Understanding water transport & storage needs in Kenya: Needs assessment and user feedback

D-BRIEF *from MIT D-Lab Scale-Ups* – **Spring 2014**

RESEARCH OBJECTIVES

Understand existing water collection, transport, storage and treatment behavior in Kenya.

Investigate current water collection, transport, and storage needs in Kenya.

Understand the use of the PackH20 water transportation product in Kenya.

Determine areas for future assessment and research.

Gaining access to convenient, affordable, clean water

In January and February of 2014, an MIT D-Lab team conducted a qualitative needs assessment study in order to gain an understanding of the current practices and needs for water collection, transport, storage, and treatment in Kenya. The team utilized semi-structured interviews, focus groups and co-design sessions to identify challenges to procuring clean and safe water and to gather feedback on an existing water transportation, storage and dispensing solution, the PackH2O water backpack.

The needs identified in the rural, peri-urban and urban communities outside of Nairobi, Kenya (Machakos, Limuru and Marurui) warrant further investivation in communities around the world facing water challenges. In particular, lack of household water storage capacity was highlighted in the results of this study as an unmet and underemphasized need. Solutions to this problem have the ability to reduce time, energy and financial stresses felt by individuals and households as a result of current water collection and transport challenges.

MIT D-Lab staff member Benji Moncivaiz transports a 20-liter jerrycan on his back, a commonly used method.

Key findings and recommendations

There are opportunities to explore transport and storage solutions that meet needs related to drinking water, and water for other uses.

Increase in water storage capacity:

- Increase total household storage capacity.
- Increase access to larger storage containers.

Reduction of time, energy, and cost for collecting water:

- Make water-intensive activities, such as washing laundry, more water-efficient (to decrease the quantity of water needed).
- Increase users' ability to collect more water at a time.
- Decrease the effort required for water collection.

A convenient and hygienic water dispensing solution:

- Increase access to storage containers with taps or faucets.

Advancing these solutions may include development of new transport, storage or dispensing solutions, or exploration of an appropriate market strategy for existing storage containers.

Methods & study design

Over the course of five weeks in January and early February 2014, D-Lab conducted a needs assessment in several communities located within two hours of Nairobi, Kenya: Marurui, an urban slum, Mitaboni (and nearby village Katalembo), a rural, hilly area, and Ndeiya (along with neighboring Limuru), a peri-urban community. These locations were selected based on geographic diversity, available information on water source types and average distance from home to source, and recommendations from Partners for Care (PFC), D-Lab's local host and collaborating organization.

The team used a variety of qualitative methods to collect information on water behavior and needs related to water collection, storage, and treatment, including 69 semi-structured interviews (with 53 water collectors and 16 other stakeholders such as PFC staff and community health workers), five focus groups and two co-design sessions (74 participants), and observation and informal conversation at 13 water sources.

Water collection & transport: a global perspective

Globally, an estimated 200 million hours are spent collecting water each day. Approximately 780 million people lack access to an improved drinking water source, and 1.5 million people—primarily children under the age of five—die each year from diarrheal disease caused by unsafe water, inadequate sanitation, or insufficient hygiene (World Health Organization, UNICEF).

Given the time requirements and the potential adverse health effects of transporting water, and the negative health effects from water contamination through unsafe storage in the home, there is a need to alleviate the burden of carrying water over long distances and difficult terrain, and improve household storage technologies. D-Lab's study in Kenya investigated the behavior surrounding these issues, and explored related needs and desired features of potential solutions.

Transporting a 20-liter jerrycan with a locally made wheelbarrow.

Current water transport, storage & treatment behavior: Kenya

The team's study showed that, in the locations visited, water collectors make a number of trips (daily or several times weekly) with small containers (commonly 20 liter plastic jerrycans carried on the back) to taps on their premises, to kiosks to purchase water, or to natural sources such as springs or streams. Many people collect water from more than one source depending on the type of water needed and the season, and fill more than one container per collection day. For instance, people might collect drinking water from the spring or kiosk and water for washing from the stream. They prioritize cleaner water for drinking, even if it means traveling further to the source.

Although the average travel time to a source is 16 to 17 minutes, the time to fill a container can range from a few minutes to an hour depending on the source and time of year. In locations where long waits at the source are common, people typically take all of their containers with them on their first trip and fill them all once their turn comes. They then transport one container home at a time (unless they have access to a wheelbarrow, cart, or bicycle) and leave the remaining full containers at the source. At kiosks in Ndeiya, approximately half of the people purchasing water bring jerrycans and transport them on their backs, while the other half bring donkey carts or hand-drawn carts with larger plastic drums to fill.

> *"I collect laundry water from the stream and drinking water from the spring. When it rains heavily during the day I drain the rain water into a tank."*
>
> — Female collector, Mitaboni water collector

Seasonal changes can affect behavior. Collection time increases during the dry season due to scarcity of water; during the rainy season, when rainwater is abundant, the number of trips to the source decreases. A large number of people harvest rainwater to complement other methods of water collection (and to save time and money), but lack access to sufficient rainwater storage (see table p.3).

Water collection may cost money as well as time. Those who have taps generally receive bills on a monthly basis for the water used. Those without a tap may have to purchase water from a kiosk, vendor, or neighbor if they do not have access to a natural and free source.

Treatment behaviors in communities vary. Some people choose not to treat their drinking water, while others boil or chlorinate their water. Those who boil their water appear to take special care to keep drinking water in different containers than those used for transport.

Findings & recommendations

The team's interviews, observations, informal conversations, and focus groups resulted in a deeper understanding of existing water transport, storage, and treatment behaviors. Content analysis of the data revealed new insights and needs, and focus groups and co-design sessions drew out design requirements and important features for potential solutions.

Unmet needs for water collection and storage in general, and for drinking water specifically (including treatment), were identified. Current behaviors and needs related to water collection, storage, and dispensing vary, and so a variety of solutions may be required to optimally meet all of the needs expressed.

1. Increase in water storage capacity.

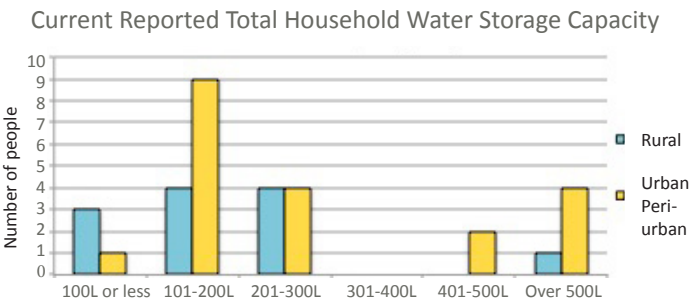
One of the major needs identified is additional storage capacity. Household storage capacity, averaging about 250 liters per household, is often made up of a number of smaller containers. However, the total capacity is not sufficient, according to research participants.

Increasing storage capacity is a way to reduce the frequency and cost of water collection. With affordable, larger-capacity containers, people could accumulate rainwater when it is available and reduce the number of additional water collection trips and dependence on piped water.

Community members with access to a municipal water supply via a tap on or near their compounds sometimes face water shortages and restrictions. Increased storage capacity makes it possible to store rainwater, and less-restricted municipal tap water, for use if and when the source runs dry.

Storage needs could be addressed through increased access to larger storage containers and an increase in household storage capacity. To increase access to larger storage containers, lower-cost containers or alternate funding options for existing options would need to be developed.

Focus group participants specified preference for large-capacity containers that were easy to clean, visually appealing, long-lasting, and portable.



Members of the D-Lab team tested a variety of water collection and transport solutions including the Wello WaterWheel, pictured above.

2. Reduction of time, energy, and cost for collecting water.

Making water-intensive activities such as laundry-washing more water-efficient can decrease the water collection burden. In general, making water collection more efficient in terms of time, money, and labor, has the potential to benefit the individual and household by freeing up resources for other needs.

By increasing the ability to collect more water at a time, the time and money spent on water collection can be reduced. For those purchasing water from kiosks or vendors, there is a cost advantage to purchasing larger quantities (such as with drums instead of jerrycans) as a result of decreased per-unit cost.

Enabling the use of transport solutions that hold more water per trip to the source, such as wheelbarrows and donkeys or carts with drums, could also result in fewer trips to the source. Compared to carrying a jerrycan on one's back, these modes of transport (wheelbarrows, donkeys and carts) may be less physically demanding. New ways of transport may be explored to do the same.

Focus group participants indicated preference for transport technologies that took less effort to use and were easy to transport, carried a large quantity of water, could be used by children, and worked well on the local terrain. Other desired features mentioned were ways to prevent water from spilling or leaking, ways to reduce fatigue from transporting water, durability, affordability or accessibility, being easy to clean, and being comfortable to use.

3. A convenient and hygienic water dispensing solution.

The majority of PackH2O recipients used the pack primarily (or exclusively) for storing drinking water, highlighting the need for an affordable safe storage option. Particularly for drinking water, people need storage and dispensing solutions that are convenient, intuitive, and hygienic. Water storage containers should be easy to clean, and ideally equipped with taps or faucets to separate intake from outflow. Drinking water that is stored in a clean container can easily be contaminated by dirty hands or dipping cups. An outflow tap integrated into the container greatly reduces the incidence of contamination. Increased access to storage containers with taps or faucets should be explored.

Understanding water transport and storage needs in Kenya

CO-DESIGN WORKSHOP

Drawing inspiration from D-Lab's Creative Capacity Building (CCB) methodology, researchers developed a co-design method, a dual-purpose hands-on design workshop and qualitative research method. In CCB-style co-design sessions, participants design and build prototypes to address a local challenge; when they explain the motivation and reasoning behind their designs, researchers gain a deeper understanding of needs and preferences, and prototypes reveal physical representations of desired features. In Kenya, groups were prompted to build something to transport 20 liters of water over a distance of two kilometers. The resulting prototypes had a variety of features that expressed different needs for a solution: some designs emphasized stability for easy filling, padded straps for comfort, and use of strong materials for increased durability.

Next steps

D-Lab encourages others to build on this study to explore ways to facilitate access to greater water storage, and to decrease the cost, reduce the time needed, and ease physical burden of water collection and transport.

D-Lab remains interested in continuing this work and welcomes inquiries from potential partners.

Future impact

Understanding Water Transport and Storage Needs in Kenya is a preliminary study that identified increased water storage capacity as an unmet, and underemphasized, water-related need in the communities studied.

The results from this study are specific to the context and market in Kenya. Similar studies in other geographic areas would add to the body of knowledge on the size and scope of this need.

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Further information & full report

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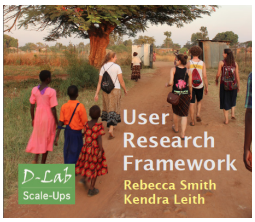

MIT D-Lab User Research Framework

This project, *Understanding Water Transport and Storage Needs in Kenya*, was used as a case study for the *D-Lab Scale-Ups User Research Framework*, published in 2014. The guide provides in-depth guidance on how to create a qualitative research plan and approach cross-cultural interviews, observation, and immersion activities as well as D-Lab's co-design method. d-lab.mit.edu/user-research-framework-download

Launched in 2011 by D-Lab, the Scale-Ups program assists social entrepreneurs from MIT and the developing world, as well as NGOs and corporations, to bring poverty alleviating technologies to market at scale.

D-Lab MIT GREIF Community Jameel

Image on page one header: A donkey cart, carrying a large drum, is used for water transport at a peri-urban water kiosk.