Availability and distribution of water for a vulnerable community in San Andrés Island

Introduction

Known as the poverty-environment nexus, the relationships are uneven, unclear and usually case specific between natural resource degradation and developmental goals. Even so, the "*nexus"* hereby called after, is understood by the environmental field, as the possibility of combining a twofold objective: poverty reduction simultaneously with environmental protection; contaminated water, a specific poverty related vulnerability, is also classified as a "brown environmental problem"(Dasgupta, 2005:617,620-621).

Furthermore, (Lusigi, 2010)[1], identifies four main dimensions linking poverty and environment: livelihoods, resilience to environmental risk, health and economical development. For all these, a social innovation is a required action, since the nexus is not always straightforward; moreover, the combination of depleting aquifers[2] from an oceanic island, -also holding a name as a Biosphere Reserve-; tourism industry intensive dependance on fossil fuel based-desalinization plants; households fragile access to water in general, who are investing large percentage of their income on bottled drinkable water; an unstable aqueduct public service provided by a private utility company; a bimodal rain pattern, and lately the uncertainty of climate change impacts, are the perfect variables that may yield an undesired outcome for all four dimensions mentioned before.

Water is not only a chemical molecule, characterized as a renewable natural resource with high importance in the survival, development and lifestyle of present human societies; also throughout all the ancient cultures or civilizations around the world its relevance is undisputed. For most of these civilizations, water issues were also spiritual issues; most of human population has been developed historically beside an important water source. As a matter of fact, the human body is highly composed of water; a person cannot survive more than a few days without drinking some of the precious liquid. The low water consumption has implications for the proper performance of the body systems.

Furthermore, access to quality water is a standing objective (number 7) of the MDGs, and have high relevance for developing countries governments. For these and other specific reasons that will be exposed in the following section, the availability of water is a critical subject that concerns all our attention. The

1 Lusigi, Angela (2010)UNEP http://trace.apcc21.net/en/guest-articles/links-between-poverty-and-environment/ last accessed: 07-23-2013.

2 The underground storage of water has replenishing cicles, depending on extracting circumstances.

challenge ahead, proposed by (Gaut, 2010) ahead is that all “growth resulting from innovation *must* be sustainable”

1. **Ideation**

1.1. Analyzes of the issue you want to help providing a solution for:

The problem mix, was identified at different levels. First, for a small oceanic island, the heavy dependance on aquifers that are revealing ongoing contamination (Official Management Report Coralina, 2013) by resident population, is combined with the pressures of the intensive touristic industry. Although many hotels (no data quantifying the exact amount) owns fossil fuel based-desalinization plants, and may solve the self supply of water, another branch of the problem arises, related to the economical and ecological risk involved in accessing, disposing and transporting these fuels (EEDAS Report for the *Ministerio Minas y Energia*, 2012); since the diesel arriving to the island is heavily subsidized by the central government, the prices of the real energy cost for the people are artificially low. A minority segment of islanders, denominated “raizales”, as regarded in the newly recognized multiethnic and *pluri-cultura*l nation, according to the 1991 Constitution, have had a traditional cultural practice of building family cisterns for storage of rain water. However, this practice had been fading out, requiring further historical research to discover the reasons of this disappearance; we offer several hypothesis: the empirical skill required to build cisterns died out with older generations; the space required, and all the architectural features involved in the water capture system

did not survived[3], the population boom, and mass constructions, from the declaration as a "Free port" in 1953. Whereas, building materials became expensive as many local owners of boat and schooners was squeezed out of the business of transportation. Although counted cisterns survived for communal access to water during "dry weather"; still, the remaining strongest hypothesis and in our perspective requires a strong social innovation, is the complex interaction between a local government development routes and promising of standard access to public services (since 1980s), specifically an Aqueduct; a private company bidding and winning to provide the public service (aprox.1990s), and the *raizales* households behavior during the management of water as a Common Pool Resource (CPR). Needless to mention, is the null affordability of a desalinization plant by one of these households. Apart from building a cistern, the other option of digging wells to access an aquifer is becoming not only dangerous for human health because of sewage water infiltration, sedimentation or high salt levels, but also for the ecological systems associated with the local vegetation, since underground salt water tables are on rise. Hence, the private company water becomes an attractive offer for households and was also promoted and recognized as a symbol of status.

Nevertheless, the private company takes the water from the principal aquifer, which is according to the zoning established by the Biosphere Reserve, located in the core of the land protected area; then from centralized machines (run indirectly by diesel) the water goes through some chemical process to further its purification. That is, anybody could win the right to access this main aquifer, if they only had the capital to do so; generally natural resource depletion is regarded as absence or imperfection of the resource "property rights" (Bahamondes, 2003:1947[Panayotou,1995]). In this case the ownership is well defined, the access to the water is privately owned either by the company or the private households digging their own wells, or harvesting rain water, yet the environmental risk remain, and quality water is low, widening the gap to good living standards. Once water is ready for distribution, from the main aquifer new problems take place. For instance, some communities may brake the tubes, using inadequate material and procedures, becoming a risk for the extraction system and for their own health.

Based on short non-structured household interviews (majority women), and 30 surveys from a section in *San Luis*, it is evident that accessing the "public service of water", is a unrealistic way of reaching status; since the intermittence of water service implies that many households might have water, in average, twice during the month. This water for general use, is usually stored in expensive plastic tanks of 1000 ltrs-2000 ltrs, (sometimes donated by governmental aid programs), or an old empty family cistern; then drinkable water is weekly bought from (another privately owned companies) trucks by the

3 (there is a diminishing number of houses on the islands that still remain with this system)

majority who do not boil, or drink the raw water, thus compensating health risk. Even though, the cost associated with this potable water is invisible to these households; some interviewees did not even considered buying the bottles as a strain to their pockets, therefore, making sense the high value that is placed upon an asset such as "health" or caring children from common water born diseases in developing countries. Another fact that could support the argument , that "poor" households might give high value to health, is the lately "rumors" among population, of the cancer-causing *asbestos; a* chemical contained *in the* "*eternit",* the traditional material extensively used for rooftops, and where rain water is drained off from.

In addition to the health risk, the aquifer in itself is vulnerable to overexploitation, since the private company loose information on how much demand there is during the distribution phase; the lack of a practice of "paying for water", and the culturally embedded practice of a decentralized water system (I.e.cistern or privately dig well), plus the company´s mismanagement of calculating the bills for households, incentive that once the water arrive through a built distribution system of pipes, families would gather to recollect "freely" the water from the main aquifer. Then the company would send, un-payable bills to a poor household, enlarging the cost of transaction and institutional strain, hampering a notion of relationship with the communities. Despite of this, the complex interaction between company, households, and local government, could be interpreted as *the* remaining model under which the access to water still functions.

Therefore, at one end of the problem chain, a local environment risk is associated with depleting a vulnerable body of underground water; the sea water option becomes also another risk, since some governmental institutions begin to appropriate the discourse of externalities produced by CO2 generation of fossil fuel based desalinization plants (included in the total of 130.000 Tons/year that is produced by all fossil fuels electric plants on the island, see EEDAS Report, 2012 and *Ministry of Energía y Minas*); as result contributing to the *global* environmental risk, of Climate Change. This becomes a significant issue, because it is translated, into a strong imbalance of 27 square kilometer of land -actual size of the island-, pumping 130.000 tons of C02-GHG into the atmosphere, and that is funded with governmental-public- financial resources.

This line of reasoning is followed, because it is already clear to "some" local institutions that alternative energy sources must be introduced at different phases of development issues for the island. The technologies (wind-*desalinizator*, photovoltaic osmotic inverse process) are proven so it would not consist in a strict technological innovation; also the technology has already fit into the necessities of a remote ethnic community on mainland Colombia; it is rather not clear *how* to gain the acceptance of the island communities. The new

setting for this proven technologies is what turn to be the challenge set forward for a social innovation.

1.2. Description of the idea that should lead to the solution**:**

Our breaking approach will be to intervene the free-rider standard practice of water usage, by arranging a cooperative strategy; taking into account that historically, there already exist a "self-supply" culture: someone goes, take water (when there is) from his/her extended family/neighbor well or cistern. A decentralized water supply system, with community based management, will solve both the free-rider behavior of accessing the water, and the lack of payment to a private company. We assume that this decentralized process will be an incentive for efficient and effective use of water. "Discussion of institutional options for solving Commons Pool Resource (CPR) dilemmas", was the theoretical input to our idea. Contrary to a non-cooperative variation of collective CPR management; in a cooperative strategy of the game involved in using a CPR, the social agents design their own binding contracts. This implies, that the presence of an external actor is not required (I.e. government), to monitor and enforce that every agent is complying with rules of the game (Ostrom, 1990: 15-17). In other words, the *raizal* community will design their own binding agreements, based on their cultural frame of reference.

Attached, to this idea was around: "We could socialize the idea, (creating environmental consciousness) that if we take water from the aquifer, we are going to *kill* a crucial ecosystem, that is "sick" and that need recovery; Hence, the household will start to place importance of taking water from the sea, instead of the aquifer; the ecological and human health vulnerability is reduced, and thus the indicators of tendency to poverty.

2.INTERVENTION

2.1 The key methodology -how to start:

First, through participatory workshops with 10 mothers, we will share with them how to recognize (and calculate) their water footprint, socializing the cost of externality[4] (for future generations). From direct observation, Islander women traditionally likes to "feel" involved in active roles for "others"; crying in funerals, baking, caring, cooking for large amount of people, and other domestic issues, are practiced as strong feminine features. Emphasizing, to "care" for nature, i.e. particularly to save water for their grandchildren (according to eco-

4 Externality can either be positive or negative side impacts for the environment and people that occurs while carrying out any economical impact. Generally it has a negative connotation.

feminist theorist [Mies and Shiva 1997]) an established connection exists between women and environmental protection, because women have a shared sense of collective exploitation as "nature" throughout history).

These women will be in-charge of the technology for desalinization, located near the shoreline, and close to a group of households and a public school. Instructions of how to monitor the amount of water produced according to wind patterns, is delivered to women, with the goal of tracing the collective water footprint. Our small adjustment to the technology will be to locate a device that will evidence the water levels in the common storage tank; red light , the tank is low, and green, then water is available.

2.2 The most critical obstacles that must be surmounted:

To "brake" the behavior barrier of indifference regarding the origin of the water; these are the deepest "emotional sediments" and the most difficult to transform, i.e. the one behind *While I have it, I don't care where it comes from*. The other issue is, maintenance of the equipment in itself; last, is the uncertainty of the initial cost for enforcement and risk of equipment damage by external people from the neighborhood. Another obstacle, could be the vested interest of political parties, and local suppliers of diesel based desalinization plants, that might influence or limit, both the participation of households or the local officials issuing the necessary license and permission to install the equipment**;** although the source of funding is a public entity, these previously mentioned caveat could transform all the process into a complete *top-down* approach. In addition, according to (Howaldt & Swharz, 2010:5), alternative energy equipments [referring particularly to photovoltaics] can provide a "good example" of how persistence of "management cultures, consumer behavior and life styles may slow down the reception and adoption of breakthroughs and their transformation from the stage of invention to that of a successful innovation".

2.3. Who are the most relevant stakeholders, and potential allies among them? The community households interested in lowering their total water bills and for which, health is regarded as high value, will make them potential allies with the process. The intention of the local Energy company Auditors, to carry out a CSR program, through investing funds for clean technologies, directed specifically for the benefit of the local ethnic community; the local environmental authority –Coralina-, who is legally in charge of safeguarding the core aquifer protected zone; at the national level, the IDEAM, the official entity in charge of

climatic stations; the *Ministerio de Minas y Energia*, whose budget is strained with subsidizing the fossil based-energy processes on the island; and the *Ministerio de Interior* (who carries out a legally binding process of Previous Consultation with ethnic communities, regarding projects that might influence their welfare). At the international level, probably the UNESCO, since these actions are in harmony with the Archipelago´s condition as a Biosphere Reserve. Finally, the manufacturers of the product may have interest to demonstrate that their technology indeed is a success in another geographical remote area.

3. Implementation

3.1. How to win supporters: The process will be accompanied by an intensive campaign in the local written and audiovisual media, about the geo-ecological impacts of the unsustainable use of aquifers. Lobby with political parties, private owned hotels, and possible consumers of the technology, about lowering the bills and give "status" to the idea, and that households may have the incentive to feel privileged.

3.2 Efforts and resource required: Wind; importation of the wind- desalinization plant-; devices and main water tank (*funding f*or *this is already available)*; License from the DIMAR (a military oriented institute in charge of maritime affairs). Meetings (and snacks) with the community: location for meetings and workshops.

3.3 Estimated time of accomplishment: timetable, depends on previous recollection of further data (1 month); licenses & permits (the most uncertain): 2-3 months. Simultaneously, campaigns in the media: 2 months. Consultation with the community: 2 months (may vary with internal dynamics of the community)**;** Installation: 2 weeks.

Total time: 6 months.

4.IMPACTS

4.1.The best measure of success: comparison of cubic meters of water per household, before and after the implementation and percentage of their income invested; generated social assets of "trust"; empowered women, and diminishing child diseases.

A scenario could be to seek outlet of the final cycle of the desalinization process: the byproduct from the wind-plant (salt), can result in a community base business; selling this to chemical companies on mainland.

Scaling up of the pilot project to other vulnerable communities on the island; and diminish resistance of other segments of the government that it is a viable procedure to solve public services on the island.

4.2.May an unintended or even foreseeable side effects occur?

Conflicts may arise between water users, if community base management becomes weak, or influenced by vested interests. On the positive side, as it will be located near a public school, it can stimulate young people interest on alternative sources of energy.

4.3 Indirect effects and balance between benefits and detriments to different social groupings.

Disruption of the vested interest of the private water utility company. The importers of diesel; also those who sells desalinization plants based on fossil fuels. All the employment network of water-truck drivers, might also be affected.

5.Try to asses how realistic your plan may turn out based on a scale from (very unlikely) 1 to 10 (vey likely): the team agreed that 8 is a balanced assessment, taking into account the caveats referred to earlier in 2.2. Since it is a interdisciplinary team, this is a plus that can give feedback on different phases of the project.

Carlos Pineda Electric Engineer (next to graduate) STUDENT Cod:222845

Luz Arabany Ramirez (Systems Engineer & Phd)

Hanny Newball (Historian & MSc Environment and Resource Management)