Aguajïra

the practice of co-design for technology transfer

MIT D-Lab Case Study

MIT | Practical Impact Alliance | SIEMENS | Stiftung


MODULO DE
OBRA CONSTRUIDA EN LA
Dr. ARCESIO JOSE ROMERO PEREZ
DIRECTOR: CORPOGUAJIRA
Dr. PEDRO SEGUNDO MANJARREZ
ALCALDE DEL MUNICIPIO
Dr. JORGE LUIS MIRANDA CORDOBA
SEC. DE

TABLE OF CONTENTS

Visiting the abandoned municipal filtration system "elefante blanco."

ACKNOWLEDGMENTS

MIT Practical Impact Alliance

Led by MIT D-Lab, the Practical Impact Alliance (PIA) is a membership network that fosters collaborative action and shared learning among a community of change-makers from leading business, social, governmental, and academic institutions. By bringing these independent actors together, PIA aims to catalyze change within organizations, generate and disseminate useful knowledge, create practical innovation, and enable effective implementation of market-driven solutions to poverty. Through PIA's activities such as working groups, summits, and innovation challenges, member organizations can increase their individual and collective impact — all while leveraging and supporting the work of MIT programs focused on global poverty alleviation.

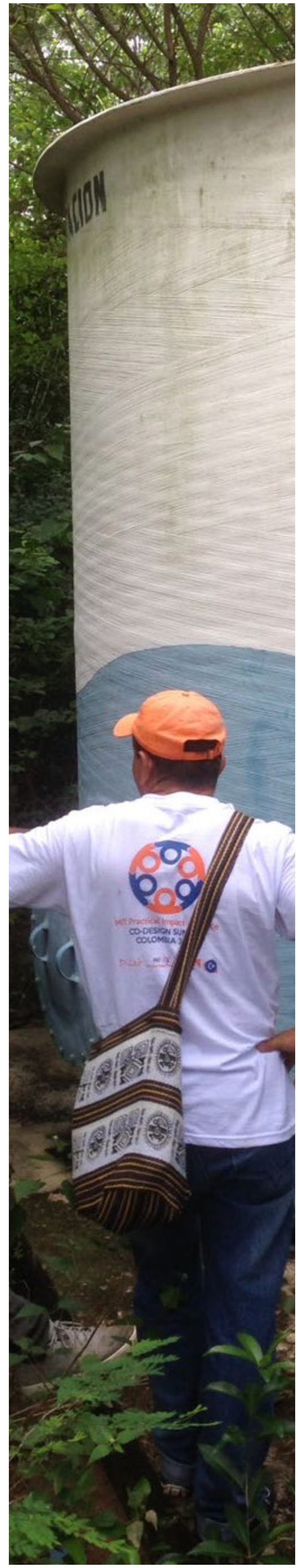
2017 PIA Technology Transfer in Action Working Group

An annual PIA flagship event, the Co-Design Summit is an immersive participatory design experience co-hosted by MIT and PIA members. In 2017, the summit took place in the vicinity of Fonseca, Colombia, in partnership with World Vision Colombia. Triggered by Siemens Stiftung's interest in exploring the role of co-design in technology transfer for development, MIT D-Lab proposed leveraging the 2017 Co-Design Summit to introduce a technology from the Siemens empowering people. Network to the summit's host community of Conejo. An experimental PIA working group formed in the months leading up to the summit to examine case studies on technology needs assessment, evaluation, and transfer. The group identified a need in Conejo around clean water access, and the SkyHydrant as a potential solution. Insights from the case presentations and discussions informed the problem framing for the summit's water team.

Co-led by MIT D-Lab and Siemens Stiftung, this working group included representatives from World Vision, Pact, Johnson & Johnson, the Melton Foundation, and C-Innova. Case presentations were provided by Siemens Stiftung on its SkyHydrant Safe Water Enterprise in Kenya; by MIT D-Lab's Off-Grid Energy research group on its Energy Assessment Toolkit; by aQysta on its Barsha irrigation pump; by MIT's Comprehensive Initiative on Technology Evaluation (CITE) on its water filter evaluation in India; by Aprotec on clean energy technology transfer in Colombia; by Antenna Foundation on water chlorination programs in West Africa & Nepal; and by PV Pure, on reverse osmosis community water filters in Mexico.

Acknowledgments

This case study was made possible by the valuable contributions and rich conversations of the 2017 MIT Practical Impact Alliance working group members: David Hoffmann, Michael Moscherosch, Jean Capili, Taylor Cruz, Lars Dietzel, Alex Freese, and Carolina Hernandez. We would like to extend our appreciation to the guest speakers who lent their experiences and insights to the cases that informed this paper and the summit design: Caroline Weimann and Tilmann Straub of Siemens Stiftung, Eric Verploegen of MIT D-Lab, Jonars B. Spielberg of MIT CITE, Lennart Budelmann of aQysta, Mauricio Gnecco of Aprotec, Fanny Bouloud of Antenna Foundation, and Huda Elasaad of change:WATER Labs. We are grateful to these contributors as well as support from MIT D-Lab's Nancy Adams for her invaluable design work and to Libby Hsu, Laura Budzyna, and Amanda Epting for reviewing structure and drafts. Lastly, a special thank you to the Aguajira team, who shared their input for this case study, as well as to the summit organizing team: Heydi Arevalo, Rosemberg Parra, Alejandra Villamil, Dana Gorodetsky, Amy Smith, and Saida Benhayoune.



FOREWORD

Aguajira: The Practice of Co-design for Technology Transfer, is a case study illustrating how participatory design can be used to catalyze technology transfer across underserved communities and contribute to a transfer's long-term outcomes.

MIT D-Lab and Siemens Stiftung co-developed this case study to share insights from the 2017 MIT Practical Impact Alliance (PIA) working group on the challenges of technology transfer. The case is built around an experiment led by MIT D-Lab at the 2017 PIA Co-Design Summit, where D-Lab's co-design methodology was used as a catalytic process to bring SkyHydrant — a water filtration technology from the Siemens empowering people. Network — to the summit host community of Conejo, Colombia.

The target audience for this case is development practitioners working to bring technology solutions to underserved communities. It is particularly relevant to those who are interested in participatory approaches to development. The MIT D-Lab online course "Introduction to Participatory Design for Development" is highly recommended as a prerequisite to this case study.

The learning objectives of this case study are to:

» Gain a broad understanding of the challenges and best practices around technology transfer in development

» Learn how to apply the MIT D-Lab co-design methodology in the context of a technology transfer challenge

» Connect key concepts of participatory design to technology transfer outcomes

The authors plan to test this case study in various contexts over the course of 2018. We invite you to reach out to MIT D-Lab if you are interested in participating in our testing phase, and we welcome your feedback and suggestions.

Saida Benhayoune
Program Director
Innovation Practice, MIT D-Lab

David Hoffmann
Project Manager
Development Cooperation, Siemens Stiftung

April 2018

TECHNOLOGY TRANSFER: A STEEP BARRIER TO SCALING SOCIAL IMPACT

Demonstration of SkyHydrant water filters. Right: Safe Water Enterprise Kiosk in Kenya.

Technology transfer, in the context of international development, is defined as the process of introducing and handing over an existing technology solution to be implemented and adopted by local communities for the purpose of yielding a lasting positive social impact.

Failures of technology solutions to address international development challenges have been attributed to mistaken needs diagnosis, inappropriate technology choices, and/or insufficient involvement or capacity of local stakeholders.

However, technology transfer can still fail due to a variety of contextual challenges even when the needs assessment is accurate and the chosen technology is appropriate. Obstacles such as insufficient time and resource forecasting, cultural and political barriers, mindset hurdles, lack of local capacity and skills, and the many challenges associated with community relations and partnership management, can inhibit the potential of numerous affordable and proven technologies to solve pressing development problems on a large scale.

Participatory design has been employed increasingly by development organizations to design appropriate technology solutions to unsolved development challenges. By actively engaging beneficiaries in problem solving, the process contributes to a more accurate diagnostic of the problem and eventually to solutions that are more suitable given the context. Participatory design can also yield other positive outcomes such as stakeholder buy-in and long-term commitment.

At the MIT D-Lab, a group of international development practitioners from the MIT Practical Impact Alliance (PIA) came together to examine a new question: How can participatory design be used to effectively catalyze technology transfer? For existing technology solutions that were already proven effective, how can participatory design contribute to a successful handover and ultimately to a sustainable implementation and adoption in new contexts?

In 2017, PIA convened a working group on the theme of Technology Transfer to explore this question and leveraged the 2017 PIA Co-Design Summit to test how the MIT D-Lab co-design methodology would catalyze the transfer of SkyHydrant – an established water filtration technology – to the summit host community.

SKYHYDRANT: A TECHNOLOGY ENDEAVORING TO SCALE

Securing access to basic services is crucial for leading independent and dignified lives. The independent foundation Siemens Stiftung aims to reduce existential deficits in basic services and strengthen local social structures through the dissemination of suitable technology and entrepreneurial solutions.

Through their empowering people. Network, Siemens Stiftung brings together innovators and social entrepreneurs to foster a combination of technical and entrepreneurial approaches. This network promotes the spread of suitable solutions as well as collaboration across development organizations. Siemens Stiftung also operates local projects with partners to implement innovative and proven solutions.

One of the foundation's local projects, Safe Water Enterprise, evolved around the dissemination of the SkyHydrant water filter in Kenya. Some 17 million Kenyans living in remote areas have no access to safe drinking water. They must often walk long distances to the nearest water supply or are forced to drink contaminated water. To address this challenge, the Safe Water Enterprise project deployed small kiosks equipped with mobile SkyHydrant water filters. The filters consist of 10,000 hair-thin membrane fibers that function as a sieve to remove suspended solids, bacteria and viruses from the water. The filtration process operates without electricity and therefore can operate in areas where there is no grid connectivity. Untreated water flows by natural water pressure from a tank. The system can produce up to 1,000 liters of drinking water and can supply nearly 500 households with water.

The purified water is sold to community residents at an affordable price, with earnings covering the operational costs. In addition to expanding the supply of drinking water, community members receive technical and business training to become kiosk operators, and the Safe Water Enterprise creates income opportunities for local residents.

To date, the SkyHydrant filtration technology, provided by the SkyJuice Foundation, is used in 19 Safe Water Kiosks in Kenya and has expanded to numerous other locations around the globe. However, according to the World Health Organization, more than 2.1 billion people still lack access to clean drinking water in their homes.

Siemens Stiftung through the empowering people. Network, is committed to supporting SkyHydrant and other proven technology solutions, by scaling their impact and replicating their success in new markets around the world.

For more information about SkyHydrant:
www.empowering-people-network.siemens-stiftung.org/en/solutions/projects/skyhydrant-water-filtration-systems/

TECHNOLOGY TRANSFER SUCCESS FACTORS: 12 LESSONS LEARNED FROM PRACTICAL EXPERIENCE

Inside a Safe Water Enterprise kiosk in Kenya with a SkyHydrant on the left.

In 2017, an MIT Practical Impact Alliance working group formed to examine the challenges around technology transfer, focusing on the successes and failures experienced during the technology needs identification, technology evaluation and feasibility assessment, and implementation and hand-off stages. Co-led by MIT D-Lab and Siemens Stiftung, the group analyzed five case studies and distilled a list of lessons learned and best practices from the successes and failures shared by the case presenters.

1. Forecast sufficient time and resources

Technology transfer is a time- and resource-intensive process. It is important to take time — sometimes months or years — to develop relationships with local partners, build local capacity, and sufficiently understand the context. It requires multiple trips and extended stays in a community, which can be expensive. Transferring and sustaining technology in remote locations can also be time-consuming and costly.

2. Earn community Trust

Engaging with the communities early in the process and earning their trust from the beginning has proven to be a critical success factor for technology transfer. Continuous presence in the community proves commitment and builds trust and confidence in the process outcomes. Connecting with people at the individual level and sharing personal stories helps to build empathy and set the stage for effective collaboration with the community.

3. Invest in training

Building local capacity in the technical skills needed to manage and repair the technology is an obvious necessity for sustained adoption. Investment in additional skills such as health promotion, economic concepts such as demand elasticity, and entrepreneurial skills development is often important to sustained adoption and the ability to build a resilient ecosystem around the technology.

4. Lead with emotional benefits

Technology adoption is often driven by emotional motivations (fear, joy, hope, pride, power, pleasure) over rational ones (health, money, knowledge). Therefore, focusing on the functional or logical benefits of the technology can be ineffective. In some cases, providing gradual access to the technology (making it exclusively available to a smaller group at first) has also proven effective in creating a pull for the technology.

5. Foster community empowerment

A first step towards technology adoption is for people to believe that the problem can actually be solved and that they have the capacity and agency to be part of the solution. Often, development problems become accepted reality because the affected people end up thinking the problem is too complex to address or that the only possible solutions are out of their reach. Cultivating a "Yes-We-Can" mindset is essential to engaging technology users and community leaders in the broader problem-solving process of which technology becomes a component of the solution.

6. Respect the local culture

Cultural aspects are as important as technical ones. It is important to learn about, understand, and respect local cultural norms and traditions, such as those related to religion, gender, and local governance structures. Showing respect for local knowledge and heritage and demonstrating humility will earn you the community's support and encourage participation.

7. Take an adaptive approach

No two technology transfers are ever alike. Technology setups must be adaptive to account for the variability in local conditions and require context-specific monitoring systems. Implementation models should carefully consider local context and choose between market-driven models and community-managed approaches. Technology transfer tends to be easier in economies where people have demonstrated a willingness to pay for the technology or its output. However, some successes have also been documented with the use of community savings or subsidized schemes.

8. Cultivate community ownership

Many development technologies end up in "graveyards" because the communities perceive them as foreign and expect the donating entity to repair and maintain them. Emphasizing a sense of technology ownership is critical to avoiding such outcomes. Practices that can demystify the technology and foster broad community ownership include encouraging broad participation by leveraging community meetings, including diverse community members, such as women, the elderly, and children in the transfer process; enabling hands-on experimentation and demonstration of the technology's components; and establishing community-led structures for technology implementation and management.

9. Emphasize education

People do not value the benefits of a technology (e.g., safe water or clean energy) if they do not know why it is important to them. They need to understand the alternatives, and why the technology is a better solution. In most cases, investment in education and behavior change campaigns has proven essential to the success of technology transfer. These efforts can be expensive, and often must continue after the technology hand-off, but can be phased out gradually as a technology is adopted.

10. Choose the right partners

The implementing partners can make or break a technology transfer project. In addition to strong ties and commitment to the local communities, several key attributes to consider in the selection of local partners are: strong interest in the technology and its benefits; access to technical expertise; openness to experimenting with technology and new business or implementation models; capacity for implementing and sustaining community education activities; a scalable platform to replicate efficiently; and an entrepreneurial mindset in contexts where a market approach is desirable.

11. Gain political support

Political support is crucial to the effective dissemination of new technologies. This applies both to internal (involved organizations) and external (local governments and informal authorities) support. Gaining high-level support and commitment from all involved partners is very important to sustaining the technology transfer over time and managing the uncertainties inherent to the process. Having the endorsement of local authorities is critical to gaining legitimacy and a license to operate and engage with local communities. Furthermore, engaging local government, though not always possible, can be indispensable to the technology's adoption, sustainability, and dissemination.

12. Make it fun

If it isn't fun, forget it! People will always engage more fully with processes that provide joy. So, making the process fun for all involved is not a "nice to have," it is required to sustain participants' attention and interest throughout the lengthy process of technology transfer. This can be done by encouraging playfulness and creativity in community interactions. And when possible, engage children if they will be using or benefiting directly from the technology.

THE PIA COLOMBIA CO-DESIGN SUMMIT OPPORTUNITY

Prototyping a water kiosk for the SkyHydrant.

In 2017, the MIT Practical Impact Alliance hosted its annual Co-Design Summit in the municipality of Fonseca, Colombia in partnership with PIA member World Vision. World Vision selected the municipality of Fonseca in La Guajira department, an area heavily affected by the recently concluded Colombian conflict.

The PIA Co-Design Summit provided an opportunity for World Vision and other PIA members to engage more deeply with the communities being served, identify concrete development projects, and engage other institutional partners in the region's development. The summit was also an opportunity to build World Vision Colombia's staff capacity in D-Lab's participatory design methodology, particularly as it pertains to technology innovation.

Since November 2016, World Vision Colombia has been working in the Fonseca villages of Conejo and Colonias. The NGO conducted an initial needs assessment that revealed pressing development needs, particularly in water, sanitation, and hygiene (WASH), as well as education. In 2017, World Vision Colombia supported the installation of new sanitary units at the primary schools in Conejo and Colonias and distributed 164 household water filters in the community of Conejo.

Encouraged by the results of this initial investment, World Vission Colombia was exploring opportunities to extend clean water access to the rest of the Conejo community (approximately 600 households and 3,000 inhabitants), one of the main design challenges identified for examination during the PIA Co-Design summit.

At the same time, Siemens Stiftung and Siemens Fundacíon Colombia (another member of the Global Alliance of Siemens Foundations) had been working in Colombia to install SkyHydrant water filtration units in and around public schools. Also, the foundation had strengthened its presence in the country, with an increasing number of their empowering people.Network members starting operations there.

MIT D-Lab convened PIA members, World Vision, and Siemens Stiftung, to consider collaborating on an experiment that leveraged the PIA Co-Design Summit as a means to explore the feasibility of bringing the SkyHydrant technology to Conejo and provide clean water to a larger portion of the population. D-Lab saw an opportunity to catalyze concrete collaborative action between two members of the alliance. This experiment also allowed D-Lab to apply and test its co-design methodology on a new type of outcome: a technology transfer.

As a supporter to many technology ventures attempting to scale through technology transfer, Siemens Stiftung was interested in how co-design could be used to catalyze technology transfer and improve its long-term outcomes. With Colombia growing as a strategic market for the foundation, this was also an opportunity to develop a platform for scaling the SkyHydrant, and potentially other technology ventures, in the country.

World Vision Colombia was intrigued by the opportunity to broaden its expertise in community engagement through the process of co-design of technology, and saw a chance to identify a concrete development project for the continuation of its WASH work in the region. World Vision also wanted to explore the possibility of a partnership with Siemens Stiftung for disseminating SkyHydrant or other livelihood technologies in Colombia.

C-Innova staff joined the summit to build the community members' understanding of the design process and support MIT D-Lab in the facilitation of the design teams at the Co-Design Summit. C-Innova was very familiar with the use of co-design to develop technology solutions with community members, but designing around an existing solution was a new concept for them. As most of their previous work had been focused on creative capacity building at the grassroots level, they were also interested in learning how to engage other value chain stakeholders, such as solution providers and implementing nongovernmental organizations, in the process of co-design for development.

The four organizations started exploring how they might use D-Lab's co-design process at the Fonseca summit to achieve the goals and outcomes outlined above.

PARTNERS

SIEMENS | Stiftung

Siemens Stiftung (Foundation), a German-based foundation, has the goal of reducing existential deficits in basic services and strengthening the necessary social structures through its empowering people. Network as well as its operative projects. **www.siemens-stiftung.org**

World Vision

World Vision Colombia is an organization focused on well-being and comprehensive and compassionate protection of the most vulnerable children through development programs, humanitarian aid and advocacy without political, religious, racial, ethnic or gender distinction. **www.worldvision.co**

C-INNOVA

C-Innova is a Colombian community-based organization that uses design as a vehicle of change for people, communities, and society. It connects community members with resources, opportunities for learning and teaching, infrastructure, mentoring, and an ecosystem conducive to the development of technologies that will have a positive impact on society, particularly in vulnerable communities. C-Innova is part of a global movement working in the establishment, protection, and promotion of self-knowledge and local wisdom of each human group. **www.c-innova.org**

D-Lab
massachusetts institute of technology

MIT D-Lab works with people around the world to develop and advance collaborative approaches and practical solutions to global poverty challenges. The organization's mission is pursued through interdisciplinary courses, research in collaboration with global partners, technology development, and community initiatives — all of which emphasize experiential learning, participatory design, and community-led development. **www.d-lab.mit.edu**

MIT D-LAB'S PARTICIPATORY DESIGN APPROACH

MIT D-Lab believes that design can and should play an important role in international development. Good design can lead to products and systems that help improve the lives and livelihoods of people living in poverty. The design process itself, however, is also a powerful tool for community development. When people are involved in the creation of solutions that improve their lives, they gain confidence in their capacity to change their situation and solve their own problems.

MIT D-Lab defines participatory design as the process of engaging users and other stakeholders in the design process, and distinguishes between three types of participatory design, which are outlined below.

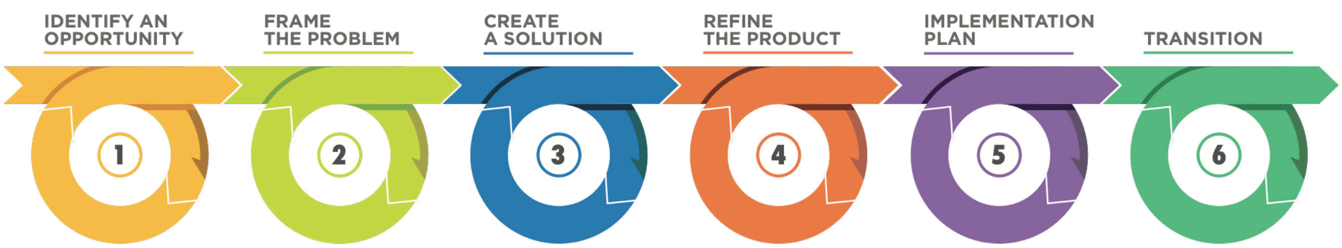
Co-design (or "design with") is the approach applied to the PIA Co-Design Summits, where community members work in teams with outsiders to solve community challenges.

TYPES OF PARTICIPATORY DESIGN

HUMAN CENTERED DESIGN	CO-DESIGN	USER GENERATED DESIGN
Designers work with users and other stakeholders to get input and feedback on the design of products or services and the needs the address. However, much of the design work is done by the designers.	Users and other stakeholders participate actively on the design team, throughout the design process, and work with designers to develop a solution.	Users and other stakeholders are the primary participants in the design team and they develop their own solutions.
DESIGN **FOR**	DESIGN **WITH**	DESIGN **BY**

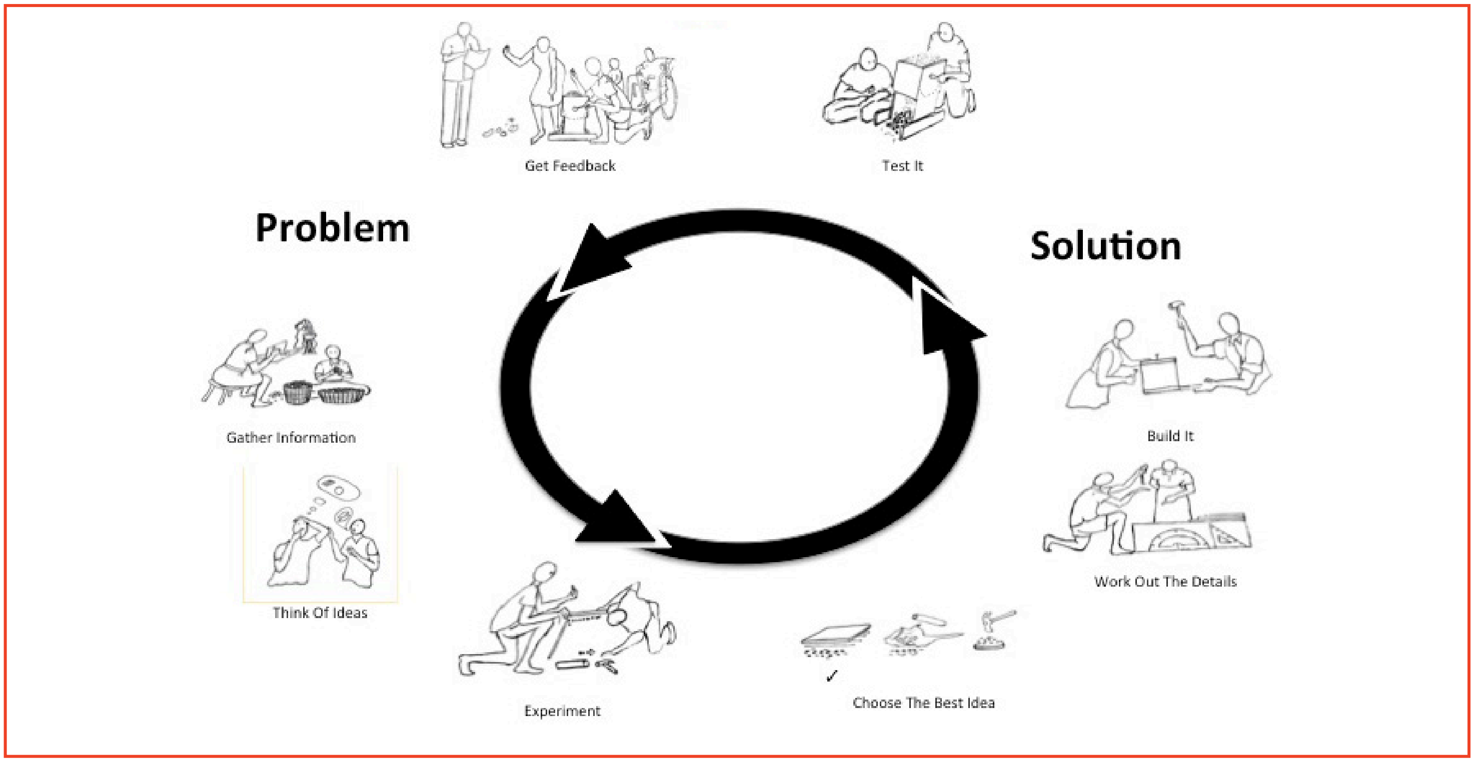
DESIGN FRAMEWORK

MIT D-Lab uses a design framework that consists of six stages, starting with the identification of the opportunity, moving through the development and refinement of the solution, and ending with the transition to implementation.



DESIGN CYCLE

Iteration is one of the most important characteristics of the design process — a constant cycle of learning that moves through idea generation, concept testing, learning from the results of those experiments, iterating again, and continuing to adapt and improve the design. This willingness to experiment and learn from the results is the essence of design and is critical to creating effective solutions that meet user needs.



PIA CO-DESIGN SUMMIT

During PIA Co-Design Summits, design teams are guided through the steps of the design cycle in order to tackle local design challenges. These teams are comprised of local community members, international social impact practitioners from the PIA member network, and stakeholders from the local development ecosystem.

The 5-day summit moves teams through the beginning stages of the design process—opportunity identification and problem framing — as well as the initial steps of solution definition. The summit culminates with a showcase where teams present their ideas for solutions to the broader community and seek feedback on the concepts they selected.

Day 1	TEAM BUILDING	PREP FOR INFORMATION GATHERING
Day 2	INFORMATION GATHERING	INFORMATION SYNTHESIS
Day 3	PROBLEM FRAMING	IDEATION
Day 4	CONCEPT SELECTION	SKETCH MODELING & PROTOTYPING
Day 5	WORKING OUT THE DETAILS	SHOWCASE & COMMUNITY FEEDBACK

AGUAJIRA: PAVING THE ROAD FOR SKYHYDRANT TRANSFER

The water project team in Conejo.

The 2017, PIA Co-Design Summit brought together forty-five participants, including PIA members, Colombian social entrepreneurs, and community representatives from Conejo and Colonias, to practice co-design and explore collaborations.

Five teams formed to tackle concrete local challenges:

- **Education** Restoring the right to education for Colonias families
- **Solid Residues** Transforming plastic waste into building material for affordable housing
- **Excess Fruit** Turning excess fruit harvests into livelihood opportunities
- **Water** Expanding affordable access to clean drinking water
- **Harvest Transportation** Overcoming terrain challenges to transport harvests to market

The water project team presented an opportunity to engage Siemens Stiftung, World Vision Colombia, and the community in co-design around the SkyHydrant technology.

The following problem statement was given to the water team as a starting point:

EXPANDING AFFORDABLE ACCESS TO CLEAN DRINKING WATER

World Vision Colombia has identified access to clean drinking water as a critical need in Conejo. One hundred sixty-four household gravity water filters have been distributed in the community over the last year, but most inhabitants lack a method of purifying drinking water, resulting in a high occurrence of diarrhea and other waterborne diseases. Siemens Stiftung's empowering people. Network has offered to donate a SkyHydrant unit — a community water filter developed by one of the network members that has been deployed successfully in other regions of Colombia — to the community of Conejo. The project team will work with World Vision Colombia staff and community members to determine whether the SkyHydrant is an appropriate solution in this context and potentially design a management system around the technology.

Co-facilitated by MIT D-lab and C-Innova, the project team included three representatives from the Conejo community, two representatives from World Vision Colombia, one representative from Siemens Stiftung, and four individuals from the regional and national development community.

Team Members

Nairis García, Community Leader (Conejo, Colombia),

Kelys Torres, Community Leader (Conejo, Colombia)

Hector Javier Vanegas, Community Leader (Conejo, Colombia)

Ximena Quintero, Director of Corporación Casa Mía (Medellín, Colombia)

María Paula Rincón, Business Developer at aQysta (Bogotá, Colombia)

Sandra Polo, Fundación Cerrejon (Barranquilla, Colombia)

Michelle Castro, Industrial engineer & environmental entrepreneur (Barranquilla, Colombia)

Inmaculada Fernández, Caribe Regional Director, World Vision Colombia (Barranquilla, Colombia)

Angie Hernández, Partnership Coordinator, World Vision Colombia (Bogotá, Colombia)

David Hoffmann, Project Manager, Siemens Stiftung (Germany)

Facilitators

Libby Hsu, Academic Coordinator, MIT D-Lab (USA)

Alex Freese, Co-Founder & Director, C-Innova (Colombia)

The representative from Siemens Stiftung was the only team participant who had experience with the technology. Through his participation in the PIA working group in the months leading up to the summit, he had familiarized himself with the many potential challenges of technology transfer as well as with some of the best practices. In preparation for the summit, he conducted site visits and tested water samples to validate the technology's technical fit. At this stage, however, many key questions remained unresolved:

» Is this technology actually appropriate for the context? If so, when should the technology be introduced to the design team and to the community?

» Will the community be open, receptive, or ready for the idea of a community filter?

» Where should the filter be installed? Who should manage it?

» Would a market-based approach be appropriate in this context? If not, what are the alternatives?

With these questions and many more on their minds, the water team invites you to join them along their co-design journey and help them explore **how each step of the co-design process might contribute to the success factors of the technology transfer**.

As you discover what the Aguajira team did through the co-design summit, review the 12 technology transfer success factors documented on pages 4-5, and try to anticipate which are likely to be reinforced at each step of the design process.

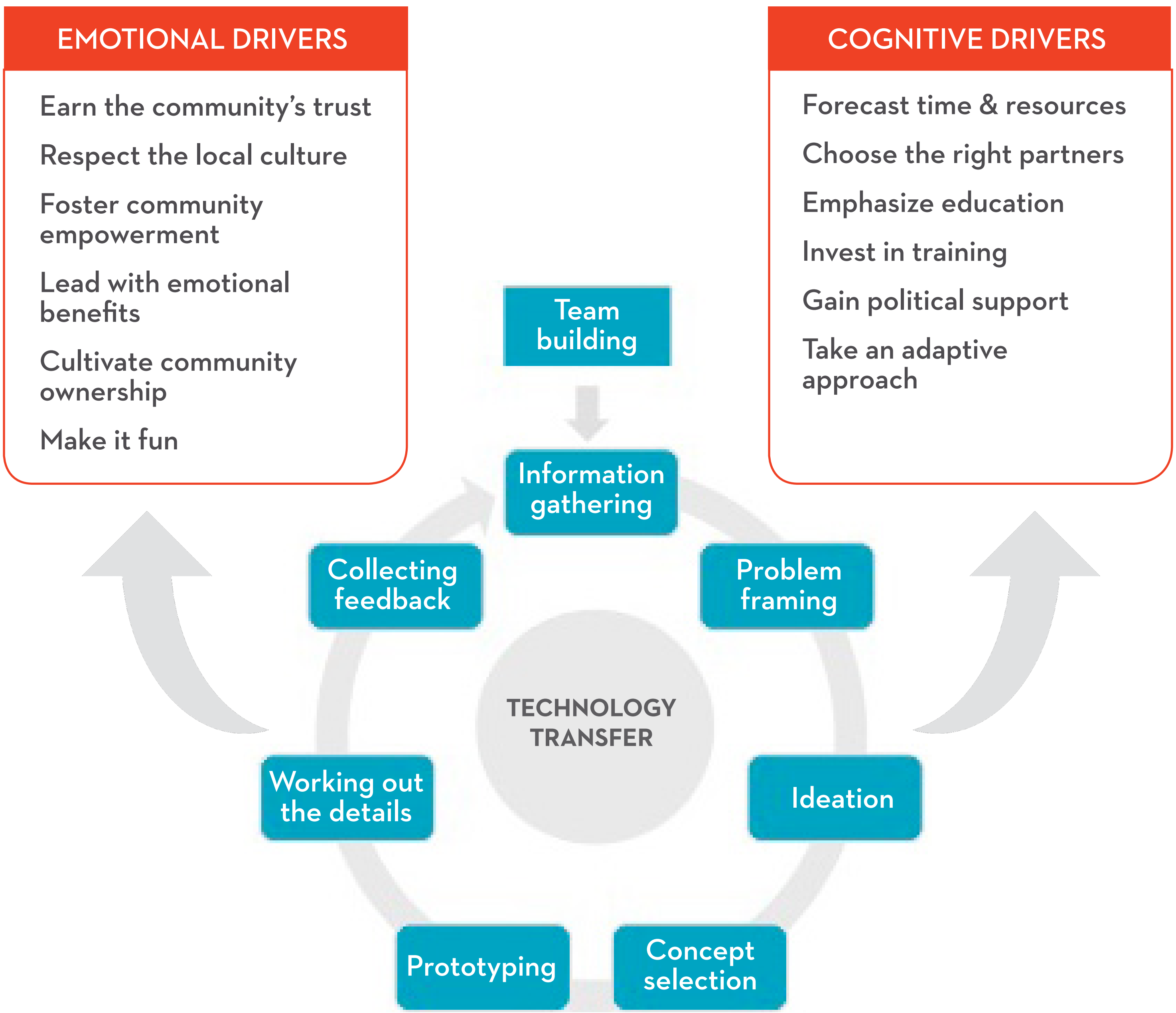
Putting the final touched to the Aguajira booth at the MIT Practical Impact Alliance Co-Design Summit showcase.

FROM CO-DESIGN TO TECHNOLOGY TRANSFER: CONNECTING THE DOTS

The five project teams embarked on their week-long co-design experience guided by MIT D-Lab through the different stages of the methodology.

The following pages describe the Aguajira team's journey and the key questions they explored at each step of the co-design process. We have connected the team's accomplishments to potential success factors of technology transfer for each step. These were selected from the list of best practices identified by the PIA working group (see pages 4-5) and represent the anticipated implications of the co-design process on the future of the SkyHydrant technology transfer in Conejo.

It is important to note that this analysis represents MIT D-Lab's perspective on the potential role of co-design in technology transfer, and that the reflections and assumptions presented have yet to be validated as the SkyHydrant transfer continues to unfold in Conejo over the course of 2018-19.



Team building

Aguajira team practicing the human knot as a team building exercise.

The water team members began the week with a co-creation exercise around community lighting needs. This workshop helped to refresh their understanding of the co-design process and its challenges, and to experiment with the team dynamics in a fun and safe environment.

Throughout the day, they engaged in a series of team-building exercises that emphasize empathy, trust, and intercultural understanding, culminating in the creation of a team charter that defined goals, roles, and ground rules. They selected the team name “Aguajira” and introduced it in the form of a creative presentation to the rest of the summit participants.

Team-building activities at the summit welcome dinner.

Aguajira team members prototyping a lighting solution during the co-creation activity,

KEY QUESTIONS EXPLORED

What challenges can we anticipate from engaging in this co-design process?

What are our respective backgrounds, motivations, hopes, and dreams?

What is our common vision of success for the project?

What assets do each of us bring to the team?

What are our respective working styles and how can we work as a team?

Who will do what?

What ground rules do we agree on as a team?

How might we work through challenges and resolve conflict if it arises?

TECHNOLOGY TRANSFER SUCCESS FACTORS

#12 Fun

Setting the tone and expectation for a joyful co-design experience and establishing that People come before the Processes and Products of design.

#2 Trust

Clarifying intentions and expectations, revealing personal strengths and weaknesses, valuing each member's assets and contributions equally, and developing and committing to a common vision of success.

#6 Respect

Developing empathy for each other's perspectives (including those of community members), understanding cultural norms, and committing to respectful ground rules and conflict mitigation processes.

Information gathering

Visiting abandoned municipal water filtration station "Elefante Blanco."

The team started by listing the key questions they needed to answer to better understand the problem and the local context. They also listed the key stakeholders they wanted to gather input from and prioritized them based on their level of interest and influence on the potential project outcomes. They gathered information through observation, conversations, and focus groups with community members, including a group of children. Some of their key learnings were as follows:

- The water in Conejo comes from a mountain river source, and water is available almost year round.
- The water piping system reaches almost all houses and is cleaned by local volunteers every 3-4 months.
- The village uses about 700,000 liters of water daily, averaging about one cubic meter per family per day, and people pay no fees for water access.
- Most families still buy potable water for 4000 COP per 18-L jug in Conejo, or for 2000 COP in the nearby town of Fonseca, a monthly cost between 70,000 and 80,000 Colombian pesos (USD 24 to 28 monthly).
- Some families use individual household filters (donated by World Vision Colombia). However, some of these families still purchase drinking water due to a lack of trust in the filtration technology.

One of the most important team discoveries was the existence of the "Elefante Blanco" (White Elephant), a water filtration system using carbon, chlorine, and sedimentation in of four 16,000-L tanks. This system was integrated into the water infrastructure and was designed to clean all water flowing into the community. It was installed by the government eight years ago, but operated for only four days. According to locals, this system failed due to the lack of government maintenance and insufficient local technical expertise. They also pointed to issues of land rights around the site where the system was erected. Considering the scale of this system, it was also unlikely that the community could have afforded its operational costs.

KEY QUESTIONS EXPLORED

What is the water source and where does water contamination come from?

How much water is used daily by the community? What is the population's spatial distribution?

What is the water used for and how much is used for drinking and cooking purposes?

How much drinking water does the average family consume weekly?

Do they buy their water or are they using the contaminated water? If bought, where and at what cost?

Are there any other available options to clean the water? What are people using? Do they trust the solutions being used?

Is there awareness of water quality problems?

What are the communities' aspirations regarding access to clean water? Is there a disparity between what people desire and what they can afford?

Who are the key stakeholders to interview or engage on this project? What is their level of interest in and influence on the outcomes of this project?

TECHNOLOGY TRANSFER SUCCESS FACTORS

#10 Partners

Understanding the history and challenges around the government's role and previous engagement with water resource management in the area.

#8 Ownership

Establishing that any initial solution must be driven and managed by the community, as government intervention has failed to launch in this context.

#11 Political support

Establishing that the solution must be developed to prove a case and bring the government back to the table.

#7 Adaptive approach

By understanding the community's ultimate aspiration for having clean running water through the municipal system, the solution must be framed as transitional. Furthermore, by understanding the willingness to pay for water, the team could establish appropriate cost parameters around the solution to make it affordable.

Design team engaging community members in focus group conversations.

Problem framing

Problem framing presentation and feedback session.

After spending a day gathering information, the team had to sort through that information to identify the real problems their solution needed to address. By using the "cause to effect" problem framing wheels, the team identified the following key issues:

- Only a small fraction of the 700,000 L per day is used for drinking and cooking purposes.
- A lot of the water is wasted! The team observed large amounts of the water being wasted, e.g., running taps, overuse of water for cleaning etc.
- High maintenance costs for a large community system cannot be afforded by the community.
- Filter systems are not trusted.
- The community has low awareness of water, sanitation and hygiene (WASH) issues.

KEY QUESTIONS EXPLORED

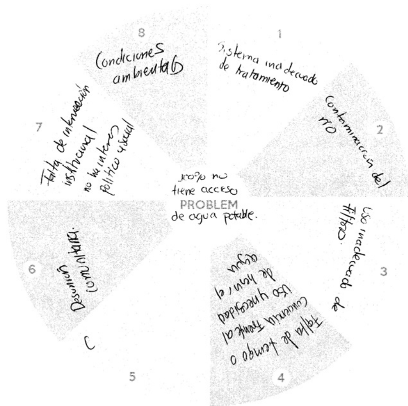
What are the core reasons for the lack of clean water access in Conejo? What effects does this problem have on the affected population?

Which of these issues should be addressed first?

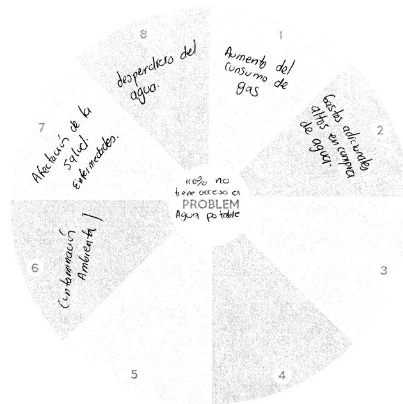
What effects are most desired by the community?

Which of these issues can be tackled effectively by the summit participants, including the community members?

Problem cause



Problem effect



Based on these findings, the team produced the following PATH statement:

"Not a single person in Conejo has access to water suitable for human consumption. This is due to inadequate infrastructure and misuse of this natural resource, and has resulted in ongoing issues for the population's health. For this reason, the Aguajira project, through a participative and formative process, infrastructure improvement, and the promotion of the good use of water, contributing to restoring dignified access and the right to this service and improve the quality of life."

To validate their framing of the issues at hand, the Aguajira team (along with the other summit teams) had the opportunity to present their problem framings and seek feedback from the rest of the summit participants.

TECHNOLOGY TRANSFER SUCCESS FACTORS

#5 Empowerment

Breaking down the problem into distinct and actionable parts that the community understands and feels they can act on.

#10 Partners

Building consensus among participating partners, including the community, around the problem, its causes, effects, and by establishing common priorities.

#9 Education

Identifying the importance of education and behavior change around water use as a critical issue to address alongside the technology transfer process.

The Aguajira team engaged in a problem-framing excercise.

Ideation

The Aguarija team shows off the results of an ideation exercise.

After defining the problem they would solve, the team began identifying design criteria for a proposed solution to holistically address prioritized issues.

They established that, for a technology solution to be viable in this context, it needed to consistently deliver a high-quality product, be easily accessible to the target population (in terms of both distance and time), and cost less than what people were paying monthly for water purchases. The team also specified that the solution should be managed by the community and operated sustainably by generating enough revenue to cover operation costs. Lastly, the team members agreed on the importance of integrating a technology solution with an education campaign that targeted behavior change around water use and management.

The team considered and compared three potential solutions.

Household filters: Some families had household filters donated by World Vision. However, this solution was not accessible to the rest of the population due to high upfront costs. In addition, the filters had a life span of just a few years and a limited capacity. Trust in the technology was also identified as a barrier to scaling this solution.

Municipal system: Reactivating the municipal filter provided by the government would be the ideal community solution. However, this solution did not seem realistically attainable in the short term. It would require greater upfront investment, substantial time and effort to gain municipal and departmental government attention, and unaffordable operational and maintenance costs.

Community filter: A community filter that is cheap to install and maintain, simple to operate, and accessible to the entire population, was considered the preferred short-term solution, while the community lobbies for the municipal solution and brings down its water consumption.

This exercise helped the team confirm that the SkyHydrant technology was worth considering because it seemed viable from a technical standpoint and met most of their key design criteria. The unit capacity was sufficient to filter the daily water volume needed for drinking purposes; the performance adequately filtered out the contaminants detected in Conejo water samples; and the system's compactness allowed it to be easily installed in the village within walking distance to households and without requiring significant capital expenditures.

At this point, the team decided to split into two groups: one focused on designing an implementation plan for the SkyHydrant technology, and one working on designing an education campaign to influence water use habits in Conejo. Both groups included representatives from the community.

KEY QUESTIONS EXPLORED

What scenarios exist around solving the problem of contaminated water?

Is a household or a communal solution preferable?

What are the design requirements for a viable solution?

What are the minimum and aspirational targets for each requirement?

Does the SkyHydrant respond to these requirements? If so, what aspects must be improved to make it a viable solution?

What are the different scenarios for technology implementation and management?

Who should be targeted by the educational campaign?

What approaches can be considered to attract the target population's attention?

TECHNOLOGY TRANSFER SUCCESS FACTORS

#5 Empowerment

By engaging community members in brainstorming and selecting key design requirements, as well as validating the technology's viability, they gained confidence in their ideas and judgment.

Necesidad del usario	Qué van a medir?	Cómo lo medirán?	Buen valor	Mejor valor
Apta para el consumo	Calidad del agua	Analisis de calidad de agua	Cumplir Resolución 2115 de 2015	Resolucion 2115 de 2015
Fácil acceso	Distancia	metros	300 mts	0 mts
fácil acceso	Tiempo	minutos	15 minutos	Inmediato
Salud	Personas enfermas a causa del agua	# personas enfermas / Total de habitantes		0%
Asequible	Gasto en el servicio	$ Costo de servicio mensual	$ 50.000	$ 25.000
Cobertura de plan de capacitación (excursion etc)	# personas que participaron	# personas que asistieron / # Totales	50%	70%
Buen uso del agua	Hábitos y conocimiento	Observación Encuestas		

Design requirements as recorded in the team design notebook.

Engaging school students in conversation about water access and use.

Concept selection

Implementation model proposed by the Aguajira team to the Conejo community.

After brainstorming a few potential solutions, the sub-teams defined specific selection criteria to narrow down their ideas.

The technology sub-team compared scenarios on how to implement and manage the SkyHydrant. The following scenarios considered the number of technology units to install, where to install them, the governance and management entities, and the business model:

- Installing several SkyHydrant units to filter all water
- Installing a unit to filter only drinking water – managed by the community
- Installing a unit at a school and providing water through the school board

Financial sustainability was one of the most important criteria for selecting the appropriate solution. To trigger behavior change, the system had to significantly reduce the cost of clean water (compared to water jug purchases).

However, it also had to generate enough revenue to cover operational and maintenance costs, and it was also important to ensure that the system could be managed and maintained by the community. The team ended up deciding on a community-led service model, where a water kiosk is managed by an elected "water committee." The water would be purified and sold at an affordable price to the community, revenues are used to cover operation and maintenance costs, and a portion is put into a community fund for the water system improvements and to potentially cover the costs associated with the water education and behavior change activities.

The behavior change team engaged with a group of schoolchildren to brainstorm ideas for educational activities that could convey key messages about the importance of water quality and conservation. The team chose ideas that were simple and interesting to diverse audiences across age, educational levels, gender, etc.

The campaign was envisioned as an educational walking trail consisting of several experiential learning stations, where audiences would be exposed to key concepts around water use and management in a fun and interactive way.

Station 1: Microscopic Look Through microscopic observations, enables water sample testing to learn about local water quality and identify the health risks.

Station 2: The Water is Gone Through visual storytelling, elucidates the consequences and dangers of water misuse.

Station 3: Water Roulette Through game play, incentivizes improved water management behaviors and sanctions irrational use of water.

Station 4: Pool of Life Through visual aids (graphics, photographs, or posters), explains water flow through the concrete tank that supplies the village and its surroundings, and helps estimate the amount of water used for human consumption versus other uses.

Station 5: Opportunity Tank Through visual aids (graphics, photographs, or posters), creates awareness about the idle municipal water tanks installed by the government and calls for advocacy efforts to restore the tanks' operation.

Station 6: Pool of Hope Through a scale model of the Sky-Hydrant kiosk, demonstrates how the technology works and is operated to demystify it and build trust in its performance.

Engaging schoolchildren in testing educational activities to promote awareness around water heath and use.

KEY QUESTIONS EXPLORED

What criteria should be used to compare the different ideas generated?

Which concepts respond best to these criteria?

Which concepts are attractive to the community team members? Why?

Are the selected concepts realistic in terms of the available resources and partners' capabilities?

Are we relying on trustworthy data?

TECHNOLOGY TRANSFER SUCCESS FACTORS

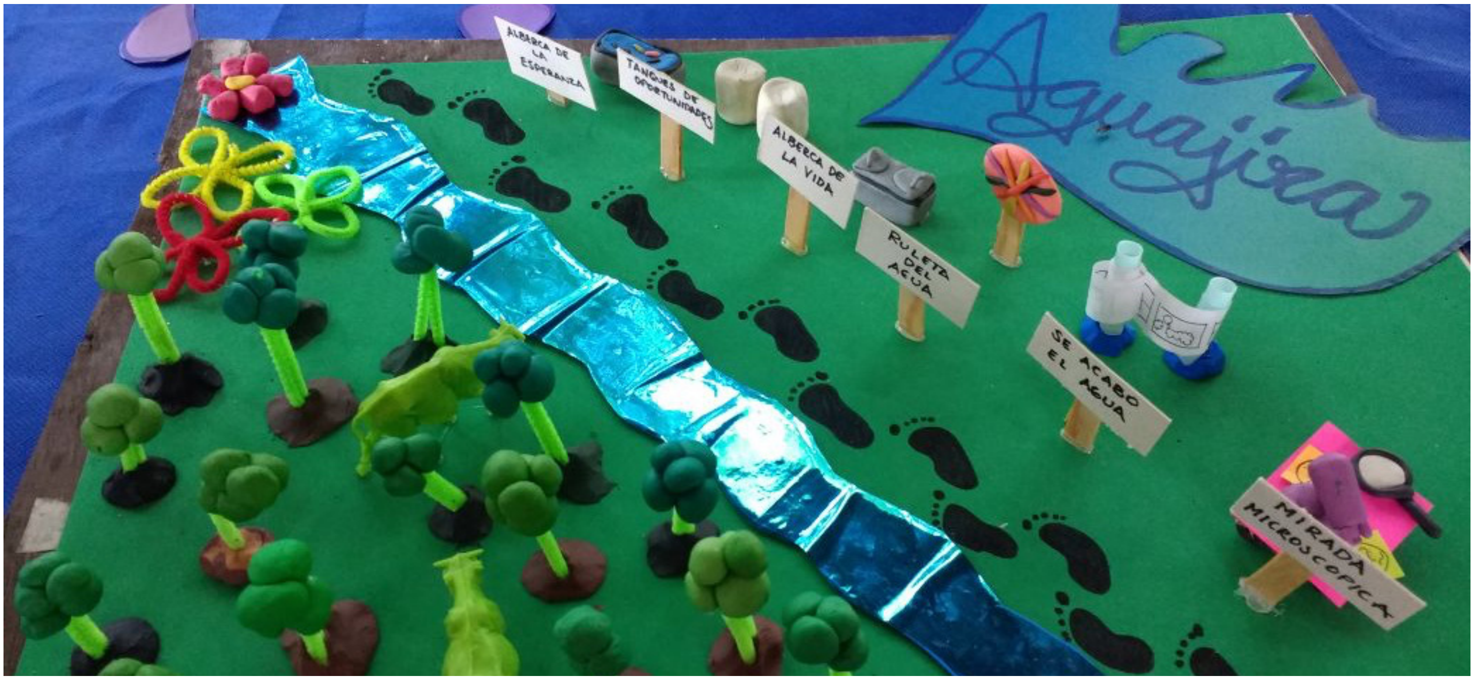
#8 Ownership

Engaging community members in the process of concept selection and giving their perspective strategic importance. Designing a system that has the community's buy-in and commitment.

#9 Education

Integrating a behavior change campaign in the design of the solution.

Prototyping



Sketch model produced by the Aguajira team.

Once ideas were selected, the teams prototyped them by creating and testing three-dimensional models of these concepts. Turning abstract ideas into tangible objects allows team members to test assumptions, identify and address potential flaws in their design, and validate their convergence on the selected solutions. The process often gives community members an opportunity to contribute building or hands-on skills, which helps strengthen their confidence and ownership of the solution. Finally, prototypes or sketch models are useful for gathering concrete user feedback from various stakeholders.

The technology sub-team built a mock-up of the water kiosk showing the stages of water treatment and storage. The behavior change team created a scale model demonstrating the stations along the educational trail. They also built near-life-size models of several educational stations to test the proposed activities at the community showcase.

KEY QUESTIONS EXPLORED

What are the goals of making and testing these 3D models?

What underlying assumptions should be tested through prototyping?

What information do we need to gather with these models? From whom?

Is the team aligned on the vision for the solution represented by the models?

How close to reality should the models be? How do we make them look attractive and engaging?

TECHNOLOGY TRANSFER SUCCESS FACTORS

#12 Fun

Breaking from conceptual thinking and engaging in hands-on creative 3D sketch modeling.

#5 Empowerment

Giving community members the opportunity to contribute and showcase their hands-on building skills.

Working out the details

Scouting potential installation sites for the water kiosk.

At this stage, the teams explored questions to help them refine their solutions and prototypes. They created a financial model for the kiosk's management. They estimated investment and operational costs and calculated the minimum price of water for the system to be sustainable. They also made demand assumptions and compared multiple kiosk locations to maximize foot traffic.

KEY QUESTIONS EXPLORED

What are the construction and operation costs?

Where are potential installation sites?

Who could operate a kiosk? Who could manage kiosk operators?

What level of technical and business training will the operators need?

What are the costs associated with the education campaign?

What are the roles of each partner in the implementation plan, including the community?

Who else should be involved that is not represented on the design team? How do we engage them?

What are the milestones towards successful implementation of the project?

The partners started to assess what needed to happen within their organizations to deliver this vision successfully. World Vision Colombia began exploring how they might be able to support the kiosk construction of the kiosk and integrate the behavior change work in their ongoing WASH and education programs for the region. Siemens Stiftung explored how they might provide technical training and support to the community water committee at the launch of the kiosk and thereafter. Community members thought about who could join the water committee and governance structure around the kiosk and community fund management.

TECHNOLOGY TRANSFER SUCCESS FACTORS

#1 Time and resources

Estimating and agreeing on the time and resources necessary to implement the solution.

#10 Partners

Defining the roles and responsibilities of each partner in the project continuity process.

#3 Trainings

Considering training needs and integrating them in the project's future plans.

Showcase & community feedback

Displaying the SkyHydrant technology, sketch models of the water kiosks and education trail at showcase.

At the Co-Design Summit showcase, project teams introduce their solution ideas to the community through short creative presentations. This event is an opportunity for the rest of the community to discover what the teams have been working on and the ideas they developed, and provide feedback.

The Aguajira team chose a theatrical approach to their presentation, in which they narrated a fictional tale of a water monster taking over a village. This caught the attention of the public and enticed them to visit the team booth where the prototypes were displayed.

At the booth, the team tested some of their behavior change activities with families and children, collecting feedback on the idea of an educational trail. They also presented the concept of the water kiosk by displaying a sketch model of the kiosk, a poster explaining the project milestone, and an actual SkyHydrant filter for the community members to examine.

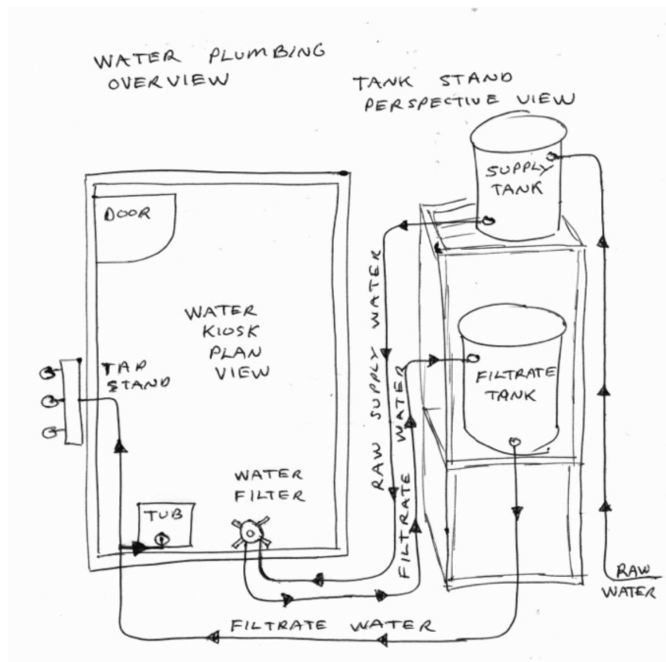
Key community members holding local political and decision-making power were in attendance at the showcase. The team had engaged with some of these stakeholders during the week and took their presence as an opportunity to get feedback and buy-in for the project. The national director of World Vision Colombia also flew in from Bogotá to attend the event and provide opening remarks at the showcase. Her presence and support gave the World Vision Colombia staff license to commit its organization to the project's future.

At the end of the showcase, a symbolic hand-off ceremony was orchestrated to mark the end of the Co-Design Summit and the commencement of the five new projects in their communities. This hand-off celebrated the human and organizational connections fostered over the course of the Co-Design Summit.

Presenting one of the educational stations to schoolchildren at the showcase.

When to introduce the technology?

This question was on the minds of the summit organizers throughout the planning process. Because many aspects of the local context were unknown prior to the summit, it was hard to predict the right moment to introduce the SkyHydrant. Ultimately, due to shipping delays, the SkyHydrant reached Fonseca the night before the showcase. Therefore, the team members encountered the technology at nearly the same time as the rest of the community. In looking back on the co-design experience, the organizers realized that this was in fact a happy coincidence. Had the technology been introduced earlier in the co-design process, it might have biased the team and distracted them from working out critical questions to the technology transfer's future success.



KEY QUESTIONS EXPLORED

Which event attendees are stakeholders with influence on the project's future?

How can we leverage the showcase to get those stakeholders' attention, engagement, and buy-in?

What impressions, feelings, or information do we want the audience to take away? How do we capture the community's attention?

How should we present the sketch models to the community? How can we manage the expectations of the community members?

Should the technology be introduced to the community at the showcase? If so, how do we manage expectations around the technology?

How do we collect the information we need to move forward?

TECHNOLOGY TRANSFER SUCCESS FACTORS

#12 Fun

Creating a joyful and celebratory atmosphere around the co-design outputs.

#11 Political support

Gaining the attention, engagement, and buy-in of key community leaders, as well as World Vision Colombia's senior leadership.

#4 Emotions

Instilling in all participants, particularly community members, a feeling of pride at having created the solution to an important problem.

#8 Ownership

Symbolically handing off the project to the community and giving them a clear pathway towards successful implementation.

THE ROAD AHEAD

View from the road connecting Conejo to Colonias.

The 2017 PIA Co-Design Summit ended with a day of reflection, where the teams debriefed about their co-design journey, took stock of their takeaways, and established continuity plans for their projects. After their team debrief, the representatives of Siemens Stiftung and World Vision Colombia gathered to agree on next steps.

Encouraged by the results of the co-design experience, World Vision Colombia committed to supporting the community in the organization of a water committee and the provision of financial resources necessary to build the water kiosk. Siemens Stiftung committed human and financial resources to support the installation of the SkyHydrant and train the water committee on its operation. The two organizations agreed to develop an MOU to formalize the donation of the SkyHydrant unit to World Vision Colombia and document the next steps agreed upon by both partners.

Reflections: What did we learn?

The Fonseca co-design summit succeeded in bringing Siemens Stiftung and World Vision Colombia together to take their first steps in this technology transfer journey. But how did this collaborative experience set up this partnership and the SkyHydrant transfer for success?

The summit organizers reflected on each step of the co-design process and identified the benefits correlating to the technology transfer success factors that had been identified by the PIA working group.

The co-design process contributed to the success factors through both emotional and cognitive drivers. The emotional drivers most frequently identified throughout the co-design process were related to community empowerment and ownership. Additionally, the fun atmosphere fostered by MIT D-Lab's approach to co-design was identified as important to establishing a positive and collaborative mindset among the stakeholders involved. Aspects related to partner understanding and alignment were the most frequently identified cognitive drivers. Another important contribution of the co-design process in this case was identifying the importance of integrating the technology transfer with education and behavior change efforts.

Through this analysis, MIT D-Lab established a new thought framework for linking the co-design practice to technology transfer success through emotional and cognitive drivers. The emotional drivers affected the design stakeholders feelings and attitudes towards the technology solution and the transfer initiative; while cognitive drivers built their understanding and awareness of the implementation conditions critical to the technology transfer success.

However, the practice of co-design could also introduce potential risks to technology transfer. While risks were not cataloged in this case, a few have emerged from the team debrief and reflections (see quotes below). When the SkyHydrant was transfered to Conejo, the co-design exercise was designed as an experiment within the context of the PIA summit, which has a pre-established audience (PIA members) and specific goals related to broad co-design learning and collaboration. One of the most limiting aspects of this set-up was the relatively limited time available for information gathering and prototyping. Another important limiting factor was the lack of intentionality in selecting the team members. To maximize the benefits of co-design for technology transfer, the members of a design team should ideally represent all key stakeholders and sufficient time needs to be allocated to information gathering and to soliciting user feedback. These steps will ensure the engagement and participation of all parties.

In conclusion, this experiment uncovered some of the concrete benefits of using co-design for technology transfer and enabled the PIA community to create a new framework for thinking about using co-design to catalyze successful technology transfer. MIT D-Lab invites development practitioners working on technology transfer to engage in testing and evolving this framework, and to join the Aguajira team in reflecting on the following broader questions.

1. What are the overall benefits of using co-design as a catalytic process for technology transfer?

"Co-design enables a high level of involvement from key actors or beneficiaries, leading to designs that are more fitting to their environment and need, and generating ownership and commitment to generated solutions." ***Sandra Polo, Fundación Cerrejon***

"The co-design managed to unify the community around a technology that was foreign and not locally developed. It also managed to generate and consider ideas never raised before in the community including managing technology and adopting it as their own." ***Alex Freese, C-Innova***

"The most important benefit of using co-design is community empowerment, which allows understanding development issues from a multiple sociocultural perspective." ***Ximena Quintero, Corporation Casa Mia***

"The participation and organization of the community around the technology, to maintain and defend a common goal is one of the values to be highlighted." ***Hector Javier Vanegas***

	Technology Transfer Success Factors	Team building	Information gathering	Problem framing	Ideation	Concept selection	Prototyping	Working out the details	Gathering feedback
Emotional drivers	Earn the community trust	●							
	Respect the local culture	●							
	Foster community empowerment			●	●		●		
	Lead with emotional benefits								●
	Cultivate community ownership		●			●			●
	Make it fun	●					●		●
Cognitive drivers	Forecast time & resources							●	
	Choose the right partners		●	●				●	
	Emphasize education			●		●			
	Invest in training							●	
	Gain political support		●						●
	Take an adaptive approach		●						

2. What are the limits or risks that could be introduced by using co-design as a catalytic process for technology transfer?

"If co-design fails to generate a real commitment on the part of the community to create, develop, and implement the solutions, this could generate misunderstanding or set false expectations regarding the role of facilitators and other participants in the design process." ***María Paula Rincón, aQysta***

"It is important to remember that by using co-design, future experiences of people, communities, and cultures are being planned, which can be complex in a world that is constantly changing. This becomes a risk for both the project and the beneficiaries, so it is necessary to interpret and anticipate the changes that may occur due to the cultural, social, historical, environmental, and economic diversity of the community." ***Angie Hernández, World Vision Colombia***

"One of the limits of this process is that you have limited historical data to contribute to decision making. For me, a risk is that if the community members were not objective at the moment of giving their opinions about the viability of the solutions, then these developments would be made with erroneous information." ***Michelle Castro***

3. How could the co-design process be improved to maximize its benefits or reduce its risks during technology transfer?

"Technology should never be put at the center of the process. In the case of Conejo, effective co-design facilitation was possible without putting the technology as the goal but as a tool to solve the main problem." ***Alex Freese, C-Innova***

"The use of the co-design process could be improved by involving more community actors, by increasing the time for teamwork, by generating opportunities to engage with state institutions and get their input, and by investing in continuous monitoring of the process and its results." ***Sandra Polo, Fundación Cerrejon***

"The process could be improved by engaging all key stakeholders in a community to give everyone the opportunity to express their opinions, and that these are heard and valued, avoiding that decision-making is inclined towards a single sector or actor in the community, or respond to particular interests." ***Inmaculada Fernández, World Vision Colombia***

Symbolic project hand-off at the Co-Design Summit closing ceremony.

Aguajira team.

design | nancy adams

D-Lab

d-lab.mit.edu