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Emerging Housing for Socioeconomic Development of Rio Muchacho Community

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Abstract

The earthquake in April 2016 that mainly affected the provinces of Esmeraldas and Manabi left destitute housing many people, causing overcrowding and problems in the conditions and quality of life of the victims. The Universidad Nacional de Chimborazo, in its commitment to strengthen the sustainable economic and social development of Ecuador and as a way to materialize the link between academia and society, assumed the construction of housing in a community that was very affected by the earthquake and that for its Small size was not the object of priority attention by the authorities. The objective of the project was to provide emergent housing to the community of Río Muchacho to improve their habitat situation. The research process was developed with an action research approach, which began with a socioeconomic study, selecting those families with disabled, elderly and female heads of household. Subsequently, financing was provided with Bomberos Unidos sin Fronteras and 10 houses of guadua cane were built. As a final part of the research process, the result of the project was evaluated by applying surveys that reflected positive benefits in the 50 beneficiaries and in the community. The results of the investigation allowed us to reach the conclusion that the best way to reinforce teaching, research and links as primary pillars of the academy is through the execution of social projects that leave a mark not only on those who have benefited but also in those actors who have participated in it.

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1. Introduction

Ecuador is located in one of the areas of highest tectonic complexity in the world, at the meeting point of the plates of Nazca and South America. It is part of the so-called "Pacific Fire Belt", with a long series of most active volcanoes that cause permanent seismic and volcanic activity and determine high vulnerability. Located within the belt of low pressure that surrounds the terrestrial globe, in the area of intertropical convergence, an area subject to hydrometeorological threats such as floods, droughts, frosts or effects of the El Niño phenomenon.

At the level of South America, exposure to natural disasters can be high and their resilience may have a low rate as described by Daniel Bitran:

The devastating effects of these events are magnified by a high vulnerability that affects society and the economy and derived from a set of factors. Among others, the lack of preventive and mitigation measures at the level of vulnerable regions or zones, the lack of measures that lead to a safer location of human settlements (Bitran, 2001).

The foregoing was reflected in the emergency that Ecuador experienced with the earthquake of April 16, 2016, which affected mainly the provinces of Manabi and Esmeraldas, which left countless human damages, material losses which amounted to the US $ 3 billion and an estimated reconstruction of the US $ 10,000 million (Redacción y Agencias, 2016).

This motivated the Universidad Nacional de Chimborazo (UNACH), in its commitment to strengthen the sustainable economic and social development of Ecuador, and as a way to materialize the link between academia and society, conduct a research project, assuming the design and construction of 10 emerging homes in the rural area of the community of Río Muchacho, belonging to the Canoa parish, Canton San Vicente, province of Manabí; with the cooperation and financing managed by Bomberos Unidos sin Fronteras de España (BUSF), with the aim of providing housing to improve the habitat situation of those affected by this earthquake, which due to its small size was not the object of priority attention by of the authorities.

In the face of natural disasters, there is always a detriment to the quality of life of the people and therefore to the social and economic development of the affected areas. The affectations are physical and psychological, since individuals are deprived of their homes, and sometimes, they are forced to be displaced. It is there where the shelters represent a determining factor in survival providing them with security, protection, shelter from the climate, and sustain family life. Disasters interrupt and alter normal living conditions, which require immediate attention. In this regard, Sanchez indicates that:

We must understand housing, not as a room in which to spend certain hours of our lives, but as an enclosure in which to enjoy and that allows us to form a home. That also gives us refuge in case of danger. That is why after a disaster situation, behind the loss of human lives, we find one of the biggest problems that we face: the housing situation (Sánchez, 2013).

Faced with these great losses, the physical, psychological and homeless conditions in which the victims are immersed, the only more tangible hopes that can be offered to them is the possibility of temporary housing that will alleviate, at least in short term, your roof problems. Emerging housing is then defined:

... as a habitat that structures new social tissues, which allows surviving survival, transiently replaces certain needs and protects from external risks by performing certain basic functions related to the protection

of climatic agents, with storage and protection of assets, with emotional security and satisfaction of privacy (Mogrovejo, 2010).

The Emerging and Sustainable Housing research project of the UNACH, sought a housing solution per family nucleus estimated at approximately five people, to provide privacy, family dynamism, quality of life and reduce situations of violence and crime raised because of the post-traumatic effects of the earthquake.
Within the characteristics of emerging housing, the use of materials from the area was taken into account, the application of strategies in favor of the environment, light but durable construction, easy transportation, and quick and easy assembly.

2. Materials and Methods

The project was developed with the action research approach, where, according to Martinez, the researcher acts by organizing and facilitating the exploratory process, acting as a catalyst for the problem (2000). Continuing with the same author, this type of research in the case of the research project was transferred to the classroom, relating its topics of studies with the complex activities of class life from the perspective of those who participate in it: making, testing , evaluate and redefine the way in which it is intervened, the teaching and learning processes, the development of the curriculum and how it is projected socially, the social development of the teachers; all in order to improve the effectiveness of educational institutions and therefore of their educators.

The needs of the selected community were verified in the first instance and a situational diagnosis was made with the respective socioeconomic study of the population, selecting those families with disabled, seniors and heads of family in the Rio Muchacho Community, Manabí -Ecuador.

With the aim of relating the academy with research, the architectural design for the emerging housing was developed as a product of a vertical workshop carried out by the Architecture Career in which 14 proposals of emerging housing prepared by students from the fourth to the tenth semester were collected. Selecting the most suitable one (IV Vertical Workshop, 2016).

Subsequently, we proceeded to socialize the design with the community to ensure that socio-cultural customs were accepted and thus the project's empowerment. Students and teachers were trained in the use of tools and constructive system through the construction of a prototype. The training was carried out at the UNACH facilities, with an expert in bamboo cane.

The construction of the 10 houses of cane guadua was carried out in three days of work in the month of January 2017, with the participation of 100 people, among whom were students, volunteer teachers from the schools of Architecture and Civil Engineering of UNACH and the Community of Río Muchacho.

After two months of construction of the houses, an evaluation of the benefits that the project had provided was carried out, conducting surveys to the direct beneficiaries and to those involved. We also proceeded with training in maintenance with natural products as a way to extend the useful life of their homes.

Figure 1 shows the process in which the research project was carried out, highlighting workspaces with the community.

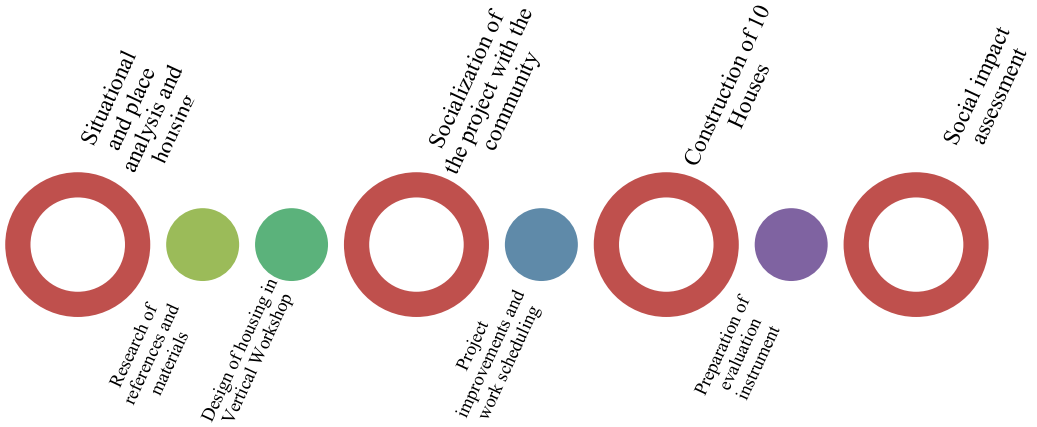

Figure 1. *The process of the Emerging and Sustainable Housing Project*

3. Results and Discussions

Taking into account that the selected homes to be built were dispersed in the rural environment, it was necessary to create a center for the collection and prefabrication of elements (see Figure 2).

Figure 2. *Collection center created*

The house has 42 m2, consists of four versatile modular spaces and its construction take approximately eight days. The system is supported by nine plinths of reinforced concrete, the main structure of bamboo cane tangential joints with the twisted rod, walls with frames of white laurel wood and chopped cane, wood floor and covered with galvalume that resists rust and is suitable for rainwater collection.

Guadua bamboo columns and panels for the walls were prefabricated. The construction aspect of the project is shown in Figure 3.

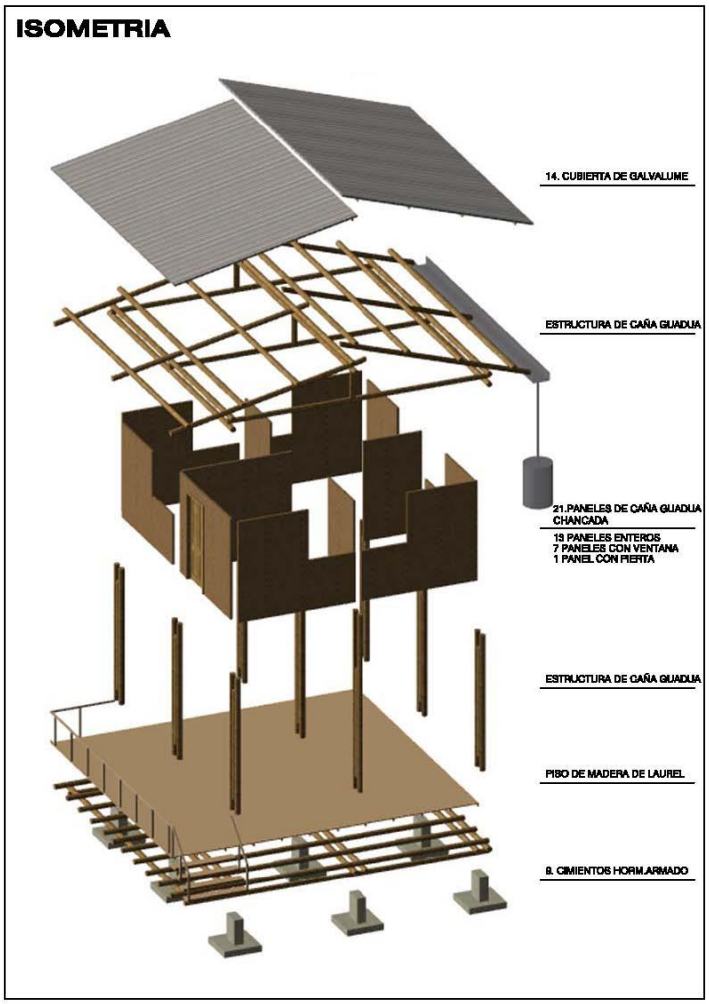

Figure 3. *Exploited isometry of the project*

3.1 Socioeconomic response of architectural design

Emerging and sustainable housing designed, is designed for rural communities or unattended peripherals, as a rapid response that requires emergencies in the temporary-permanent solution of families affected by the earthquake of April 2016 and in general post disasters natural

The architectural design is adapted to respond bio-climatically in subtropical zones of Ecuador or worldwide in zones of similar climates and characteristics. The modulation of the environments allows flexible and versatile spaces that adapt to the different needs of the users. The house can accommodate four members, but if necessary, the structural and distributive modulation of the construction, allows the building to expand to reach a total of 10 family members, without altering the criteria of architectural design, structural and even environmental climatic

The bamboo cane is the main material of the building, the same one that has shown its structural benefits, is abundant in the area and economically affordable. Likewise, sustainability is manifested in the optimization of natural resources including cross ventilation, rainwater harvesting, and recycling of organic waste. In the long term, it represents energy and economic saving for the family.

The scale of production is homogeneous and allows prefabrication of panels and columns for a quick assembly in situ which allows reducing production costs and subsequent energy savings.

The houses had a cost of approximately US $ 3,500 each, financed entirely by BUSF, the City of Madrid and some minor donations obtained by the research team.

It should be noted that, at a social and economic level, some suppliers from the area benefited from the project, as well as restaurants, hostels, and taxi services. As for the families, some of them took advantage of the situation to strengthen their businesses, such as those near the collection center. Figure 4 shows a house completed in its entirety.

Figure 4. *Emerging housing completed*

3.2 Benefits of project implementation

With the achievement of the goal of the project to provide emerging housing to the affected families to a greater extent in the community of Río Muchacho, it was intended to welcome at least 10 families of the nearly 80 affected. The selected dwellings were those that had the greatest damage and needs at a socio-economic, disability and vulnerability level.

The socio-economic benefits of the project are reflected in the direct utility of the families that received a home without having to make an investment or loan to build it. Also, since the community was involved and supported in the construction days, they learned new technical skills for construction with a bamboo cane that can contribute to new sources of work in the reconstruction of the area or as a possible source of family income for the rest of their lives.

Countries like Colombia that are in a similar geographic position as Ecuador, the adobe architecture is developed mainly in highland areas, which are in turn marked as high and medium seismic hazards; in addition, it has an appreciable seismic activity given its location in the convergence of the Nazca, Caribbean and Suramericana plates (Sánchez, 2007); Rural houses are also built with bamboo cane that has seismic properties and that can be used in almost the entire Andean region.

In America, there is almost half of the world's diversity, reporting a total of 41 genera and 514 species, which are distributed from the Southeast of the United States of North America to Central, and South America, and the Caribbean Islands (Sanchez *et al.,* 2016).

The implementation and implementation of the project motivated teachers and students a lot; this motivation was due to the fact and feeling of being able to help people in need who did not have the resources to get ahead, but especially because of the satisfaction of seeing the quality of life of the people who had been affected by the earthquake improve (see figure 5) with all the beneficiaries).

Figure 5. *Beneficiaries of the Emerging Housing Project*

Regarding the professional field, the positive benefit was the fact of learning a new constructive system based on the bamboo cane together with the knowledge and experience acquired. It should be noted that the most relevant experience was the fact of learning to work in a team.

The most important achievement was the social one, reflected in the obtained by the beneficiaries, the contact made with the community of both the students and the teachers, having the students had a work experience manifested in a unique life experience, the sharing of the students with the teachers and at the same time between classmates, the fact that the project has been done with voluntary help, the fact of having used a classroom practice as a practical form of service to society, and important is having participated in the improvement of the quality of life of a group of people who were deprived of housing.

Recommendations

Below, a series of useful recommendations are made for this project or related projects:

a) Encourage the continuation of work together with entities such as BUSF to continue with the proposal and implementation of social projects such as Emerging Housing and Sustainable.
b) Follow up on the fact that BUSF uses the project proposal for the construction of emerging housing so that they can be replicated in other countries with similar characteristics to that of the Ecuadorian coast.
c) It is important to involve the community from the initial part of the project and to have a permanent contract for the empowerment of the same.
d) It is recommended to do good planning of the tasks to execute in a project since this will affect the improvement of the quality and of the response times and the culmination of the project.
e) It is important the number of professionals who attend the construction days, so it is recommended to make a good calculation of the amount of these needed by groups.
f) It is essential to make a good calculation of the time that will take the construction days.
g) It is important to consider in projects of this nature, the systematization of the construction, that is to say, that by groups they work in the construction of panels, columns, among others. It is also convenient to make a collection center of materials to avoid dispersion, as well as to elaborate kits that contain the materials to be delivered by houses, which greatly facilitates the distributions.

4. Conclusion

In the research project, 100 students and teachers participated, which was carried out with the learning-doing, the students and students learned about the management and construction of bamboo cane with all its properties, favoring 50 direct beneficiaries, whose conditions and quality of life were improved. A contribution was made to the rural community with a proposal to build new homes using materials from the environment that provides greater security and resistance in the case of earthquakes, low cost, sustainable and sustainable.

The results of the investigation allowed us to reach the conclusion that the best way to reinforce teaching, research and links as primary pillars of the academy is through the execution of social projects that leave a mark not only on those who have benefited but also in those actors who have participated in it.

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