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A Willingness to Pay Assessment for

Project Tatirano (Phase II): Improving access to clean drinking water via rainwater harvesting in the Anosy Region, southeast Madagascar

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SEED Madagascar

Suite 7, 1a Beethoven St, London, W10 4LG, United Kingdom

Villa Rabemanda, Ambinanikely, B.P. 318, Tolagnaro, Madagascar

Tel: +44 (0)208 960 6629

Email: projects@seedmadagascar.org

Web: madagascar.co.uk

UK Charity No. 1079121, Company No. 3796669

1. Executive summary

A willingness to pay (WTP) assessment was carried out across eight communities in the southeast Anosy Region to quantify demand for Project Tatirano Phase II household rainwater harvesting (RWH) systems. The main objectives of the research were to assess the level of demand for the systems and provide data about the amount of money that households would be willing to contribute. Additionally the research sought to provide data on the current state of drinking water provision in the target communities whilst investigating indicators of local attitudes and priorities with regards to drinking water. Data was collected over 13 days through a household survey conducted by trained enumerators.

Results showed that conditions for drinking water supply were extremely poor in the surveyed communities. At the time of the research there were high levels of reliance on surface water and unprotected boreholes as primary sources of drinking water (58% of households) and limited access to improved water sources[1] (only 21.3% of households). While levels of satisfaction with these sources of drinking water were very low (72.1% dissatisfied or very dissatisfied), access to water was on average prioritised below access to healthcare, education and food.

With regards to Tatirano, results illustrated both a high level of interest in the Tatirano RWH kits (95% of households surveyed thought the system would be useful to them after watching a demonstration video) as well as a high level of willingness to pay for the system (91.5% of total households surveyed were prepared to pay for the system). When offered the choice between payment up-front and staggered repayment over time, households demonstrated an overwhelming preference for the latter. The average amount that households were prepared to pay over a six month period was 7700Ar per month.

2. Background

In May 2017 Project Tatirano undertook a WTP analysis in order to gauge demand and willingness to pay for household RWH kits among households in the eight target communities (see figure 1[2] below). Data from the research directly informed the decision making processes on kit design, marketing and pricing structures.

[1] Improved water source defined using the Joint Monitoring Programme definition: "[a water source] that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter." (JMP, 2015)

[2] Sainte Luce is the collective name for the three communities: Ambandrika, Ampanasatomboky and Manafiafy and has a collective population of 2,160

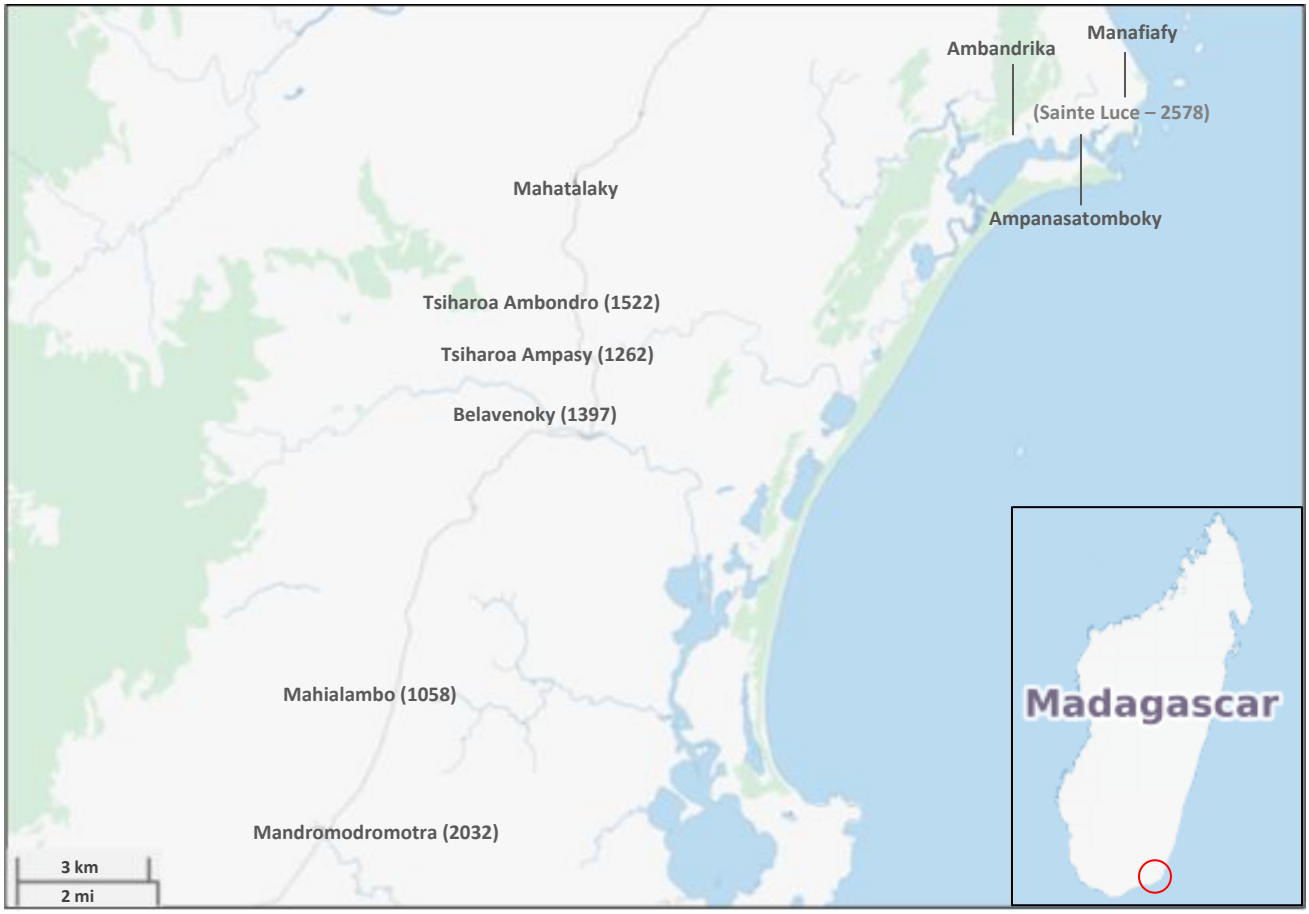


Figure 1: Map to show the target communities and their respective populations

(Population statistics: ONG ASOS (2006). Map: OpenStreetMap (2017))

3. Aims and Objectives

3.1 Aims

To provide data from target communities to help inform product design, marketing and pricing structures for Tatirano Phase II.

Objectives

- To provide an overview of current drinking water sources
- To measure attitudes towards drinking water
- To gauge attitudes towards RWH as an alternative source of drinking water
- To assess the willingness of households to pay for a RWH system

3.2 Methodology

Data collection for the WTP analysis took place over three phases:

- Review of existing literature on WTP methodologies and international best practice.
- Qualitative data collection to understand context of drinking water supply in target communities.
- Quantitative data collection through household survey.

Following a desk review of WTP methodologies, a phase of qualitative research was undertaken through community meetings, site visits to current drinking water sources and meetings with local leadership. The purpose of this phase was to understand the context of water usage in the target communities so as to be better equipped to draft a locally specific and relevant household survey.

The third phase of data collection was a structured, household survey, designed to provide quantitative data on the level of demand for Tatirano households systems and the level at which households would be prepared to pay for them. Following 3 days of training in data collection methods, the questionnaires were administered in Malagasy by two enumerators over a 13 day period. Due to a lack of sampling frame for the target communities, households were sampled randomly using the Expanded Programme Immunisation (EPI) method (see appendix for detail).

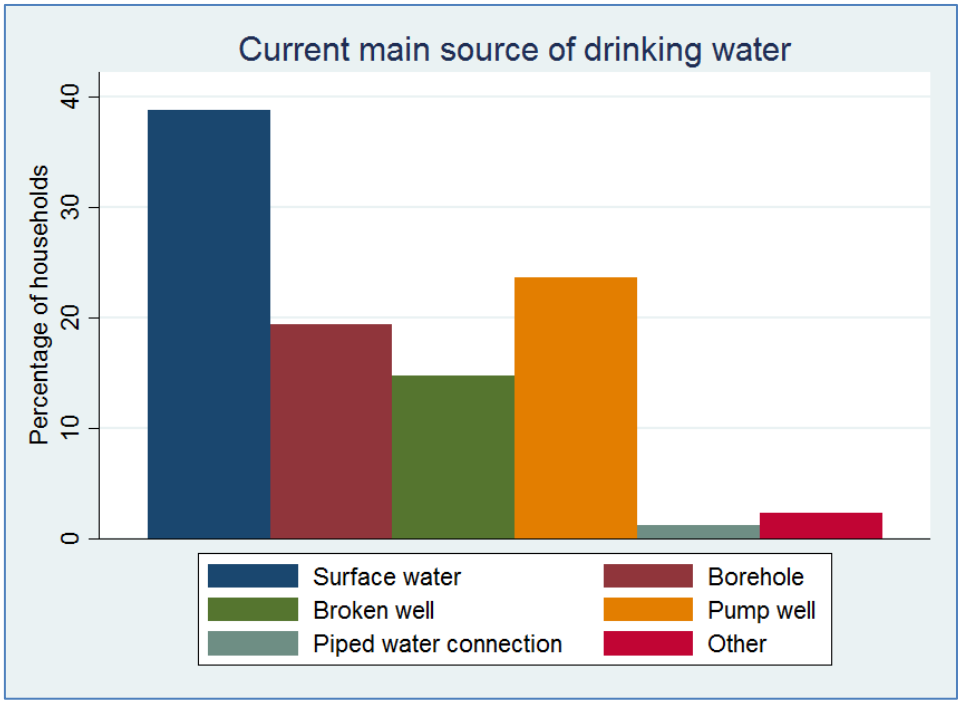
Data analysis was carried out using Stata14. Associations between variables were tested for using Chi-Squared tests, two sample t-tests, and logistic and multiple regression models.

3.3 Results

<u>Overview of current drinking water sources</u>

There was a high reliance on inadequate sources of drinking water across all communities, including surface water and unprotected boreholes (58% collectively). 15% of households relied on water from wells that were not maintained effectively, while only 23.6% of households were using properly functioning pump wells. Piped water connections and other forms of improved water access such as RWH or protected boreholes had a limited presence or were non-existent (Graph 1).

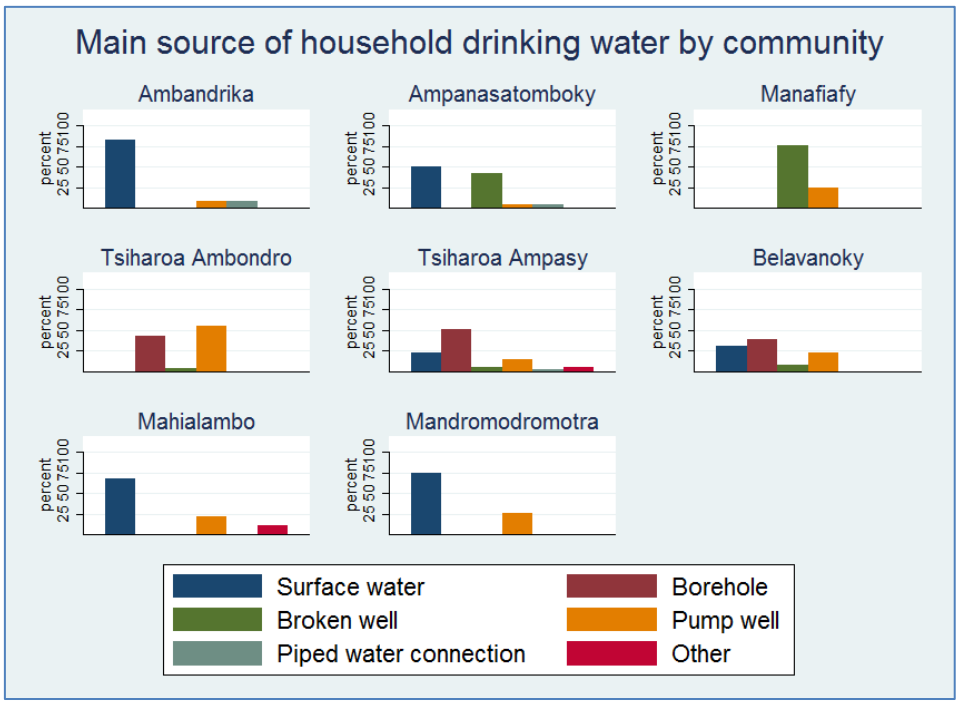
Once distance to source was accounted for, 21.3% of households were classified as using an improved water source - assuming that all functioning pump wells were included in this definition and that all boreholes were not.



Graph 1: Current main source of drinking water

There was a high variance in sources of drinking water between communities - but drinking water sources within communities was relatively homogeneous with all but one community having a category of water source that accounted for >50% of all households (Graph 2). Conditions for water provision were least poor in Tsiharoa Ambondro, where over half of the households surveyed were using a functioning well as a primary source of drinking water (54.5%)

Treatment of water before consumption was uncommon, with 89% of households failing to ever



Graph 2: Current main sources of drinking water by community

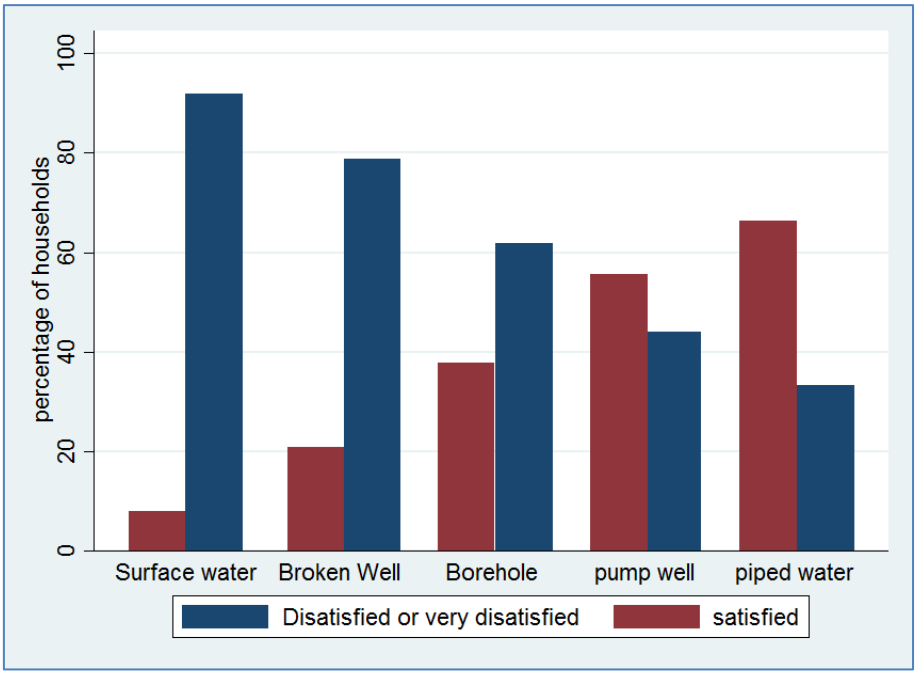
treat their water and less than 10% reporting consistent treatment. This was a self-reported figure so could potentially overestimate the true proportion of households consistently treating water.

Better educated households were not more likely to collect water from higher quality water sources than those with lower levels of education, nor were higher levels of education associated with likelihood to treat water before consumption.

89% of households lived within a 30 minute round trip from their water source, including collection time. On average households spent 1hr 20m a day collecting water, a task which was shouldered by women in 98% of households. While 69% of households used this water exclusively for drinking and cooking the remaining 31% also used it for personal hygiene or domestic cleaning as well.

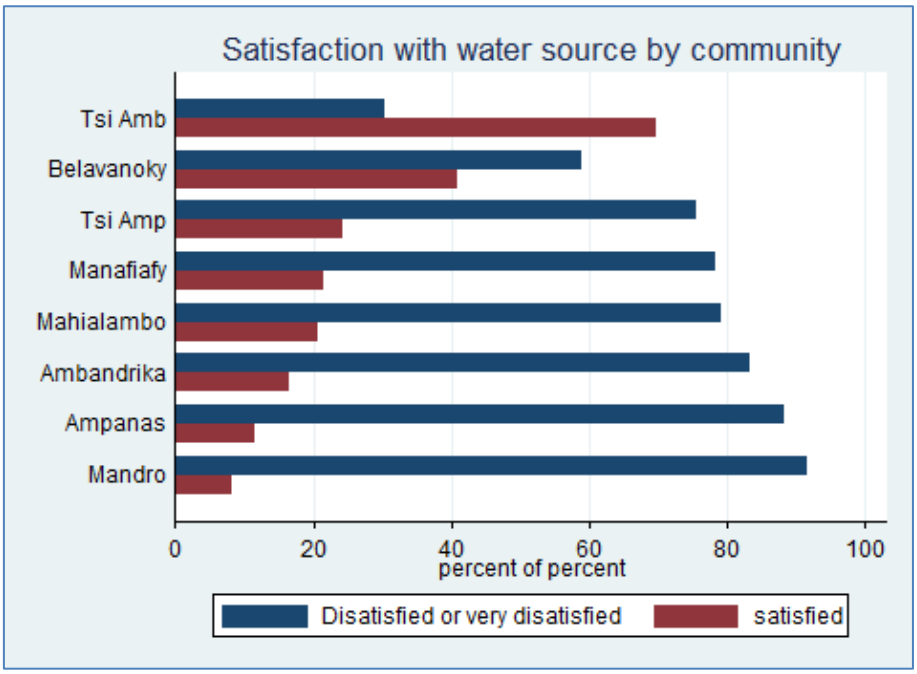
Attitudes towards drinking water

Only 27.9% of households reported being satisfied with their current drinking water source, with 55% dissatisfied and 17% very dissatisfied. Satisfaction with current drinking water source was strongly associated with type of water source with 92% of households that rely on surface water reporting being dissatisfied or very dissatisfied, compared to 44% for those using pump wells (graph 3).



Graph 3: Levels of satisfaction with current water source by type of current water source

Levels of satisfaction were also strongly linked to community, with Tsiharoa Ambondro reporting 70% of households as being satisfied with their current source, against Mandromodromotra's 11.6% (Graph 4).

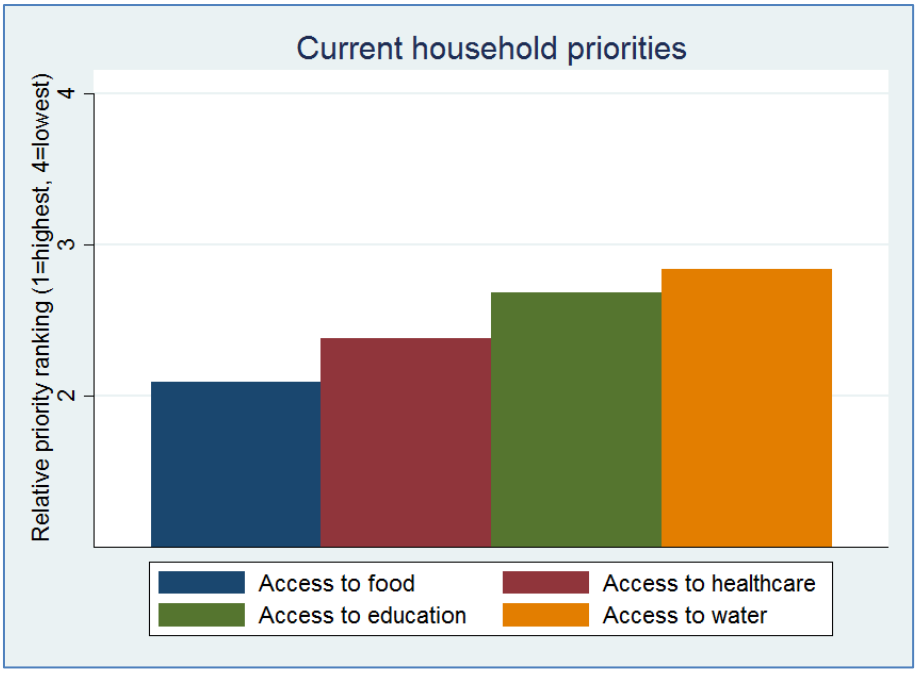


Graph 4: Satisfaction with water source by community

Educational level of the head of household was clearly linked to satisfaction with current water source. After controlling for other risk factors (sex of respondent, type of current water source, and community), those who attended up to primary school level were 60% less likely on average to report being satisfied with their water source when compared against those who have no education. Heads of household who attended up to middle school were 70% less likely to record satisfaction with their water source when compared against those with no education.

Female respondents were more likely to report dissatisfaction with current water source than Male respondents (80% dissatisfied against 65% dissatisfied). However, there was some evidence that this difference could be due to confounding by other factors.

Despite high levels of dissatisfaction, water was on average prioritised behind access to food, healthcare, and education in terms of current household priorities (Graph 5). Levels of satisfaction with current water source were not associated with prioritization of access to water.



Graph 5: Current average household priority scores (1=highest, 4 lowest)

Just over half of households (52.3%) reported using their current water source due to the lack of an alternative. Just under half of households (46%) cited proximity to water source as at least one reason for choosing their current source and 31% of households cited cleanliness of water as a criteria for reason for selecting their water source.

Households using properly maintained pump wells were 8.6 times more likely to cite cleanliness of water as a reason for using their current water source and 5.3 times more likely to be satisfied with their current source of drinking water than users of other types of water source.

Attitudes towards RWH as a source of drinking water

31% of households had previously heard of RWH as a technique to collect water, while communities with a known recent history of RWH (Sainte Luce communities and Mandromodromotra) containing a higher proportion of households who had heard of the technique.

Upon being shown a video demonstrating a prototype of the Tatirano Phase II RWH system, 95% of households thought the system would be useful to their family.

93% of households cited its provision of clean water as a reason for wanting the system and 89% cited its provision of a water source next to the house. Its ability to provide a lot of water, raise social standing or its attractiveness were cited by less than 5% of households as reasons for wanting the system.

48.2% of households that thought Tatirano would be useful to them had some reservations about the system. Of these households, 37.6% thought that it would not provide enough water for their family. Fear of outside tampering with the kit either through theft, vandalism or poisoning was also prevalent with 7.6%, 9.6% and 6% of households registering concerns respectively.

Anticipated uses for Tatirano matched closely with current uses of drinking water brought to the house with 93% of households citing only drinking or cooking as uses for the water. 7% of households also cited personal hygiene. None of the households interviewed cited domestic cleaning, agricultural or livestock as uses for the water.

Willingness to pay for household RWH systems

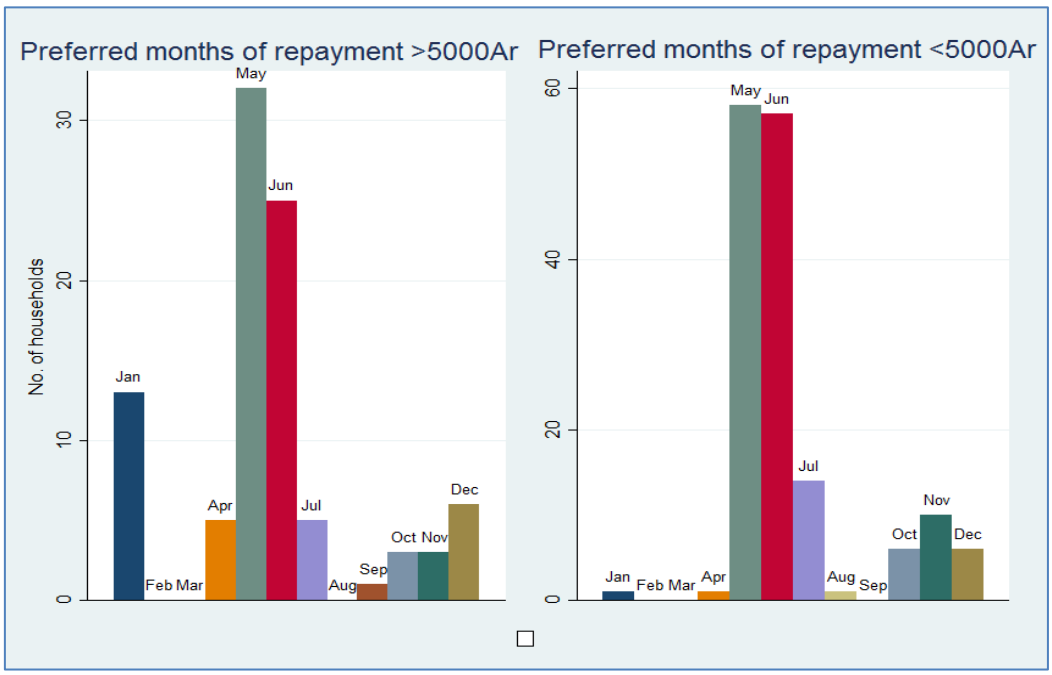
Of the households that thought Tatirano would be useful to them, 94.4% were prepared to pay to have the system. While 91.47% of the total number households surveyed were prepared to pay for the system.

Households that were prepared to pay for the system prioritised water as a more important issue (2.8 mean average prioritisation) when compared against education, health and food than those who were not prepared to pay (3.4 mean average prioritisation).

Distance to drinking water source, current main drinking water source, sex of respondent, age of respondent and educational level of the head of the household were not associated with preparedness to pay for the system.

For households that thought the system would be useful to them but were not prepared to pay, cost was the overwhelming consideration with 85% of these households citing lack of extra money as a reason for not wanting to pay for the system.

58.9% of households reported a particular time of year that they would be more able to repay the cost of the system. The most popular periods for repayment were May-July and October-January. There was some indication that households that were willing to pay more for the system (>5000Ar per month) had a greater preference for repayment during the month of January than households prepared to pay less for the system (<5000Ar per month). Beyond that, distribution in preferred months of repayment between the two groups appeared to be similar (Graph 6).



Graph 6: Preferred month of repayment by amount willing to pay

When asked to choose between up-front payment for the system or staggered repayment over a six month period, households overwhelmingly preferred the latter (89% of households out of households that would be willing to pay).

Age appeared to be associated with this decision, with respondents preferring to pay upfront being on average 6.4 years younger than respondents who preferred repayment over time.

Amount willing to pay

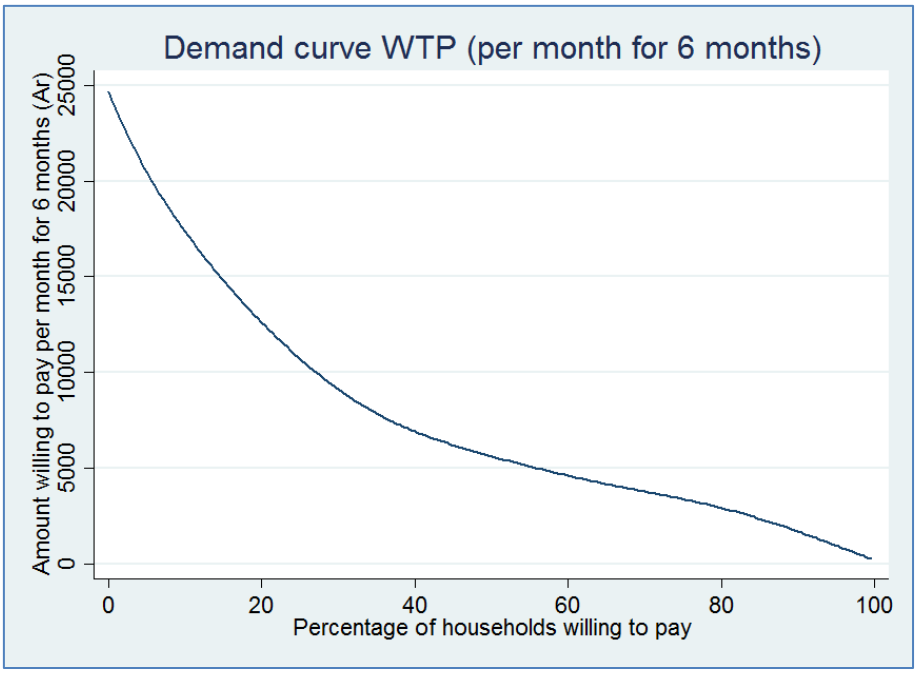
The mean amount that households preferring payment over time were willing to pay was 7,702Ar per month for six months. For households preferring up front repayment the amount was 75,400Ar. The 90th percentile -or the price at which 10% of households were willing to pay for the system- was 15,000Ar per month for six months or 150,000Ar upfront (table 1)

Table 1: Amount willing to pay by payment option

Payment option	**Average amount willing to pay (Ar)**	**Price at which 90% of households can afford the system (Ar)**	**Price at which 10% of households can afford the system (Ar)**
Over six months	7,702	2,000	15,000
Payment upfront	75,400	20,000	150,000

Those preferring repayment over time were on average willing to spend less in total than those who preferred to pay upfront (46,100Ar against 75,400Ar).

A demand curve demonstrates the percentage of households, preferring staggered repayment that would be willing to pay at any given level of cost (Graph 7).



Graph 7: Demand curve for willingness to pay per month for 6 months

Ambandrika, Ampanasatomboky and Manafiafy demonstrated a notably higher amount of willingness to pay in comparison with the other communities (table 2).

Table 2: Willingness to pay over six months by community

Community	**Number of households responding**	**Average amount**	**Price at which 90% of households can afford the system (Ar)**	**Price at which 10% of households can afford the system (Ar)**
Ambandrika	7	21,428	10,000	30,000
Ampanasatomboky	12	15,416	5,000	38,500
Manafiafy	21	12,571	5,000	24,000
Tsiharoa Ambondro	26	6,653	2,000	16,500
Tsiharoa Ampasy	35	7,314	2,600	12,000
Belavenoky	37	6,472	2,000	11,000
Mahialambo	35	4,400	1,000	10,000
Mandromodromotra	37	5,294	1,000	15,000

The level at which households were willing to pay was not associated with sex of respondent or educational level of the head of household. However, it was associated with the age of respondent with each additional year of age of the respondent on average lowering the amount willing to pay by 77Ar per month.

3.4 Key learnings

Current context of drinking water provision

The current state of drinking water provision was, despite some variation between surveyed communities, extremely poor with a high reliance on surface water and unprotected boreholes. However, despite low levels of satisfaction with these sources, access to drinking water was on average prioritised below access to food, healthcare and education by households.

In choosing their primary source of drinking water households prioritised proximity of source above all else. Cleanliness of water was the second most cited reason but very few households were willing to walk more than a 30 minute round trip to reach (potentially cleaner) water sources.

Households using functioning pump wells were more likely to be satisfied with their current source and more likely to cite cleanliness as a reason for choosing the source. Despite this, households were not more likely to travel longer distances (above 30 minute round trip) to reach these wells - again highlighting the low prioritisation of water as a key issue facing households.

Women almost entirely took the responsibility for collecting water. Linked to this was a higher proportion of women reporting dissatisfaction with current water source than men. However, prioritisation of access to water in comparison with food, healthcare and education was equally low among both sexes.

Households with better educated heads were more likely to be dissatisfied with their current source. Potentially hinting at a possible link between education and knowledge of what constitutes an unsafe drinking water source and the health implications of consuming dirty water.

Demand for Tatirano

There existed a high level of interest in the Tatirano system with the majority of households declaring that the system would be useful to them. Further to this, despite low levels of income and a history of 100% subsidies in past projects throughout the region, a significant proportion of households showed a willingness to pay for the system.

If the price were to be set at 15,000Ar per month for six months then 10% of households would be willing to pay for the system (from among households that preferred the repayment over time option). For households that preferred payment upfront, 10% would be willing to pay if the price were set at 150,000Ar.

Younger people were more likely to pay up front and more likely to be willing to pay more for the system than older respondents. Demonstrating either greater spending power or more ambition than older respondents.

Households preferring to pay for the system over time were prepared to pay less on average than those preferring to pay upfront. This could be due to a lack of recognition of how much a certain amount per month is worth in total or a difference in spending power between the two groups.

The context of drinking water supply varied considerably between communities, as did the level of willingness to pay for the system. For example, low thresholds for willingness to pay in Tsiharoa Ampasy, Belanvanoky and Mahialambo could feed into decision making on the priority in which the intervention is rolled out.

3.5 Limitations

- Differences in results between enumerators, while insignificant for results on willingness to pay, were present in some questions that related to attitudes and opinions. This is more likely to have occurred because of the way questions were asked and responses recorded instead of real differences between households on these questions. As such, some caution has to be exercised when interpreting results pertaining to opinions and attitudes.
- Classifications of 'working' and 'not working' pump well were not clearly defined prior to research being under taken. As such, there may be some inconsistencies in results generated for primary source of drinking water.
- Due to limitations in the capacity of the research, the number of households surveyed per community was often not enough to test for true differences between communities.
- Self-reported distance to water source is a typically inaccurate measurement of true distance to a water source. As such results pertaining to distance travelled to water source have to be treated with some caution.

4. Appendix

1. Data collection timetable

Time period	Activity	Output
Week 1-2	Desk review and preliminary qualitative data collection	Internal learning resources e.g. lit reviews, notes from interviews, minutes from community meetings
Week 3	Drafting of household survey	1st draft of household survey
Week 4	Internal circulation of survey for comments and revisions	2nd draft of household survey
Week 5	Translation of survey + independent verification of translation	Translated 2nd draft of household survey
Week 6	Piloting of survey in community + revisions based on feedback	Translated 3rd draft of household survey
Week 7	Training of enumerators + revisions to survey based on enumerator feedback	Trained enumerators + final draft of translated household survey
Week 8-9	Data collection	Completed household surveys returned
Week 10-11	Data input and analysis	Completed database and results document

2. Sampling strategy

Due to the lack of a utilisable and up-to-date sampling frame for the target population and the insufficient capacity within Tatirano to build one prior to data collection, a typical multistage cluster randomised sample was not feasible. In lieu of a sampling frame, the analysis employed a sampling strategy similar to that of the Expanded Programme Immunisation (EPI) method.

Using imaging from Google Maps, targeted communities were demarcated based on the approximate boundaries set by local inhabitants. Communities were then split into clusters which were based on geographic distribution of households as well as community level understanding of what the different neighbourhoods were within the communities.

An approximate estimation of the number of households within each cluster was arrived at through counting dwellings within each cluster on Google Maps. The amount of time enumerators spent collecting data in each cluster was then weighted according to the estimate population within the cluster.

Enumerators proceeded to a pre-established ‘central point’ within each cluster using a GPS tracker. Once there they proceeded in a random direction until they reached a household which was then sampled. From that point they proceeded in another random direction until they reached another household which was then sampled. This process continued until the time allotted for that cluster expired.

3. Summary statistics

Variable	Value
Mean age (years)	44.4
Sex (% male)	52.3
Mean size of household	6.1
mean number of children <5	1.1
Highest educational level of head of HH (%)	
none	27.8
EPP	44.7
Middle	24.7
High	2
University	0.8
Current main source of drinking water (%)	
River water	21.7
Running palm water	6.6
stagnant palm water	10.5
borehole - traditional well	19.4
well - broken	14.7
well - with pump	23.6
Piped water connection	1.2
other	2.3
Treatment of drinking water (%)	
Treating drinking water	9.0
Sometimes treating drinking water	1.2
Not treating drinking water	89.9
Survey results (%) (n)	
completed Surveys	83.5 (258)
Permission not given	8.4 (26)
uncompleted surveys	8.1 (25)
total number of Surveys	**100** 09)