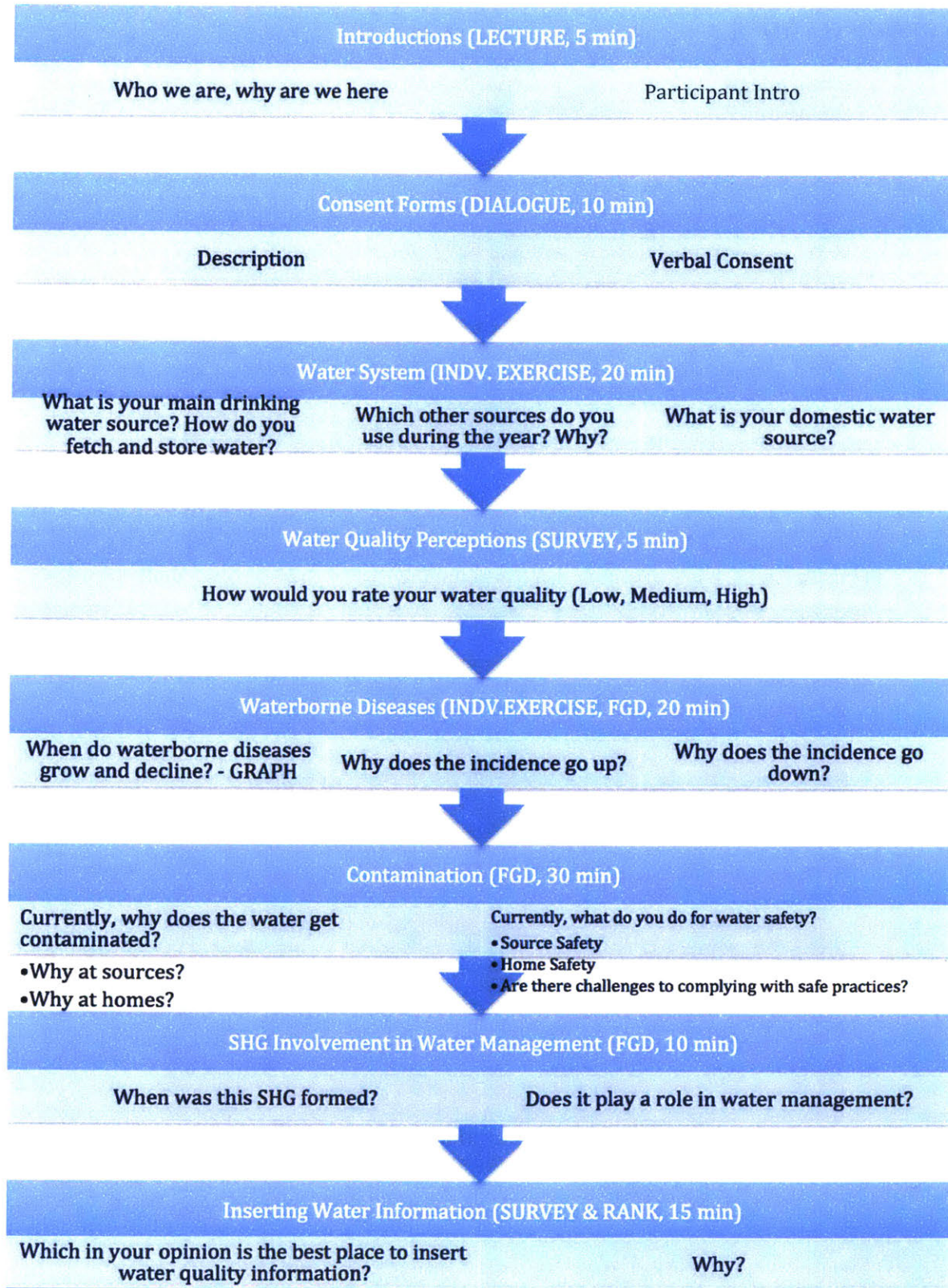
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APPENDIX A: FIELD RESEARCH MATERIAL

INTERVIEW QUESTIONS

1. Can you generally describe the main ways you interact with communities regarding water and sanitation?
2. In your interactions with communities, what kind of information do you share with the community concerning water quality? Why?
3. How detailed of a message do you think is best to share?
4. Who do you talk to in the community specifically? Why?
5. Are you expecting what you share/teach them to flow the community?
6. Is there information that you choose not to share with a community regarding water quality?
7. Can you give some specific examples of times you shared information with a communities about WASH?
8. What were the (social/economic/geographic) characteristics of each community?
9. What were some of the ways that communities responded to you sharing information with them?
10. Did they respond differently or the similarly? Why do you think this happened?
11. Did you change the message based on the community you worked in?
12. What is the most effective way to distribute information to a community? Why?
13. What are some other ways that you could spread information to a community?
14. What have been your more successful interventions? What is a project that has worked?
Can you give an example of a time that a project didn't work?
15. What is already being told to end users?
16. Who do you think it is most beneficial to distribute water quality information to?
What interventions have been most successful? Why? Who was the major driver of that intervention?
17. How do you usually engage with a community about other topics that are important to a community? Why do you do that? What factors have contributed to their success?

GROUP MODEL BUILDING PROTOCOL



APPENDIX B: PHOTOS OF FIELD WORK

FOCUS GROUP SESSIONS

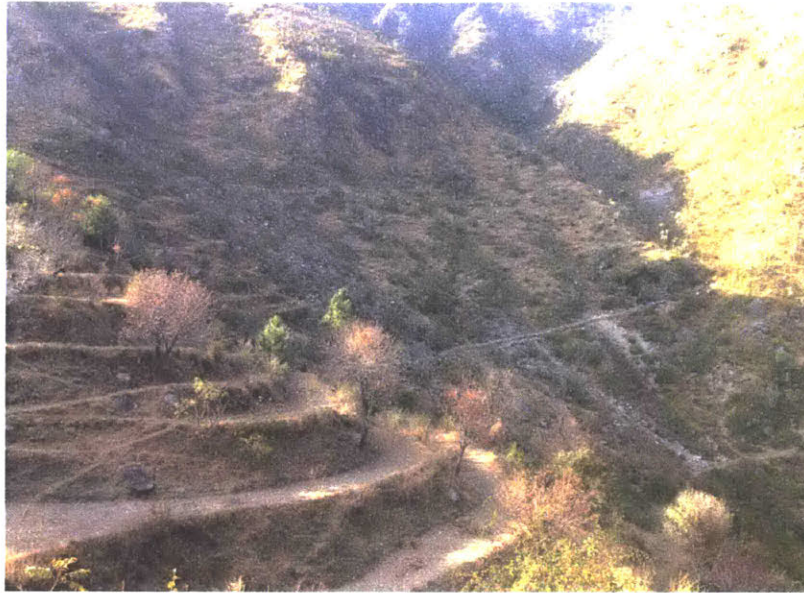


Focus Group Session in Jadipani, Uttarakhand with the NGO Himmotthan



Focus Group Session in Ronhe, Jharkhand with the NGO PRADAN

ENVIRONMENT



Uttarakhand Landscape where Gravity-fed Piped Water Infrastructure is Prominent



Jharkhand Landscape Where Wells are a Common Form of Water Infrastructure

ADVANCED WATER SYSTEMS



Water Catchment and Solar Pump for a Piped Water System in Chureddhar, Uttarakhand



Water Tower in Ronhe, Jharkhand



Solar Pump for Water Tower in Rohne, Jharkhand

APPENDIX C: CAUSAL LOOP DIAGRAM DOCUMENTATION

DYNAMICS OF COMMUNITY ORGANIZATIONS		
Base of Arrow	→	Tip of Arrow
Required Critical Mass for Representing Women's Issues	Women's Representation Gap	Churredhar Focus Group w/ Community Mobilizer: Before the SHGs were made there was no platform for women to come together
Actual Women's Representation	Women's Representation Gap	<u>Formulation</u> : Less Women in a Community Organization means a bigger gap in adequate representation
Women's Representation Gap	Need for Collectivizing Women	PRADAN member Interview: PRADAN is forming SHG federations everywhere they go and encouraging them to take charge
Women's Representation Gap	Emphasis on Women's Priorities	Churredhar Focus Group w/Community Mobilizer: Eventually, it was this SHG that brought about the issue of water, among other issues. "And that's where Himmothan, because it was always engaged in it, got to know that we could do something about water"
Emphasis on Women's Priorities	Demand for Sufficient and Safe Water	<u>Formulation</u> : Women's issue must surface+ also have a way to be addressed; the combination of NGOs hearing their voices & being able to act on it creates a viable "demand for sufficient and safe water"
Need for Collectivizing Women	Participation in Women's Collective	PRADAN member interview; Their goal is to collectivize women. <u>Formulation</u> : The identification of the need for collectivizing women + NGO action to collectivize them results in SHG participation
Incentive to Collectivize Women	Participation in Women's Collective	<u>Formulation</u> : Incentives (Trust + Loans) to Participate in Women's Collective will translate to actual participation, especially when combined with NGO's effort to collective women
Participation in Women's Collective	Actual Women's Representation	<u>Formulation</u> : More Participation in the Collective Means More Women Representing
Participation in Women's Collective	<i>Surfacing</i> of Women's Priorities	Churredhar Focus Group w/Community Mobilizer: Eventually, it was this SHG that brought about the issue of water, among other issues. "And that's where Himmothan, because it was always engaged in it, got to know that we could do something about water" PRADAN member interview: SHG brought up the issue of scarce drinking water PRADAN member Interview: issue of domestic violence/rape surfaced from women
Surfacing of Women's Priorities	Demand for Sufficient and Safe Water	<u>Formulation</u> : Women's issue must surface+ also have a way to be addressed; the combination of NGOs hearing their voices & being able to act on it creates a viable "demand for sufficient and safe water"
Participation in Women's Collective	Savings of the Women's Collective	Churredhar Focus Group w/ Community Mobilizer: Concerning joining of the SHG, it was only after some critical mass was there and the


		processes were transparent enough that people joined
Savings of the Women's Collective	Loans Available to Collective Members	<u>Formulation</u> : Women must contribute regularly to the group for their to be a pool to draw loans from
Loans Available to Collective Members	Incentive to Participate in Women's Collective	Senior Executive, Tata Trusts, Interview: Women's participation in the collectives is driven mainly from the desire to have savings and loans.
NGO Involvement for Collectivizing Women	Participation in Women's Collective	Interview with PRADAN member: They enter into communities like Rohne to create SHGs
Loans Available to Collective Members	Experience with Women's Collective	Senior Executive, Tata Trusts, Interview "The mindset is all about the money" Women will sit for one and a half hours for money management... they will attend if they can make some money out of it.
Experience with Women's Collective	Positive WOM About Women's Collective	Churredhar Focus Group w/ Community Mobilizer: Concerning joining of the SHG, <i>it was only after some critical mass was there and the processes were transparent enough that people joined</i>
Positive WOM about Women's Collective	Trust in Women's Collective	Churredhar Focus Group w/ Community Mobilizer: Concerning joining of the SHG, <i>it was only after some critical mass was there and the processes were transparent enough that people joined</i>
Trust in Women's Collective	Incentive to Participate in Women's Collective	Senior Executive, Tata Trusts Interview: Women generally do not have a lot of economic or purchasing power, but this group allows them to help each other

Table 5: Dynamics of Community Organizations CLD Documentation

DYNAMICS OF WATER INFRASTRUCTURE		
Base of Arrow		Tip of Arrow
Population	Water Availability Gap	Formulation: Population Influences How much water a community will need
55 LPCD	Water Availability Gap	Interview, HIHT Community Organizer: The government's guidelines are 55 LPCD Formulation: Population * 55LPCD = Minimum Water Needed for a Community
Water Availability Gap	Water Sufficiency Gap	Formulation: The water Availability Gap is the Gap Between Actual Water Available and Minimum Water Needed for a community, as formulated above. The water sufficiency Gap addresses whether this quantity of water is "sufficient" for everyone.
Water Sufficiency Gap	Need for Water Infrastructure	Formulation: The bigger the "gap" in sufficiency, the greater the "need" to solve the problem
Need for Water Infrastructure	Construction of Water Infrastructure	Formulation: This "Need" is one factor leading to eventual construction of water infrastructure
Demand for Water Infrastructure	Construction of Water Infrastructure	Formulation: As formulated earlier, Demand for Sufficient and Safe Water is one factor that leads to eventual construction of water infrastructure.
Financial Infrastructure	Construction of Water Infrastructure	Interview with HIHT Community Mobilizer: Village chose to do a cheaper water management option based on their ability to pay for it
Construction of Water Infrastructure	Gravity-Fed Infrastructure	Observation @ Kudiyal Gaon & Churedhar
Construction of Water Infrastructure	Rainwater harvesting Infrastructure	Observation @ Churedhar: RWH tanks installed Kudiyal Gaon Focus Group 2: Himmotthan was involved in installing tanks
Construction of Water Infrastructure	Overhead tank/Piped Water Construction	Observation @ Ronhe, Belkhara, & Jolha Karma
Gravity-Fed Infrastructure	Usable Water for Downstream HH	Formulation: Infrastructure Leads to More Water That Can be tapped into
Rainwater Harvesting Infrastructure Construction	Usable Water for Upstream HH	Formulation: Infrastructure Leads to More Water That Can be tapped into
Overhead Tank/Piped Water Construction	Usable Water to HH with Home/Community Taps	Formulation: Infrastructure Leads to More Water That Can be tapped into
Usable Water for Downstream HH	Actual Available Water	Formulation: More usable water that can be tapped into leads to actual available water
Usable Water for Upstream HH	Actual Available Water	Formulation: More usable water that can be tapped into leads to actual available water
Usable Water to HH with Home/Community Taps	Actual Available Water	Formulation: More usable water that can be tapped into leads to actual available water
Actual Available Water	Water Availability Gap	Formulation: More Available Water Shrinks the Availability Gap
Rain Fall	Potential Available Water	Kudiyal Gaon Focus Group 1: They struggle with having sufficient water when there is less rain
Potential Available Water	Actual Available Water	Formulation: Actual Available Water is due to the Amount of Potential Available Water in the System & The

		amount of infrastructure that can tap that available water
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Table 6: Dynamics of Water Infrastructure CLD Documentation

DYNAMICS OF OPERATION AND MAINTENANCE		
Base of Arrow		Tip of Arrow
Built Water Infrastructure	Required Maintenance	PRADAN Group Meeting: There is often external dependence for repairing advanced water systems
Required Maintenance	Operation & Maintenance Gap	<u>Formulation:</u> The Operation and Maintenance Gap is the difference between Ongoing Operation and Maintenance and the Required Operation & Maintenance
Operation & Maintenance Gap	Functionality of Water Infrastructure	Himmotthan GMB: Operation and Maintenance effects the quality of the stored water <u>Formulation:</u> How much of the required maintenance is being done effects the functionality of the water system Ronhe Focus Group: Their water system had not been properly maintained
Functionality of Water Infrastructure	Water Quality	Belkhara Focus Group: People like that their water is purified and has a good taste; also diarrhea has gone down since the installation of the system Jolha Karma Focus Group: precipitous drop of disease with installation of tank
Functionality of Water Infrastructure	Actual Usable Water	Ronhe Focus Group: When it is cloudy the solar scheme doesn't work and you have to go to the well Belkhara Focus Group: After installation, they liked that water was available Jolha Karma Focus Group: If the pump is not running due to clouds they have to go to the pump
Functionality of Water Infrastructure	Time Saved	Belkhara Focus Group: The installation of pipes has increased the availability of time for women Jolha Karma Focus Group: Before the piped water system, they would spend 2 or 2.5 hours per day fetching water, twice.
Water Quality	Incentive for Operation and Maintenance	Belkara Focus Group: Expressed enthusiasm for water system because of lower disease and better testing water
Actual Usable Water	Incentive for Operation and Maintenance	Belkara Focus Group: Expressed enthusiasm for water system because of availability of water
Time Saved	Incentive for Operation and Maintenance	Belkhara Focus Group: Expressed enthusiasm for water system because of time saved
Incentive for Operation and Maintenance	Ongoing Operation and Maintenance	<u>Formulation:</u> The increase in water quality, actual usable water, and time saved contributed to the incentive to keep maintenance going.

Ongoing Operation and Maintenance	Cost of Operation and Maintenance Per Household	Jolha Karma Focus Group: Every household pays 60 rupees per month, and the operator is being paid 1000 rupees. There was a complaint in the water pricing; some families were big and others were small but they still pay the same amount.
Ongoing Operation and Maintenance	Labor Required for O&M	Jolha Karma Focus Group: The SHG plays a role in managing the water distribution system. They appointed one women who is also an SHG member to look after the system. The water user committee is the main stakeholder is managing water; they get members from all 6 SHGs.
Cost of Operation and Maintenance per Household	Free-Riders on Water Infrastructure	Jolha Karma Focus Group: There was a complaint in the water pricing; some families were big and others were small but they still pay the same amount; greater pressure to "free-ride" Principle: "Tragedy of the Commons"
Labor Required for O &M	Free-Riders on Water Infrastructure	<u>Formulation</u> : The more labor required to upkeep the system, the greater the pressure to "free-ride" Principle: "Tragedy of the Commons"
Free Riders on Water Infrastructure	Incentive for Operation and Maintenance	<u>Formulation</u> : The more free-riders that exist, the less incentive there is for continued operation and maintenance

DYNAMICS OF SANITATION		
Base of Arrow		Tip of Arrow
Actual Available Water	Toilet Use	Pradan Group Model Building: Toilet Use is directly correlated with the availability of water there to use the toilet
Toilet Use	Social Pressure to Use Toilets	Interview with Executive Director of PRADAN: Toilets without more water is dangerous
Social Pressure to Use Toilets	Toilet Use	Interview with HIHT Community Organizer: Each time a mobilizer delivers the messages that using toilets is important, more people have aligned themselves with that message and can "deliver" the message also
Sanitation Infrastructure Gap	Toilet Use	<u>Formulation:</u> Toilet use is dependent on both social behavior as well as the presence of infrastructure
Sanitation Infrastructure Gap	Sanitation Infrastructure Gap Identification	<u>Formulation:</u> The larger the gap, the easier it is to identify the lack of sanitation. This, combined with the Healthy Home Survey, leads to effective Gap Identification.
Sanitation Infrastructure Survey (e.g. Healthy Home Survey by IHHT)	Sanitation Infrastructure Gap Identification	Interview with HIHT Community Mobilizer; The Healthy Home Survey is Used to Identify the Sanitation Scenario.
Sanitation Infrastructure Gap Identification	Door to Door Advocacy by NGO for building toilets	<u>Formulation:</u> As the need for more sanitation infrastructure is identified, NGOs are mobilized to action
Door to Door Advocacy by NGO for building toilets	Awareness of mechanisms to pay for personal toilets	Interview with HIHT Community Organizer: The NGO will sometimes offer incentives to install toilets
Door to Door Advocacy by NGO for building toilets	Consensus Building to Provide Space for Toilet Construction	Interview with HIHT Community Organizer: The NGO can facilitate meetings about where to install a toilet to make more space
Awareness of mechanisms to pay for personal toilets	Affordability of Toilet Construction	<u>Formulation:</u> Being aware of difference financing options from the government & NGO incentives leads to more toilets
Consensus Building to Provide Space for Toilet Construction	Availability of Space for Toilet Construction	Interview with HIHT Community Organizer, "That's how, through that consensus, some (toilets get installed)"
Availability of Space for Toilet Construction	Toilet Construction by Households	<u>Formulation:</u> You need both finances and space to construct a toilet
Toilet Construction by Households	Current Sanitation Infrastructure	<u>Formulation:</u> Construction by households reduces the sanitation infrastructure gap
Current Sanitation Infrastructure	Sanitation Infrastructure Gap	<u>Formulation:</u> The sanitation infrastructure gap is the difference between current sanitation infrastructure & required sanitation infrastructure
Required Sanitation Infrastructure	Sanitation Infrastructure Gap	<u>Formulation:</u> The sanitation infrastructure gap is the difference between current sanitation infrastructure & required sanitation infrastructure (usually considered as 1 unit per family)
Current Sanitation Infrastructure	Community Pride in Having and Using Toilets	Interview with HIHT Community Organizer: Then, when that coverage reaches 60 or so percent, then it

		becomes a question of sort of a status and pride, that some people will start feeling bad that everybody has one,
Community Pride in Having and Using Toilets	Pressure to Construct Toilets for Households Resisting Toilet Construction	Interview with HIHT Community Organizer: "There is still some fraction that is left who is still going out, they are stubborn, and they tried to convince them, but they also sort of in some ways gang up on them a little bit"
NGO Behavior Change Trainings	<i>Social Pressure to Use Toilets</i>	Interview with HIHT Community Organizer: They use skits

Table 7: Dynamics of Sanitation CLD Documentation

DYNAMICS OF WATER QUALITY		
Base of Arrow	→	Tip of Arrow
Toilet Use	Total Contaminants in Source Water	<u>Himmotthan</u> GMB, PRADAN GMB: Both identified Open Defecation as a factor impacting water quality
Rainfall Runoffs	Animal Waste	<u>Formulation</u> : Rain causes runoffs of Animal Waste
Animal Waste	Total Contaminants in Source Water	<u>Formulation</u> : Animal Waste contributes to total Contaminants in Source Water
Total Contaminants in Source Water	Total Contaminants in Storage Water	Principle that contamination flows with water; confirmed by <u>Himmotthan</u> GMB & PRADAN GMB
ACTUAL OPERATION AND MAINTENANCE	TOTAL CONTAMINANTS IN INGESTED WATER	~ <u>Ronhe</u> Focus Group: Using a reference mode for discussion: "From the last 2 years, once this [piped water system] was put in place, diarrhea has almost stopped" ~ <u>Belkara</u> Focus Group: Before piped water, diarrhea was more prevalent
Safe Water and Hygiene Practices	TOTAL CONTAMINANTS IN INGESTED WATER	<u>Gopla Parkaratoli</u> Focus Group: Water can be <u>uncovered</u> in the home/hands are inserted into it.
NGO Advocacy	Safe water and hygiene practices	Interview with HIHT community mobilizer; the NGO does surveys & behavior change trainings in the community
Total Contaminants in Ingested Water	Incidents of Waterborne disease	Scientific Principle of Waterborne disease
Incidents of Waterborne disease	Safe Water and Hygiene Practices	<u>Kudiya Gaon</u> Focus Group 2: When people get sick they go to the doctor who tells them to boil or filter water for 1 month <u>Ronhe</u> Focus Group: Sickness rises because they don't boil water.
Time in Fields	Ingestion of Water from Uncontrolled Sources	<u>Kudiya Gaon</u> Focus Group 2: People drink water from everywhere/uncontrolled sources <u>Belkara</u> Focus Group: During rainy season they have to go to the field and drink water from various sources
Ingestion of Water from Uncontrolled Sources	TOTAL CONTAMINANTS IN INGESTED WATER	<u>Formulation</u> : Drinking from Sources that are not purified leads to total contaminants in ingested water

Table 8: Dynamics of Water Quality CLD Documentation