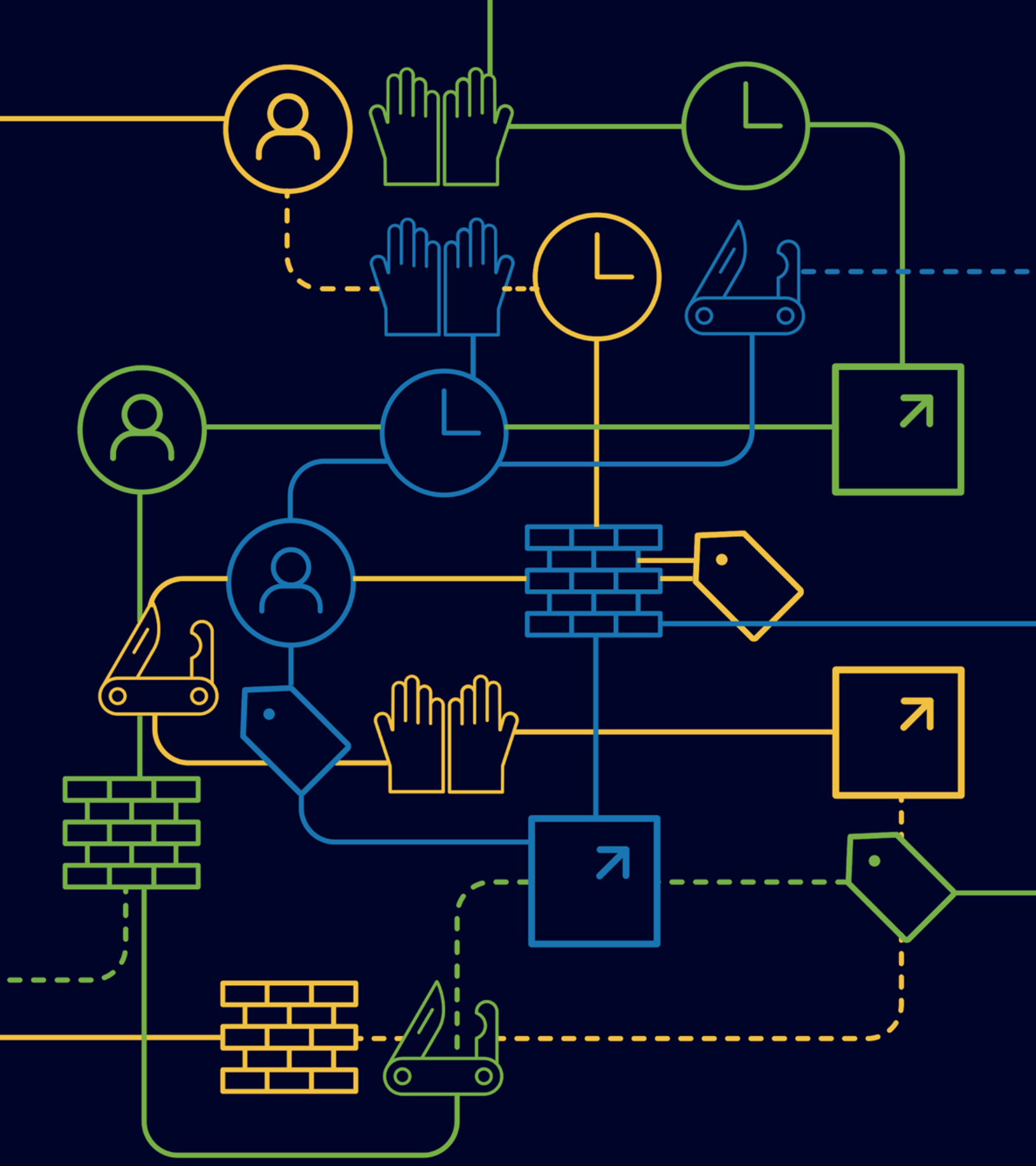


Matchmaker Resource Package

Water-trucking Monitoring

2019

RESPONSE INNOVATION LAB

Welcome!

The design of this Matchmaker Resource Package has been initiated after an application by the Danish Refugee Council (DRC) in Uganda on the website of the Response Innovation Lab (RIL), seeking innovative solutions to improve monitoring of water-trucking operations.

Early-findings of research on this topic showed the relevance of this challenge not only in Uganda but also at the global level. It was thus agreed between the DRC and the RIL to slightly broaden the scope of the research for solutions in order to also capture learning that may not have any direct applications for Uganda but could be of relevance in other contexts.

This resource package contains a detailed review of top four best solutions to the challenge as well as additional interesting Global Insights.
The RIL Uganda can be contacted by any partner interested to learn more about this package and/or to test a solution.

Summary

LOCATION
Uganda

SECTOR
WASH

DEMOGRAPHIC
All demographics – especially displacement contexts

HUMANITARIAN NEED
Uganda is currently host to close to 1.2 million refugees. In 2017, a large number of South Sudanese refugees came to the West Nile region of northern Uganda. During an early-stage crisis, water-trucking is often the only option to meet life-saving needs and during that time more than 850,000 refugees received drinking water through trucks. This meant as many as 600 trucks contracted by a range of INGOs and a single organization such as the DRC could be managing water flows of over 18 million liters per month.

PROBLEM DESCRIPTION
Innovative solutions, that can be easily deployed in an early-stage crisis response, are needed to improve partners' ability to remotely monitor and plan water deliveries by contractors hired for water trucking services.
The cost of water trucking is inherently large and it is difficult to monitor both the location of the trucks and the water level in the trucks' tanks.
The 2018 operating model of the DRC in Uganda relied on water trucking contractors paid per trip and water monitors hired from within the community to track the water delivery. The system of monitoring water trucking was susceptible to reporting irregularities and did not provide real-time information which could ensure quality-monitoring and guide optimization of routing schedule.

Summary

OBJECTIVES OF SOLUTION

An improved water-trucking monitoring system should address four key factors:

- **Transparency and accountability**: there is a need to reduce the risk of irregularities and the reliance on human-only reporting mechanisms.
- **Cost-efficiency**: considering the short time-frame during which water-trucking operations are supposed to be implemented, the initial investment costs need not to be too high. Prior to the application to the Matchmaker Program, a potential solution was proposed by a private sector actor, however the proposed pilot cost would have been of USD 400,000, exceeding the investment capacity of most of the likely partners delivering this type of assistance.
- **Quantity-monitoring**: measuring volumes delivered by trucks, time of said deliveries, and speed of consumption by community of water in stationary tanks, would provide critical parameters for the optimization of routing schedules to ensure meeting the needs of communities most appropriately and securing cost-efficient agreements with trucking companies.
- **Quality-monitoring**: one important aspect is the verification that trucks are filling tanks at agreed, safe locations to ensure the transporter delivers water of a quality that has been vetted. An interesting add-on could be the verification of Free Residual Chlorine levels at delivery.

DESIRED SOLUTIONS CRITERIA

The Danish Refugee Council expressed a preference for a technology-based solution, having already explored more process-oriented, HR-driven solutions.

The general guiding criteria for this research was to focus on solutions that can be implemented with minimal staff and with limited funding considering water-trucking is meant to only be a temporary service during the early-stage of a crisis response. Furthermore, roll-out time needs to be short to align with the emergency response timeline.

CONTEXTUAL CONSIDERATION

- Remote management option due to distances and large network of tanks and water-trucks
- No access restrictions for security reasons in Uganda but it is the case in other operational contexts where water-trucking is used
- Rural environment
- Limited internet and telecoms (GSM) connectivity

BUDGET AND TIME

- No time constraint
- 5,000 - 10,000 USD

Overview

The DRC Uganda's challenge statement was investigated by staff from the RIL Global Program and the Lab Manager in Uganda. The staff used the RIL innovation databases, the RIL networks, and contacted subject-matter experts within the Humanitarian Sector and Private Sector to source solutions that met the criteria and needs outlined. Special attention was given to finding suitable alternatives that could be carried out by the DRC's team and would represent a cost-effective solution.

Our research and investigation concluded that no off-the-shelf tested and proven product or solution to the challenge currently exists.
To be fully comprehensive, solutions for monitoring of water-trucking operations should ideally :

1. Collect data on water levels inside the trucks' tanks
2. Collect data on water levels in stationary tanks (delivery points)
3. Monitor truck movements and routes
4. Ensure real-time or regular collection and transmission of data to a centralized monitoring system.

The challenge lies in the integration of those components in a cost-efficient way, bearing in mind connectivity challenges and the need for the solution to be rolled out to the field quickly at the onset of an emergency response.

Encouragingly there are currently a number of pilots and tests which are underway and ongoing to solve this challenge and provide greater accountability and monitoring.

Many products are currently available for monitoring the water levels when a tank is stationary; and there are ready-to-use solutions for tracking the position and movement of trucks using GPS already applied by many humanitarian actors. Meanwhile, monitoring water-levels in mobile tanks (trucks' tanks) remains challenging and no pilot conducted to date has identified a suitable solution. Finally, a range of connectivity options for data transmission can be considered – the most promising ones seem to be using Low Power Wide Area networking protocol or GSM/mobile networks.

The pilots presented in this Resource Package include: the recent UNHCR pilot project in Uganda & Iraq (Solution One), the ACF pilot (Solution Two), as well as the ongoing Oxfam-Vodafone pilot (Global Insights) and recent Acted and Norwegian Church Aid projects (Global Insights). Solution Three presents a potential innovative way of increasing remote monitoring for greater transparency and accountability with FieldSight.

Furthermore, based on the evidence review, the Uganda RIL summarizes with Solution 4 an untested protocol that could address the core concerns in this challenge in a minimalist and cost-efficient way. Alternatively, in partnership with interested stakeholders, the RIL could run a Call for Innovations to incentivise innovators to work on this specific challenge once the ongoing pilot tests outlined above have been completed.

1- UNHCR Pilot Testing

Key challenges, findings and learnings from the UNHCR pilot project in Uganda and Iraq

2- Action Against Hunger Pilot

Learning from field testing of prototypes on water trucking and desludging

3- FieldSight

Increasing accountability and remote monitoring of field sites through applied technology.

4- Ideation/Call for Innovations

Sourcing new ideas or testing a minimalist, low-cost approach

Global Insights

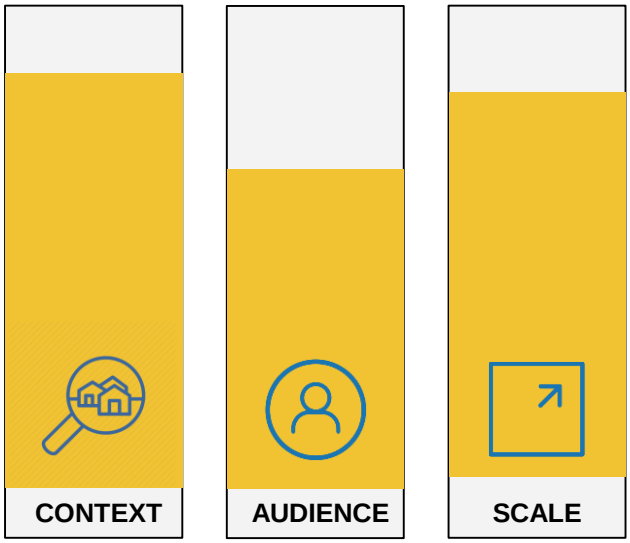
Oxfam-Vodafone
Mobi-Water
City Taps
NCA IOT sensor
Acted WAPP/WADI
Upande
Water ATMs
…

Additional resources from Action Against Hunger, Elrha, GSMA, RIL Iraq, Save the Children, UNHCR, etc.

UNHCR

UNHCR Uganda, Iraq (& Kenya): Pilot Water Trucking Monitoring Technologies

OVERALL MATCH



Key Information:

Traccar
Modern GPS Tracking Platform

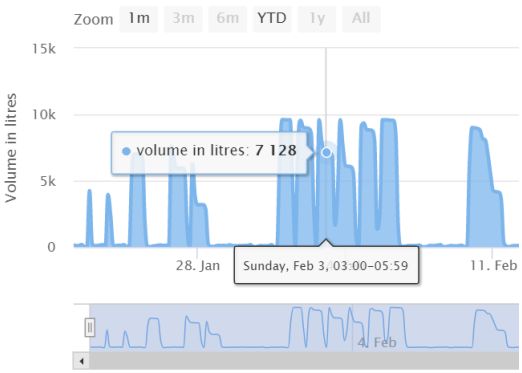
+

LoRa

+

Tekelek TEK766

+



* Access to NGO who are not UNHCR implementing partners not currently confirmed.

ABOUT THE PROJECT

UNHCR Uganda has carried out extensive research into water trucking monitoring technologies. The aim was to pilot various real-time technical solutions for mobile and stationary water tanks remote-monitoring with the goal of improving the effectiveness of UNHCR's water trucking programming globally. Tools (monitoring dashboard, guidance) will eventually be provided to all UNHCR water-trucking partners* – see more in Global Insights section.
The test was carried out within refugee camps in West Nile (Arua) in northern Uganda in January 2019 and in Iraq in March 2019.
A smaller-scale pilot focused on water-flow monitoring (not in the context of water-trucking operations) was also conducted in Kenya.

KEY VALUE

RIL identified this pilot as one of the most relevant and in-depth ongoing studies currently available. The findings are fully applicable to the challenge statement, adressing its four components (see Overview on previous page).

Whilst testing is still ongoing in Iraq, the overarching recommendations from the field testing carried out in the Uganda context are of value to any actor seeking to implement a similar solution

Of particular value were findings and recommendations on:

- An affordable and reliable device for water-level monitoring in stationary tanks (Tekelek technology);
- A connectivity model using LoRaWAN, as a successful alternative to GSM and with multipurpose applications, i.e providing local connectivity for other programs and/or to affected communities in area of intervention ;
- Useful insights on how the relationship and contracting with the water trucking contractors could be adjusted in a performance-based way to assist in implementing solutions that are encouraging greater accountability and increased transparency.

UNHCR

Learnings from UNHCR for innovative water trucking monitoring applicable in the Ugandan context and globally.

Key Information

1. SECTOR

WASH, Accountability

2. ADDITIONAL RESOURCES:

Contact: Mr Ben Harvey harveyb@unhcr.org
https://www.traccar.org/ (GPS tracking)
https://www.thethingsnetwork.org/ (LoRaWAN network)

3. NEXT STEPS

Connect with the UNHCR to stay up to date with the ongoing testing and piloting.

IMPLEMENTATION - Provisional Findings from Pilot Project (January 2019)

Difficulty

The initial installation of devices would require both time and technical skills. After initial expert configuration, the management of the system is straightforward and the data integrated in a UNHCR one-stop-shop platform.

Time

Further testing and piloting is ongoing. If the model is confirmed successful (expected end 2019), replicating the setup in another operation could be done in a couple of weeks. Getting GPS-tracking systems on truck is fairly simple and quick.

Barriers

- Ease of device configuration
- Security of installed devices (need for devices to have a lower visual footprint and robust design)
- High initial costs of hardware devices

Cost

The cost would depend on the scale of the programme. In a model using a LoRaWAN gateway for data collection and transmission from devices on 100 stationary tanks, the material costs alone (without installation or management) would be of approximately USD 7,500. The material needed for installation of LoRaWAN network is costed at USD 1,600 and the most cost-effective LoRaWAN-enabled water-level monitoring device was found to be Tekelek TEK766 with a cost of USD 59 (over USD 350/device from other brands).
If monitoring more than 3 reservoirs, the break-even point for the installation of LoRaWAN network is reached after 5 years (with options to provide connectivity to additional programs beyond water-trucking). For small programs, if GSM coverage is available, that option is cost-efficient although the cost of the recommended device is higher per unit (Tekelek TEK733 at USD 99).

Key Challenges and Findings during trials:

- Risk of vandalism or accidental damage to water level monitoring hardware such as 'tree damage'
- Unreliability of devices such as batteries becoming flat was a challenge which would need to be overcome.

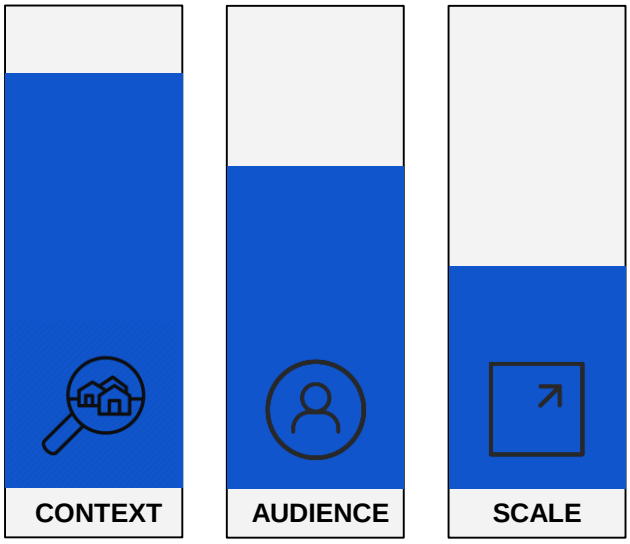
Despite piloting different types of devices, monitoring in mobile (trucks') tanks remains challenging and current devices are not ready for widespread adoption (high potential for false readings due to waves, moving water). A large range of devices was tested, including Libelium Plug and Sense 3G + GPS, Tankmatix Fuel Tanker 3G + GPS and bluetooth ultrasonic devices (for the latter the range proved inadequate - signal from device installed within the reservoir could not go through)

Key Learnings and Considerations:

- Ultrasonic and piezometric devices were both found to be effective for water-level monitoring in stationary tanks. Ultrasonic devices are recommended unless there is a requirement for groundwater monitoring.
- LoRaWAN (Long Range Wide Area Network) IOT (Internet of Things) technology was tested as part of this pilot and was found to be cost-effective, useful and able to collect data from devices within an area of 1,200km2 at ranges of up to 29km. On the long-term is it a cost-effective investment with 7-year battery life, no need to include a sim-card and performance with low power)
- Tekelek devices are most cost-effective and performing either in combination with a LoRaWAN or GSM network (tested DecentLab, Libelium, and HummBox devices too).
- Terms with the water trucking contractor need to be established so that it is the responsibility of the water trucking contractor to ensure that GPS devices are functioning. 1- Payment terms with water trucking contractors should be on a 'no data / no payment' basis. 2- Water trucking companies could pay a reimbursable deposit for the GPS tracking devices to be taken out of initial water trucking payment.

Action Against Hunger: Pilot testing

OVERALL MATCH



Key Information:

ABOUT THE PROJECT

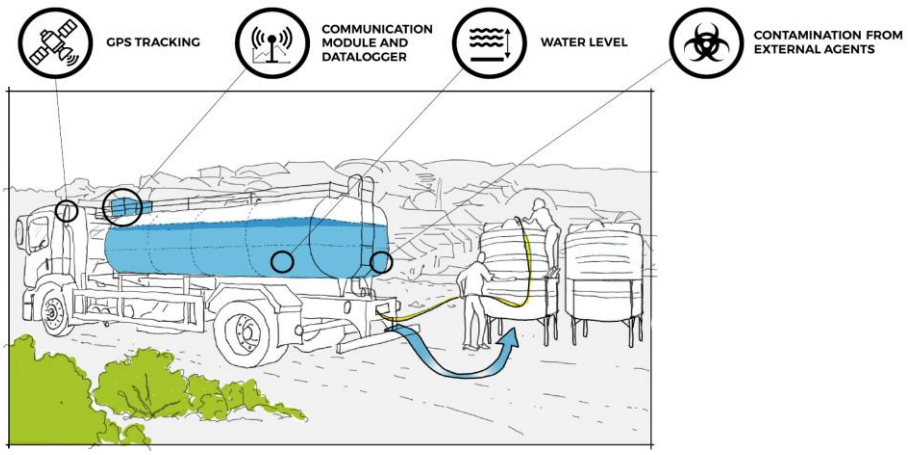
In 2016-2017, Action Against Hunger Spain conducted a comparative study in partnership with private sector tech companies to explore a range of solutions to improve the monitoring of water-trucking and desludging operations. This project took place in the Bekaa Valley, in Lebanon, a region hosting Syrian refugees since 2011. Action Against Hunger is providing water and wastewater management services to over 40,000 refugees. The initial results are being used for a further phase of research.

Action Against Hunger, learning from the experience in Lebanon and beyond has also produced an extensive operational water-trucking manual (currently in Spanish).

KEY VALUE

RIL has identified the ACF pilot project of providing value to current and future water-trucking programming. Whilst a number of challenges were identified through this pilot, the RIL decided to include this pilot as a solution as increased learning has the potential to support both future pilot programmes as well as providing opportunities to incorporate these learnings into current water trucking programming both regarding water-quantity and quality. It is also one of the only pieces of research taking into account desludging operations.

Another interesting aspect of the research is the comparison of various connectivity approaches concluding that 2/3G was recommended over radio transmissions which proved unsuccessful.



ACF Pilot Findings

Key Information

A comparative research project with field-testing of prototypes provides applicable learnings for innovations for water trucking monitoring technologies.

1. SECTOR

WASH, Accountability

2. RESOURCES:

https://www.accioncontraelhambre.org/en

3. NEXT STEPS

Connect with Action Against Hunger Spain, Global Wash Advisor:
Mr Pablo Alcalde Castro
palcalde@accioncontraelhambre.org

IMPLEMENTATION

The pilot compared approaches and material by two different tech companies, H2ONow and Hidroglobal.

Difficulty

The initial installation of devices would require both time and technical skills. Further work on the development of the data management platform is intended.

Time

A next phase of testing and piloting is still necessary before possible replications.

Barriers

- High initial costs of hardware devices
- Solidity/robustness of devices
- Security of installed devices
- Gaps in internet network coverage

Cost

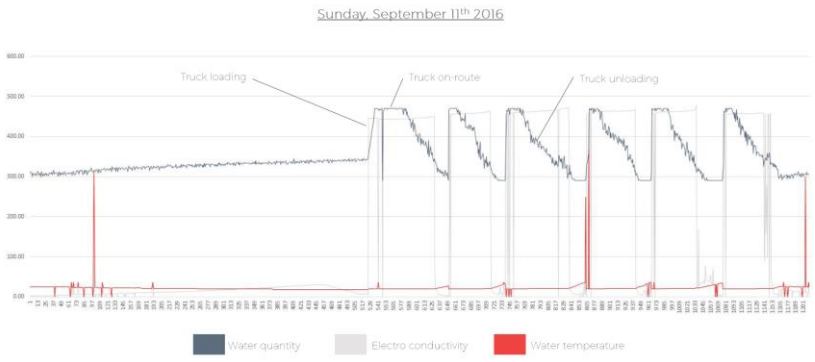
The current estimated cost for a robust water-flow meter GPS- and 2/3G- enabled is of approximately USD 1000 (without the costs of the connecting GPS and data-logger, shipment, installation or data management platform).

Key Challenges and Findings:

- Risk of vandalism
- Temperature variations can affect the data collected by pressure sensors. This can be addressed through proper calibration of algorithms.
- Tanks sometimes have internal partitions which limit the use of single pressure sensors (need to open partitions)
- Radio transmission of data seemed attractive in low internet connectivity context but proved unsuccessful.

Key Learnings and Considerations:

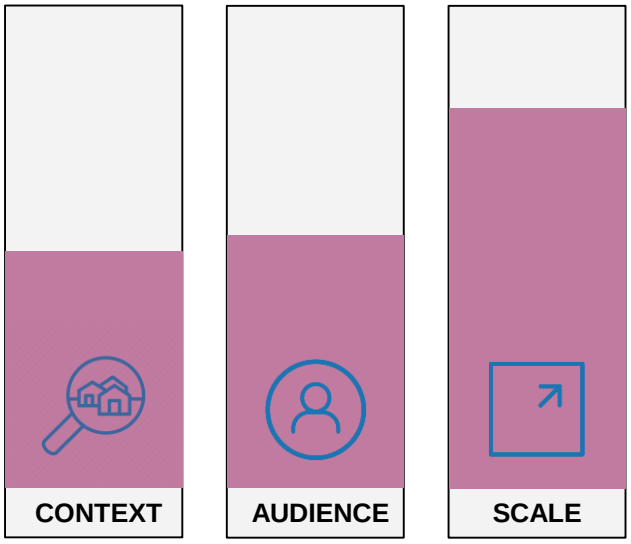
- 2/3G network seemed to be the recommended mode of connectivity for the transmission of data. Solutions thus need to ensure a built-in off-line functionality for data collection and transmission at regular time intervals when trucks reach areas with sufficient coverage. This may require a specific provision in the SOPs to ensure drivers pass through such predefined areas regularly.
- Although ultrasonic sensors proved some level of reliability for monitoring water levels within tanks' trucks, they are generally too fragile for desludging operations during which the high pressurization and depressurization damaged the sensors. Open-membrane sensors were tested as an alternative but collected data was unreliable. One alternative with potential may be to install a waterflow meter on the pipe (not inside the tank) if a meter with sufficient internal diameter is found (remains to be tested as the pilot used too narrow devices).
- Experimentation with GPS tracking showed that it is difficult to obtain reliable data in areas with many facilities (reservoirs, desludging areas) that are in close vicinity.



FieldSight

Field Sight: Remote monitoring of field sites

OVERALL MATCH



Key Information:

ABOUT THE ORGANISATION

FieldSight is the first humanitarian digital platform designed for project monitoring and infrastructure quality assurance. Developed iteratively over 2 years, the platform is now being used to monitor more than 60,000 houses, WASH sites, schools, police stations, and other infrastructure in 14 countries. Built to work on mobile devices and in remote and difficult-to-access locations, with an off-line functionality, FieldSight creates actionable data and interfaces that help partners deliver higher-quality, lower-risk projects.

The FieldSight technology is available open source for any organization to use. Organizations with the capacity to develop their own tailored content can set up an account or install it on their servers and start using it for projects. Alternatively FieldSight provides subscription plan to support tailored setup.

KEY VALUE

RIL has identified FieldSight as an organisation that could provide support to increasing the level of transparency and accountability for water trucking across field sites. The solution can be deployed quickly during and at a minimum cost.

The key value in applying FieldSight to the problem statement regarding water-trucking is that this is a simple, straightforward and ready to rollout application which would assist in solving one aspect of the challenge statement: to ensure sufficient water reaches the delivery point from a collection point. FieldSight is a tested, up-and-running application which has been used in remote field contexts (such as Nepal) and would require minimal training and staff time to be able to implement effectively. It is a cost-efficient solution that does not require acquiring specialized material.

FieldSight

Key Information

A UNOPS-powered digital platform built for infrastructure and project monitoring in the humanitarian, development, and public sectors.

1. SECTOR

Accountability, MEAL, WASH

2. ADDITIONAL RESOURCES:

http://fieldsight.org/

3. NEXT STEPS

RIL Uganda can facilitate introductions to the FieldSight team to find out more detail about the services and products that they offer and how tailoring opportunities.

IMPLEMENTATION

Difficulty

The application is straight-forward to use and user-friendly. Users need periodic internet access to upload information and data to the system.

Time

Very quick roll out and implementation period after consultation and confirmation of design of system and subscription type with FieldSight team.

Barriers

There is still a risk that data entered into the system may not be correct.
This application will not automatically measure water-levels but rely on a triangulation of data entered manually to verify accuracy.

Cost

The cost would depend on the scale of the programme and subscription plans vary from USD 20 - USD 150 per month. After discussion of this specific challenge, a tentative preliminary cost for monitoring 100 reservoirs (twice a day) would probably fall under the USD 150/month plan to account for over 700,000 data entries per year.

FieldSight applied to water-trucking monitoring

The following solution was explored as it is an innovative way of increasing the transparency for remote monitoring of field sites and ensuring that an evidence-based approach to water quantity monitoring for water trucking.

FieldSight are able to provide a mobile application (app) which can be set up and configured to the needs of a particular project. Its strength lies in the collection of multiple data-source to increase credibility of information collected: GPS coordinates, picture and text/data entry.

The FieldSight app could be used as follows:

- a designated individual (community monitor or truck driver) would capture a photo with the measurement of water contained inside a water truck at the point of water collection, GPS coordinates and manually confirm filling the tank.
- A second photo would be taken at the point of delivery capturing the measurement of the water deposited and uploaded onto the FieldSight system.

Capturing the measurement of water collected and delivered with an evidence-based measurement would provide greater accountability and a simple methodology for monitoring water delivery. This solution would work best if basic means of measurement for water levels exist at both the collection site and site of deposit. Alternatively SOPs could be drafted to indicate what type of photo would provide sufficient evidence (for instance a top view of a stationary tank after refilling).

Areas of risk with this approach remain that the data is entered by humans which presents the possibility of the data being incorrect or deliberately manipulated. A system of training and incentives for accurate completion of forms could be one way of managing this risk.

In the medium-term, FieldSight intends to create a functionality to connect the app with other devices (like remote sensors). This approach would become very similar to Solution One but have the advantage that it can be deployed independently from UNHCR, including in contexts with no refugee presence.

Ideation/Call for Innovations

Key Information

CALL FOR INNOVATIONS

On this occasion, as there is no obvious and existing off-the-shelf innovation that addresses all components of the challenge presented by the DRC, the RIL can assist in running and managing a call for innovative solutions on your behalf.

An overview of the main modalities for running such a call follows:

Step 1: Issue a call for ideas through social media, local media, and local and global networks, including outreach to the organizations with partial solutions to your challenge. The specifications on the researched solutions would be agreed in partnership with DRC.

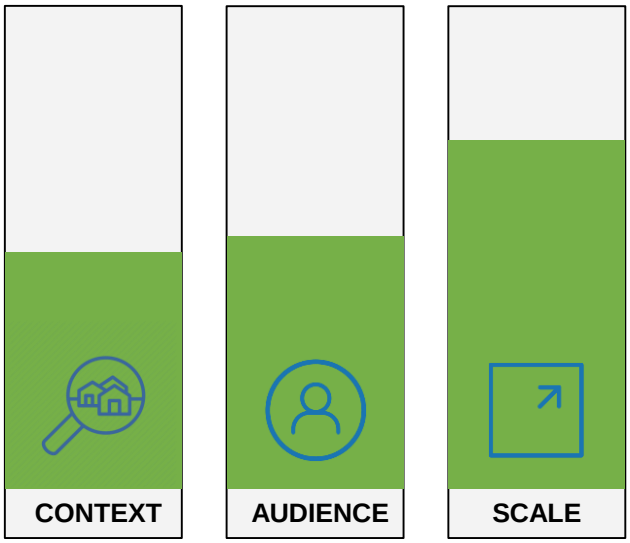
Step 2: Application: Organizations may apply for different stages of funding based on the stage of development of their innovation:

- Stage 1 – Proof of concept <USD 25,000 to test a solution's feasibility in the Ugandan context.
- Stage 2 – Piloting: USD 25 to 100,000 to test and strengthen a solution's delivery model.
- Stage 3 – Transitioning: >USD 100,000 to support the scale-up and replication of successful project models.

Step 3: Selection: Each proposal is judged against others within the same category using defined criteria. The RIL Uganda will produce a short-list which will be presented to the RIL Executive Committee and the DRC for final decision.

Step 4: Development of the solution with support from both the RIL and DRC.

OVERALL MATCH



CALL FOR INNOVATIONS

Based on the review of existing solutions to date as well as the challenge specifications, which included a low-cost for the solution (<USD 10,000), what follows is a summary of an untested protocol that may address the core concerns raised.

Key stakeholder discussions recommended to exclude the GPS-tracking component from the solution if the actual monitoring of routes (for accountability regarding fuel consumption for instance) is not a core concern.

Instead, using an app that allows geolocalization of data in combination with a picture of water-filling would be sufficient to verify that water is collected from verified, safe boreholes.

Secondly, the same app can be used at water-delivery points in combination with simple analog waterflow meters on pipes (estimated costs of approximately USD 20-50) that will verify the amount of water discharged into the stationary reservoirs. Such meters could also be installed at filling points. However, if the main concern is that planned quantities reach affected communities, the delivery points should be the first area of focus.

For routing optimization, NGO monitors or community monitors can be trained to use the app and collect information on speed of consumption at the various community reservoirs over a period of two weeks (with verifications twice or thrice daily) until consumption patterns emerge.

The integration of safeguarding mechanisms as presented in Solution One in contractual agreements with commercial water-trucking companies, would also be a low-cost optimization.

To conclude, although such an approach would not provide real-time information on water-levels within trucks' tanks at all time, it may be a cost-efficient and quick way to improve transparency.

GLOBAL INSIGHTS

The following solutions were explored as part of the Matchmaker research process and while not deemed to be strong matches with the challenge, are nonetheless interesting solutions that the Danish Refugee Council Uganda may like to explore in future or as complementary solutions.

Oxfam-Vodafone Pilot project, Kenya
https://policy-practice.oxfam.org.uk/our-work/water-sanitation-and-hygiene/wash-technical-briefs
Oxfam and Vodafone have entered in a partnership to pilot an alternative connected device for water-level monitoring which may address the up-to-date unresolved challenge of level monitoring in mobile reservoirs. The device is twofold, one piece is screwed onto the truck while a magnetic sensor attaches within the reservoir. When the tank is stationary it measures the water level and water quantity. When the device is in movement within a mobile range area it sends the positioning GPS and water quantity readings back to a receiver. It is then possible to see on a map exactly where the tanker went and where it discharged how much water. The cost of the device is estimated USD 300. Currently the device is being tested with results anticipated by mid-2019.

Mobi-Water, Kenya
http://www.techwatersolutions.com/
Mobi-Water is a real-time water monitoring and management technology that provides information regarding the amount of water in any tank or reservoir to connected mobile devices (phone or computer). The information on the water level is relayed in real time Via SMS format or via the Mobi-Water App. This is a tested innovation that supports the monitoring of water levels within a stationary tank or reservoir.

CityTaps, Niger
https://www.citytaps.org/for-water-utilities
Applying technology such as the CTMeter, which is a Smart Prepaid Water Meter, that measures and sends water usage data in near real-time to Cloud software could support a solution to the challenges surrounding water trucking. Using a device such as the CTMeter which automatically shuts off water access when the customer has no more credit, has the potential to be fitted to water trucks, with a “prepaid” key provided to staff or community member at the delivery point. It would then be possible to measure when and how much water is deposited from the water truck to the site of deposit. This innovation has been tested, is being implemented and working in a commercial setting, it has not yet been utilised in the context of humanitarian water trucking. Such a smart-meter device can also record consumption data (water outflow) to guide optimized routing schedules for water deliveries.

GLOBAL INSIGHTS

The CityTaps approach shares similarities with other pay-as-you-go approaches that are being applied to water distribution such as:

- Uduma, in Mali: https://www.uduma.net/en/uduma-mali-grant-gsma/
- DRC and Grundfos AQTaps in Uganda: https://www.grundfos.com/products/find-product/aqtap.html
- Oxfam's water ATMs in Bangladesh: http://water.oxfam.org.uk/blog-en/atm-water-connecting-technology-to-the-urban-poor/

Norwegian Church Aid experience building a low cost IOT sensor device
Overview presentation and access to open source specifications and code:
https://github.com/haavardaagesen/NCA-WaterSensor
The Water Sensor Project aims to build an IoT (Internet of Things) water sensor for humanitarian water projects around the world. With funding from Innovation Norway, a low-cost solution that is easy to maintain and repair and works off-grid (IOT) is being developed with the intention of being fitted at water delivery points (such as hand-pumps). A test is ongoing in Burundi and Tanzania.

Upande: WaSHMIS platform and picoBRCK, Kenya
https://washmis.com/ and https://www.gsma.com/mobilefordevelopment/blog/three-lessons-to-consider-while-field-testing-iot-hardware-learnings-from-the-upande-grant/
Designed for water and sanitation utility management companies, this solution is an integrated system that supporting data-driven decisions by collecting, transmitting, analyzing and visualizing hydraulic data (flow, pressure, and level), water quality data (chlorine and PH) and customer data from sensors.

SWEETsense Flow
http://impacttrackertech.kopernik.info/products/sweetsenseFlow/
SWEETSense FLOW is a modified flowmeter that monitors water movement through a pipe to derive water usage in various appliances, such as hand washing stations. Sensor can send out alerts at pre-defined alarm point and relays data over GSM networks directly to the cloud server. A variant has also been developed to specifically measure usage of rural hand pumps. Unit cost estimated between USD 400 and 700.

Elrha's Wash Innovation Catalogue, a collection of innovations for the humanitarian sector https://www.elrha.org/wp-content/uploads/2019/01/HIF-WASH-innovation-catalogue-WEB_9.5MB.pdf
Including p44-45: BRCK, UNHCR and partners in Dadaab refugee camp, Kenya developed a custom 'internet of things' reporting tool. The PicoBRCK(Chlorine) water meter collects information on water flows and chlorination testing for remote monitoring in areas where security conditions are an issue.

Wapp/Wadi by Acted, Jordan
To improve management of large amounts of data related to water-trucking in Za'Atari refugee camp in Jordan, Acted is developing a software that will allow digitization of the processes and easier management of routing schedules. The approach includes an electronic voucher system at delivery points.

GLOBAL INSIGHTS

Real-time Chlorine monitoring in water trucks, Save the Children in Iraq
Real-time remote monitoring of water safety (measure of Free Residual Chlorine) delivered to the truck, can be measured with a chlorine miniaturized Chlorine analyser with built in 2G/3G telemetry. This device has been successfully tested and used on stationary water towers in Laylan camp for internally displaced persons and could be adapted to water trucks (if volume and planned duration of use of truck is sufficient to justify the invesmsnt). The cost of the necessary material (Chloroclam, data logger and 2G/3G communication module) is estimated to approximately USD 2,500/system.

More readings:
The 2018 GSMA Mobile for Development Utilities report: The Mobile for Development Utilities programme improves access to basic energy, water and sanitation services in underserved communities using mobile technology and infrastructure.
https://www.gsma.com/mobilefordevelopment/resources/intelligent-utilities-for-all/
and https://www.gsma.com/mobilefordevelopment/m4dutilities/our-insights/

Other interesting resources which can be shared upon request:
- Action Against Hunger has developed a comprehensive operational manual for Water Trucking Operations (currently in Spanish, translation coming up).
- UNHCR has produced a short Briefing Note on Water-trucking guidelines and a series of templates that can be of use to partners, including: Sample Water Trucking Contract, Water Tanker Inspection Checklist, Certificate of Acceptability and Water Tanker Logbook and Refugee Monitor Logbook.
- Response Innovation Lab Iraq: Solutions Pack on alternatives to water-trucking.

We're here to Support you

For further information and support please contact Global Program Director: catherine@responseinnovationlab.com or RIL Uganda Manager : uganda@responseinnovationlab.com and charlene@responseinnovationlab.com

SERVICES WE PROVIDE

1 CONVENE

- Discuss areas you want to improve, for better understanding and solutions
- Find innovations you can use in country
- Find innovators that you can work with in country
- Access innovation forums
- Join a community of innovators

2 MATCHMAKER SERVICE

- Refine your humanitarian challenge
- Search our networks for existing solutions, globally and locally
- Be paired with tested innovations that meet your challenge
- Get evaluation and implementation support

3 SUPPORT

- Access funding pathways
- Get referrals to global innovation networks
- Plan your financial model
- Get support with monitoring and evaluation of innovation projects, business models ethics, intellectual property and so much more.
- Test, pilot, and scale innovations