Africa User Research in Water and Sanitation

Tanzania

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Introduction: PATH Safe Water Project

To increase access to safe drinking water and reduce the incidence of waterborne diseases, PATH's Safe Water Project (SWP) has been exploring the potential of market-based approaches to provide clean water for low- and middle-income households. In the initial phase of the SWP, the need for new and improved technologies to support this work became clear. The goal of the SWP's product development work has been to understand user needs and preferences around household water treatment and storage (HWTS); to foster widespread demand for and availability of new and/or improved products; and to raise the bar for affordability, quality, value, and performance of HWTS products. The SWP initially focused on India and Southeast Asia (in particular, Cambodia and Vietnam). The end-user research described in this report expands the project's work to three countries in Africa—Mali, Tanzania, and Ethiopia. This report focuses on the results of the user research in Tanzania.

Africa user research


Gieta, Tanzania.
Credit: PATH/Elizabeth Blanton

The end-user research in Africa was exploratory and designed to assess the HWTS and sanitation needs of households in each country setting. The study's main goal was to identify the needs, experiences, and preferences of potential low-income users in Africa in the areas of water treatment and storage as well as sanitation. The study was intended to inform new product development activities and possible adaptation of safe water products developed primarily for users in Asia.

The specific objectives of the Africa user research were to:

- Collect information on potential users and their environment, including water sources; water collection, storage, and treatment practices; awareness of water treatment methods; as well as similar issues involving sanitation.
- Compare and contrast findings with results of the device user research conducted by the PATH SWP in India and Southeast Asia.
- Begin to identify potential HWTS product solutions, options, concepts, and/or prototypes.

The research included qualitative interviews with women in urban, peri-urban, and rural areas and observation and documentation of household water collection, treatment, and storage practices as well as sanitation and hygiene facilities.

To ensure feedback on a variety of water sources as well as water treatment and storage practices, interviews were conducted with 16 potential users of water and sanitation products in urban and rural areas in Tanzania (eight each). The two research sites were selected in consultation with the PATH office in Tanzania. The urban interviews were conducted in Buguruni ward, Dar es Salaam, and the rural

interviews were conducted in Gieta (Mwanza). To provide context, interviews were also conducted with seven stakeholders including health workers and local government officials including water and sanitation system managers.

Identifying appropriate solutions

To understand user needs, experiences, and preferences in the areas of HWTS and sanitation, it is important to first understand what current *choices* are available—what water sources are available and what water treatment methods, if any, are used.

Awareness of and concerns about drinking water safety are also important, as they affect potential demand for household water treatment products.

Successful product development and market-based solutions need to consider *access*—both to markets where products can be purchased and individual resources available to pay for products.

Framework—understanding user needs. Credit: PATH.

Findings on HWTS

Choice

Drinking water collection and storage

In Dar es Salaam, all of the participants relied on taps—outdoor standpipes—for their water. None of the participants had water piped directly into their homes. Just over half of the participants reported that they were within a close proximity to their homes (with a round-trip to collect water taking six minutes or less). Another participant reported that even though another tap was closer to her house, she chose to make an hour round-trip to collect water from a tap that was "clean" not "salty."

In Gieta, participants primarily relied on well water; tap water; and unprotected springs for their household drinking water. The remaining participant reported purchasing water from a water vendor—who brings water in from a well at a church. Participants using water from unprotected springs reported a

Public water tap, Dar es Salaam.
Household well, Gieta.
Credit: PATH/Elizabeth Blanton.

15 to 30 minute round-trip walk to collect water. The remaining participants use either a well on their own property or a neighbor's property. One participant had a well at home; however, she also reported using another source—a nearby tap—for household drinking water.

In Dar es Salaam, all the participants used covered plastic buckets to collect and store their drinking water. In addition, each household had multiple plastic buckets stacked on top of each other for this purpose. In Geita, half of the participants stored their water in traditional clay pots covered with a plastic lid or dish; the remaining participants used plastic buckets. In both areas, the buckets and/or pots were stored on the floor or placed on top of another bucket.

Water storage buckets, Tanzania.
Credit: PATH/Elizabeth Blanton

Water treatment methods

The majority of participants (12 out of 16) reported treating their drinking water by either boiling and/or filtering their water through a cloth. While these findings do not reflect the 2010 national Demographic and Health Survey (DHS) which showed that 60 percent of Tanzanians use no treatment method prior to drinking, our findings illustrate the potential geographical and source differences that are present in these types of surveys. All eight of the rural participants reported using some type of treatment method (DHS 2010).

While half of the participants (in both the urban and rural areas) reported being familiar with and/or using WaterGuard in the past, none of the participants reporting currently using WaterGuard to treat their drinking water. Almost all of the participants who were familiar with WaterGuard reported not liking the smell; taste was also an issue in the rural areas. "I like boiling the best because the water does not remain with any smell compared to WaterGuard." (participant) According to the DHS survey, the most common water treatment method is boiling (30 percent), followed by straining through cloth (9 percent), and only a very few households (2 percent) use bleach or chorine-based water treatment (DHS 2010).

Awareness

Need to treat

The perceptions of drinking water quality varied among the participants; just over half of the participants in urban and rural areas reported being satisfied with their household drinking water. Reasons for satisfaction included that the water was "clean" or safe (already treated), "tastes and smells good", and "comes from deep in the earth." The participants who reported not being satisfied with their water were concerned about safety, smell, and taste (too salty).

Interestingly, all but one of the participants who were "satisfied" with their drinking water also reported treating their drinking water by boiling and or filtering. Two of the rural participants also made a distinction between water that appeared to be "clean" but was not necessarily "safe." "The quality of water is not good although it is clean [clear], as you can see, that's why we boil it." (participant, Gieta) In addition, a few of the participants reported using different water sources for drinking and other household uses. When asked about common health concerns, water-related illnesses were two of the top three health concerns reported by participants—diarrheal disease, worms (Gieta), and malaria.

Available products

While half of the participants were familiar with consumable water treatment products (such as WaterGuard) and some knew where to purchase them, none of the participants had any experience with or even mentioned durable HWTS products.

Access to markets and resources

Although participants do not purchase either consumable or durable water treatment products, they do need access to markets to purchase clay pots and plastic buckets (which cost between US$.95 for a 10-liter bucket and US$2.50 for a 20-liter bucket) for water collection and storage as well as cloth for filtering and charcoal for boiling. Most of the participants paid in some way for access to water—either for the water itself or for resources needed to treat their water.

Charcoal for sale. Credit: PATH/Elizabeth Blanton

In Dar es Salaam, all of the participants reported paying for drinking water (50 Tanzanian shillings [Tsh] for five liters of water). In addition, half of the participants reported using charcoal to boil their water at a cost of 1000 Tsh (US$.62) per use. Another issue related to access was reported in Dar es Salaam; due to power outages, sometimes participants were not able to get household drinking water.

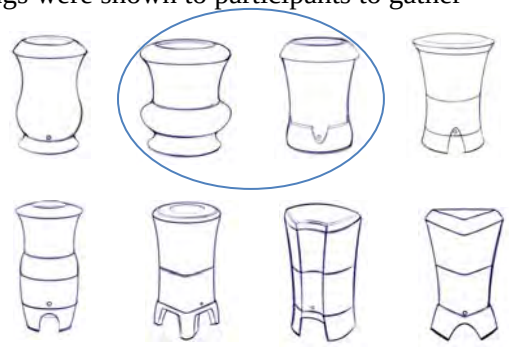
While only three of the participants reported paying for their drinking water in Gieta, six of the participants reported boiling their water. Except for one participant who used firewood, which was free from the forest around her house, the remaining participants paid between 500 and 1000 Tsh to boil their water. One participant reported buying a large bag of charcoal for 20,000 Tsh.

The cost of charcoal was described as "expensive"—"1000 Tsh to boil just 5 liters"—as well as a potential barrier to treating drinking water. "I used to boil water when the family was small but since it has gotten large I cannot afford the cost of charcoal, therefore I just filter." (participant)

Identifying potential solutions—product options and concepts

Formative research and subsequent product development conducted by the SWP in India and Southeast Asia resulted in a set of design guidelines for HWTS devices, three new gravity-fed HWTS devices, and a redesigned ceramic water pot. The Africa research aimed to gather user feedback on product options and concepts, including the three gravity-fed devices based on these design guidelines.

In Tanzania, two types of product concept cards were used to assess user opinions about device configurations and characteristics. First, a series of line drawings were shown to participants to gather feedback on potential product shapes without the influence of color and material. Second, a set of color photos of durable HWTS products were shown—including the new product prototypes developed following the formative work described above. Participants were asked about overall product preferences—which product they liked best, least, and why, as well as about particular product attributes such as shape, size, durability, and perceived affordability.



Favorite line drawings
Credit: PATH/Andy Beddoe.

Product feedback—shapes and products

The participants expressed needs and preferences related to specific attributes of durable HWTS products.

For the **line drawings**, the most popular shapes were a drawing of a traditional clay pot with a narrow and rounded middle and a wide curved base and a drawing of a very clean-lined, slightly curved water pot with a lid and tap (see two circled line drawings above). Preferred product attributes were shape and stability (products that looked as if they had a flat base and would not fall down. Participants also called out specific features, in particular they commented on liking products with a tap and lid.

For the **photographs**, participants reacted most strongly to the attributes of shape and size. Among the urban participants, there was not an overwhelming favorite; however, "good shape" and size were the key attributes mentioned by participants. Participants also appreciated the tap and the availability of a cover. Among the rural participants, the drawing of a covered clay pot with tap was preferred by the majority of participants followed by a more modern design with a stand and tap. The least favorite product was a metal HWTS device—participants did not like the material, did not think it was attractive, and were concerned about rust.

Participant reviewing concept cards.
Credit: PATH/Elizabeth Blanton.

Given general unfamiliarity with durable products, the interviewer provided a brief explanation of water filters and how they work to participants. Despite their lack of experience with durable products, all

participants expressed interest in owning a product that would provide clean water and contribute to their family's health.

HWTS user needs

Water collection, Gieta
Credit: PATH/Elizabeth Blanton.

The formative research on HWTS and sanitation in Tanzania provided information about user needs—both expressed (needs that were clearly articulated by the participants) as well as observed (needs that were identified through the research but not overtly stated by participants).

The majority of participants in this research reported treating their household drinking water. Among participants, traditional methods dominated—with most either boiling and/or filtering their water. However, while filtering with a "white cloth" removes organic matter and particulates, it does not address microbiological or chemical contaminants. In addition, neither boiling nor filtering provides protection against recontamination during storage or through dispensing practices.

Although boiling—which was practiced by half of the urban and three-quarters of the rural participants—does address microbiological contamination, boiling takes time and can also be expensive. Participants also reported waiting up to seven hours after boiling to drink the water. The cost of charcoal is significant and was described by at least one participant as a reason for no longer boiling their drinking water. Cost was also raised as a concern related to chlorine-based water treatment products.

While participants were familiar with chlorine-based water treatment products, none of the participants reported using either WaterGuard or Shabu (a local chlorine treatment product). In particular, participants reported that they did not like either the taste and/or smell of these products. One participant was concerned about cancer. "I have never used WaterGuard because it smells bad and people say it can cause cancer." (participant)

The researchers observed needs related to safe household drinking water. First, there is a clear need for a better understanding of perceptions of drinking water quality, the need to treat, and reasons for treatment. As discussed above, even participants who were "satisfied" with their drinking water also treated their drinking water. Second, even if source water is clean or if the water is treated prior to storage, the team observed a variety of opportunities for recontamination during collection, transport, and storage—insufficient cleaning of transport and storage containers and potential for contamination during dispensing drinking water at the point of use. Finally, there is a need for more information about drinking water quality—both of source water and water stored for household use.

Results for sanitation needs

The Africa user research also included an initial exploration of user sanitation needs and experiences. According to the most recent World Health Organization/United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation data, only 10 percent of Tanzanians use improved sanitation facilities, 70 percent use unimproved facilities, and 12 percent practice open defecation (WHO/UNICEF 2012).[i]

User experiences—sanitation

Sanitation facilities

All of the participants—in both Dar es Salaam and Gieta—use pit latrines. On the whole, the latrines were not new, although two were currently building new latrines, and several participants reported that the latrines were there when they moved to their home.

Latrines in Dar es Salaam. Credit: PATH/Elizabeth Blanton.

In the peri-urban area, all of the participants used covered pit latrines. Since they lived in rental housing, all latrines were shared (by four or more households). Latrines are built out of a variety of materials—including concrete, metal sheeting, and wood. While all of the latrines had walls of some sort, only 3 of 8 had some sort of finished superstructure. Some of the latrines had doors, and all had concrete floors. One participant described her latrine as a "hole in the ground."

"Our toilet is a '*hoo cha shimo*'"

In the area where the study was conducted, there had been a push for every household to have a latrine. However, at least among the participants, none of the latrines were new. Half were reported as being built over a decade ago, and another three participants had no idea of the construction date, saying that the latrine had been there when they moved in. There were some problems reported with maintenance. Unless the participant had access to waste management services, latrine waste was dumped directly into the environment. Some participants said that their latrines were full or overflowing and that their landlord

Closed up latrine
Credit: PATH/Elizabeth Blanton.

[i] "Improved" sanitation facilities are defined by the World Health Organization as sanitation facilities that (a) ensure hygienic separation of human waste from human contact, and (b) are not shared (used by a single household).

had not taken any action. As opposed to organized waste management, most households reported closing up a latrine with rocks when it was full and digging/starting a new pit.

In Dar es Salaam, several households and one stakeholder reported that they experience issues due to pit emptying and maintenance in Buguruni. He expressed that sometimes the pits are full and the households do not have money to pay a truck to come and empty; therefore, they simply open the pit when it is raining and sewage flows into the environment.

The latrines in Gieta were also built out of a variety of materials. Most of the latrines had roofs, and all had walls and doors. All had some sort of stand or squat plate, including one with a white ceramic plate. Overall, latrines were very well maintained. Most participants reported cleaning their latrines on a daily basis; and almost all reported cleaning with brush and soap, although one participant used hot ash which she believed had microbial properties.

Latrine in Gieta
Credit: PATH/Elizabeth Blanton.

In Gieta, the participants reported a mix of construction dates. Two of the latrines were built within the last two years, three had been there for ten or more years, and three were already in place when the participant moved in. Overall, there was a high number of users—five participants reported 7 or 8 users; one reported 14 regular users plus "passers-by"; and the remaining two reported 20 people, including irregular users. As a result, the emptying frequency varies. Latrines with a higher number of users were emptied two or three times a year, while other participants reported emptying their latrines every three to four years.

Open defecation

Participants were asked if open defecation was a problem in their community. Half of the participants in both the urban and rural areas described open defecation as a problem. "[Open defecation is] a very big problem here because they can put the long call in the plastic bag and throw it anywhere." (participant) Reasons given by the participants who did not think open defecation was a problem included that the community shares their latrines, households have their own latrines, and some saw no evidence of a problem.

User needs—sanitation

This initial assessment helped identify user needs and preferences around toilet facilities. The functional sanitation ladder provides a framework for thinking about improving sanitation facilities and potential next steps for product development (Kvarnström et al. 2011). The rungs of the ladder include (1) excreta containment, (2) safe access and availability, (3) grey-water management, (4) pathogen reduction in treatment, (5) nutrient reuse, (6) eutrophication risk reduction, and (7) integrated resource management. The first two rungs of the functional ladder, in particular, identify criteria for improving latrines as well as evaluating sanitation facilities. Observed needs around sanitation facilities included adding a lid and

adding hand-washing facilities (rung 1) as well as improving privacy (rung 2). Although there was some awareness around hand washing, there was minimal use of soap.

Excreta Containment	Safe Access and Availability
• Clean facility in obvious use • No flies or other vectors • No fecal matter lingering in or around latrine • Hand-washing facility with soap in obvious use • Lid • Odor free	• 24 hour access, year round • Privacy, personal safety, shelter • Adapted to needs of users (such as children, women, elderly)

Functional sanitation ladder (rung 1 and 2). Credit: PATH/Jennifer Foster.

The research also pointed to some community-level needs around sanitation. “Diarrhea is related to water and sanitation because of the random emptying of rubbish and sewages that cause the increase of flies that cause disease.” (participant) Latrine maintenance and waste management were key issues raised by participants. “When it rains, people really suffer a lot (from diarrhea) because there is a lot of unclean water in the area and some sewages burst.” (participant)

Public health and expanding product choice

Product development and public health

This study constituted an initial phase in a user-centered design process, gathering information about the needs, experiences, and preferences of low-income potential users of HWTS and sanitation in three settings in Africa. This user-centered approach is crucial to developing a solution that is appropriate for the local context and environment, that is acceptable to potential end-users, and that will be used correctly and consistently to improve the health of low-income households. While qualitative, exploratory, and introductory by nature, findings from this study suggest directions for potential product solutions and concepts that could improve the health of children under the age of five and their families.

Appropriate solutions

Need for HWTS products

The Millennium Development Goals describe effective access to drinking water in two ways—as access to a reliable “improved” source and availability of safe water, that is, water that meets standards for microbiological, chemical, and other contaminants. This research highlights that access to clean water at the source is necessary but not sufficient, since the researchers observed many behaviors that can cause recontamination during collection and storage. The need for improving consumer choice of household-level solutions is clear, including increasing the availability of both durable (HWTS devices) and consumable products (chlorine products).

HWTS product development

Products need to match local conditions and needs. Participants expressed clear preferences in terms of water aesthetics, in particular, around taste. An HWTS product should not leave drinking water tasting salty or of chlorine. Products also need to address different use cases—for participants who are satisfied with the quality of their drinking water, a product that could be used during cholera or diarrheal disease outbreaks would be sufficient; whereas other participants, who treat their water more frequently, need a product that can be used on a daily or weekly basis.

Products need to be tested by actual users. While participants expressed interest in the products featured on the concept cards, these products need to be tested in the field—to evaluate the *user* experience (from initial setup and daily use to cleaning and maintenance), overall acceptability (including flow rates, storage capacity, taste of treated water and temperature of stored water), and durability. In addition to extended product use, attention also needs to be paid to supply chains and consumer financing to ensure access. All these factors informed product design and market development as part of the Safe Water Project in Asia.

Products need to be accessible. Improving product choice is only the first step; for these products to have a health impact, potential users need to have **access** to markets and resources (including financing options)—to buy products, get replacement filters, and also to access repair and maintenance services if needed.

Products are only part of the solution. HWTS products that are correctly and consistently used can provide safe water for families. Activities that increase awareness of water quality (including where and when to treat drinking water) and correct misperceptions (such as the belief that clear water is clean water) are also important. Complementary activities to improve sanitation and hygiene are also required to maximize the health benefits of HWTS.

Sanitation product development

This initial needs assessment provided valuable information on how product development could help improve sanitation facilities and move participants up the functional sanitation ladder.

Product development—beyond latrines. Building a better latrine is only one step along the ladder to improve sanitation facilities as well as household and community health. In areas where latrines are more permanent and constructed of durable materials, a focus on latrine emptying and waste management technologies is important to support both healthy households as well as communities.

Product development—upgrading existing facilities. In areas where latrine use is prevalent and households have access to and use latrines, the next phase of product development could focus on upgrading and/or modifying existing sanitation facilities, in particular, looking towards the first two rungs of the sanitation ladder to improve health and better meet user needs. For example, adding hand-washing facilities could potentially have an impact on health.

Product development—supporting behavior change. Since open defecation is a concern, increasing awareness around and reducing open defecation is important. These activities should also be accompanied by the development of appropriate, acceptable, and affordable sanitation products.

Product development—rethinking improved latrines. While all of our participants had access to latrines, because they were shared, none of the latrines could be described as "improved." Given the reality of latrine sharing, the development of an improved pit latrine design based on the functional sanitation ladder that provides a positive use experience and manages the demands of multiple users could improve health and redefine what is meant by an "improved" latrine.

Next steps

The PATH Water, Sanitation, and Hygiene (WASH) team is actively looking for partners to pursue follow-up activities for the Africa user research, not just in the three countries where the research was conducted, but also in Africa more generally.

Current activities (existing and proposed) that build on and incorporate the learnings from the Africa user research include the following:

- Pilot product and user experience testing by partners in Africa, for example, in Uganda and Rwanda.
- Extended user testing of one or more of the three gravity-fed water filtration devices or the redesigned ceramic water pot. This would include in-home product placement with months of actual use as well as monitoring and evaluation of the impact and use of the devices.
- Sanitation activities in Africa, including a superstructure design project in Kenya.
- A WASH evaluation and targeted intervention in coffee-growing communities in Tanzania. A community needs assessment was just conducted in Mbozi district, Mbeya. We expect an intervention based on this work to launch in May 2013.

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