SECURING WATER FOR FOOD

Naireeta Services
Performance Evaluation Report
Bhungroo Water Harvesting System in India

NOVEMBER 2019
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ABSTRACT

By and large, extreme uncertainties in the climate have been on the rise, and unfortunately, farmers are the worst hit. In fact, crop failure due to recurring droughts, or even incessant rainfall and chemical overdose led to farmers taking their own lives due to unprecedented climate variability, than any other cause.

Gujarat, the western state of India, is a semi-arid region. Patan district, similar to many other districts of the state, faces drought and flooding in rapid succession. Due to the close proximity to the desert region, soil salinity is extremely high making farming a challenging and expensive process. Salinity limits rainwater seeping into the soil profile, therefore destroying the irrigated pre-monsoon crop due to flooding.

The district of Patan has recorded an average rainfall of 664 mm over the last three decades (1989-2018) (Gujarat State Disaster Management Authority). The occurrence of rainfall limits to few days in the season resulting in flooding. Post the monsoon, the region suffers from extreme dry spells and as water does not reach the sub strata of the soil due to impermeability, there is no water left for the next crop. The continuous failure of the crop cycles with partial or no income from other livelihood sources becomes a grave situation for smallholder subsistence farmers, many of them with no option to migrate to other regions as migrant workers. This scene is even more troublesome for women farmers with no social status nor financial power in the societal hierarchy.

The report details monitoring and evaluation of The Bhungroo systems through assessment on agricultural practices, water usage and expenses, household income, crop pattern and yield, perceived benefits, and expectations from the technology.

The report contextualizes acute water stress in the region, factoring into account land desertification and degradation, soil impermeability, frequent dry spells, and rainfall intensity. Overall viability of the innovation is discussed within this context.

Along with water availability, other benefits identified by farmers were better income, higher quality crop yield with greater chance of survival, decreased cost of water, and the empowerment of women in the selected region. Farmers had an overall positive attitude towards the Bhungroo systems and about 96% of farmers recommended the innovation and suggested to use it in the next five to ten years.
INTRODUCTION
Many regions in India are facing dry spells, desertification and limited access to water, particularly in the western regions of the country. Gujarat, the westernmost state of India, has always been susceptible to land degradation and drought compared to its richer northern and southern counterparts.

In the state of Gujarat, millions of hectares of land are affected by soil salinity, which is the food security of smallholder farmers. Smallholder farmers - defined as those marginal and sub-marginal farm households that own and/or cultivate less than 2.0 hectares of land - constitute about 78 percent of the country’s farmers (Agricultural Census 1990-91), owning only 31 percent of total cultivated land, but nonetheless, producing 41 percent of total food grains. Thus this region is vital for the agricultural economy of India. The western region of India, in particular, faces recurring droughts and floods, which exacerbate food insecurity for already suffering farmers. This decreased productivity further increases their indebtedness, pushing them into a vicious debt cycle. Once in this cycle, they either work as bonded labor with some farmers even committing suicide.

The innovation by Naireeta Services Private Limited (Naireeta) received a monetary award and support from the Securing Water for Food (SWFF). The innovation’s aim is to conserve rainwater for irrigation purposes. As part of the innovation, the primary product - Bhungroo (straw or hollow pipe) filters, injects and stores excess water from waterlogged fields allowing farmers to retrieve it during dry periods. The technology works to reduce salt deposits on soil and manage water and ensure its supply during dry spells.
Additionally, given the proximity of the Patan district to the Rann of Kutchh salt marsh in the state of Gujarat, soil salinity is a major problem threatening food security of local farmers. It requires more sophisticated technological interventions including geohydrological surveys, and water and soil analysis. These assessments are expensive and require subject matter expertise. Therefore, the innovation recommends the type of Bhungroo system to be installed based on a complete analysis of farming lands.

The innovation focuses on empowering marginalized rural smallholder women farmers. Women have low social status and usually are deprived of any legal rights over farm lands. This situation puts them in an extremely risky and vulnerable place. Male farmers migrate to urban cities for work-related opportunities, leaving women farmers in adverse situations during a water crisis. The innovation aims to capacitate women by giving them water usage rights, and allowing them to participate in agricultural related influence and decisions. This essentially makes it a woman-driven process including installation and maintenance. As part of the innovation, smallholder women farmers who own Bhungroo systems are given financial agency by selling access to water to other smallholder farmers. They receive training in providing fee-based services to other farmers in their villages. The Bhungroo technology is made locally which eliminates any copious costs of production. This locally-manufactured technology ensures access to post-installation services specifically to women farmers who may have limited exposure to the servicing market.
How does the Bhungroo work?

The Bhungroo consists of a small cemented pit that measures about 1m x 1m. It is raised roughly 50 cm above the ground, preventing litter from entering the pipe. The lowest point in the ground is chosen as the bhungroo site. The ground is drilled until good water retention strategy is reached. A pipe of a diameter between 10 cm and 50 cm, depending on the requirement, is lowered through the drilled hole. In most places, water enters the Bhungroo because of the natural gradient of the land. If necessary, a slope is made, enabling the water to reach the Bhungroo. When the field needs to be irrigated, a portable motor pump is used to lift the water.

This evaluation investigated the performance of the Bhungroo water harvesting system in year two of its operation in Harih block of Patan district, Gujarat. The evaluator conducted 51 interviews with registered users in 11 villages. Respondents were selected through random stratified sampling and surveyed on their agricultural practices, primary sources of income, usage and perception of innovation, experience, benefits and overall feedback, among other topics. The results show the areas where the innovation has helped farmers in the irrigation of farm lands during dry spells, identifies the challenges to the uptake and usage of Bhungroo units, and discusses areas where the innovation could be improved.
The state of Gujarat has received erratic rainfall in the last few years. In 2018, it recorded a deficit of 21 percent compared to the mean annual rainfall, however, in the year 2019, it recorded over 126 percent of the average rainfall. As Figure 1 shows, Patan district in particular received the scantest rainfall among all the districts of Gujarat in 2018, followed by regions such as Kutch and Mehsana, which are adjacent to Patan district. This entire terrain is the most vulnerable as soil salinity poses a huge threat along with rainfall variability.

**FIGURE 1. GUJARAT’S RAIN ASSESSMENT IN THE YEAR 2018**

According to Gujarat State Disaster Management Authority (GDSMA) data, the state received 82 percent of the mean annual seasonal rainfall in 2015, 77 percent in 2016 and 94 percent in 2017. The state government was forced to use the supply from the Narmada river water to meet irrigation needs, thereby increasing pressure on already debilitating natural resources. In 2019, the state government extended monetary relief to farmers affected by excessive rain. This inconsistent pattern is posing a huge threat to the farmers’ livelihood, irrigation resources, farmlands, and routine agricultural activities.

The field evaluator surveyed 51 farmers in 11 villages in Patan district, Gujarat. The survey was conducted using the Fulcrum mobile application, and interviews were recorded separately (with farmers’ consent). In 2019, a heavy monsoon resulted in water clogging and damaged sown crops. However, farmers recharged the Bhungroo systems to use the stored water in the next cycle.

The following section explains the demographic characteristics of the sample.
Gender

Ninety-eight percent of the surveyed farmers (50 of 51) were women as shown in Figure 2. Ownership of farmland is intrinsically male-dominated. The Bhungroo systems include water sharing mechanisms consisting of female farmers who hold legal joint ownership of water rights associated with Bhungroo systems. Although, men were typically present during the interviews as they were also included in the installation process (along with the women) and were able to explain the technical aspects of the innovation such as material used, expenses incurred in procuring agri-inputs, and construction and maintenance of the innovation in the farmland.

![Figure 2. Gender Distribution of Respondents](image-url)
Sources of income

The two main primary occupations for women farmers are agri-farming and cattle farming (selling milk and dairy products from owned cows and buffalo) as depicted in Figure 3. Thirty-five of 51 (69 percent) reported agri-farming as their primary occupation. An additional 11 respondents (21 percent) were involved in cattle farming. Additionally, 5 of 51 (10 percent) engage in daily wage labor on another farmer’s farmland.

Figure 3. Primary income sources

n=51

- Agri-Farming: 69%
- Cattle Farming: 21%
- Wage Labor: 10%
For secondary sources of income, 28 of 51 (55% percent) of women farmers are involved in cattle farming while 14 of 51 (27% percent) engage in agri-farming. An additional seven respondents (14 percent) are involved in daily wage labor. Two respondents reported not having any secondary occupation. Majority women farmers engage in agricultural and cattle farming. Even farmers engaged in cattle farming heavily rely on agri-farming for fodder cultivation for the sustenance and maintenance of cattle. Therefore, agri-farming is crucial to sustain cattle farming given the reliance on fodder, particularly. This extends the need to address water shortage due to extreme irregularities of climate change as various secondary occupations depend on agri-farming for their sustenance.

A few farmers, particularly those whose primary occupation is cattle farming, suggested using water from the innovation source for raising cattle. Farmers explained that the water might be too saline for agricultural purposes, but could be suitable for raising cattle, and for drinking and household purposes. Farmers use different strategies to reduce or completely remove salinity from water such as boiling, etc. Farmers reported higher income by relying on cattle farming using water from the innovation source than in the previous years where the availability of either fresh or saline water was a challenge due to prolonged shortages in water supply.
METHODOLOGY
Sample selection

The Bhungroo technology has been imparted to 53 clusters covering 422 active women farmers designed on the basis of geographical locations in Year 1 (Y1) of implementation. In Year 2 (Y2), technology was implemented in 77 clusters covering 593 families. It was made available beyond Gujarat in areas of Karnataka, Himachal Pradesh, and Maharashtra. Usually, each cluster has one owner of the technology and seven other farmers who share the benefits of the innovation through mutual understanding. The owner incurs the expenses to build the technology as it is constructed on the owner’s farmland. The sample was selected to include a farmer from each cluster to cover almost all the geographical locations where the technology has been implemented to mimic a stratified sampling since the clusters were already designed.

The 11 villages in the study area include: Boratwada, Jaska, Jamanpur, Jasomav, Khakhadi, Mata Jorawar Pura, Paloli, Sarwaal, Tamboliya, Vaghel and Vejawada from Harij and Sami Block of Patan district of Gujarat. The field interviewer started by surveying farmers from Y1, but realized it was too soon for them to establish facts about crop yields, income, innovation, water use, benefits, problems and suggestions with respect to the innovation with only six months experience. After an initial two villages from Y2, all the interviews were then conducted from Y1 clusters covering 9 villages. Respondents were then able to express a more nuanced understanding of the innovation since it had been active in their lands for 18-20 months. It was observed that respondents from Y2 had more specific knowledge regarding technicalities, developments, as well as an overall understanding of the innovation.

MAP 1. SAMPLED VILLAGES PLOTTED USING GOOGLE MAP
The questionnaire designed by SWFF included questions related to occupation, time spent on agricultural activities, perceived benefits of the innovation, and changes in income, which was uploaded to the Fulcrum Mobile Application and used to conduct the interviews. At the beginning of each interview, the interviewer explained the purpose of the evaluation and asked for verbal consent, which was captured in audio recordings. Interviews were also conducted in the local languages (i.e., Gujarati) through an interpreter.

Fifty-one primary interviews were conducted across various regions (as seen in Map 1). In order to establish contact with the selected interviewee, phone numbers for Bhungroo groups were called and interview times were arranged. If the potential interviewee was unavailable, then another woman farmer from the same group was selected.

MAP 2. SELECT 51 RESPONDENTS SPREAD ACROSS 11 VILLAGES
RESULTS
Bhungroo was first introduced in 2017, and was gradually rolled out to other regions of Sami and Harij blocks of Patan district. During the time of the interview, Y1 interviewees who had had the Bhungroo systems installed 18 months prior to the visit, were able to determine specific information regarding the innovation. Farmers used the Bhungroo systems in different ways, during different time periods, and with varying levels of success. Farmers received one level of training and orientation on how to install, the type and cost of the equipment, and the accessories needed for sustainable benefits.

**TABLE 3. NUMBER OF MONTHS FARMERS HAVE BEEN USING INNOVATION**

<table>
<thead>
<tr>
<th>NUMBER OF MONTHS</th>
<th>NUMBER OF FARMERS</th>
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<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
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<td>3</td>
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<td></td>
<td>n=51</td>
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When asked about the number of months the farmers had been using the innovation, 15 of 51 (29 percent) farmers claimed they had been using the system for 18 months; 8 of 51 (15 percent) farmers had been using it for 13 months; 7 of 51 (14 percent) had been using it for 6 months; 6 of 51 (12 percent) had been using the system for 15 months; 5 of 51 (10 percent) had been using it for 12 months; 4 of 51 (8 percent) had been using it for 14 months; 3 of 51 (6 percent) farmers had been using the system for 20 months of usage; 2 of 51 (4 percent) had been using it for 7 months; and one farmer (2 percent) had only been using the system for 5 months.
More generally, interviewees understood that the innovation was a water recharge and storage system and would be beneficial in the longer run. The smallholder women farmers expressed that they are better equipped with agriculture and irrigation specificities of the farming cycle due to the training and development modules received as part of the innovation. Farmers stated that they had used alternative water harvesting tools in the past (such as farm ponds and tube wells), but reported limited success due to cost and maintenance challenges. Additionally, farmers expressed concerns regarding salinity in the water made available by the innovation, however, they understand that it is a water harvesting tool that reduces salinity and recharges groundwater after 2–3 cycles of continuous water storage. Therefore, they are ready to wait a few years to fully utilize the benefits of the innovation.
When respondents were asked if they will use the innovation again in the future (in the coming 5 to 10 years), 100 percent of the respondents agreed.

**Agricultural activities benefit**

By providing a recharge and reuse system, Naireeta Services aims to improve soil fertility, making thousands of acres of smallholder farmers’ land areas cultivable. The innovation will provide irrigation in the winter season when the region suffers from water scarcity. The intention is to develop sharable water user rights among women working as agro-laborers, local communities and in the village at large. The innovation’s impact on agricultural activities was identified through various questions and observations from the field. More than one response was recorded when assessing the benefits. Among the most important of these changes was water availability in the dry season, as reported by 23 out of 51 farmers. The region suffers from dry spells quite frequently and receives critically low rainfall compared to the national average of India. The availability of water, specifically during the dry season, is crucial for agriculture sustainability in this region. Eleven of the 51 farmers stated that with access to water storage systems, they can now rely on the availability of water and in turn, rely on agricultural activities as a source of livelihood. Farmers also understand that the return on water storage would show reduction in salinity and increased recharge of groundwater in a few years.

**FIGURE 6. AGRICULTURAL BENEFITS OF THE INNOVATION**

n=51

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Number of Farmers</th>
</tr>
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<tr>
<td>Better yield</td>
<td>5</td>
</tr>
<tr>
<td>Water availability in dry season</td>
<td>23</td>
</tr>
<tr>
<td>Water recharge and reuse</td>
<td>11</td>
</tr>
<tr>
<td>Extra season of cultivation</td>
<td>8</td>
</tr>
<tr>
<td>Facilitate cattle rearing</td>
<td>5</td>
</tr>
<tr>
<td>Not having to pay 1/3 agricultural revenue</td>
<td>6</td>
</tr>
<tr>
<td>Provision of water for domestic</td>
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Eight of the 51 farmers interviewed stated that in order to get an extra season of cultivation, they must crop in the winter, which traditionally is not a cultivating season. Provision of water for domestic purposes is another critical element to assess benefits from innovation. Seven of 51 farmers reported that they can now use water for domestic purposes such as cleaning, bathing, and drinking. Six of the 51 farmers reported they did not have to pay one-third of their agricultural revenue to rent pumps. As a general practice due to desertification in this region, farmers get water from canals and rivers using electric pumps. Most smallholder farmers do not own a pump which led to a practice in which farmers are forced to rent them from wealthy farmers, and in return, pay one-third of the total revenue generated after cultivation. This practice further victimizes already impoverished farmers. One of the most critical concerns among farmers is paying high prices for water. With access to the Naireeta innovation, farmers get water free of charge and do not need to pay hefty prices in order to rent a pump. Five of the 51 farmers reported a better yield of crops after using innovation’s water, while 5 of the 51 farmers reported the facilitation of cattle rearing through the provision of water from the innovation. One farmer even began buying cattle after having access to the innovation.

**Water benefits**

All farmers reported that they relied on methods of rainfed and hand watering for farming. This region had heavy rainfall this year, however it has been extremely erratic over the last few years.

![FIGURE 7. WATER SOURCE FOR CROPS](image)

When asked about the source of water, 8 farmers reported using more than one source of water for irrigation. As Figure 7 demonstrates, 29 of 51 (56.8 percent) rely on canals, 12 of 51 (23.5 percent) rely on nearby rivers, four farmers (7.8 percent) each rely on rainfall and ponds on their farms, while two farmers (3.9 percent) rely on a self-constructed borewell and/or a self-constructed Bhungroo. One respondent out of the 51 farmers relies on innovation sources and community ponds.
Crop benefits

Farmers are at a risk of cultivating less or sometimes no crops per year in this region. It was reported that 2019 brought heavy monsoons whereas in 2018 there were heavy droughts. The occurrence of extreme climate irregularities results in recurring disturbances which stresses the agricultural conditions of already overly stressed regions. When asked if respondents observed crop benefits using the innovation, 94 percent of farmers reported cultivating one or multiple crops using water from the Bhungroo. The remainder (6 percent) reported no cultivation. The detailed breakdown shows that 37 of 51 (72 percent) cultivated one crop, 10 of 51 (20 percent) cultivated two crops, one farmer cultivated three crops, and 3 of 51 (6 percent) cultivated no crops.
When asked about the most preferred crop by farmers, the majority selected castor\(^1\) which is grown for its seed. Castor is an extremely important crop in the dry regions of Gujarat. The dry zone of this particular region offers ideal climatic conditions to cultivate this crop due to low soil fertility, expected rainfall below national average and low humidity. It can be grown under both rainfed and irrigation conditions. The oil extracted from Castor seeds is widely used for medicinal purposes, as a lubricant in airplanes and high-speed engines, and the manufacturing of soaps, varnishes and printing inks. Farmers reported heavily growing castor due to its demand in local and international markets.

As Figures 9 and 10 depict, farmers reported growing a greater number of crops with a focus on the most economically valuable crops after they were given access to the innovation. Cultivation of castor grew by 21 percent. Cultivation of fodder which include grass, bajra and jowar grown specifically as a source of food for cattle reduced from 34 percent to 26 percent. Since it is easier to grow fodder because it requires less water usage, farmers opted to grow it in previous years to generate income from cattle farming. Now that they have access to innovation sources, their focus has shifted to crop farming since it generates more income than cattle farming. Black gram grew from 8 percent to 10 percent and whole wheat declined from 10 percent to 2 percent as farmer’s opted to grow castor due to its prominence in the market. Cultivation of tobacco remained the same.

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\(^1\) https://www.agrifarming.in/castor-cultivation-information-guide
Income benefits

One percent of the farmers reported extreme poverty with an average annual earning of 30,440 Indian National Rupees ~ (406 USD). Agri-farming is a major source of income generation for farmers and with the occurrence of irregular climatic conditions, the majority of farmers had to fall back on cattle farming. Thus, reducing earnings and leading to extreme poverty.

With the introduction of an innovation that works in an environment affected by salinity and soil erosion due to heavy rainfall, water is stored and retrieved when needed most. Before access to the innovation, farmers reported no income due to no cultivation. After access to the innovation, farmers gradually started earning income using the water harvested through Bhungroo systems. The Bhungroo has also helped farmers generate income through non-farm sources. When asked about the percentage of income from non-farm sources such as cattle farming and daily wage labor, figure 11 shows that 11 of 51 farmers (22 percent) earned between 0-25 percent of their income from cattle farming; 12 of 51 (24 percent) earned 26-50 percent; 8 of 51 (16 percent) earned 51-75 percent; and 8 of 51 (16 percent) earned 76-100 percent of their income from cattle farming. With the improvement of water in each cycle of restoration from salinity, farmers in a few of the villages stated it might not be completely usable for irrigation purposes, but is completely acceptable for domestic use. Farmers are now focusing on earning income through wage labor on other wealthy farmers’ lands, knowing that their family’s need for water is taken care of by the innovation. As Figure 11 explains, only one farmer generates income in the bracket of 0-25 percent through daily wage labor, while 5 of 51 (10 percent) farmers generate income in the bracket of 76-100 percent. This notably states the income benefits perceived by farmers after a period of no cultivation and almost negligible income in previous cycles.
One farmer from Vejawada village reported complete reliability on cotton crops which requires more water than other crops. He stated that the income benefits related to this year’s cultivation using water conserved from the innovation has yet to be assessed. In addition to the quantitative income benefits, farmers experienced benefits related to water utility for cattle rearing and domestic purposes. Two farmers also expressed difficulty in rearing cattle for commercial purposes due to a lack of available water for fodder and grass cultivation. Hence, they utilize the cattle for domestic purposes as they do not have another source of income.
Poverty reduction benefits

To estimate poverty reduction benefits, the field evaluator asked questions related to access to credit and how end-users spent their increased income. The majority of farmers spend their added income on sending children to school, followed by investments in farming and house improvements. When asked about the farmer’s current approach towards financing agricultural activities, Figure 12 explains the linkage between innovation access and the investment procured for the next cycle of agriculture. Thirty-two of 51 (63 percent) farmers reported that they utilize the income generated through agri-farming, cattle farming, and daily wage earnings as discussed in the above sections. Farmers stated they saw increased income and an overall successful year compared to last year which saw drought spells and a complete loss of crops. This loss was due to both heavy monsoons and the innovation source. It is extremely critical to note that farmers were able to generate their own funds and were not indebted to large retailers and wealthy farmers who exploit farmers by undertaking heavy interest charges.

Sixteen of 51 (31.3 percent) farmers reported utilizing both their own savings, as well as credit and saving schemes such as the Agricultural Produce Market Committee (APMC), and schemes through local banks like Dena Bank and Seva Sahakari Mandali (Gujarat State Seeds Corporation Limited), which charges nominal interest rates and safeguards farmer’s interests. Additionally, farmers relying on cattle farming raised investments from local milk booths, which are rural level co-operative societies helping farmers get finance and subsidy from co-operative banks at a cheaper interest rate. If their own savings were not enough after expenditures related to domestic purposes, farmers levied these schemes. Three of 51 farmers (6 percent) reported utilizing only credit and savings schemes since they were not able to generate enough savings for agricultural activities.
Gender differences

The evaluator asked respondents about their use of the innovation, including: the overall benefits perceived (ranking their top three), farm inputs before and after using the Bhungroo, spending on and usage of fertilizer, pesticide, herbicide, seeds, charcoal (as a natural pesticide), water, and family and hired labor. As Figure 13 explains, most farmers (39 of 51) included in their top three that Naireeta Services made a special effort to include women farmers and make water reusable. Since the technology is typically owned and managed by women, it has made the environment more inclusive and less male dominated. Women farmers are seen with respect and now they know how to operate water in and out of the structure. It has also helped women build resilience to climate change.

Interestingly, 18 farmers ranked “helping women farmers as well as men” in the top three ranking. Flooding and erratic rainfall patterns have led to crop destruction and a prevalence in crop disease, severely affecting agricultural productivity, particularly for smallholder farmers. This technology helps farmers free waterlogged lands during heavy monsoons and store water underground to retrieve during dry periods. Both genders perceived the benefits, but particularly women since they are the owners and legal recipients of the innovation, deciding the water usage rights in the agricultural community. The gender-based approach of the technology lies in the simplicity and the user-friendly nature, making it easier to adopt among poor farmers in the area. The higher acceptance among women is due to the fact that the intervention believes that irrigation development will achieve greater results with a gender integrated approach, rather than focusing solely on the male farmer population which is a general trend in the country.
Apart from the gender differences, the graph shows that 12 farmers ranked “helps by lowering cost of inputs” and 9 farmers each ranked – “it helps me to decide which crops to plant” and “helps in producing more of our most important crops” in the top three benefits (see the “Discussion” section of this report for more details). Eight farmers ranked “increases my yield through timely forecasts”, while 7 farmers ranked “improves health and strength of livestock” in the top three categories.

**Regional differences**

Fourteen of 51 farmers reported to have better yield along with less usage of water after using the innovation compared to when they did not use innovation. Of these 14 farmers, 7 farmers are from the Khakhadi village. The success rate in this village is particularly high as technology comprehension is elevated among farmers compared to other farmers. This is due to extensive capacity building initiative by the community with the help of Naireeta. Farmers shared knowledge, usage mechanisms, benefits, problems faced, and solutions more frequently, compared to the other villages where interviews took place. Therefore, a focus on frequent training and orientation sessions from the innovation is advisable to capacitare farmers with the essentials of the Bhungroo. The remaining 4 of 7 farmers came from Jamanpur village and 3 from Tamboliya village all with similar findings.
Since the majority of the respondents were using the technology for more than a year, they were able to share concrete details about the usability, uptake, as well as suggestions and improvements to the technology.

As Figure 14 notes, 53 percent of respondents “strongly recommended” and 43 percent “recommended” the innovation, while 4 percent would not recommend the innovation. This heavily explains the certainty of the general perspective of interviewees. This is due to the fact that farmers see the innovation as a single source of water availability when they are deprived of usual sources. While many farmers would reap the full benefits in a few years as they understand it is a recharge system, they are satisfied with the overall benefits received to date with the hope of better water service delivery in future. They suggested many improvements in usage and availability mechanisms and pointed out the barriers in innovation uptake which are discussed in detail below.

**Usage and Availability**

As discussed in the “Results” section above, 41 of 51 (80 percent) farmers used the innovation for 12+ months and 100% farmers were using the innovation at the time of the survey. When probed about the ease of usage and the availability of resources to access the innovation, farmers gave insights directly from their daily agricultural practices. The general perspective on installation of the technology is associated with the exorbitant one-time price paid for by the farmers since the benefits from the recharge system are generally received after one or two years. Though it makes water available overall, farmers were concerned about the saltiness. When told that the water would become less salty after 2 to 3 cycles of water recharge, many respondents were skeptical as they could not see instant benefit. This made them apprehensive to incur this one-time cost.
However, innovators believe that this one time fixed cost would create ownership among the farmers and would reap greater benefits in future. More capacity building for farmers to clarify such concerns is needed from the innovator side. This would increase farmer confidence to invest in the technology.

One farmer said that the grouping was based on the housing, but unfortunately her farm was far away from the leader’s farm, making it difficult to access water on a regular basis. Hence, better mechanisms to form women groups would be advisable. Few farmers reported temporarily using generators which use copious amounts of diesel to pump water from the technology. In the meantime, they have applied for electric connections which takes a lot of time to process due to bureaucratic hassle. However, it is extremely important to note that farmers, as part of their original water source, were using electric pumps to pull water from canals, including farmers who do not own electric pumps, paying one-third of the farming revenue in order to rent pumps. The innovation aims to eradicate this practice by introducing transparent mechanisms of getting an electric connection via a government subsidiary and specifically helping smallholders’ farmers. Additionally, it saves a lot of diesel costs, in turn reducing the cost of inputs for farming.
Crop and water benefits

From unploughed land, farmers are now involved in growing multiple crops a year as shown in Figures 9 and 10 above. There is a direct effect in the rates of crop survival due to the innovation as Figure 15 demonstrates. Seventeen of 51 farmers (33 percent) observed more resilience in the crops after using the innovation. Of these 17, four noted that they initiated inter-cropping (which was a first time for them). Twenty of 51 farmers (39 percent) reported similar levels of crop resilience. This was mainly because they used water from the innovation primarily for fodder for animals or used it for rearing cattle. In some cases, they prioritized water for domestic purposes, therefore could only observe similar resilience.

Fourteen of 51 farmers (28 percent) observed no change. These are the farmers who did not use innovation sources for several reasons such as salinity in water and no electric connection or electric motor. Even if they did have diesel pumps, they opted against using the innovation since diesel usage is quite high while pumping out the water. This increases the input cost severely making access to the innovation unaffordable.

These 17 farmers who observed higher resilience in the crops were empowered by the technology and thus approximately 85 individuals who are members of these women farmer families. As discussed above, the average land holding size is 7.38 Bigha, leaving about 125.46 Bigha of uncultivated land for cultivation during both monsoon and winter seasons, and ultimately resulting in rooting migration and displacement in the region.
When it comes to assessing water benefits, the method of irrigation for a majority of farmers (47 of 51) were both rainfed (supplied primarily with rainwater) and hand watering, while two farmers suggested sticking with either hand watering or natural rainfall systems only. With water availability from the technology, eight farmers who relied on these systems previously, now reported a lower dependency on rainwater. One farmer stated:

“The water from Bungroo is sweet (good) and usable. I don’t think that I will be relying on rain water anymore. I wish this technology came earlier; it would have saved me many years of struggle to earn my livelihood.”

In order to meet water expenses, farmers rent diesel/electric motors and pay one-third of their total revenues from cropping. This practice is associated with risks such as debt or loss of land if inadequate harvest occurs. Farmers stated with the innovation and potential electric connection, all worries relating water expenses might reduce.
Changes in income

Farmers’ income this year has increased after complete crop loss last year. As Figure 16 explains, not all farmers were able to reflect a change in income related to agriculture due to the innovation. Thirty-six of 51 (70 percent) farmers experienced no change in income related to agricultural activities, but they did recognize the associated income benefits from cattle rearing and availability of water for domestic purposes. They also recognized other benefits after using this innovation including learned skills, less usage of water, and better yield of the crops.

Eight out of 51 (16 percent) farmers reported “somewhat” of an increase in income. They considered reduction in input costs, such as the cost of diesel used in motors to pump water from the canal, after using innovation. They also took into consideration additional income related to daily labor and selling milk. Four of 51 (8 percent) farmers reported a “significant” change in income. One of the main reasons was that they were able to sell more with better quality crop yields because they could get better market prices. They were able to make an explicit connection between finer crop yields and better income perceived. One of the farmers stated:

“I am growing cotton for the first time in years. I was encouraged with the water availability this year. I am hopeful for myself and my family.”

Three of 51 (6 percent) farmers could not respond confirmatively to associated questions. Apart from the quantitative change in the income, farmers also observed qualitative benefits. One of the most important benefits observed was improvements in soil fertility. Farmers reported that they observed better produce over the time. The land that has remained fallow due to degradation over years, was now being cultivated for monsoon and winter crops, which has helped generate income opportunities in the area, and ensured food security and fodder for animals. Fifteen of 51 (29 percent) farmers stated that post-monsoon crops helped ensure farmer food security and provided fodder for animals while winter crops brought increased income since it is an additional season of cultivation for them.
Gender differences

Naireeta Services has prior experience working with rural women, which led them to develop this women-centric model taking into account their eagerness to try new ideas and their strength and resilience living under hard circumstances. They required that the Bhungroo rights remain with the women, which was vehemently opposed by many men in those communities. The women witnessed this resistance and decided to showcase a united front. They realized their strength lies in togetherness and that individual entities cannot win this battle alone. Men eventually relented as they learned more about the technology. The women were encouraged to supervise the installation, construction of pits, drilling, and even maintenance.

As part of the innovation, the major difference is that women were inducted with the technical specifications which is not usually a regular occurrence. They were informed and were able to respond to questions regarding technical know-how of the innovation, materials used, quantity and cost of inputs and equipment, access to credits and saving schemes, market prices, water practices, and income generation among others. In fact, they were equally informed (if not more so) about the specifications and were completely involved in related decision making. Apart from this difference, men in the region possess an opportunity to migrate to other regions, while women farmers are confined to either helping on others’ farmland (which offers meager wages) or to being a domestic maid. With this technology, they have the liberty to work on their own farms, making various farm related decisions together.
Affordability

The innovation requires a one-time low capital investment including drips, PVC pipes, submersible motors, cables, bricks, cement, gravel, electric board equipment, and associated cost of labor. The detailed list and associated costs are listed in the table below.

<table>
<thead>
<tr>
<th>Type of Investment</th>
<th>Cost Incurred* (in Indian National Rupees)</th>
<th>No of farmers opted</th>
<th>Percentage of farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology unit installation</td>
<td>16000</td>
<td>28</td>
<td>55%</td>
</tr>
<tr>
<td>Technology installation + Room constructed in the land for storage and electric connection</td>
<td>150000</td>
<td>7</td>
<td>14%</td>
</tr>
<tr>
<td>Not installed (Beneficiaries)</td>
<td>0</td>
<td>10</td>
<td>19%</td>
</tr>
<tr>
<td>Not installed (fear of saline water)</td>
<td>0</td>
<td>6</td>
<td>12%</td>
</tr>
</tbody>
</table>

*The cost is all inclusive for material used, labor used, and transportation charges.

Fifty-five percent of farmers reported they spent a one-time installation cost of 16000 rupees (~223.69 USD). Farmers said they were able to incur this price with the hope of water availability. Although it was difficult to make the payment, they somehow managed and were able to recover the cost in one crop cycle only. 14 percent reported the water unit installation cost along with the cost associated with the construction of rooms which will house electric boards for connection, as well as storage. The cumulative cost reported was 150000 rupees (~ 2097 USD). However, they were disappointed paying an exorbitant amount like this especially when they observed salinity in water. They said that, naturally they were happy with the water availability, but due to salinity, they were unable to cultivate as much land as they anticipated. Hence, they should not have paid this much initially, but a room is needed to house an electric connection board so they were not left with much of a choice. Innovators may want to look into solutions where there is a subsidy in installation cost or material used. Approximately 20 percent of farmers reported that they did not install technology as they were beneficiaries. Approximately 12 percent of farmers reported that due to fear of saline water, they are apprehensive of installing it in their farmlands. A capacity building program can be initiated to eliminate such fear from farmers.
Impact on poverty

As presented in the “Change in Income” section above, the innovation made a small impact on the income and poverty alleviation since the heavy monsoon and subsequent water logging led to crop destruction this year. The number of farmers continued in a similar pattern with few farmers improving their incomes. The data explains income generation for some farmers after years of no income in this region. Additionally, better yield and water-at-hand can also be seen as beneficial. This is in line with the overall trend that shows less poor farmers felt that the innovation brought direct income benefits. However, farmers from all income groups were interested in continuing the service as they feel any help would be beneficial during a situation of distress. One of the beneficiary farmers who saw direct income benefits stated:

“My mother-in-law is the owner of the Bhungroo and she paid for the installation and electric connection which got approved quickly. Although money is spent on installing it, it is worth it as the water is really usable. I am one of the beneficiaries and I look forward to each day now.”

It was not possible to estimate the exact reasons behind this trend but future tracking and monitoring would shed more light on concrete income-related data and show more tangible innovation benefits.
**Benefits of innovation on community**

Two farmers reported having the freedom to decide when and how much water is to be used for irrigation purposes. This freedom allows them to optimally manage water resources which encourages agricultural activities and also helps farmers navigate through climate uncertainty by conserving water at their own pace. The main idea behind the innovation is built on community cohesion. As the technology is used by farmers in a group of seven to eight, it brings ownership and managerial rights exclusively to women. Although, because women are placed at the lowest of societal and familial hierarchical status in the region, equal or even more participation in the farming activities and other livelihood-generating activities can be difficult. It becomes a challenge for women to own or exercise their rights of equal partnership in farming, specifically in the cases of separation or divorce from their partners. When organized in groups, however, women can watch out for and support each other in times of distress or fighting, resulting in cohesion within the community.

Additionally, while this technology is women-centric, it benefits the entire community. Women farmers manage the technology in the farmland, but the workload is traditionally shared by both men and women, automatically benefitting anyone and everyone in the community.

**Comparison with market alternatives of the proposed technology**

While options like farm ponds, man-made reservoirs, check dams, and tube wells have existed for years to meet water needs, the innovation takes up less space, freeing up more space for cultivation. It also offers durability, and cost efficiency. The success rate of the alternatives remains limited in sustaining ground water levels which have been over replenished to meet increasing irrigation demands.

Unlike tube wells that artificially recharge water by injecting it into the existing subsoil water table, Bhungroo retains existing water and responds to natural environment conditions. It filters, injects, and stores rainwater at multiple subsoil strata, which can take place in the water table and/or use soil that is comfortable for water storage.
CONCLUSION
In regions, such as the western Indian state of Gujarat, that already face substantial problems of water scarcity, waterlogging and soil salinity, as well as natural disasters (for example the devastating earthquake in Gujarat in 2001), innovative solutions like water recharge and reuse systems, organic farming, water harvesting systems, and agroforestry, will aid farmers by rejuvenating groundwater and soil texture. Simple technologies, which are easy to comprehend and manage, are a way for farmers to revive agricultural practices in the current hostile climate conditions.

While farmers look forward to the southwest monsoon in the months of July and August every year in anticipation of the rains, they are now simultaneously relying on water from the innovation source throughout the year for crop cultivation.

The Bhungroo systems were installed in May and June 2018 (Y1), while additional systems were installed at other locations in May and June 2019 (Y2). The study primarily focused on Year 1 systems which were about 18 months old at the time the evaluation took place. Some of the crucial findings emerging from the field are presented below:

- Electric connection is promoted to a great degree among the farming community, however, procuring one is still a challenge. Innovators have tried to help beneficiaries by issuing a certificate to Gujarat Electricity Board (GEB) to facilitate the electricity connection process. Due to extreme bureaucratic hassles, this process is getting delayed by months, affecting penetration of the innovation among the community. It is critical to understand if the primary beneficiary is not able to procure connection due to either land disputes or incomplete paperwork, since it affects the entire group. They are equally stuck. The innovators may want to examine the possibility of shifting the construction of the innovation to another beneficiary’s land, provided that they have clear requisites to obtain a connection. The alternatives to electricity connection are expensive and not feasible for farmers.

- When the flood water recedes during the dry period, the blistering sun leaves salt deposits on the ground surface which causes all sorts of problems including cracking and crusting of soil and lessen soil respiration, ultimately leading to land degradation and desertification. Even though farmers were able to harvest water, due to salinity, they were discouraged to use it for irrigation purposes. However, they do realize that in a few recharge cycles, the salinity will decline. In the meantime, farmers suggested bringing an instant solution to obliterate salt from the water. They suggested mixing it with low saline canal water or recycling with fresh water sources especially during heavy monsoons. This would increase the quantum of water to be used for irrigation purposes, thus the innovation water can be ultimately utilized. This would also encourage farmers to incur one-time installation cost which seems like an added burden when they cannot see instant benefits. Further probing related to the cost and feasibility of such solutions should be examined going forward.
• Group formation and sharing should be reviewed, as it is crucial to understand whether or not sharing arrangements were successful. A farmer reported that the innovation owner and a few of the beneficiaries have now been relocated to the Harih block as they are now involved in trading practices which has made them unable to access the innovation. To ensure that no one is left out, Naireeta Services should define clear mechanisms and guidelines to follow when such an instance happens. Farmers have no way of instantly shifting their association to other Bhungroo farmland which kills cultivation seasons for them. Innovators may want to issue a detailed guideline on technology sharing practices to continue harmony and cohesion in the community.

• In order to make the innovation more affordable for farmers, a collaboration with Government institutions or MFIs that may provide subsidies in procuring material and other related expenses should be addressed. It is difficult for farmers to prioritize innovation expenses and domestic expenses. Additionally, due to erratic weather conditions, farmers cannot guarantee that they will be able to pay back the loan from bank or money lenders. Therefore, a mechanism to pool resources needs to be enabled to provide a solution for this temporary hindrance.

• Apart from the innovation’s capacity building initiatives, innovators should consider imparting knowledge about the heartier crops more suitable for semi-arid regions such as the Patan district. This may be seen as an extension to services but will have an overall impact on agricultural practice.

Farmers showed positive inclination towards the innovation and saw a potential in local solutions such as the Bhungroo systems.

https://www.agrifarming.in/castor-cultivation-information-guide


https://www.deshgujarat.com/2020/01/01/gujarat-govt-extends-application-time-for-non-seasonal-rain-affected-farmers/


https://www.smartfood.org/project/bhungroo-to-olla-5-simple-ideas-that-can-help-farmers-save-water-in-summer/
ANNEX 1: SURVEY
FARMER INFORMATION

NAME _____________________________________________________________

AGE _______________________________________________________________

DATE _____________________________ TIME ______________________________

GROUP INTERVIEW? □ Yes □ No

GROUP INTERVIEW NOTES

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

HOW MANY FAMILY MEMBERS LIVE WITH YOU? ___________________________

GENDER □ Male □ Female

WHAT IS YOUR PRIMARY OCCUPATION?
 □ Farming
 □ Wage Labor
 □ Seasonal Migrant Labor
 □ Small Enterprise
 □ Other: __________________________________________________________

DO YOU HAVE ANOTHER OCCUPATION?
 □ Farming
 □ Wage Labor
 □ Seasonal Migrant Labor
 □ Small Enterprise
 □ Other: __________________________________________________________

SIZE OF FARM (ACRES) ______________________________________________

NAME OF VILLAGE __________________________________________________

HOW MUCH LAND DO YOU OWN? ______________________________________

HOW LARGE IS YOUR FARM/PILOT?
 □ Large
 □ Medium
 □ Small
 □ Very Small
HOW MUCH IS LAND RENT? ____________________________________________

OTHER LAND NOTES

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

HOW LONG HAVE YOU BEEN USING THE BHUNGROO? _______________________

DID YOU PARTICIPATE IN AGRICULTURAL ACTIVITIES THIS YEAR?  ☐ Yes ☐ No

HOW MANY MONTHS IS THE PRIMARY GROWING SEASON? ____________________

HOW MANY TIMES DO YOU HARVEST PER YEAR? __________________________

FARM INFORMATION

WHAT CROPS DO YOU GROW AS A RESULT OF THE BHUNGROO? LIST FROM MOST IMPORTANT TO LEAST IMPORTANT:

1. ______________________________________________________________

2. ______________________________________________________________

3. ______________________________________________________________

DID THE MOST IMPORTANT CROP BENEFIT?  ☐ Yes ☐ No

DID THE SECOND MOST IMPORTANT CROP BENEFIT?  ☐ Yes ☐ No

DID THE THIRD MOST IMPORTANT CROP BENEFIT?  ☐ Yes ☐ No

WHAT IS THE WATER SOURCE FOR YOUR IRRIGATION OF CROPS?

☐ Own pond
☐ River
☐ Groundwater
☐ Innovation Source
☐ Other: ________________________________

WHAT IS YOUR METHOD OF IRRIGATION?

☐ Drip feed
☐ Flooding
☐ Hand watering
☐ Rainfed
☐ Other: ________________________________
HOW MUCH HAS YOUR WATER USAGE CHANGED SINCE USING THE BHUNGROO? __________

_________________________________________________________

USING THE BHUNGROO HAS YOUR ACCESS TO WATER:
anyak Had no change
☑ Improved
☑ Fundamentally improved (Improved a lot)
☑ Other: ___________________________________________________________

PREVIOUSLY GROWN CROPS: DID YOUR FARM PRODUCE DIFFERENT CROPS IN THE PAST THAT ARE NO LONGER GROWN HERE? IF SO, WHICH ONES? ________________________________

_________________________________________________________

MASS OF PRODUCE: WHAT YIELDS DID YOU HAVE FOR YOUR FIRST CROP?

_________________________________________________________

MASS OF PRODUCE 2: WHAT YIELDS DID YOU HAVE FOR YOUR SECOND CROP?

_________________________________________________________

USING THE BHUNGROO HAVE YOU, FOR EACH CROP:
☑ Used more water
☑ Had no change in water use
☑ Used less water
☑ Other: ___________________________________________________________

USING THE BHUNGROO HAVE YOUR CROP YIELDS (ASK FOR EACH CROP):
☑ Declined
☑ Remained the same
☑ Increased
☑ Substantially increased

IS THERE A DIFFERENCE IN THE SURVIVAL RATES OF YOUR CROPS DUE TO THE BHUNGROO?
☑ Yes  ☑ No

HOW MUCH OF YOUR PRODUCE DID YOU CONSUME IN YOUR HOUSEHOLD? (BUCKET, BUNCH, KG)

_________________________________________________________


HOW MUCH OF EACH OF THE FOLLOWING INPUTS DID YOU USE BEFORE THE BHUNGROO?

- FERTILIZER __________ (KG)
- PESTICIDE __________ (KG)
- HERBICIDE __________ (L)
- CHARCOAL __________ (KG)
- WATER __________ (TOTAL)
- LABOR __________ (DAYS)
- OTHER __________

HOW MUCH DID YOU SPEND ON EACH OF THE FOLLOWING INPUTS BEFORE THE BHUNGROO?

- FERTILIZER __________ (KG)
- PESTICIDE __________ (KG)
- HERBICIDE __________ (L)
- CHARCOAL __________ (KG)
- WATER __________ (TOTAL)
- LABOR __________ (DAYS)
- OTHER __________

HOW MUCH OF EACH OF THE FOLLOWING INPUTS DO YOU USE AFTER THE BHUNGROO?

- FERTILIZER __________ (KG)
- PESTICIDE __________ (KG)
- HERBICIDE __________ (L)
- CHARCOAL __________ (KG)
- WATER __________ (TOTAL)
- LABOR __________ (DAYS)
- OTHER __________

HOW MUCH DID YOU SPEND ON THE FOLLOWING INPUTS AFTER THE BHUNGROO?

- FERTILIZER __________ (KG)
- PESTICIDE __________ (KG)
- HERBICIDE __________ (L)
- CHARCOAL __________ (KG)
- WATER __________ (TOTAL)
- LABOR __________ (DAYS)
- OTHER __________

HOW MUCH DID YOU SPEND ON EQUIPMENT BEFORE AND AFTER THE BHUNGROO? __________

HOW MUCH DID YOU SPEND ON TRANSPORT AND STORAGE BEFORE AND AFTER THE BHUNGROO? __________
INCOME AND EXPENDITURES

WHAT IS YOUR ANNUAL HOUSEHOLD INCOME?
- extreme poor
- low income
- middle income
- upper income

HOW MUCH INCOME DID YOU MAKE BEFORE THE BHUNGROO ________________
AFTER THE BHUNGROO? ________________

HAS THE BHUNGROO IMPROVED YOUR FAMILY INCOME? ________________

WHAT PERCENTAGE OF YOUR INCOME DO YOU GET FROM NON-FARM SOURCES? ___________

HOW MUCH PRODUCE DID YOU SELL FOR EACH OF YOUR CROPS IN THE LAST SEASON AND THE
LAST YEAR? ________________________________

WHAT IS THE PRICE PER KILO YOU RECEIVED FOR EACH OF YOUR CROPS FOR THE LAST SEASON?
______________________________

USING THE BHUNGROO HAS YOUR ACCESS TO CREDIT:
- Not improved
- Improved
- Improved and have been able to repay over a short period

HOW DO YOU CURRENTLY FINANCE AGRICULTURAL ACTIVITIES?
- Own savings
- Credit and savings scheme
- Other credit

HOW MUCH DO YOU PAY FOR THE BHUNGROO? ________________________________

HOW MUCH ARE YOU WILLING TO PAY FOR THE BHUNGROO?
- Nothing
- The Bhungroo is free
- The same as what I pay now
- 50% less
- 50% more
- Other: ________________________________
HOW HAVE YOU SPENT YOUR NEW INCOME?
- N/A (if no new income)
- Send children to school or keep children in school
- Social functions (like weddings)
- Investment in farming
- Improving house
- Other: ________________________________

OTHER INCOME NOTES (OPTIONAL)
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

PERCEPTIONS OF THE BHUNGROO

WILL YOU USE THE BHUNGROO IN THE FUTURE (5 TO 10 YEARS)?  □ Yes  □ No
Please elaborate: ________________________________________________
________________________________________________________________________

HOW, IF AT ALL, HAVE YOU CHANGED YOUR FARMING PRACTICES DUE TO THE BHUNGROO?
- No change
- Introduced new crops
- Changed irrigation system
- Reduced water usage
- It helps me decide when to plant
- It helps me decide which crops to plant

HAVE YOU FACED ANY DIFFICULTIES OR PROBLEMS USING THE BHUNGROO?  □ Yes  □ No

HOW CAN THE BHUNGROO BE IMPROVED? ________________________________
________________________________________________________________________

HOW DID YOU HEAR ABOUT THE BHUNGROO?
- Wealthy farmer
- Neighbor
- Innovation personnel
- Extension worker
- Other: ________________________________
WHAT FACTORS INFLUENCED YOU TO TRY THE BHUNGROO?
- Demonstration from neighbor’s farm
- Innovation is free from extension services
- No alternative water source
- Other: ________________________________

DO YOU SHARE YOUR KNOWLEDGE SKILLS FROM THE BHUNGROO WITH OTHERS?  □ Yes  □ No

IF SO, HOW? __________________________________________________________________________

WHAT DO YOU FEEL ARE THE BENEFITS OF THE BHUNGROO? ________________________________

HOW HAS THE BHUNGROO HELPED YOU? PLEASE RANK THE TOP 3 AND EXPLAIN POSITIVES/NEGATIVES.
- Makes water reusable ____________________________________________________________________
- Helps women farmers as well as men ____________________________________________________________________
- They made a special effort to include women farmers ____________________________________________________________________
- Helps in producing more of our most important crop ____________________________________________________________________
- Increases my yield through timely forecasts ____________________________________________________________________
- Helps by lowering cost of inputs ____________________________________________________________________
- Improves health and strength of livestock ____________________________________________________________________
- Helps reduce labor ____________________________________________________________________
- Reduces crop wastage ____________________________________________________________________
- Helps me decide when to plant ____________________________________________________________________
- Helps me decide which crops to plant ____________________________________________________________________
- Other: __________________________________________________________________________
WOULD YOU RECOMMEND THE BHUNGROO?
- No
- Yes
- Yes, would strongly recommend

ARE THERE NEGATIVE IMPACTS FROM THE BHUNGROO IN THE COMMUNITY?  
- Yes  
- No

IF YES, PLEASE EXPLAIN: ____________________________

______________________________

______________________________

IF THERE HAVE BEEN ANY NEGATIVE IMPACTS, HAVE EFFORTS BEEN MADE TO RESOLVE THEM?
- Yes  
- No

PLEASE EXPLAIN: ____________________________

______________________________

______________________________

DO YOU HAVE PROBLEMS FINDING A MARKET TO SELL YOUR CROPS IN?  
- Yes  
- No

PLEASE EXPLAIN: ____________________________

______________________________

______________________________

DO YOU HAVE PROBLEMS GETTING YOUR CROPS TO THE MARKET?  
- Yes  
- No

PLEASE EXPLAIN: ____________________________

______________________________

______________________________

HAVE CHANGES IN RAINFALL OR TEMPERATURE AFFECTED YOUR FARMING PRACTICES OR CROP YIELDS COMPARED TO HISTORICAL RAIN/DRY SEASON PERIODS?  
- Yes  
- No
Securing Water for Food has sourced and invested in a portfolio of innovative solutions that aim to help farmers use water more efficiently and effectively, improve water storage for lean times, and remove salt from water to make more food. Our cohort of innovators are helping people in 30 low-resource countries with tools they need to produce more food with less water.

To learn more about Securing Water for Food, visit www.securingwaterforfood.org.