

History of Technology and Humanitarian Technologies

A case study regarding the design and deployment of humanitarian technologies among rural communities in Colombia

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Abstract— This paper reports a project that integrated grass-root communities of Alto Magdalena and Tequendama, Cundinamarca and academics from Uniminuto (Colombia) and Algoma (Canada) Universities. This partnership led to the participative design of a technological training program about regional development. This program combines three elements: world views, ancestral knowledge and the needs that the farming and peasant communities of Cundinamarca perceive as imperative. The authors were invited to join the initiative by leading a historical reflection on the conflicting views of technology as a source of community and environmental difficulties, and also as an opportunity to overcome the pressing challenges that rural communities face nowadays (i.e. young people migration, low productivity and environmental degradation). This dialogue between academics and community members dealt with technological initiatives, such as energy for lighting and cooking, grass-root initiatives for rural connectivity and social media, water & sanitation, and agricultural technologies. In addition, a debate took place that focus on the community memory about large scale institutional programs for technological development. The paper discusses the motivation, methodology, outcomes, and conclusions of this partnership. The discussion has a socio-technical perspective, linking concrete technological initiatives to a broader understanding of the economical, political, cultural and environmental factors that define successful humanitarian technology implementation.

Keywords— *History of Technology; Technology Studies; Rural development; Participative research; Humanitarian technologies*

I. INTRODUCTION

This paper reports a project that integrated grass-root associations of Alto Magdalena and Tequendama in Cundinamarca- Colombia and academics from Uniminuto and Algoma Universities. This partnership led to the participative design of a technological training program about regional development; program that combines world views, ancestral knowledge and the needs that the farming and peasant communities of Cundinamarca perceive as imperative. The author were invited to join this initiative in 2015 by leading a historical reflection about technology.

The historical perspective makes it clear that agricultural technology (fertilizers, graft trees, GM seeds) and modern urban lifestyle (city-lights, consumerism, sedentary habits)

have been regarded by the participants, belonging to the rural communities of Tequendama and Alto Magdalena, as a threat to both, the environment and their own productive activities (the program for technical modernization of coffee production, leaded by Federación Nacional de Cafeteros, being a case of especial interest). Community memory associates technology to long term environmental and socio economic problems, ranging from the devastation of the forest to the present day water scarcity. This process is historically linked to the construction of the railroad, during the 1920's; the cutting down of the native forest, juxtaposed to the modernization of the coffee plantations and the introduction of new varieties of coffee plants, during the 1970's; the loss of control of the corn seed market (along with other types of seeds), by the end of XXth century, and the fears about soil instability, due to mining activities around Alto del Trigo, in the present decade.

Stories about the Bogotá River –the river that demarcates the Tequendama Region along its downhill route into its mouth in the Magdalena River - include memories of Sunday walks to fish and cook the lunch on the riverside; a picture that contrasts dramatically with the impacting view that offers the present day Bogotá River leaving the city, almost death, with an ugly smell and a toxic black bluish color.

Besides the environmental crisis, the rural communities of Tequendama and Alto Magdalena have in mind three interrelated problems: 1) uncertainties about a clean diet after the adoption of the green movement technologies and practices, and the adoption of urban consumerism habits; 2) the drastic cultural transformation of the new peasant generations and their preferences for urban opportunities and the urban style of life; a style that have resulted in the desertification of the countryside; and 3) the lack of productivity of the region because an increasing proportion of the productive lands have been devoted to non-productive recreational and touristic activities.

The dialogues between academics and the members of the community included technological initiatives and community memories about institutional programs of technological development. The discussion was built from a socio-technical perspective, connecting concrete technological initiatives with a broader understanding of the economic, political and cultural

factors that are required for a humanitarian technology implementation to succeed.

II. ADVANCING TECHNOLOGY FOR THE BENEFIT OF HUMANITY

The IEEE motto: "advancing technology for the benefit of humanity" is a big and abstract slogan. The image of the encounter of technology with humanity covers implicitly two groups of actors: actors that represent technology (say an IEEE volunteer) and actors that represent humanity in need of help (a Colombian peasant in our present case). The Participatory Action Research Methodology (PAR) [1], used in this research, questions the assumption that there is a clear-cut delimitation of both roles. This is something of enormous interest for the NGO's and the technological enthusiasts that sit together at this conference. Also, in Uniminuto we do not seek absolute states of welfare, rather, we talk about a development from less human life conditions to more human ones. This is something that can be applied symmetrically to all the groups of actors involved in humanitarian activities.

III. THE CONTEXT OF THE REGIONS OF TEQUENDAMA AND ALTO MAGDALENA

Studies developed in 2007 by the Thinking Tank on Competitive Strategies of the Universidad del Rosario and the Development Research Center of the Universidad Nacional de Colombia highlight the huge potential of the Tequendama and Alto Magdalena regions for the touristic services sector, as well as their relative advantage for the development of green business.

Even though the main cities of Tequendama and Alto Magdalena (Girardot, La Mesa, Tocaima) are located on main roads and can be accessed within two or three hours from Bogotá, both regions also include far rural territories with vast areas attended by tertiary roads in poor condition. Tequendama and Alto Magdalena are multi-cultural regions with diverse climates and products. Coffee is predominant, but also sugar cane, corn, fruits and other food crops are produced. Both regions were initially occupied by great coffee ranches -during the end of the XIXth century- and eventually they became the cradle of Colombian socialist party, during the first half of the XXth century. More recently (1980's-1990's), both regions were devastated by successive waves of guerrilla and paramilitary uprisings.

Jerusalem, a small village in Alto Tequendama well known for the quality and abundance of its corn crops, was the first city in the country in which a representative from the communist party was about to be elected Mayor in 1988. Unfortunately the candidate was threatened by paramilitaries and he had to leave the country with his family, leaving the space free for a candidate of the rightwing party to be elected with only 10 votes. Happily, the region is in relative peace nowadays and even though it faces enormous challenges, for example, the lack of productivity of the traditional models of productions and the migration of younger to the main cities, the inhabitants have again been able to re-engage in activities for the benefit of themselves and the territory they occupy. Moreover, they have inherited a historical consciousness about

the need to organize and resist external risks, ranging from governmental development plans -too often allied with the economic interests of mining and oil production foreign corporations - to the invasion of urban people that spend their weekends in their modern vacation houses without any worry about the productivity and the sustainability of their recreation farms from an environmental standpoint.

The farmers of upper Magdalena and Tequendama possess and treasures ancestral knowledge, like traditional practices of protection and respect for the environment. Besides, the peasant associations in which they are organized support reflection and to collective action to come up with new perspectives, meanings and practices to assume man's relationship with nature and its resources. Therefore, their knowledge is valuable for the new generations of farmers and professionals that want to understand the environmental problems they have to face and wish to contribute significantly to the improvement of the quality of life of these provinces inhabitants, with their labor and the knowledge they have from their own disciplinary fields.

This ideal is far from present reality. One of the most pressing challenges that Tequendama and upper Magdalena provinces face, for sustainable development to happen, is to provide qualified educational and employment opportunities consistent with the vocation of the territory and its strengths. Strengthening human capital requires for the regions to develop their capacity to understand and exploit the agro industrial and eco-tourism potential of the territory that they inhabit in a sustainable way.

IV. THE CONTACT

In May 2015, We met some of the representatives of the Association for the Integral Promotion of Rural Communities (ASOPRICOR by its initials in Spanish), a nonprofit organization devoted to the promotion of grassroots communities in the regions of Alto Magdalena and Tequendama since 1978. We were introduced to Jairo Lancheros, Evita Bergaño, Gilma Reyes and José Agustín Reyes by Maria Teresa Restrepo and Orlando Barón, the teachers of Uniminuto that had been working with this association for two years. We spent three days working with the community in a rural school-yard of Alto del Trigo. They were building a Technological Curricular Program on Rural Development, following a participative methodology that integrated grass-root communities and academics from Uniminuto and Algora Universities.

Our proposal was to enrich their initiative with a historical reflection on technology, both as a source of some of the economic, social and environmental difficulties of the community and also an opportunity to overcome the pressing challenges that rural communities face nowadays.

V. METHODOLOGICAL DESIGN

The methodology applied to the research includes three main elements: the project; the historical account and the sociotechnical analysis. The conception of the project and the workshops were based on Participatory Action Research (PAR), the historical account was based on oral history and the

sociotechnical analysis is derived from Science and Technology Studies (STS).

Following Alicia Kirchner [2], PAR methodology combines theory and practice to facilitate participative learning and critical awareness of the community members about their reality. This methodology expands the social networks, strengthens the processes of collective mobilization and transforms action. Collective action, therefore, precedes, accompanies and allows happy PAR exercises.

PAR by itself is a collective action because of its ability to link theory and praxis. The Colombian sociologist that developed this methodology, Orlando Fals Borda, used to say that the collective way in which knowledge is produced and the concomitant collectivization of that knowledge, make PAR different from other social research methodologies [3].

PAR research is housed in the critical social, constructivist and dialogical paradigm and it assumes that knowledge is a shared creation that is built by means of the interaction of researcher and the community. In this process values mediate or influence the generation of knowledge, making it necessary to get into reality under analysis, to understand both its internal logic and its specificity [4].

In accordance to that, all the workshop proposals of this project were designed and discussed with the community leaders. They were acknowledged as critical, participatory and proponent subjects, capable of posing their own questions and research routes and able to contribute to the design of university courses, based on their ancestral knowledge. As Sandoval emphasizes [4], restauration and legitimation of ancestral knowledge is possible by means of dialogue, consensus and inter-subjectivity. In this sense, the aim of this research has been to understand the logic and the feelings of the grass root communities' members about the stories of their own technologies and develop lines of action to control risks and take better advantage of the future benefits of technology for the community goals.

Regarding oral history P. Joutard [5] considers that it is the best method to find traces that link everyday life to greater political and economic processes. The oral history methods that back the findings of this research include testimonies about events; ethnographic contributions regarding technology in everyday life; and samples that enlighten the way in which the participants' memory about technology works. Another feature of oral history is that it can capture the non-institutional memory and opposes it to the dominant memory. Oral sources, moreover, facilitate the study of everyday life and allow the discovery of new relevant relationships not registered in institutional written sources.

Following Science and Technology Studies [6] [7], this research recognizes that technology is not an independent process, limited to the design of artifacts to allow that natural forces and resources benefit humans. Instead, technologies (and societies) area considered a heterogeneous phenomenon involving humans and artifacts entangled in a dynamic network of cultural, economic, social, symbolic and/or physical relations.

The theoretical framework that supports this research also includes categories such as Education for Sustainable Development [8] concepts of development for rural communities [9] [10] [11], as well as notions around Social Pedagogy [12], Knowledge and Pedagogy of Peasants [13] and Popular Knowledge [14].

VI. TECHNOLOGY STORIES

Initially we planned four stages for the deployment of the research. The first workshop was designed to meet and foster an initial dialogue about technology and social change, in order to lately discuss the possible inclusion of a course about technology in the Technological Program on Rural Development that they were building. This workshop took place in the rural school of the Vereda Alto del Trigo, with the participation of 30 members of Asopricor and the researchers of Uniminuto. We proposed to devote the session to two main objectives: to recover the memories about the most significant socio-technical processes for the communities of Tequendama and Alto Magdalena in the fields of family, work, community life and communications; and secondly, to build an inventory of grassroots innovations. The proposal was accepted with minor changes –oriented to simplify the instruments and focus on the experiences of the participants.

As a result of the first workshop we collected memories of the elders about the construction of the railroad to transport the coffee crops to the Magdalena River for its exportation. Don Cipriano associated this process with the beginning of the mountains deforestation. Other remembrances were also sad, as the stories about the contamination of the Bogotá river, and the elder's memories of their youth, fishing and cooking Capitanes in a fireplace besides the crystalline river.

With respect to the productive field, the community talked about the advice of the extensionistas (technological innovations animators from the Federation Nacional de Cafeteros) of replacing old coffee plantations with hybrid varieties, and the imposition of technical conditions, such as the removal of beneficial trees (Guamos, Robles) from the coffee fields, arguing that they would reduce productivity.

Other memories of the community about technology in the productive sector were about the unfair distribution of the risks and the benefits of technology, among the producers of sugarcane derivatives (panela, sugar, and sugarcane-syrup). Modern hygienic regulations tend to restrict the market for small rural producers that lack the resources to invest in cleaner production tools. The case of the production of panela also involves the use of Clarol, a harmful chemicals used to clarify the color of the final product. In this case, Jairo Lancheros remarked the paradoxical preference of urban consumers for the clearer panela, in spite of the fact that darker ones are healthier.

Another negative association to technology that emerged in the first workshop was the association made between mining and oil exploration activities in the zone (developed without previous consultation with the community) and the instability of the soil that have resulted in cracks and avalanches.

Other memories were of anecdotic character, like Gustavo's story about the corn planter that a foreign vendor brought to the Sunday market. The man was so incredibly skillful planting corn grains with total easiness in the most difficult terrains that he sold all the planters that he had brought. Monday morning Gustavo –that had bought two planters- awake early to plant his corn field using the tool, only to learn that he was totally unable to plant a grain using the gadget.

Yersy Campos remembered a coffee cropper suit that was once promoted by Federación de Cafeteros to enhance the productivity of coffee croppers. A suit too hot for the local climate that proved to be efficient only for the most inexperienced croppers, but seriously reduced the performance of the more experienced croppers.

Other technological issues that arose in the first workshop were the water provision system and Internet. The group that chose to work with technologies to improve clean water supply sketched the system in a rather distant way, outlining the components of a modern urban aqueduct system that had no relationship to the precarious aqueducts of rural areas of Alto del Trigo. However, when We proposed considering aqueducts as a relevant topic for the exploration of the community's socio-technical processes, this initiative was received with low enthusiasm. The argument that Fabiola posed to reject emphasizing technologies for sanitation and water distribution was the fact that water sources are drying up, and under that condition there is no point in worrying about aqueducts, having no water to feed them.

Regarding Internet provision the feelings of the community were biased by the presence of Hayder, a young member of the community that studied information technologies and nowadays run a service company providing last mile connectivity (voice and data) in rural areas of Alto del Palmar. A more interesting issue about Information Technologies is that, in contrast to most urban modern technologies, they are not perceived as a threat by the community leaders. Rather they are considered tool that they can use to exercise their resistance actions, and get in contact with other grass root organizations that share their worries about climate change and starvation.

During the first encounter we also discussed long and short term objectives and we achieved a preliminary agreement in the following aspects: to open a space for historical reflection on technology and development in the design of the Technological Program on Rural Development; to undertake the reconstruction of some technological networks chosen by the participants in the next workshop; to pursue practical and political objectives regarding the community processes of socio-technical innovation (instead of only a written academic reflection).

The leaders of the grassroots associations that participate in the project asked if my interest in it was for a limited period of time and expressed interest to pursue continuity in time to the working relationship between Uniminuto and Asopricor around technology and regional development.

Other agreements included the purpose of making reconnaissance visits and field trips to interesting or critical

points from an environmental perspective, and the interest in starting a dialogue with representatives of institutional programs of technological development in particular fields.

VII. SECOND WORKSHOP

The second workshop about technology was staged in Alto del Trigo three month later. We began the session with a free brainstorm of ideas that the participants evoked in relation to technology: advance, wisdom, change overcome, aid, tools, science, easiness, entertainment, development, vanity, addictions, and even lazy habits.

Afterwards we analyzed the actors involved in the sociotechnical networks associated to the production of coffee in the region. Before, We had seen the beneficiadero installation that Yersy introduced in his farm for the benefit of his coffee crop. This is a facility designed to carry on the processes applied to the coffee grains in order to obtain dried grains of coffee for the market. The stages of the process include the removal of the pulp, as well as the subsequent washing and drying processes. This last actions produce residual waters that have to be treated before drainage.

As a part of the process for the official certification of the quality of the diverse stages of coffee production in his farm, Yersy had built a series of water filters, introducing changes to adapt the standard design of the installation to local materials and conditions. As this certification represents important benefits for the producers we asked him about the reasons why adoption of the certification process by other coffee producers had been slow.

During the dialogue a wide variety of reasons were presented to explain the fact. Not surprisingly the reasons adduced where different according to the role played in the network. Fabiola spoke that as laborer of the farms there is not difference for her if the farm is certified or not, and they lack the resources to fulfill the requirements to certify the production of her small farm. Other laborer also lamented that the certified producers do not pay for the extra work that represent a more rigorous selection of mature grains.

Jairo Lancheros remembered that coffee production was a very lucrative industry 40 or 50 years ago. Because the production had a rather different cost structure: the coffee plants proliferated as stubbles, and the coffee plants produced abundantly without fertilizers until the soil got exhausted. He also remember that his grandfather and uncles were croppers in the big ranches of the region, where the idea of more human relations with the workers did not exist and laborer's rights were denied systematically by the patrons and their foremen.

Another determinant of the decrease in productivity was the negative effect of the plantations updating -led by the Federación Nacional de Cafeteros- that included the cutting down of the Guamo and Cedar trees ever present in traditional plantations and the restrictions imposed to the production of platano and other food crops, in order to promote a coffee monoculture. Moreover, new coffee hybrid varieties like Caturra and Castilla proved to be less resistant to plagues and pests. At that time, the producers and animators of the updating considered, that the farmers' generalized lack of interest in the

modernization process was due to ignorance or lack of entrepreneurship drive.

The second workshop session finished with a moving intervention from Don Cipriano who remarked that in spite of the many difficulties perceived at all levels (families, veredas and regions) the community has to awake and find solutions to preserve trees and the environment with the aid of everyone,: the families, the community associations, the political leaders and the official institutions. He posed the example of an aqueduct serving 27 veredas that depended on a water fountain that was threatened by deforestation and the presence of cattle nearby. With the aid of majors and organized communities they bought 127 hectares of good land, order to preserve them from the presence of animals and allow the native flora to recover by itself.

TABLE I. CONNOTATIONS GIVEN BY THE COMMUNITY TO SOME ARTIFACTS AND TECHNOLOGIES

<i>Technological System or Artifact</i>	<i>Connotation</i>
Railroad transport	Apocalyptic
Bogotá River Drainage	Apocalyptic
Coffee monoculture	Apocalyptic
Automatic corn planter	Ludic
Coffee corpper suit	Ludic
Water filtering and disposal	Appropriation
Water fountains preservation	Appropriation
Internet	Appropriation

VIII. FINDINGS

The project has enabled the construction of dialogue scenarios between the community and the participants universities. This dialogue, based on trust, has strengthen the necessary ties for the PAR exercise to occur. The permanent community involvement both in the design of strategies and in its subsequent implementation; as well as its active and reflective participant role, proved to be a valuable source of knowledge construction about the technological history of the Alto Magdalena and Tequendama regions communities.

The research workshops proved to be good instances, where the didactic and pedagogical tools, necessary for the meeting and exchange of knowledge between researchers and community college, were provided. This facilitated the retrieval of traditional, ancestral and contemporary knowledge, based on experience and the oral tradition of the peasants.

The experience also demonstrated that the technological component of social life can not be reflected upon apart from other components since it actually forms an integral part of the culture, the beliefs, and the economic, social and political circumstances of the community.

The peasants' thinking about technology is holistic and contextual and therefore it can not be taught nor learned in a fragmented way [15].

IX. WHAT DOES TECHNOLOGY HAVE TO OFFER TO COMMUNITY CHALLENGES?

Another aspect of the problem addressed in this research is the concern of the peasants' leaders of ASOPRICOR, for the protection of their environment natural resources, amid growing threats such as the tourist resorts that are being built in the region, the recent incursion of mining, the degradation of agricultural production and the devaluation of prices, the implementation of environmentally harmful practices of agricultural industry, and the one that they consider more dangerous: the quickly cultural transformation, in terms of the new generations' customs, values, practices, knowledge and interests.

When we discussed the orientation of a new stage of the project, by the end of 2015, ASOPRICOR communities were reluctant to establish a dialogue about technology with other institutional actors of the Colombian system of Science and Technology. This happened during an electoral period, a delicate period that threatened turning the workshops into mere political propaganda arenas - and in the middle of a severe draught period that lasted all the year 2015 -and that was foreseen by Asopricor's community members earlier than by any modern urban institution devoted to weather supervision. By explicit request of the community representatives the topic of the following stages of the project changed from just the technological issues, to embrace wider reflections and actions related explicitly to the solution of the environmental crisis and the promotion of intergenerational dialogues about this problem and water and food self-sufficiency issues.

X. POTENTIAL FOR IMPACTING PRACTICE AND RESEARCH

Besides negative and alien associations, the memories about technology also include positive elements that inspired interest and curiosity; a fact that can be of interest for similar projects in the future. While automation and remote supervision technologies still seem to need a boost, social networks and connectivity are well accepted by the community and are perceived as an effort aligned with the possibility to get in touch with other actors and alternative initiatives, to get to know cleaner modes of production and consumption and to establish more fair practices of distribution and commercialization.

In certain instances, the loss of hope and the lack of vision has become evident: what is the point of building rural clean water systems if there is no water to distribute and the fountains have dried up?

Happily, we are now far more aware and open to the transcultural nature of technology transfer than we were by the 70s and the end of XX century. A word of caution must be said. Thinking that transcultural dialogue is something already achieved can lead us to deception. But it is not so.

Cleaner ways of production are of wide interest and, in order for them to survive, grass root innovations should also include reactive defense strategies. In spite of official efforts to destroy traditional ways of farming and living in the countryside the community should endure: composting, seed preservation, dialogue and respect for the nature and the use of traditional healing practices are actions that can easily take place.

This, of course, suggests that humanitarian technologists face enormous challenges as well as vast opportunities. In this sense we consider that there is a window of opportunity to articulate the potentials of humanitarian technologies with the socio-economic realities of rural communities in Colombia. However, filling this gap will demand far more conscious efforts to overcome the cultural and historical barriers that constrain dialogue. The ludic character of the technologists and the rural communities is a point of contact. The better appropriation of communication and connectivity technologies, by the rural communities of Tequendama and Alto Magdalena, should also be mentioned. The peasant identities of the XXI century include numerous competences and technological skills that are also a valuable point of entrance to the work with organized rural communities.

An obstacle, not easily solved, is the arrogance of the western Tecno-Scientific culture regarding traditional knowledge. Even though Colombians have learnt important lessons on the importance and richness of transcultural dialogue, the doubts and uncertainties still outnumbered the achieved goals in the transcultural arena. One important question to be solved in this field is to determine who learns more during the development of participative projects of technological innovation: the rural communities or the foreign actors - namely the groups of scientists and technologists, or the representatives of the modern, urban institutions that want to help.

The lack of recognition of this bidirectional perspective is something that still has to be learnt by the representatives of many techno-scientific institutions. In our view, this is a requirement for it to achieve a clearer recognition of the relationship between modern urban capitalist lifestyle and the environmental crisis. Under this perspective, our modern techno-scientific conception of the world, can be enhanced and enriched by means of partnering with traditional knowledge in the quest of alternatives to solve the problems of global society, as a whole.

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