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Social Innovation Route as a Methodology for the Construction of Socially Sustainable Innovations

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Abstract

Social innovation is a new solution to a community's problems or needs. This concept is gaining traction in the management of development projects in Colombia given its relevance for the transformation of territories. In this regard, the Social Innovation Route is a methodology created by the Parque Científico de Innovación Social (Social Innovation Scientific Park) of UNIMINUTO that is developed in seven stages: enlisting, understanding, analyzing, creating, implementing, packaging, and scaling; developed in a way to build sustainable social innovations. This article presents how the Social Innovation Route Methodology has been implemented for the consolidation of the entrepreneurship ecosystems, the supply of water to a community, and the strengthening of productive chains and its main results. Therefore, this document constitutes a

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methodological contribution for project managers and development project management institutions whose interest is to generate greater impact and sustainability of their initiatives.

Introduction

The implementation of the Social Innovation Route as a methodology for the generation of social innovations that contribute to the sustainable and integral development of the territories has served as an efficient tool for the collective construction of solutions that promote competitiveness and social appropriation of knowledge. Its practicality allows it to be easily implemented, and it brings together actors to solve real problems. Moreover, it is a tool for the generation with social value that allows the generation of positive social, environmental, and economic transformations, which in turn are sustainable and replicable to the extent that they are generated from the communities.

Step by step, the development of the Social Innovation Route is a guide that serves several purposes, namely: (1) defining problematic situations that afflict cities and communities; (2) understanding the social, environmental, and economic dynamics of the territory; (3) analyzing potential restrictions and limitations; (3) creating solutions; and (4) implementing new strategies that would allow linking public and private actors as well as communities in the construction of new territories from a participatory approach guaranteeing the sustainability of actions and the management of knowledge for continuous improvement.

Thus, this document presents the implementation of the Social Innovation Route in three cases where transformations and empowerment have been achieved in communities. First, it presents the way in which the Social Innovation Route was implemented in the Engativa district of the City of Bogota to strengthen the entrepreneurial capacities of young people in the area. In the second case, we present how this methodology was implemented in the promotion and strengthening of productive chains to promote the sustainable use of natural resources and the generation of income for rural families. Finally, the third case involves the municipality of Mapiripán, where the methodology was implemented for the community's water management, thus linking the inhabitants of the region with the participatory design of water resource management strategies in the region.

Social Innovation and the Social Innovation Roadmap

Social innovation is currently a concept that has been conceived from different angles, since it is still a flexible concept that can be approached from different disciplinary approaches and can also be diverse depending on the territories (Hernández, Tirado, & Ariza, 2016). In the academic literature, it is still a flexible concept that can be approached from different disciplinary approaches and that can also have diverse application depending on the territory. Similarly, Howalt (2016) emphasizes that social innovation is still an uncodified field without a common set of theoretical foundations, data sets, or proven causal relationships. Despite this diffusion of concepts, there are key aspects that are transversal in the conceptual diversity such as cooperation, collaboration, trust-based networks, and the participation of users in the design of products. (Abreu, 2011) .

After years of documenting and managing projects for the development of communities, UNIMINUTO's Social Innovation Science Park designed the methodology of the Social Innovation Route for the management and participatory construction of social innovations for one territory, thus solving pressing social, environmental, and economic challenges. For the PCIS-UNIMINUTO, social innovation is considered a new solution to a problem or need of the community.

This new solution can be consolidated as a product, a service, or a management model that is more efficient than the existing solution. Furthermore, its origins are participatory and link communities and researchers, and that is also sustainable, scalable, and able to generate permanent changes in society.

Illustration 1: Social Innovation Route. Elaborated by PCIS, 2021.

The development of this methodology consists of six stages that can be developed iteratively by the participants. Below are the stages of the social innovation pathway and the purpose of each:

Enlisting: The scope of what needs to be achieved through the route is defined, and the most relevant aspects for the construction of social innovations are planned at this stage, such as the reference framework, work plan, stakeholder mapping, schedule, and financing needs.

Understand and analyze: In this stage, the problematic situation is examined in detail through the recognition of traditional knowledge and scientific knowledge so that both interact in a dialogue of knowledge that allows for the recognition of the region's problems.

Create: In this stage, the different actors that are part of the territories propose one or several solutions to the problematic situation in a participatory manner and based on creative processes.

Implement: Next, the solutions designed are applied in the specific territories, in projects that allow learning in a cyclical manner between implementation, evaluation, learning, and improvements.

Packaging social technology: Once the solutions have been implemented, the methodologies are packaged so that they can be replicated in other contexts with similar problems. In this phase, validated social technologies are built.

Scaling up: Finally, in this phase the social technology is implemented in another context. Here, the process of the social innovation route is carried out again to adapt the social technology to the needs of the territories where the proposal is implemented.

Each of the stages must be carried out in a participatory manner, and from the beginning of the implementation of the route, the actors that are part of the problematic situations must be involved. This participation allows the solutions to be socially, economically, and environmentally sustainable, while they are appropriated by the communities to last over the long-term. Based on the above, three cases of where the social innovation route is implemented to bring about significant social innovations are presented.

Case 1: Generation of capacities for innovation and social entrepreneurship in young people of the Engativá district Bogotá - Colombia

The project "Generación de Capacidades para la innovación y el emprendimiento social en jóvenes de la localidad de Engativá" (Generation of Capacities for innovation and social entrepreneurship in young people in the town of Engativá) is based on the problem of *"high unemployment rates in the town of Engativá"* reported by the local government in its development plan. For this purpose, the Social Innovation Route is employed.

For the Enlist stage, the following parameters to be defined are investigated:

Project scope: According to the stages of the roadmap, the design team defines the scope of the project up to the Packaging stage.

Work team: This comprises professional profiles in the areas of business administration, engineering, social communication, and graphic communication, thus generating an interdisciplinary team that allows us to approach the project with a diversity of perspectives.
Population Group: Based on the problems identified in the locality, the population group is defined as young people between 14 and 28 years of age who have an affinity for entrepreneurship.

Local institutions: In order to identify local actors related to the defined population group, the team conducted a search in secondary sources, consolidating the information and generating an initial map of the territory with arrival routes and names of those responsible for the institutions. The following institutions were identified:

No	Institutions	Number
1	Public and Private Schools	166
2	Universities	3
3	Institutes of higher education	3
4	Technical education institutes	4
5	Non-formal education and labor education institutes	7
6	Youth platform	21
7	District restorative justice program	3
8	Equal Opportunity House for Women	2
9	Community Action Boards	128
10	Indigenous Councils	1
11	Churches	35

Coordination mechanisms: The coordination mechanisms include the areas of project management, community liaison, communications, information analysis and logistical support. Each of the areas are interrelated under a systems thinking approach. Also, technical committees are established for collective decision making, with monthly meetings taking place.

Subsequent to the enlisting stage, the team of professionals develops reports with the analysis of the territory, maps for understanding the dynamics of the locality, generates checklists, and establishes the project team, functions and communication mechanisms that facilitate the development of the understanding stage.

In the understanding stage, Participatory Action Research (PAR) tools are used with the objective of structuring the complexity of the identified problematic situation "*high unemployment rates in the locality of Engativá*" and understanding the visions of the actors of the territory together with their possible solutions. To this end, the territorial liaison team schedules visits with the different actors of the territory, conducts interviews and focus groups, from which they learn that the local youth are supported by their parents who in turn have businesses and constantly motivate them to establish their own businesses. Among the solutions proposed by the actors is to learn from examples of entrepreneurs who give their life testimonies and motivate young people to become entrepreneurs. Moreover, they propose entrepreneurship courses that focus on motivating young people to develop businesses in their locality and that can be taken enrolled in at a university.

Next, based on the results obtained in the comprehension stage, the information analysis team reviews in the databases topics in line with trends in education, identifying the learning methodology by making use of Virtual Learning Object for teaching young people. This involves

reviewing trends in the topics for the creation and start-up of enterprises, including the fastest growing sectors in the locale and country, thus defining and further developing the motivations of young people to start their career projects.

- Learning by doing
- Virtual Learning Object
- Themes in entrepreneurship
- Highest growth sectors
- Motivations to establish life projects.

After obtaining information in a structured manner from the stages of understanding and analysis, the team in charge of the creation stage develops the Inspiration, Orientation, Constitution (IOC) Management Model for the generation of entrepreneurial skills focused on young people between 14 and 28 years of age in the locality, comprising the following components:

Inspiration (I)

In order to motivate and inspire local youth to take the initiative to become entrepreneurs, the team designed a series of meetings for 800 local youth consisting of 11 conferences at strategic points in the locality. At each meeting, a business leader from Colombia presents his or her personal life story, including discussing how their careers started from scratch, careful to include both failures and successes in a way that is relatable to the youth, who can interact by asking questions to the presenters. To close each meeting, the team develops a format for the characterization of the young people, with the objective of knowing in more detail their contexts and realities of life. Analysis of these details allows us to understand the dynamics and ways of thinking of the local youth, their tastes, interests and motivations for entrepreneurship. This has revealed a high interest in social entrepreneurship, the solution of environmental problems in their territories and working with their families in the development of their ideas for solutions.

Orientation (O)

To access this component of the model, participants are required to have attended the largest number of conferences of the Inspiration component and develop a motivational letter demonstrating their interest in continuing in the process. The information analysis team develops an evaluation rubric to identify the 300 young people with the highest motivation for entrepreneurship. At the same time, the project management team designs a 40-hour course under the "learning by doing" methodology, identified in the analysis stage. Practical sessions of four hours per week are proposed to motivate the creativity of young people. The course design includes topics such as ideation, problem solving, teamwork, and presentation of ideas to various audiences. In order to provide an understanding of entrepreneurship as a global movement, the team proposes a workshop on Korean culture with volunteers from this country, who present their customs and ways of learning and discipline, creating a dialogue of cultures among young people. During the

topic of validation, an anthropological reconnaissance of the locality is designed where students know strategic points of their locality and validate their ideas of entrepreneurship with local inhabitants who give feedback, thus generating low-cost validations for entrepreneurs. At the end of the course, a Business Fair is designed, which is the real interaction of entrepreneurs with potential customers and where they have the goal of generating sales of their products or services. This fair is held in a high-travel space and lasts six hours.

Constitution (C)

To access this component of the model, participants are required to have satisfactorily passed the orientation component and developed a one minute video to be uploaded to a virtual platform in which they present their business idea, their contribution to the town of Engativá, while demonstrating their interest in continuing to be involved in the process. The information analysis team develops an evaluation rubric to identify the 100 young people with the greatest motivation for entrepreneurship. At the same time, the project management team designs a diploma course comprising 120 hours under the "learning by doing" methodology, identified in the analysis stage, and practical sessions of four hours per week are proposed to motivate the creativity of young people. The course design includes four modules on prototyping and first invoicing for entrepreneurs, green business for entrepreneurs, marketing for entrepreneurs and costs and finances for entrepreneurs. As a complementary learning tool, the management team designs a Virtual Learning Object (VLO) that enables young people to perform online activities, forums, wikis, taking into account their tastes and affinity for virtual content. During the diploma classes, students build a business plan with financial components that provides a clear picture of the business and serves as a tool for seeking seed capital resources for their ventures.

With the methodological designs obtained from the create stage, the project team begins the implementation stage, obtaining the following results.

IOC management model

To carry out the management model, the implementation team managed the physical locations and materials for the conferences, diploma and non-diploma courses, contacted the most renowned speakers in Colombia, identified the best trainer profiles and developed the logistics for each component. The results obtained in each are presented below.

Inspiration (I)

The participation of the youth population exceeded the expectations of the initial design, yielding a favorable perception of young people's interest in entrepreneurship. It is noteworthy that in the conferences, 20% of the participants are accompanied by their relatives, mainly their parents, who have businesses in operation. Further, in this component they can approach recognized entrepreneurs and ask them about their successes and failures to apply in their own lives.

Item	Planned	Executed
Number of conferences	11	11
Number of participants	800	1300

Table 1. Participants in the inspiration component

Orientation (O)

The 40-hour short course classes are held at the facilities of the Corporación Universitaria Minuto de Dios - UNIMINUTO, providing young people with a university space to motivate them to pursue higher education. For admission to the course, each young person met the requirements designed in the creation stage, resulting in the participation of 330 young people distributed in 13 groups with flexible schedules in the morning, afternoon, evening, Saturdays and Sundays to ensure the participation of young entrepreneurs. According to the design of the course, the students live a shared experience with young Koreans in the Korean Culture workshop, building their entrepreneurial ideas that were validated in the anthropological excursion of recognition and validation of ideas in the town of Engativá. Finally, they sell their products at the Engativá Emprende Entrepreneurship Fair. In the orientation stage, the participation and integration of parents with the young people's entrepreneurship is more clearly evident.

Constitution (C)

For this component, the motivated young people once again meet the entry requirements and the operational team defines those selected to continue in the 120-hour entrepreneurship diploma course in flexible schedules, on weekdays, afternoons, evenings, nights, Saturdays, and Sundays. The total of those selected corresponds to 120 young people with entrepreneurial ideas that progress as each module of the diploma course is completed, until they reach the minimum of being converted into viable products. As accompaniment, the team has two business plan formulators who provide tutoring to students who come accompanied by their parents and 120 business plans are structured throughout the course. At the end of the course, 113 young entrepreneurs graduate with business ideas consolidated and validated in markets, ready to start their entrepreneurial process.

In the packaging phase, the project team conducted an analysis of the lessons learned throughout the project and drew up a consolidated set of best practices to be taken into account when developing further entrepreneurship projects with young entrepreneurs.

- Inspiration, Guidance, Constitution (IOC) Management Model
- Conference development
- Speaker management
- Information analysis of young entrepreneurs
- Development of courses and diplomas for entrepreneurs.
- Integration of parents in youth entrepreneurship ideas

- Development of entrepreneurship fairs
- Management for the participation of international young Koreans
- Management of anthropological reconnaissance trips in Bogotá's localities
- Development of graduation events

Based on the good practices developed, the team is seeking funding for more entrepreneurship projects to be carried out in other parts of the country.

Case 2: Strengthening of the Guadua Production Chain in Cundinamarca

Bamboo is the common name attributed to the group of Gramineae plants (relatives of grasses and cereals) that comprises more than 90 genera and 1,600 species around the world. Due to its versatility in the international market there are different products made from bamboo, such as food, textile fibers, activated carbon, laminates, including use in the construction sector (Quevedo, 2018). In addition, it is an important environmental resource that provides ecosystem services such as biodiversity conservation, CO2 capture, water and soil protection, and temperature regulation (Muñoz, Camargo, & Romero, 2017).

Colombia is second only to Brazil in bamboo species diversity, with 28 genera, 105 species, and five varieties distributed in the departments of Norte de Santander, Cundinamarca, Cauca, Valle del Cauca, Antioquia, Huila, Nariño, and Quindío (Observatorio de Agrocadenas Colombia, 2004). Colombia formed the Guadua Production Chain in 2004, and the departments located in the western mountain range have made the most progress in terms of technology and production. On the other hand, Cundinamarca is characterized by the wild production of the Guadua angustifolia kunt species, despite the fact that there is currently no detailed inventory according to province (CAR, 2012). There is an estimated 606 hectares of guaduales in the department, of which 378 hectares are natural and 228 hectares planted (Fiquitiva, 2018). In total, the department has about 5,000 hectares of which 95% are natural guaduales and 5% are plantations.

Despite the fact that the department has all the necessary conditions for the productive development of Guadua, this resource has been valued as a material for the "poor" people, which has led to the waste of its potential for the production of products and, consequently, to its economic and environmental waste. In addition to this, several factors have led Guadua producers in Cundinamarca to ignore the market potential of bamboo, including: limited spaces for the transfer and construction of knowledge for the technological and productive development of this resource; the scarcity of market studies; and the lack of knowledge of the Colombian standard for the sustainable use of bamboo. Therefore, theses producers have preferred to eradicate it and replace it with short-cycle crops that generate a faster return on investment, such as coffee, cocoa, and citrus.

Given this scenario, the Parque Científico de Innovación Social – UNIMINTO has been working on the Social Innovation challenge "Aprovechamiento Sostenible de la Guadua para el fortalecimiento de la Cadena Productiva de Cundinamarca" (Sustainable Use of Guadua to

strengthen the Productive Chain of Cundinamarca) as a bet to promote its sustainable use and the diversification of the income received by rural communities present in territories that are victims of the department's conflict. The development of this challenge through the Social Innovation Route Methodology began in 2017 when, together with the inhabitants of Rionegro Province, a potential for the use of this resource and its transformation into products that would allow families to diversify their sources of income was identified.

The implementation of this methodology began with the Enlist Stage, in which the frame of reference was defined, including the description of the problematic situation, the context, the people involved, and some initial ideas for solutions. This work was carried out through working groups with institutional and community stakeholders in the Rionegro Province, who defined the initial problem as the sustainable waste of guadua in the Rionegro Province. Subsequently, a stakeholder analysis was carried out, listing those public and private entities that support or are harmed by the use of guadua, identifying a total of 120 regional, departmental, national, and international stakeholders that are part of the guadua production chain at different scales. Subsequently, a brainstorming session was held to postulate different solutions and project ideas to the problematic situation raised from the different visions of the participants, among which the following stand out: (1) Forming forestry nuclei, associations and civil society organizations, (2) Providing technical support for the silvicultural management of the guadua trees in the area, (3) Training people to work in the production chain, (4) Consolidating green businesses with the guadua in the territory, and (5) Establishing a guadua processing plant in Rionegro to make chopsticks.

The Understanding + Analyzing Stage was developed through an immersion exercise where professionals from different areas of expertise such as business administration, social work and engineering of PCIS-UNIMINUTO, collaborated with the guadua producing families of the municipalities of Pacho, La Palma, El Peñón, Topaipí and Yacopí for two months in an exercise of approach, listening, and understanding of the communities' appreciations about guadua and their relationship with caring for, conserving, and using this resource. As a result of this exercise, an analysis of the problematic situation from the point of view of the different actors that are part of the challenge, the analysis of the interests and contributions that those involved can give to the challenge, and the definition of the challenge with which the design and creation of the solutions will be carried out.

In the Creation Stage, workshops were held to create solutions and projects to be implemented over the short-, medium- and long-term, which would contribute to the solution of the challenge "Aprovechamiento Sostenible de la Guadua para el fortalecimiento de la Cadena Productiva de Cundinamarca" (Sustainable Use of Guadua to strengthen the Productive Chain of Cundinamarca), in an initial phase in the Rionegro Province. From these working groups, initiatives were created to strengthen the challenge of Social Innovation from development and research projects as a commitment to strengthening in two ways from the social management of knowledge. As a result of this phase, the development project "Extensión y puesta en marcha de la estrategia identificada frente al uso y aprovechamiento sostenible de la guadua en los municipios de Pacho, La Palma, El Peñón, Topaipí y Yacopí" (Extension and implementation of the strategy identified

for the sustainable use and exploitation of guadua in the municipalities of Pacho, La Palma, El Peñón, Topaipí and Yacopí) and two research projects "Caracterización ambiental para el desarrollo y uso de la guadua en los municipios de Pacho y La Palma" (Environmental characterization for the development and use of guadua in the municipalities of Pacho and La Palma) and "Estudio de los efectos frente al aprovechamiento de Guadua Angustifolia Kunt, generados por programas sociales en los municipios de Pacho y La Palma, Cundinamarca" (Study of the effects of the use of Guadua Angustifolia Kunt, generated by social programs in the municipalities of Pacho and La Palma, Cundinamarca) were designed.

Finally, in the Implementation Stage, during 2017 and 2018 the development project was executed with funding from the Corporación Autónoma Regional de Cundinamarca- CAR, with the participation of 360 families. The first phase that was implemented was the Social Component: here 10 civil society organizations and three forest nuclei were formed for the use of guadua. The groups were accompanied by experts to learn how to apply for harvesting permits and improve the quality of the guadua. Next, the Forestry Component was implemented through the improvement of existing guadua plantations and the establishment of new hectares of guadua under the sustainable production approach. Next, the "Fortalecimiento de la Cadena Productiva de la Guadua en la Provincia de Rionegro" (Strengthening of the Guadua Production Chain in the Province of Rionegro) diploma course was developed, fortifying the capacities of 180 people on issues related to the silvicultural management of bamboo, the value chain, associativity and post-harvest, and processing of guadua. Finally, new green businesses were consolidated from the use of guadua and commercial alliances were established to facilitate the sale of products made from guadua generated by the participating families.

From the implementation of this project, the communities of the participating municipalities understood the environmental, productive, and social importance of guadua in their territory, valuing it as a resource that was part of their history and with which they can diversify their income through sustainable use. Likewise, the development of this productive project from the social innovation approach based on the implementation of the Social Innovation Route allowed the participating communities to become involved and take ownership of the process to continue generating community initiatives that strengthen the region's productive chain, and thus participate in the forest governance of this resource. Currently, due to the results of the project and the acceptance of the communities of the methodologies implemented. The components and service packages provided during project implementation are in the packaging stage so that this model can be replicated in other similar contexts and/or with other production chains.

Case 3: Water is life for the cooperative

Between November 2018 and September 2019 the Social Innovation Scientific Park of UNIMINUTO and the Research Unit of the Orinoco headquarters of UNIMINUTO carried out the project **"Manejo *y tratamiento del agua mediante tecnologías apropiadas en la inspección de La Cooperativa-Mapiripán (Meta*) con apropiación social del conocimiento mediante las TIC'S " (Management *and treatment of water through appropriate technologies in Inspección La Cooperativa-Mapiripán [Meta]* with social appropriation of knowledge through ICT**).

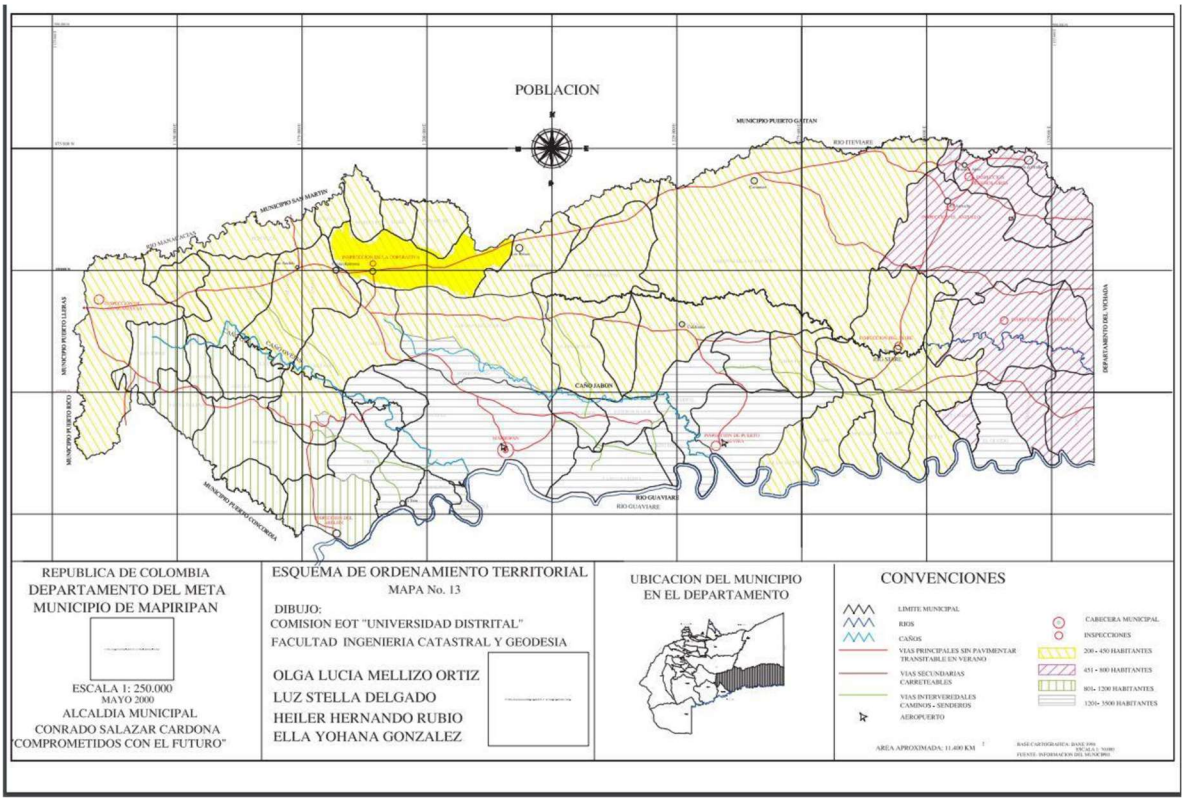
In concert with the mission and vision of UNIMINUTO, for the development and implementation of the solution, we used the Participatory Action Research (PAR) methodology, with the Praxeological approach. PRA is seen as a way of life, which bets on the collective and the generation of social fabric and capacities for learning by doing, in which the knowledge of all participants is important and new knowledge is woven through a dialogue of knowledge.

The technical solution revolves around the social appropriation of knowledge, and for this we developed the process proposed by Colciencias regarding the social appropriation of science, technology, and innovation, in which it is seen as an **organized and intentional** process. Therefore, in the different activities of the project, the whole community participates with functions, roles, and with the community objective of managing water. Appropriation is carried out **with the entire social group** of Inspección La Cooperativa (children, young people – very few, only for vacations – young and middled-aged adults), of the town center and the nearby farms that have been beneficiaries, who, despite not working in science and technology, are willing to learn. This ensures the **generation of articulation** between **researchers, technicians and the community;** i.e. the community has been **empowered by the knowledge** because they themselves are the ones who do the follow-up and are capable of solving simple problems with respect to the solution. Moreover, they also apply their learning with technical support with expressions such as: "Why do we need a water purification filter if the aqueduct will guarantee drinking water? It's better to give the filters to family xxx of farm xx who have babies and small children". The community of Inspección has done a very important **collaborative work**, they have the time to carry out the work, even though it means not working for at least four days in a row.

Furthermore, La Inspección de Cooperativa of the municipality of Mapiripán -Meta, is part of the communities Subject to Collective Reparation -SCR (Law 1448 of 2011 and Laws 4633, 4634 and 4635 of 2011), which is specific for ethnic communities and establishes, in the framework of a transitional justice process, a set of individual and collective administrative measures for the benefit of victims of human rights violations and breaches of international humanitarian law that occurred during an internal armed conflict, ensuring the effective enjoyment of the rights of these victims to truth, justice, and reparation and guarantees of non-repetition, recognizing their status as victims, and dignifying them through the realization of their constitutional rights (which can be accessed here. Furthermore, they participated in the Ideas for Change program of COLCIENCIAS, whose purpose was to support ideas for innovative solutions that from science and technology, contributing to improving the quality of life of poor and vulnerable communities Colombia (Colciencias,2017).

Prior to the realization of the first visit to the cooperative, in November 2018 the **enlistment** was carried out, which focused on locating and reaching Inspección La Cooperativa. Inspección is geographically located to the northwest of the municipality of Mapiripán Meta. It is considered one of the seven concentrations of housing that the municipality registers. The hamlet is located between the geographical coordinates 3°14'04" N and 72°21'16" W, at a crossroads in the process of penetration of productive agricultural, livestock, and oil exploitation projects. According to data

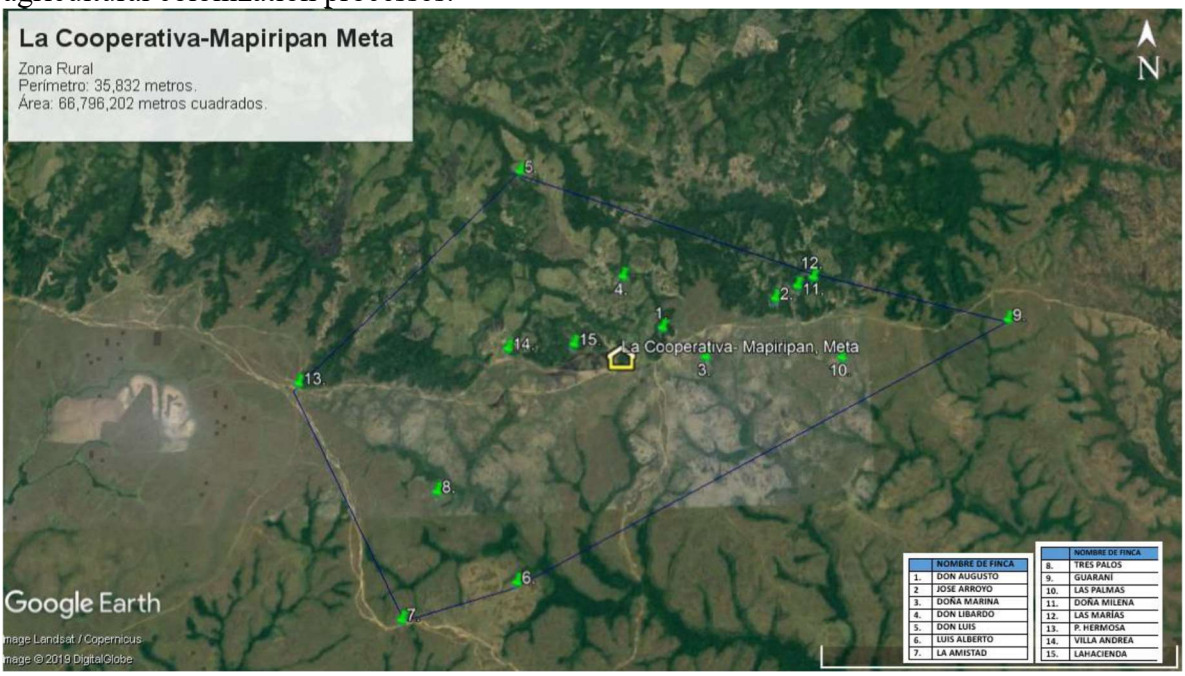
from the Mapiripán Municipality Development Plan 2016-2019, Inspección La Cooperativa has 75 inhabitants, distributed in 15 houses, without specifying the rural population located there.



Photograph 1: Map of the Inspection La Cooperativa, municipality of Mapiripán (Meta). (Alcandía Mapiripán cartography source).

The area has a relief that presents diverse topographic shapes, ranging from flat to undulations, whose slopes range between 3% and 25% with heights above sea level that are between 150 and 300 meters, forming the physiographic units known as "savannas" or "highlands". According to studies conducted in the territory and the information reported in the Mapiripán Municipality Development Plan 2016-2019, in Inspección La Cooperativa the soils are characterized by type V, with natural and improved pastures, forest plantations, cocoa, cassava, plantain and other "pan coger" crops that the inhabitants have in their productive units, with fattening cattle being the main economic activity of the inhabitants where the burning scheme for pasture renewal prevails. In the middle of the savanna, there are wooded areas with morichales palms and plants that adapt to flooded soil conditions. The area has a savanna climate with an average annual temperature between 26°C to 26.5°C (Alcaldía de Mapiripán, 2016) with a rainy period between April and November, with an average humidity of 80%, and a dry period between December and March with an average humidity of 55%.

The population of Inspección La Cooperativa is composed of descendants of settlers who migrated to the Colombian Eastern Plains between 1949 and 1965 from the center of the country, who were displaced by the civil war that was taking place in the country at that time, forming the population centers of the department of Meta and then, with the boom of illicit crops in the 70s and 80s, began the process of penetration into virgin areas (Rausch, 1999), which later gave rise to agricultural colonization processes.



Photograph 2: Satellite image of farms near the urban center of Inspección La Cooperativa participants. (Source Google Earth)

Photograph 3: Satellite image of Inspección La Cooperativa, municipality of Mapiripán. (Source Google Earth)

Additionally, Inspección La Cooperativa, could be reached only via two routes: one via a 1 1/2-hour plane trip from the city of Villavicencio to the municipality of Mapiripán, followed by a three-hour trip in a rental van; and via road from the city of Villavicencio through the municipality of Granada, entailing a paved road journey lasting three hours, followed by a journey of eight hours over unpaved road to reach Inspección La Cooperativa.

In order to **understand and analyze**, the **Community Liaison was** generated from a participatory exercise in the territory with the **approach to the municipal authorities of Mapiripán** who informed us of the aqueduct project that was underway that would benefit Inspección La Cooperativa, We made the first visit to the Inspección La Cooperativa in which, together with the population, water was prioritized as their primary need, community leaders were identified and the Water Committee was formed, with the participation of all members of the community, both from the town center and those living in nearby farms, and it was with them that the sustainable collective strategies were defined.

During our first visit we engaged in characterizing the community, identifying and analyzing 20 families, of which eight correspond to the sample of the 16 families of the surrounding farms (photograph 2) and 12 to the sample of the 20 families of the urban case participating in the research (Photograph 3), with a coverage of 6,679 ha of the territory of the municipality of Mapiripán. With this information, a frequency analysis was performed, making contrasts and feedback with the baseline provided by the Knowledge in Action TU (2018) and with documentary information available for this community in the Development Plans of the municipality of Mapiripán (Meta).

With the clarity that the priority in Inspección La Cooperativa was water, the **analysis** began, and the initial conditions of the solution were identified to respond to the real needs of the community. The technical components immersed in the solution were enlisted for its efficient solution. Further, the proper solution was determined, and the entire technical process of **creating** the solution was structured to go from the initial tests to the installation of the solution. In order to ensure the social appropriation of knowledge, an offline APP was incorporated, on the one hand, and on the other, a Communication Plan whose objective was to contribute to the effective social appropriation of knowledge through communication strategies was provided. The whole process was developed focusing on the social appropriation of knowledge mediated by ICT's, in which the four elements of the SAK (Social Appropriation of Knowledge) were made visible.

Regarding the **resources available** in the community, there was no element that could be taken into account for the execution of the project and that household income was scarce. However, the community's willingness was total, as they accepted the service of the project motorcycles, tractor and the trailer to move the elements to the farms, La Morichera and the road that was reforested; and of course, they requested help with gasoline which is expensive and scarce. The contribution of **civic workdays** was agreed upon for common tasks that were done on days other than those of the workdays with the project's professionals. The intervention of the community was also important since all the families in the town center benefited directly from specific activities such as food preparation, lodging, installation of systems, and the transportation of materials and personnel to the farms.

Similarly, since neither the Inspección La Cooperativa nor Mapiripán had suppliers for the supply of materials and inputs, it was necessary to arrange for **supplies from Bogota and Villavicencio**.

Taking into account the recommendations given by the different stakeholders involved in the proposal, the **installation of the rainwater collection systems, each one equipped with a Sawyer brand drinking water filter,** was initiated on **18 farms**, previously selected by the community. The installation was carried out by three work teams composed of community members and UNIMINUTO's civil and environmental engineering professionals. This activity included the training process for the installation of the water harvesting system, and for the management and maintenance of the filters. Likewise, water sampling was carried out to verify the physical, chemical and microbiological properties found: three samples were taken, one at the beginning, which was done in La Morichera and in one of the houses in the town center, another once the systems were installed, which included chemical and microbiological analysis, and one at the end, which was only done to determine the microbiological contaminants. It was determined in this way because during the first and second samples the chemical analyses were very similar and without any major contaminants. Coli bacteria were present in Samples 1 and 2. **As an additional activity of the rainwater collection system**, it was decided with the community to deliver an additional filter to each beneficiary, on the condition that it should be delivered to a family or a friend who lives on an Inspección La Cooperativa farm, and for no reason whatsoever should the

filters be delivered to people who live in the town center or in municipalities that have safe drinking water.

The installation of an **ekomuro and the Guardian of Life Tree** in the educational institution El Rocio was carried out with the community since this is the only community space. The Guardian of Life tree was provided with a SkyHydrant POD filter, and its installation was led by experts from the Siemens Foundation. The ekomuro was installed with a Sawyer filter with expert advice from Eko-group. **Eco-efficient systems were installed in 18 houses in the urban area**, which included the installation of "ekoduchas", "ekolavamanos", and whose objective is the reuse of gray water generated in showers and sinks. In order to perform this installation, we ran diagnostics, which revealed a lack of cisterns and sinks in 16 of the 18 houses of the Poblado center. Therefore, these elements had to be purchased as part of the project. Finally, throughout the installation training was done for the management and maintenance that was then reinforced in the common days where we made sure that all the information was appropriately conveyed through games and discussions.

For the integration of the water source with the community, the regeneration of the perimeter adjacent to the source was established with a protective barrier composed of 256 forest trees and 25 guadua plants. Similarly, the reforestation of 2000 linear meters (1000 on each side) of the road leading to the La Morichera the water source was carried out. The activities carried out included the process of cleaning, hollowing, construction of a fire line, liming, fertilization, application of hydroretainers, planting, replanting, and installation of an artisan solar drip irrigation system, in addition to the adoption of the trees in which each one was tagged with the names of people from the community, including the names of the children, siblings, mothers, and friends of the inhabitants of the town center and the neighboring farms.

As further positive reinforcement, planting activities were implemented in a nursery and a vegetable garden at the school. Each of the beneficiaries, both from the farms and the town center, were given a seed kit. A fence was installed at the spring that identifies and ensures the appropriation of the place and its value by the inhabitants, reminding them of their responsibilities for its upkeep. A fence was installed at the place where the water route begins, which was the name given to the road to La Morichera, which like the fence at the La Morichera water source, seeks to reinforce and appropriate the meaning of the place for its care and maintenance.

Throughout the development of the project, appropriation exercises were carried out, which ensured that what was taught was learned and improved upon by the community. This was supported with photos of the follow-up visit and project closure, where both in the farms and in the town center the technical solution was adjusted to the needs, making the most of what was learned. Another exercise of **social appropriation of knowledge was** the construction of the **offline application**, called MorichApp, built under the XP (Extreme Programming) methodology, which focuses on the needs of the client – namely in this context, all the actors involved in the project. For its construction, the initial survey of the conditions was carried out, depending on the community in question, then proceeding to establish the requirements of the users, the estimation of priorities, scopes, and definition of the architecture, after which the graphic design,

programming and validation of the functionality by the users was undertaken. The members of the community who owned a cell phone could install the application via download from the virtual Android Play Store.

It should also be noted that this exercise also led to the creation of a Water Committee for the community, the approval of its management plan, workshops on the use and management of all the solutions implemented, the preparation and dissemination of audiovisual material on a YouTube channel "Morichapp," as well as the development of recreational activities such as children's news, interactive games, community cinema, and a day of "sharing," all with the objective of reinforcing the lessons learned.

Once the visits were made, a community workshop was held to evaluate and provide feedback on the functionality of the solution, and the community sustainability plan agreed upon by the community over the previous days was presented, while also considering the JAC-UNIMINUTO alliance, which guarantees the optimal performance of the solution. Inspección La Cooperativa is now a model case study for water care.

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