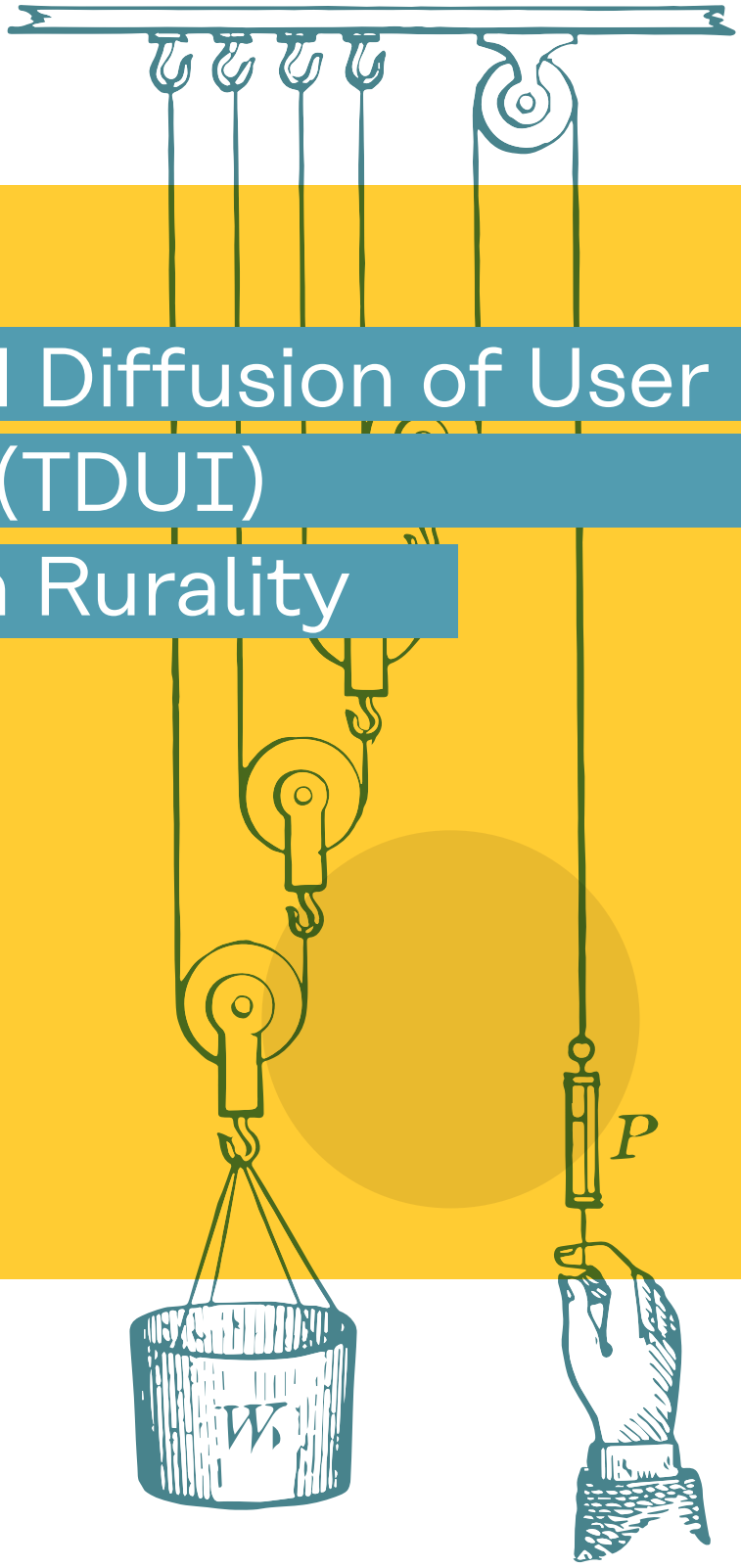
Teaching and Diffusion of User Innovations (TDUI) in Colombian Rurality

December 2023.



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Title
Teaching and Diffusion of User Innovations (TDUI)

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Summary

Summary

The project is focused on experimenting and understanding how to promote the teaching and diffusion of local innovations in rural Colombia. We selected four appropriate technologies from four different territories in Colombia, together with a group of community leaders from those territories. Based on their interests and needs, we prioritized these technologies, researched them, built them in the respective territories, and designed a series of theoretical-practical workshops to disseminate them by building a replica in each region. At the same time, we documented one of these solutions in a detailed and precise manner through audiovisual media, supported using the RETOS technological platform. We accompanied this process with a diffusion strategy through social networks to identify if the public was encouraged to build said technology on their own. All this with the interest of promoting these types of technologies in Colombian rural areas, strengthening networks of community leaders in their regions, and recognizing what incentives are necessary for people to be encouraged to develop technology. Through this we were able to recognize some elements that facilitate diffusion and appropriation in person, such as: the mobility of technologies, articulation with local experts, interrelation with local knowledge, versatility of the technology, or the incorporation in previous work routines, among others. On the other hand, we do not have conclusive results regarding the effectiveness of the exclusively digital diffusion of these innovations because, although we registered people interested in manufacturing them, we were not able to obtain evidence of their construction autonomously, so it is necessary to test other channels and diffusion strategies through these media.

"Grateful for the project because it allowed me to learn about water management in a short time and for allowing us to have theory and practice at the same time"
Peasant in Aguabonita village

General figures

4 Community leaders

4 Replicas of the technologies

4 Territories of Colombia

4 Different appropriate technologies

27 Participants in the co-creation workshops

2.023 Clicks on the diffusion material on the construction of a technology

160 Views of instructive audiovisual material on the construction of a technology

1 Overview

"Our responsibility, as members of a community of scientists, is to know how to interpret this transformation and derive adequate data to understand it in order to help build the future."
Orlando Fals Borda, How to investigate reality to transform it?

The gaps between the countryside and the city in Latin America mean that multiple user innovations cannot be disseminated beyond the moment of being created in a specific place. Some theories propose that this is due to the lack of a platform that facilitates this diffusion or the absence of incentives for this to happen[1]. However, our experience has told us that creating a platform is not enough. For this reason our project seeks to test these hypotheses.

With this in mind, we set out to teach and facilitate the diffusion of these user innovations in rural areas, seeking to recognize what elements are relevant to its success through four technologies and two different approaches[2]. On the one hand, seeking to create communities of learning and practice, interested in disseminating user innovations that have already been completed and considered successful internally. On the other hand, testing whether the detailed documentation of its construction through RETOS, an open platform for the documentation of local innovation, and the promotion on social networks, could generate the necessary interest for other users to autonomously replicate and disseminate such technologies.

In the first case, we make use of action research, and in the second, non-participant observation. The result of these processes generated learning that can be tested and adapted in similar collaborations in other projects in Latin America. We highlight that this project supported the development of technology in the field, the strengthening and creation of links between actors who have historically been excluded from state innovation ecosystems, in addition to corroborating or falsifying widely held theoretical hypotheses about the nature of the diffusion of user innovations. On the other hand, with this project we provide social benefits by creating and sustaining support exchanges between rural organizations that disseminate technologies created by themselves. The diffusion, valorization and visibility of these technologies eases the creation of bridges among users in Latin America.

[1] The Importance of Lead User Innovations—& How to Find & Use Them | Eric von Hippel | Talks at Google, from: here

[2] With user innovations we refer to inventions, or modifications on pre-existing technologies, that are strongly guided by the needs, knowledge and skills of the user in their implementation, which leads them to experiment and propose redesigns adjusted to their possibilities and conditions.

This proposed approach has three great strengths. First, the support of the RETOS platform created in order to document and follow this type of technological developments. Second, it provides support for theoretical advances from experts in grassroots innovations, such as Professor Eric Von Hippel. Third, the use of methodologies such as action research and non-participant observation allow us to know, reflect and intervene in a parallel and continuous manner through two different approaches to the same phenomenon. In addition, it allows a short project feedback cycle and can reduce asymmetries between people and researchers. Finally, it is important to highlight that the project will directly strengthen the diffusion capacities of four groups of grassroots innovators.

The project allowed the following results to be developed:

- 4 different technologies installed.
- 4 replicas of these technologies.
- Structure of workshops for teaching 4 technologies.
- Audiovisual material for the creation of a wastewater treatment system.
- Video of the process.
- This report compiles the process and learnings.

2 Structure

The project was structured in phases:

7 months
Teaching and face-to-face diffusion strategy

3 months
Virtual teaching and diffusion strategy

2.1. Stages of the educational 1:1 diffusion strategy

This strategy was the first to be developed and lasted 7 months, it had the following moments:

1

Convene strategic partners
Starting point of the project that lasted a month. Based on previous long-term relationships and seeking to continue strengthening our relationships with these people and these territories, we invite people to participate in the project and think about topics and technologies of interest.

2

Create a community of learning and practice
For 6 months, through virtual meetings and two multi-day in-person meetings, we created trust and work teams that could support each other while we developed technical skills, researched, and learned new ways of teaching.

3

Select, build and refine technology
We went from exploring the problem to deciding the ideal solution path to developing the necessary construction skills or obtaining allies who could support us in the construction of version 1.0 of the technology.

4

Diffusion in the territory
We profiled the ideal user, disseminated the workshops in the territories, created selection parameters and selected the partner with whom we developed the teaching and construction workshops on their farm.

5

Systematization of experiences:

We explained what this methodology consists of, we created questions of interest for the experience and then we repeatedly answered them through the weekly workshop experience. Finally we meet to process the information collected.

6

Monitoring the use of technologies

During the 4 months after completion, calls were made every month to inquire about the use of each of the technologies.

Timeline phases

Stage	Convene strategic partners	Create a community of learning and practice	Select, build and refine technology	Diffusion in the territory	Systema tization of experiences	Monitoring the use of technologies
Activities	**February** List potential partners and technologies Establish selection criteria Clarification of commitment and payment Clarification and signing of contract	**March April** Listen to ideas from partners Align texpectaions Create inter-personal ties Agree on meeting times Define forms of work and intervention Create a com mon language Create agreements Recognize capabilities Create work team	**April May** Technology analysis Refining proposal Purchase of materials Creation of improvement plan	**May - June** List possible replicators Selection of replicators Design of weekly work sessions Weekly work sessions	**May - June** Research discussion Creation of systematiza tion plan Documentation Reconstruct history Sort and classify information Analysis and synthesis The background reflections Critical in terpretation	**July - October** Calls to inquire about the use of technology

2.2. Stages of the virtual diffusion strategy

This virtual strategy was the B side of the project. Here we sought to explore the second hypothesis of the project: to understand if, through a technological platform and a detailed manual for the construction of a user innovation, any person was interested in carrying out the autonomous construction of said technology. For this we hired an expert in social media management with whom we designed and operated this strategy during the months of October, November and December. This strategy focused on two main movements, the positioning of a blog entry on the e DIVERSA page and a Meta Ads campaign through Facebook and Instagram. Below we describe the schedule of said strategy.

Stage	Creation of the proposal	Strategy creation	Strategy deployment
	October	November	November - December
Activities	Replication of audiovisual material of construction technology	Strategy development and feedback	Publication and content guidelines
	Search for an ally for social media strategy	Metrics Clarification	Review of metrics and messages from stakeholders
	Creation of diffusion ma terial on networks	Correction of diffusion material on networks	Collection of learnings and recommendations
	Signing of the contract with a social media ally	Creation of blog post	Report making

Below is a detail of what was done in each phase.

3 Educational and diffusion strategy 1:1

3.1. Convening strategic partners

"These types of projects, in which we receive remuneration for our community work, have been a great support to be able to continue betting on making a transition in and to rurality to continue sharing ways of caring for the ecosystem"
Community leader, Aguabonita village.

Through years of different co-creation exercises between universities and rural communities in the country, we have built and maintained a network of more than 100 partners with diverse profiles and interests. From this list, we decided to invite two men and two women, looking for them to be from different territories. For this selection we prioritize their community leadership, their autonomy and our previous experience in past collaborations.

This was the first stage of the project and in which we focused on selecting the partners, explaining to them what the project consisted of and beginning to have a preliminary conversation about the possible technologies of their interest. For this, we first look for territories in which we have been able to generate projects that have lasted over time thanks to the collaboration with these people. In a first measure, different regions and in which we will be facilitated with field visits to be able to support the entire process in a more direct way. Thus, 3 of the partners are located in the Cundinamarca savanna at distances that do not exceed a day's travel from the capital. The fourth partner is located in the Bajo Cauca region, in the department of Antioquia, which is a day's drive away and a 1-hour plane ride from Medellín to Bogotá.

Here, through a call, we made a brief presentation of the project and invited them to dream of working on a project that was of interest and for their region, where they could be linked for 6 months with a payment as compensation for their work. It is important to highlight the above, because as an organization we want to begin to be able to generate different labor and financial relationships; most projects related to rurality end up replicating a center-periphery relationship, where people with some academic training who live in the city They travel to rural regions as experts to teach or lead technological development projects. In these ways, the farmer ends up assuming a passive, unpaid role and "beneficiary" of the project. We seek to break these colonizing dichotomies to generate different relationships in the territory and facilitate their consolidation as experts on their topics in their territory in a formal and paid manner.

Below we present the descriptions made by them.

3.1.1. The partners

Cristhella Rodríguez

She is a woman native of Guasca and most of her life has been dedicated to promoting environmental care, agriculture and conservation of peasant knowledge. She is a seed keeper and mother of three children.

Franklin Espitia

He is father of two daughters, who has dedicated himself to farm work all his life in Guavio Alto. He is making the transition towards agroecology, particularly the production of coffee and cocoa. He has always been a person interested in creating machines.

Gilberto García

He is father of five daughters, he has dedicated himself to multiple tasks, including agriculture and mining, but he has always been characterized as a leader who manages projects for his community, mainly finding alternatives to the miners and women.

Eliana Robayo

She is a woman, who, after the birth of her children, began to be interested in environmental issues and moved with her family to the countryside where she learned about self-construction techniques, water management, solar energy and rural education issues.

3.1.2. Their territories

The work territories were:

Silvania

Silvania is located in the eastern Andes mountain range, in the department of Cundinamarca, province of Sumapaz, at an altitude of 1,470 meters above sea level. and only 45 km from Bogotá. Its territory is 163 km2. In this municipality there is the Aguabonita path, which is synonymous with abundant and pure water, since it is the path that is located against the mountain range, at a high point between Sibaté and Fusagasugá, and closest to the foothills of the Páramo del Sumapaz, it is It is characterized by being mostly cloudy, its large water sources and its frequent rainy precipitation. Agricultural production is high, mainly dedicated to fruit trees and vegetables. It is 1 hour from the town center of Fusagasugá.

Aguabonita Forest, from "Comunicaciones Corpochivor", taken from "The mine that threatens the name of Agua Bonita" The 2 shores, recovered from: here.

Guasca

Guasca is a municipality in the department of Cundinamarca. It has a population close to 15,000 inhabitants. It has an average temperature of 15 °C and is located at an altitude of 2700 m above sea level. n. m., situated between the cold and paramo thermal floors. It is located 50 kilometers northeast of Bogotá. It is a place with a tourist vocation, with great water wealth, its economy is based on agriculture (blueberries, potatoes, onions, carrots, strawberries), livestock (focused on dairy production) and floriculture.

Guasca (municipality), taken from Wikipedia, retrieved from: here.

Fusagasugá

Fusagasugá is a municipality of Cundinamarca and is the capital of the Province of Sumapaz, it has grown in recent years reaching around 170,000 inhabitants, being the third most populated municipality in the department after Soacha and Bogotá. It is located 59 km southwest of Bogotá, on a plateau delimited by the Cuja River and the Chocho River, the Fusacatán Hill and the Quininí Hill that make up the so-called Sutagaos Valley and the Chinauta Plateau. Guavio Alto is a village located in the southwest of the municipality, 1 hour by car from the town center. Its main economic activities are agricultural, concentrated in the cultivation of coffee.

Fusagasugá, taken from Linkedin, recovered from: here.

Bajo Cauca

The Bajo Cauca of Antioquia is a subregion of the northeast of the department of Antioquia, in the foothills of the Central Cordillera of Antioquia. It has a population of around 225,000 inhabitants. Zaragoza is one of the towns of lower Cauca and is one of the main river ports on the Nechí River. It has hills from which you can see wide panoramic views, many rivers that form natural pools and a swamp. The main economic activity in the region is mining, there is also agriculture, livestock and fish farming.

Cauca River, Caucasia (Antioquia) Colombia, taken from Wikipedia, retrieved from: here.

3.2. Creating a community of learning and practice

This was a transversal strategy that consisted of having periodic virtual meetings to discuss the topics of interest of the project in a horizontal way. Here we will develop technical skills, research technologies, learn new ways of teaching, among others. We also share our ideas, designs, work strategies and give each other feedback. We were also able to hold two face-to-face meetings at the beginning and at the end of the project. This way of working allowed us to build trust and mutual support, while addressing the issues listed below:

1. Get to know each other, understand the problems and present the technologies.
2. Provide feedback on each of the technological problems and possible.
3. What is appropriate technology?
4. Analysis of the risks of technology development.
5. Design of a work schedule.
6. Skill mapping.
7. Systematization of experiences.
8. Detailed technology design.
9. Creation of parameters for the selection of the replicating neighbor.
10. Design of educational workshops.
11. Design of construction workshops.
12. Feedback from educational workshops.
13. Feedback from construction workshops.
14. Creation of dynamics and participation strategies.

Weekly virtual meetings with community leaders.

The virtual meetings were the weekly accompaniment space to be able to advance at an adequate pace, in this we opened with an icebreaker facilitated by one of the partners, then We shared the work progress of the previous week, to continue addressing some of the previously mentioned topics. At the same time, we had constant communication through a WhatsApp group, where we shared each other's doubts and progress.

Most of these sessions were spent on detailed research and design of the technology, and design and feedback from educational and construction workshops. On the other hand, we had two face-to-face meetings: the first was in the month of April and took place on the Eliana farm, in the Aguabonita village, the objective of this first meeting was for us all to meet in person, each partner to prototype the technology to be developed, and also, test the design of each one's first educational workshop. From this meeting we built a common structure for the design of these workshops. The second meeting was in the month of June for 3 days and we focused on processing the documentation collected during the systematization process to highlight the learnings, we also closed the participation of the partners in the project.

Whatsapp group chat:
"Research Action Appropriate Technologies"

First face-to-face meeting in Aguabonita Cundinamarca.

24 virtual meetings
2 face-to-face meetings of 3 days
4 built technologies
14 educational workshop designs
Accompaniment

3.3 Selecting, building and refining technology

Based on vital interests, their experience and the particularities of the territory, we generated ideas for technologies to work on and then discussed their relevance until we were completely sure that they were appropriate for the project.

This technology selection process lasted two months, from the moment we contacted each partner and they thought about a possible theme, problem and technology, until through our virtual meetings, multiple questions and research on their part, we arrived to decide the problem to work on and the best technological alternative that could be developed. Once this was decided, each project invested between 2 and 4 weeks building the first version of its respective technology.

In this journey we continually questioned whether the interests and abilities of the partner, together with the needs and potential of the region, led us to work on one or another problem and technology. This was the trajectory of each one until reaching the final technology:

- Dry and wet bathrooms / Black and gray water treatment system / Greywater treatment system.
- Dry bath / Solar energy irrigation system / Agricultural bicycle machine.
- Manual and homemade water suction pump / Aquaponic system / Fish farm system.
- Fruit dehydration system / Home energy generation system / Biodigester.

Resources

- 1 workshop on appropriate technologies.
- 1 investigation on the problem and user.
- 1 research on technology.
- 1 in-person prototyping workshop.
- Weekly feedback meeting
- Virtual accompaniment

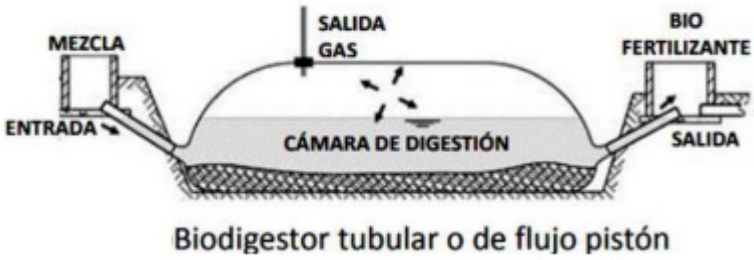
3.3.1. The technologies

Once we went through a series of problems and decided which one we would work on, each partner took the time to thoroughly investigate the different possibilities of the technology, what its operating principles were and what its final design would be. Each technology and its construction process are detailed below.

Biodigester

Problem:

The Colombian rural areas do not have adequate energy systems; most houses cook with firewood or buy gas in pipettes, which implies a high cost in relation to their economic income. On the other hand, animals such as chickens and pigs are raised in these territories and usually end up contaminating the territory's water sources. It is also important to highlight that many of the region's crop waste is not used properly.



Tubular biodigester scheme, taken from "Residual biomass in greenhouse heating system in Cundinamarca", recovered from: here.

Technology:

A biodigester is a technology widely spread throughout the world that consists of a closed tank, where organic waste mixed with water is introduced to be digested by microorganisms. This process produces biogas that can be used to be burned as an energy source after adequate treatment by filtration. On the other hand, a liquid rich in nutrients known as biol is produced and used as fertilizer. Within this technology there are multiple models, but the most popular, due to its ease of construction and economy, is the "Taiwan" model, which consists of a plastic cylinder, sausage type, connected to a loading and unloading chamber, this is accompanied by a series of PVC pipes packed with different types of materials that filter the biogas generated.

Design, experiments and construction of the tubular biodigester version 1.0.

Fish farming system

Problem:

Bajo Cauca is an area that has historically been characterized by mining, mainly gold. To extract this mineral, mercury is typically used, a highly polluting substance that is harmful to human health. When it reaches the water, it enters the food chains because the organisms that ingest it bioaccumulate it. On the other hand, the presence of multiple armed actors and the difficulty of access to the region do not allow for adequate economic development, so the opportunities for legal work are few and poorly paid.

Technology:

In this situation, alternatives have been sought for the food sovereignty of people who seek to consume fish, since it is one of the main foods in the region, but when caught in the river it possibly has traces of mercury. For this reason, the implementation of a fish farming system that can be had at home presents two opportunities, feeding the family and representing an economic income that adapts to the times and possibilities of the tasks that are assumed within a house. This system basically consists of a tank that allows the breeding and growth of the fry, and that at the same time facilitates the oxygenation of the water.

Design and construction of the fish farming system version 1.0.

Agricultural bicycle machine

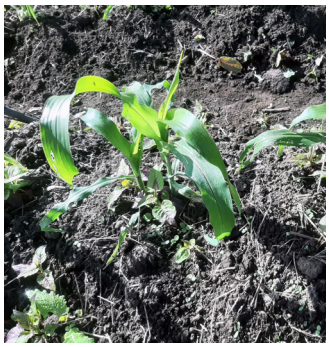
Problem:

The lands of the Andes tend to be uneven and are characterized by being organized into small smallholdings that many families have for sale, for food or as a recreational activity by cultivating in the form of gardens. For these reasons, the use of heavy agricultural machinery is uncommon, since it does not adapt to the characteristics of the terrain or accessing it is very expensive. Furthermore, since this is not their main economic activity, they are often managed by elderly people and children. For these reasons, it is necessary to have mechanisms that facilitate their work, since it is increasingly difficult to find labor for this type of agricultural work.

Agricultural bike version 1.0 and 2.0.

Technology:

Bicycle machines are alternatives to facilitate mechanical tasks in multiple spaces thanks to their economy and the fact that they do not require electricity. For this reason, a technology inspired by the plowing tasks that were formerly carried out by oxen was developed. This consists of a wheel with an axle and a handlebar to which different accessories can be attached for plowing, soiling and furrowing. In addition to developing a simple tool that helps with weeding tasks.



Garden and agricultural bicycle test.

Greywater treatment system

Problem:

Wastewater management in rural homes in Colombia is deficient and is often not done, and in the cases that it is done it is not adequate, since a septic tank and a grease trap are used that are never discharged or are It carries out maintenance leading to the infiltration of said waters, carrying fecal matter and grease to the water sources of the territories.

Technology:

In this sense, it was decided to work on the management of gray water, that is, the water that comes out of the sinks and the kitchen. For this, it was decided to work on three interconnected systems: a grease trap, an artificial wetland and a solarization system. The first allows the aqueous phase to be separated from the oily phase, the second allows most of the contaminants in the water to be retained and treated, and finally solarization allows the remaining microorganisms contained in the water to be removed.

Construction of the greywater treatment system version 1.0 and 2.0.

3.4. Diffusion in the territory

Here each one began to evaluate the possible neighbors to make the replica and formulated the characteristics that were relevant for their selection. Then they agreed on a work agenda and proceeded to develop workshops and construction sessions periodically.

At this time, each of our partners focused on designing a series of cycles of educational workshops and the construction of their technologies and then began to socialize these workshops in their territory. In this diffusion, he profiled possible interested neighbors to finally choose one of them as the main replicator. From there, teaching and construction workshops were held interspersed during the months of May and June. Below are the replicator neighbors, the educational and construction workshops of each of the projects.

Theoretical-practical in-person workshops and territorial call.

3.4.1. Local replication

Below are the descriptions made by each of them about who they are:

Paola Vargas

43-year-old woman, resident of Guasca, mother of a child and industrial engineer. After trying life in the city for a while, she decided to return to the countryside. When she returned to Guasca, she created a garden and is always looking for mechanisms that make her work easier. She is part of an association of quinoa producers, Asoproquinua, where she has coordinated several collaboration projects with the UNDP.

Jorge Andrés Rozo

A 32-year-old man from Guavio Alto, he is dedicated to pig farming and coffee growing as his main activity. In his free time he likes to play soccer and basketball. He recognizes that he is good at identifying new business activities, establishing relationships with people, and has a good ability to transmit ideas so that people are motivated to undertake their own initiatives.

Mauricio Combariza

He is an artist from Bogotá, who migrated to the countryside 3 years ago. He is concerned about the environment, the land, and mainly the management of water sources, and this concern has led him to take action on these issues. He is skilled in crafts and construction.

Cindy Plazas

She is recognized as a social and collaborative person. She has been living in rural areas for 3 years, and is currently learning about permaculture and environmental care. In her free time, she likes to be with nature, take care of animals and learn. She has technological and social skills and considers herself cheerful and very positive.

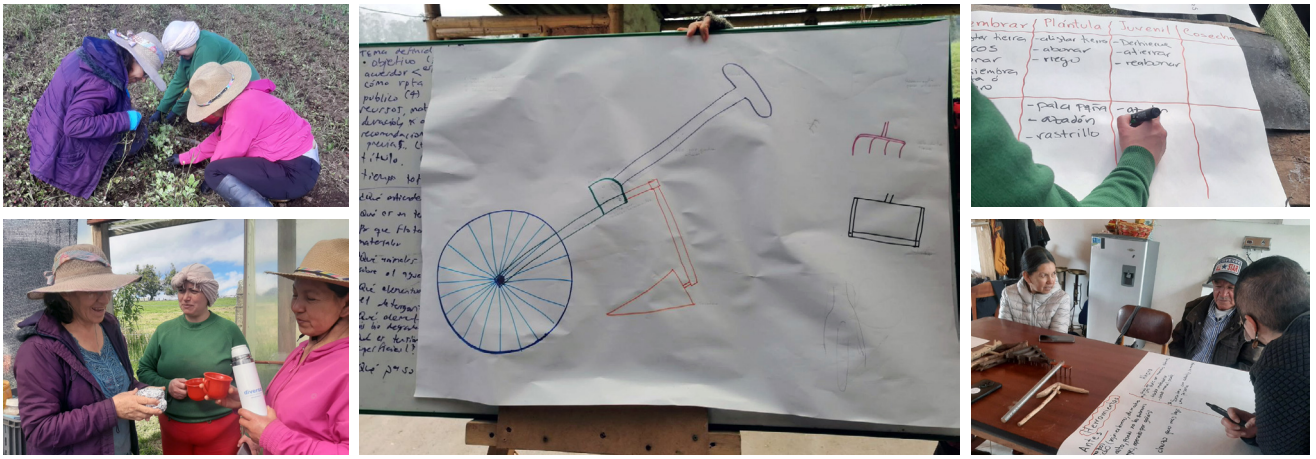
Yeni Suarez

She is a woman who likes to listen to music, takes care of her animals, her house, her children, raises her chickens, works in the garden, and works with the community. She enjoys studying, and listening to others so that they will listen to her.

3.4.2. Educational and construction workshops

Once those interested were gathered, a weekly meeting time was agreed upon where everyone could participate. In this, the learning sessions designed by each of our partners were interspersed with minga-type construction sessions where the neighbor and the other participants actively participated in both the theoretical learning and the assembly of the technology. The topics of each session are detailed below.

Agricultural bicycle machine



Theoretical-practical workshop on agricultural bicycle machines.

Prototype design and construction of the agricultural bicycle machine.

Learning workshops

- Garden work
- Past and present of garden tools
- Ergonomics
- Commissioning of the tool

Construction workshops

- Tool sketches
- Tool prototype assembly
- Tool Base Construction
- Construction of tool accessories

Biodigester

Theoretical-practical workshops and construction of the tubular biodigester version 2.0.

Learning workshops

- Energy use and generation
- Biodigester operation and calculations
- Management of the biodigester
- Commissioning and filtering

Construction workshops

- Civil construction
- Filter and pipe assembly
- Assembly of valves and water trap
- Chorizo assembly

Fish farming system

Theoretical-practical workshops and construction of the fish farming system.

Learning workshops

- Mercury and health
- Food sovereignty
- Environment

Construction workshops

- Handling tools
- Exact measurements and cutting
- Reusing and reducing
- Pond construction

Greywater treatment system

Theoretical-practical workshops and construction of the greywater treatment system version 2.0.

Learning workshops

- What transformation does water present with the products and waste that we add at home?
- How and where does gray water flow from our homes?
- What are the characteristics of an artificial wetland and how do we size it?

Construction workshops

- Setting up the trap
- Pipe and grease trap installation
- Wetland
- Operation and start-up

3.5. Systematization of experiences

The systematization of experiences is a critical interpretation of an experience that, through its ordering and reconstruction, discovers or explains the logic of the process experienced, its factors, the relationships between them and why they have done it this way. It can also be understood as a form of qualitative research that comes from popular education[4], and is characterized by being friendly to different types of users, which facilitates the recording and critical observation of a process by its participants. All this to be able to learn and transform the situation from which we start.

Main features

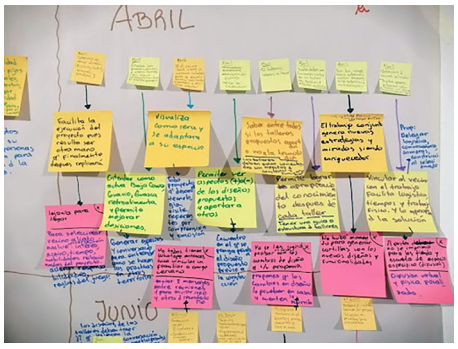
- It produces knowledge from experience, but that aims to transcend it.
- It recovers what happened, reconstructing itself historically, but to interpret it and obtain learnings.
- Values the knowledge of the people who are subjects of the experiences.
- It helps to identify tensions between the project and the process.
- Identify and formulate lessons learned.
- It makes it possible to document experiences and develop communicative materials and products useful for the work of organizations.
- Strengthens individual and group capabilities.
- The people who are the protagonists of the experience must be the main protagonists of its systematization, although to carry it out they may require support or advice from other people.

[4] Mejía, M., & Muñoz, J. (2013). Entretejidos de la educación popular en Colombia. L. Cendales (Ed.). Ediciones desde abajo.

Phases

1. Generate a systematization plan
2. Document the process
3. Recover the process
4. Reflect deeply
5. Generate the products
6. Integrate learning and projections

This was the mechanism we decided to use so that we were all part of the research process.
We start from the creation of a systematization plan to document the learning in the development of the educational and construction workshops of each of the 4 technologies. This was done periodically for 2 months using audios and texts via WhatsApp. Once the workshops were over, we had the meeting in Guasca, at Cristhella's place, where we focused on recovering the process, reflecting and generating proposals for improvement.



Theoretical-practical workshops and construction of the fish farming system.

4 Virtual diffusion strategy

Campaign in Meta Ads

This virtual strategy was the B side of the project. Here we sought to explore the second hypothesis of the project: to understand if, through a technological platform and a detailed manual for the construction of a user innovation, any person was interested in carrying out the autonomous construction of said technology.
This strategy was focused on two main movements, the positioning of a blog entry on the e DIVERSA page and a Meta Ads campaign through Facebook and Instagram. Below we describe the schedule of said strategy.

We carried out a Meta Ads campaign (Facebook and Instagram) with the objective of generating traffic with previously built content, seeking that interested parties will enter the RETOS platform to download the content.

Challenges platform

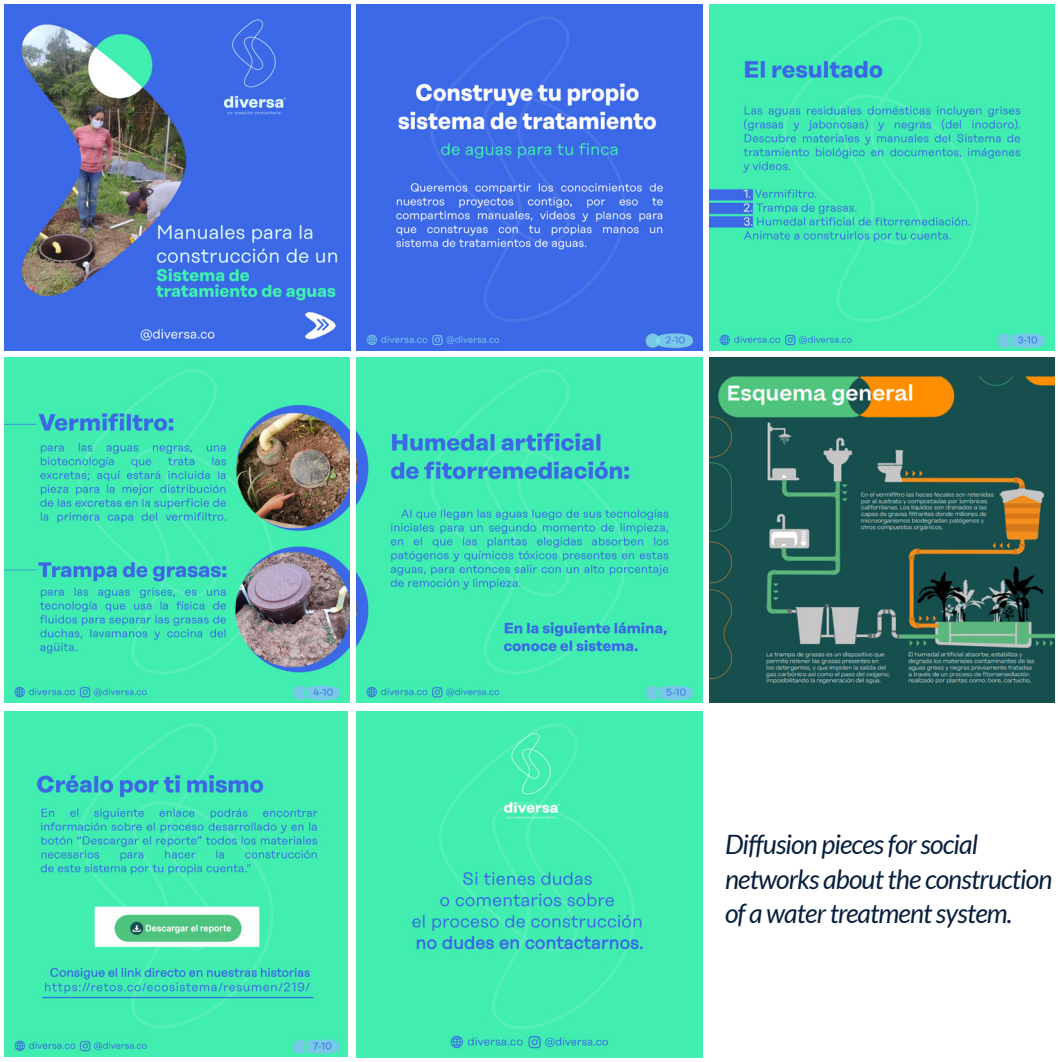
Blog positioning

We sought to create a blog entry based on keywords of the search intention of “construction of wastewater treatment systems” to position the DIVERSA website through Google and the traffic of people towards downloading the documentation. of the project.

Blog entry on the DIVERSA page about the construction of the Water Treatment System.

Resources

- 3 videos of construction of a water treatment system.
- 3 construction manuals for each of the parts.
- Indexing of construction documentation on the RETOS platform.
- 1 carousel of 8 advertising pieces of the construction material of the water treatment system.
- 1 advertising video of the construction material of the water treatment system.
- Commercial guideline for 4 weeks in Meta Ads.
- Segmentation of the interested public.



Diffusion pieces for social networks about the construction of a water treatment system.

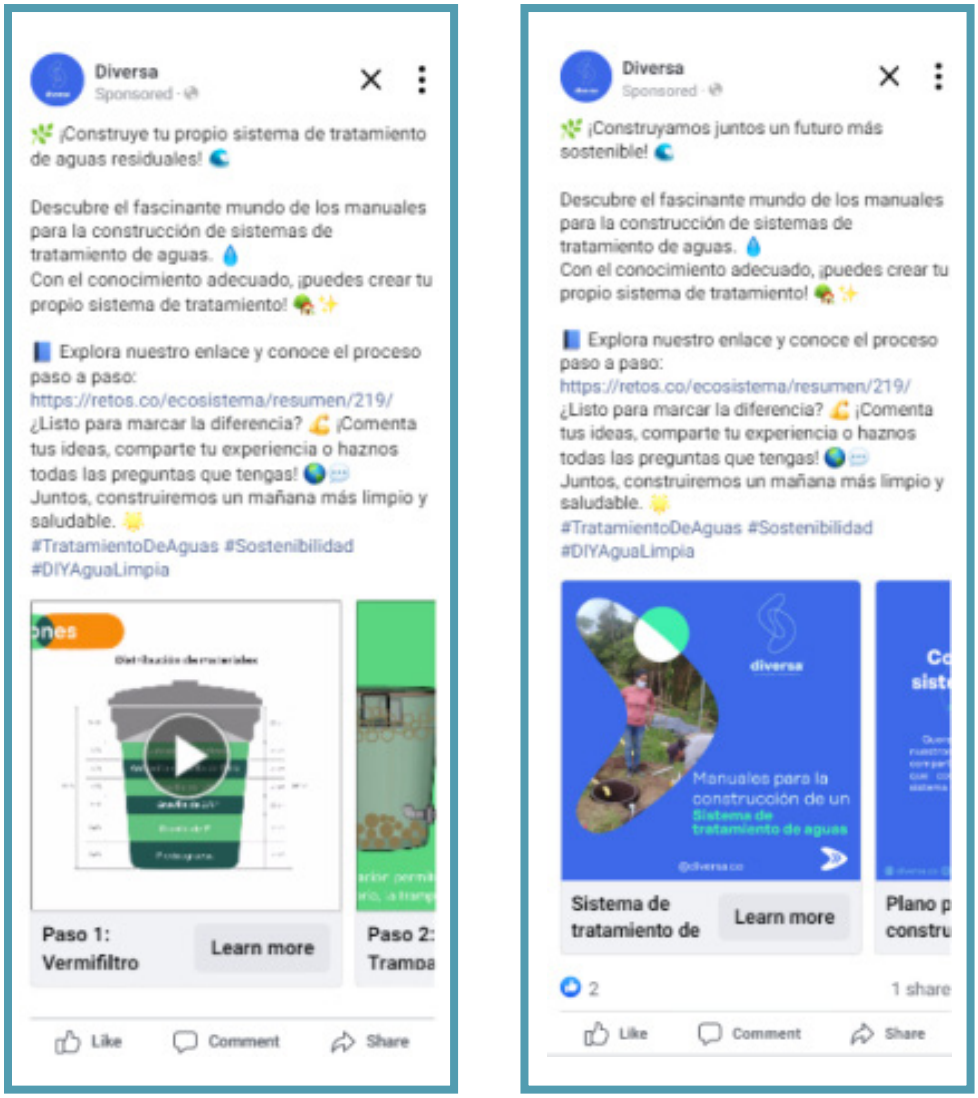
Indicators

The advertising campaign was open from November 16 to December 8. The first week, advertising was advertised daily to understand which days were with the highest performance and based on this information, specific days were chosen for the following weeks.

- The days with the best performance in impressions in Meta Ads (number of times the advertising was viewed) were Mondays with an average of 12,800 impressions and the least were on weekends with 9,500.
- The day with the best performance in clicks was November 22 with 336.
- More generally, Wednesdays were the best-performing days of the week for clicks.
- Based on this data, it was decided that the campaigns would be turned off on weekends to optimize the budget.
- The departments of Meta and Cundinamarca are the ones with the best CTR[5] with 2.1% and 1.8% respectively.
- The general CTR on the publications was very good, almost reaching 3%, which demonstrated interest in the content. However, the CTR to the link on the page, where the manuals were, was only 1.7%, so other calls to action and the page loading speed must be evaluated in future opportunities.
- 50% of clicks come from people between the ages of 35 and 54.
- The public between 25 and 34 years old had a marked interest in clicking to look in detail at the published content.
- Valle del Cauca is the department that has the most clicks with 1,230.
- Although users aged 25 to 34 are not directly segmented, they have a significant interest in advertising.
- Based on the results of this campaign, it is suggested to segment a maximum of two departments with a message specific to the idiosyncrasy of each one.

[5] The CTR (Click Through Rate) is the number of clicks that a link receives compared to its number of impressions. It is always calculated as a percentage, and is a metric that is normally used to measure the impact that a digital campaign has had.

- The advertising with the best performance has been the videos with a CTR of 3%, 2,741 clicks and 74,800 impressions.
- The carousel of images was not attractive to the public, so after the first week it was suspended and only the piece was continued in video format.
- 160 people watched all the videos completely, while 2931 watched it incompletely.
- There were 25 people who saved the publication, which indicates that there is special interest.
- The reach of advertising in images was much smaller, only 28,000 people reached, compared to the 50,000 of the video campaign.
- There was no entry to the blog-type news written on the Diversa page due to the recent indexing of the page.



Publication of diffusion pieces for social networks

5 Results

5. Results

The following 9 deliverables were developed as products of this project:

- *4 different technologies installed.*
- *4 replicas of these technologies.*
- *4 peasants leading processes of technological change in their territories*
- *15 replicantors were involved.*
- *16 training workshops and construction of 4 innovations for users.*
- *Design of the workshop structure for teaching 4 technologies.*
- *Audiovisual material for the creation of a wastewater treatment system.*
- *Video of the process.*
- *This report contains the process and learning.*

6 Learnings

In relation to our fundamental question, about the conditions that facilitate or impede the diffusion of user innovations in rural Colombia, we can affirm that:

- The success of the replication of a user innovation is strongly linked to how it can connect with the previous routines of the potential user. In the 4 replications of the developed technologies, we made subsequent visits and calls to learn more about the use of the technologies. The least used technology in this case was the biodigester, and the reasons for this were related to the fact that the feeding of the biodigester implies an important physical and time effort for the users in their daily life. This feeding task interrupts the routine work of the farm and was not a priority, which encourages its disuse[6].

- The creation of a learning community in relation to a specific topic, for example water treatment, is a useful complement to Von Hippel's proposal to create a toolbox for the "innovative user". This is to the extent that both proposals are aimed at fostering the agency of the user as an active creator of innovations.

- Dissemination mediated by the creation of a learning and practice community should contain elements related to the user's previous knowledge and skills to facilitate their appropriation. In our case we saw this in the design of workshops that are linked to the day-to-day life of the participants. For example, when talking about knowledge, it was important to inquire about fermentation processes through materials from home or to examine the properties of the soaps they use for washing. On the other hand, previous skills such as carpentry, painting or masonry were fundamental to actively involve participants in the design and construction of each of the technologies.

- The user as a producer of innovations has several characteristics that play in its favor: 1) It has knowledge of a local reality that conditions its operation. 2) They have social networks in

[6] During the last visit to Frank, the community leader who proposed this project, on his own initiative and with his own resources, began the construction of a place to raise a pig. This construction is directly connected to the biodigester to automate the feeding of the biodigester with the fecal matter of the sow. This action was born from previous conversations with Frank recognizing how unsustainable it has been to date to feed the system manually on a daily basis.

their territory that facilitate the diffusion of an innovation. 3) It is closer to the means of production of the innovation, which facilitates its direct intervention in case of failure. The first can be seen, for example, with the type of wood and the time of the month when it had to be cut so that its quality is adequate for the construction of the fish rearing tanks. The second could be seen in the search for actors interested in replicating the technology, which was much more effective compared to the virtual dissemination strategy. The third could be exemplified in the improvement developed autonomously by Frank after the completion of our project to have an automated system for feeding the biodigester through a place for raising pigs that he designed and built with his own hands.

- The implementation of a technological platform, in this case RETOS, supported by a dissemination strategy through social networks is not enough to promote the dissemination of user innovations in the territories we work in. We can affirm this based on the fact that we promoted and recognized a virtual public interested in building an appropriate technology on its own through advertising construction manuals through a technological platform supported by social networks such as Facebook and Instagram, we have no evidence that Some of these potential users have built said technology on their own. For this reason, we believe that in the environment in which we work in Colombia, the development of these technologies requires other types of external incentives and other channels of dissemination, both digital and analog. In this case we highlight the importance of a supportive community.

- As explained in the "Systematization of experiences" section, we proposed a series of questions to each of the leaders to observe their practice in the design and execution of the learning and construction workshops. After collecting this information periodically, we proceeded to organize and process it collectively in a 3-day meeting, from this exercise we were able to demonstrate the learning that we present below, organized in 3 categories: methodological, educational and territorial.

Process of building, teaching and disseminating user innovations.

6.1 Methodological

To briefly recall the methodological sequence followed, the partners selected a problem and a possible technology to solve, verifying its relevance in the region. Then they researched in depth about the functioning and development of this technology to make a design and be able to build it on their own and with the support of allies (e.g. a welder) if necessary. From here we had the first version of the technology installed in each of the houses of the partners, after this we proceeded to design a series of conceptual and construction workshops that would allow an interested neighbor to build the technology again while understanding how it worked. These workshops were carried out with the selected neighbor and other interested community members and ended with the start-up and operation of the technology. The following lessons learned from this experience are reported:

6.1.1. Technology Replication

The category that has been of greatest interest to us when talking about replication is that of "appropriation of technology", because it allows us to explore the use of technology by putting the user in an active position, where he creates his own meanings and ways of using it. From this perspective we have been able to highlight the following lessons learned from our experience.

- Technologies that are not installed in one place have a greater potential for dissemination, since circulation in the territory facilitates reaching more interested actors. This is the case of the agricultural bicimáquina that could be circulated by different actors involved in agriculture within the territory. This contrasts with the technologies installed on site, such as the biodigester or the water treatment system, which could only be disseminated to the participants of the teaching and construction workshops.

- For the appropriation of the technology, it is important to incorporate skills already developed in the community to involve, at least partially, the community in the construction phase of the technology. For example, in the manufacture of civil works, carpentry or artistic work that typically has knowledgeable people in the territories.

- In the 4 technologies developed, we recognize the importance of articulating with regional experts for their dissemination, for the development of educational and construction workshops, and to build robust technologies. The biodigester was the only case that did not achieve this, that is to say, to articulate with territorial experts, had a lower diffusion, participation and presented greater difficulties in the realization of the educational and construction workshops and its operation.

- The manufacture of customized agricultural machinery that we developed and call bicimáquina is very expensive compared to conventional commercial alternatives, each version had an approximate cost only in labor and materials of 120 US, while a set of these tools if modified has an approximate value of 50 US.

- In the development of technologies where the construction activities involve a series of technical skills with a certain degree of difficulty, for example metallurgy, the realization of full-scale functional prototypes is an appropriate strategy to involve the participating community in the design of the final solution and at the same time facilitate the appropriation of the tool.

- Only one of the four cases had a third cycle of autonomous replication, in which one of the participants involved in the workshop decided to buy and build the water treatment system for his farm on his own. This highlights the difficulty of replicating appropriate technologies without external incentives such as economic support, workshops or the accompaniment of experts in the territories we work in Colombia. Although there was interest and promises from other participants to, for example, replicate the fish farming system, economic limitations and the prioritization of other projects in people's lives made it impossible to do other autonomous replications.

- Technologies such as the fish farming system have had a strong appropriation in the territory mainly due to three characteristics: the economic potential it can represent, its functional versatility (it can be used for its own food and for sale) and the coupling of its management to the daily dynamics of a household.

6.1.2. Design

- Technological development projects should be based on needs and potentialities felt in the territory and, as far as possible, in relation to the themes of the networks of people with whom we work. Although this seems obvious, the artifactual ways of relating them to technology and the arrival of projects in rural Colombia often overrides this first stage, being a novelty for many of the participants. For example, in the initial formulations, one idea was to make a fruit dehydrator, at the request of one of the participants. Although this may respond to one of the needs of the territory where a lot of fruit is lost due to lack of processing, it is a place where energy availability is very expensive, which makes such a project unfeasible. That is why we moved to another project to cover this energy constraint and decided to build a biodigester.

- The first stage of verification of the problem and the technological solution to be worked on must have some kind of verification with actors of the territory. People's imagination in relation to the potentialities and needs of a territory are limited, so if we do not make an initial review of them with other actors of the territory, we may be working on issues of little interest that will be difficult to replicate in later stages of the project.

- A design that is not totally closed allows involving the neighboring replicators in a more active and proactive way in the development of the technology. We saw this with the modifications proposed for the replica of the fish breeding pond where the shape of the land and the location of the river made it necessary to build a water tank at a considerable height. This challenge allowed those involved to take ownership and design the support structures and all the necessary details to make this modification work.

- The most relevant characteristics when selecting the neighbor replicator through the previous profiling and the work of the partners with their neighbors are: positive, active, communal

and practical. Positive" refers to people who, faced with the difficulties presented, see the possibilities of a solution and do not get stuck. Active" refers to people who were not always waiting for instructions, but proposed the next steps to be taken. By "communal" they mean people who are able to relate to multiple actors in their territory and enjoy this "social bonding" work. By "practical" they mean a person who could intervene quickly in a given situation without having to go round and round in circles.

- Technological development projects must be based on needs felt in the territory. Although this seems obvious, the artificial ways of relating them to technology and the arrival of projects in Colombian rural areas often nullify this first stage, being a novelty for several of the participants.

- The first stage of verification of the problem and the technological solution to be worked on must have some type of verification with actors in the territory.

- A design that is not totally closed allows replicator neighbors to be involved in a more active and purposeful way in the development of the technology.

- The most relevant characteristics when selecting the replicator neighbor through previous profiling and the work of the partners with their neighbors are:positive, active, communal and practical.

6.1.3. Autonomy and communality

- Peer-to-peer work (farmer to farmer) facilitates the creation of trust and solidarity in a work team, seeking to reduce subordinate relationships as much as possible.

- It is important to have expert support when, no matter how much research is done, there is no certainty about the decisions to be made in the development of a technology. However, this should only be an occasional support for farmer leaders seeking to promote the technological autonomy of the community.

- It is strategic to look for experts and knowledgeable people from the same territory in the research and development of the technology to encourage the creation of allies to the project and its dissemination.

- The autonomous construction by the community leaders of a first version of the technology allows recognizing the skills, technical details and concepts necessary for a more accurate replication of the technology.

- Delegating the purchase and assembly of each technology to community leaders facilitates the creation of territorial ties, promotes the dissemination of the project, strengthens the local economy and facilitates the appropriation and repair of the technology in case of failure. This also makes it possible to obtain appropriate materials in the region and to demonstrate how territorial knowledge is very important for the success of the technology, for example for the fish farming tank, the type of wood and the season in which it should be cut.

- It is important to catalyze the project to support the research of each partner's technology and that this will not be done individually because it is a new process for most of them that can be overwhelming at first due to their lack of knowledge and the pressure of having to build a functional technology.

- Although a collaborative construction of the technologies is encouraged, many of the tasks needed to move forward were not accomplished in the construction workshops. Due to this limitation, the partners began to delegate tasks to the neighboring replicators, generating leadership skills on the one hand and autonomy on the other.

- The participating communities recognized the importance of physical group meetings as an increasingly rare practice in the region, according to them these allow them to generate routines, strengthen continuous learning, generate empathy, and enable a group projection as a collective.

6.2. Education

The educational approaches to this project came from a perspective that sought to strengthen local knowledge, self-learning and the linking of theory and practice. In this sense, the first step was for each of the partners to prepare a syllabus on the important points to be taught in order to understand how each technology works, and then each one of them would design a workshop based on their knowledge. From this initial test and their respective feedback we reached an agreement on the elements that are essential for the design of educational workshops, these are: Title, objectives, learning outcomes, subject matter, methodology, duration, audience and recommendations. This was the structure we used as a starting point so that peasants without formal experience in education could design educational workshops on different topics and facilitate them in their respective territories. The following lessons were learned from this work:

- It was recognized that the use of videos for the educational workshops was an effective tool, however, this contrasts with the difficulty of using them by the partners due to the technological gap both in terms of devices and poor connectivity in the territories.

- The realization of simple experiments, for example, observing the fermentation of different products at home, facilitated the involvement of the farming community in the workshops and the link with the project in a more recurrent way from generating conversation around the monitoring of the experiments through virtual and group communication channels such as whatsapp. In addition, it was a useful tool when dealing with complex concepts.

- The participation of the conversation in whatsapp by the different people involved was an indicator of the cohesion of the group.

- The design of educational workshops through the formulation of meaningful questions related to people's daily lives, for example "How do you think a laundry detergent works?" facilitated the involvement of the rural population and the appropriation of this knowledge. This is thanks to the fact that knowledge creation is

a collective exercise and that in one way or another we all have knowledge about the world around us. In this same line, the importance of synthesis is evident and that each workshop will close with a summary of the general ideas of the session carried out by the participants as a group.

- The mixture of theoretical and conceptual workshops allows for a pertinent educational exercise, which recovers the sense of teaching concepts and at the same time allows participants to understand why the technology works and is built in a certain way, in order to be able to make informed decisions in the development of their own assemblies in the future. This could be evidenced in actions such as the recommendations of changes of materials in the development of the technology by the participants. Here we see the potential of this type of approach in which the participants go from replicating a technology to appropriating it, according to their possibilities, knowledge and material resources.

- The first workshop should be held at the farm of the community partner where the functional technology is installed, thus contributing to the generation of expectations in the participants. Then, depending on the particularities of the territory, the other workshops can be held in the farm of the neighboring replicator or in several farms to alternate the organizational leadership in relation to the management of the space, facilitate the creation of neighborhood ties and allow each one to visualize the installation of the technology in their own farm. Likewise, alternating between a theoretical and a practical workshop facilitated the connection of concepts and people's participation.

- It was useful to work with the partners based on their experience, ideas and cultural references and then move on to concepts or abstractions, which facilitated the learning process. For example, in the selection of the ideal partner, they first thought about the person and then about the characteristics or parameters that made that person a good partner for the project.

- It is important to bring in theoretical elements from the areas of Science, Technology and Society to make evident the political and social dimensions of any technological development, since the discourses of technological neutrality, developmentalism and technological dependence are strongly rooted in rural Colombia

- It is important to teach people techniques that allow them to search for information on the Internet from reliable sources. This is given in relation to the fact that for many people the main access to the internet are social networks and google without taking into account tools that allow them to make specific searches and also allow them to filter reliable and useful information.

- Functional prototypes are shown as a relevant initial strategy for each partner to facilitate the understanding of the technology.

- Academic knowledge in relation to ergonomics for the agricultural sector presents many gaps for the conditions of the Colombian countryside characterized by small farms with little mechanization.

- The two male partners do not have professional training, nor basic training, however they have strong skills in relation to manual work, either related to agriculture or mining. Thus, the writing related to workshop design did not have detailed documentation compared to their female counterparts. On the other hand, both women had professional training and one had a master's degree, although neither currently practiced in her field of professional training. This resulted in their documentation of the project being much more accurate and detailed.

- In general, in rural areas they have been accustomed to the visit of technicians who are recognized as experts and explain in a masterly manner some topic to a passive audience. The previous and the magisterial experiences in the schools of the region are the main educational references, for this reason the alternation of practical theoretical workshops and the design of activities that actively involved the participants in the workshops was a novelty and was attractive.

6.3. Territorialities

Three of the territories in which they work (Agua Bonita, Guavio Alto and Guasca) are located in the savannah of Cundinamarca, a region embedded in the Colombian Andes, close to the capital, with typically cold climates and characterized by agricultural and livestock farming. On the other hand, the fourth territory is Bajo Cauca, a sub-region of Antioquia, a day's drive from Medellín, characterized by mining and the historical presence of different armed groups. Thanks to the meetings we had, the partners were able to realize the particularities and similarities of their respective places. The most relevant lessons learned are presented below:

- In Bajo Cauca, the patriarchal particularities in the constitution of the family made it evident that women and children were the main stakeholders in building a fish farming system, and also through them the involvement of men was facilitated.

- Due to the low employability rate in Bajo Cauca and a lower presence of state programs, there are more people with free time at home, which is why attendance to the workshops is higher.

- In the 4 territories it was recognized that community meeting practices are decreasing or in some cases null, for this reason the creation of meeting spaces led by people from the community facilitated the resumption of this practice.

- The promise of developing technological projects in rural areas is particularly attractive to communities mainly due to the material implications they represent in comparison to many projects that are characterized by the realization of workshops and with a large rhetorical component that do not show evident material changes in the community's day-to-day life.

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