Housing design with sustainable criteria for the town of La Danta, Colombia

Juan José Cuervo Calle
School of Architecture and Design, Universidad Pontificia Bolivariana
juan.cuervo@upb.edu.co

Luis Felipe Lalinde Castrillón
School of Architecture and Design, Universidad Pontificia Bolivariana
felipe.lalinde@upb.edu.co

Maryelín Botero Ocampo
School of Architecture and Design, Universidad Pontificia Bolivariana.
maryelin.ocampo@upb.edu.co

Abstract

This text is an academic research project that develops integral economic housing proposals with social impact, where interdisciplinarity is articulated to propose a building model with sustainable principles. It is based on the use of local materials, the correspondence between spatial needs, and the life conditions of people residing in La Danta, as well as autonomy in energy production.

The Sustainable Habitat Integrative Workshop is an exercise with a bet to empower social transformation through research by using its methodology as the axis for this work. The workshop is executed in one year, and thus structured in two phases. The first provides a solution to a design problem identified by students, based on fieldwork. Then, the second includes an analysis and the project synthesis process, considering not only sociocultural, political, and economic criteria, but also as a response to the population inhabiting the area. This, with the purpose of developing community workshops and self-construction processes with the inhabitants that contribute to the students, who have the capacity to develop critical thinking and to produce realities in a context that has been the target of paramilitary and guerrilla violence.

Keywords: Housing design, basic needs, integrated planning, education for sustainable development, interdisciplinary design

Introduction

This research project proposes, under sustainable criteria, some alternatives to develop a prototype for housing and furniture, that grant progress and productivity, with the intention of generating a socioeconomic impact on the population of the town of La Danta. The developed project proposals, as well as the social integration workshops, are based on the recognition of the inhabiting conditions of the diverse actors involved in such location, related in one way or another to the history of a population that has been strongly affected by the Colombian guerrilla conflicts in past decades (Gallego, 2013).

The research was developed by an interdisciplinary group of students and professors, engineers, architects, and industrial designers, who wanted to work on the construction of a complex programme that evaluated not only sociocultural, political, and economic criteria, but also those that responded to constructive and formal issues of the urban space and the housing unit. All this with the purpose of developing critical

thinking and create new realities, especially in a context of people being hurt by violence throughout history.

After recognising the context, the project articulates different components that intend to solve problems through interdisciplinary actions. Starting from the development of an experimental housing unit, this research is about the search for complements of social, cultural, economic, technological, and political innovation under a view of sustainability throughout time. This view contributes to the debate about the production of priority interest housing in the country, since it is well known that the current norms for the construction of this type of housing units standardize housing results, materializing solutions that do not respond to particular living situations (Carvajal, G. 2015).

This research, in favour of the Colombian juridical regulation that promotes and enables the access to housing (based on Law 1537 of 2012), intends to discuss about the formulations approved in the Peace Agreement between the National Government and FARC-EP, which presented proposals for mechanisms for an integral access to housing, with adequate spatial and technological solutions, adapted to each community in particular (Republic of Colombia & FARC-EP, 2016). This is an opportunity to contribute to this issue, mainly about the measures with normative character, since these restrain, affect, and alter the ways of life and expressions of people in La Danta.

Particularly, we pretend to board those issues that allow to recognise the complex system of physical, biotic, social, and cultural relations that act on the habitat, mainly the domestic environment and the public space of the community of La Danta; which, due to the particular context conditions, require a detailed sustainability criterion in order to produce an adequate housing model.

To achieve this purpose, this text is articulated in four sections. The first addresses the research methodological process, while the second describes the context framework in which the general work was developed. The third section highlights the conceptual elements of greater interest

that market the guidelines of the empirical work, and finally, the fourth discusses the results.

Methodological process of the project

This is a research project with mixed focus on the fields of design, architecture, and engineering that questions the residential space of the inhabitants of La Danta, Colombia.

The project execution was defined in two phases, each one of them determined in a temporary frame of one semester. The first phase was structured in two parts: there was a document review through diverse sources, mainly examining scientific articles and books regarding the issues of the habitat; with this information, the main categories to board the empirical work were determined. In the work on-site, besides reviewing the historical component of the town (Gallego, 2013), the housing needs regarding climate, constructive aspects, access, and considerations regarding the budget managed for each housing unit were identified (Díaz et al., 2011). Then, the second part is a contextual analysis about the social, cultural, economic, and environmental conditions of the general community of La Danta, focused on the special issues of the housing unit. The collection of information was done mainly through observation, validation, and verification techniques of the issues being researched. From this, five factors were verified: technical-productive, functional-operative, aesthetical-communicative, economic-administrative, and historical-political; all of which were considered both in the design project of the housing unit, and in its integrated furniture (Barrera, 2004; Rivera-Crespo, 2016).

In the first on-field contact, we detected the main needs of the community in everyday life, in terms of space and basic furniture. The initial result proposes, for each interdisciplinary work team, three architectonical project drafts for the housing units with a series of integrated furniture, as well as the design to address diverse technical

issues. In this stage, the design process is presented as the axis, as a procedure, and as a project; which, in its different stages, articulates formative research, theory, and the practice of projections for the formation of its students.

The second stage (in the second semester) was also structured in two parts: the first one synthetises the previous architectonical project drafts in one architectonical idea to consolidate a single proposal; the second one contemplated the detailed tracing of a housing unit and its integration with the context, the constructive systems, the engineering applied to the housing systems and urbanisation, the equipment or the domestic habitat, furniture, and supplies that are including, sustainable, and feasible, as well as the management of information between the work teams, the proposal, and the execution of community workshops and use of furniture.

Context framework: The town of La Danta

The town of La Danta belongs to the municipality of Sonsón (Antioquia-Colombia), located in the south-east of the department, at the Central Mountain Range, in a zone named as Magdalena Medio; this one is considered as a "...historical zone of colonization in Colombia, where six departments are gathered around the Magdalena River ...Bolívar, Boyacá, Cundinamarca, Santander, Caldas, and Antioquia"[1] (Gallego, 2013). Our intervention was specifically done in the neighbourhood of La Esperanza.

The first colonizers of this area arrived in 1938 from Aquitania and the municipality of San Luis, baptising this land as La Danta due to the abundant presence of tapir[2]. In 1961, a large part of the prominent land of La Danta was acquired by two men: Eloy Arbeláez and Siveriano González, from the city of Bogotá, who started to open the mountain and uncovered the great marble rocks (Restrepo, 2001); a resource that later became the

1 Our translation

2 ..."due to the abundant presence of these animals"... annotation: did not mean tapir.

main economic activity for the inhabitants of this place (Gallego, 2013). In 1977, there was presence of political and armed groups throughout the zone, which entered the territory with the purpose of supplying the basic needs of the population such as education, health, employment, and housing. The Colombian Revolutionary Armed Forces (FARC) took over La Danta in 1982, which generated fear in the population, to the point that almost 40 years later, this fear is still present. Because of the guerrilla take over, Autodefensas Unidas de Colombia (AUC), commanded by McGyver, settled as the armed group in the zone to defend the territory, which was well received by the population due to their permanent fear (Gallego, 2013). 2002 was the start for the demobilisation process of AUC throughout the national territory; MacGyver turned himself in by 2006 and as of this moment, there is a new beginning for the town.

Together with the peace agreements signed with FARC, different companies and organisations have been interested in being part of the integral improvement processes through management and social development, to contribute to the current peace and reconciliation process implemented in the country (Mi Oriente, 2016).

Considering the *Antioquia Piensa en Grande 2016-2019* Development Plan, which aims at improving the territory in regards to education, economy, infrastructure, and connectivity among municipalities, the execution of this project required us to consider diverse social, technical (rehabilitation), and cultural processes; all supported from the concept of sustainability. Also, there is the valuable assistance of the Berta Martínez de Jaramillo Foundation, which has the objective of generating inclusion and development opportunities in socially vulnerable communities, through the implementation of management and development models that contemplate investment in housing and social infrastructure, education, and economic and labour promotion.

According to the guidelines of the conceptual framework, one of the key fundamentals for the execution of the architectonical proposal was the environment build in the territory. These differences offer

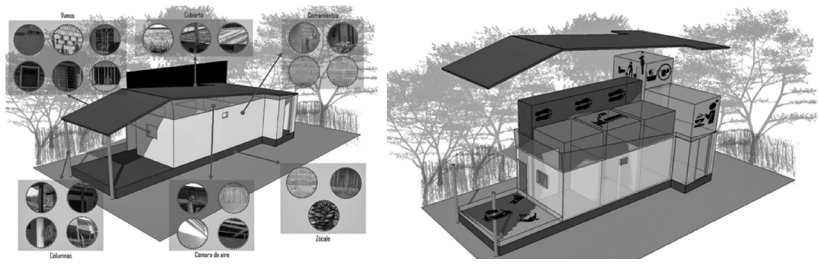
the possibility to talk about systemic sustainability, involving not only environmental but also socioeconomic aspects, by doing an integral intervention in the communities, supported by Decree 1285 and Resolution 0549 (Ministry of Housing, City, and Territory, 2015) that teach about sustainable construction.

Having the construction of a sustainable housing unit as a base required the identification of both urban and residential aspects. Regarding the infrastructure in La Esperanza neighbourhood, there is a lack of public space for recreation and access, a lack of public lighting, and a high percentage of houses without sewerage or basic utilities because they are in an environmental risk zone.

After analysing the dynamics of the houses and their constructive types (Figure 1), we identified the following aspects: the need to implement strategies for crossed ventilation and controlled natural light, as many houses lack an adequate ventilation system; the use of concrete, metal, and wood is identified in the constructive processes, mainly for the structure of the houses; and the use of roofs with leaves, clay tiles, and zinc sheets.

We also identified that the space distribution in the existing houses have common aspects: the front of the house is associated to socialisation and food consumption practices; the kitchen is located at the back, sometimes in open air and equipped with wood combustion stoves; the bathrooms are also in the backyard, and the rooms inside are used for resting and storage (see Figure 1).

Figure 1. (Left) spatial and material synthesis of houses in La Danta. (Right) Spatial distribution in houses



Source: Camila Hernández; Mariana Guzmán

Conceptual framework. The sustainable habitat as field of study for Architecture and Design

Considering conceptual development of sustainable habitat as field of knowledge that moves in a shared space (Follari, 1982) implied to put each one of the disciplines participating in this project in contact with one another, enabling a better positioning of their knowledge based on such interdisciplinary dialogue. For Architecture and Design, conceiving a sustainable habitat in conjunction with other fields could have been considered as an extremely complex issue both in its conceptualisation and in practice, since its research and topic dimension covered a great platform of possibilities and associations (Ardila et al., 2016).

The inclusion of architecture and design with sustainable habitat has transcended the usual relation with the natural system (biological) (Echeverría, 2009), in words of Leroi Gourhan (1971, 42), it is a habitat that "...is not exclusively or essentially referenced to the natural system, but to the culture-nature relation, and is located in the field that studies

human life from the particularities of the human being"[3]; nevertheless, there are few conceptual and theoretical elaborations from the discipline without a deep problematisation, even though multiple studies introduce the term sustainable habitat in the construction of their discourses (Echeverría, 2009).

For this project, we understood *sustainable habitat* as the construction of networks and weaves that subjects establish in a determined environment under certain conditions in cultural, political, social, economic, and spatial (not just physical) terms, and through which it was possible to establish diverse forms of inhabiting, where the human being configures and transforms the types of organisation, of the production of habitats and habits. In such construction, the relations of the subject with the habitat are modified and are in constant evolution, offering the possibility for multiple readings and interpretations that are based on a specific knowledge. Here is where we talk about sustainable habitat as an interdisciplinary event, where each researcher, in a particular manner, structures theories, knowledge, methods, methodologies, and instruments that configure this specific field of knowledge (Echeverría, 2007).

According to Echeverría (2009), the study of the urban and territory in relation to the habitat is mainly connected to three factors: "the processes inherent to politics and the territorial ordering, the inter and intra national territorial conflicts, and the transformation in the senses of the space in the age of globalization and urbanization" (pp. 32-33). The territory, viewed from the habitat, also focuses on the interpretation of this one as the material support for human beings and as base for social, political, economic, and cultural development, derived from its own activity and transformation. In this sense, it is important to clarify that studying a territory is not the same as studying the habitat:

[3] Our translation

> based on considering that territorializing is different than inhabiting [...] Even though every habitat is configured as territory, not every territory gets the sense of habitat; and even though by inhabiting you territorialize, not necessarily when territorializing do you inhabit (...) "The habitat, support of life, place where the verb inhabiting sits, is the space where the productive, cultural, aesthetical and affective activities of mankind are developed". (Leff, 2002, p. 243) [4]

This enables us to do a fundamental relation between the concepts of habitat and inhabiting, thus the importance it had on fieldwork; the recognition of the domestic and urban practices, as well as the ways to inhabit La Danta in general. Leff (2002), in that sense, contributes that such relation:

> will imply to grow from the habitat as a support territory, to the habitat as a productive potential, support for cultural significations and aesthetical values. This would mean to think about the habitat as a project that transforms the environment, as a social appropriation process of the habitability conditions. (Leff, 2002, p. 250)

Thus, the effort to recognise the social and cultural practices of the area. The habitat, as support and condition of inhabitation:

> generates habits and defines existential senses that have led to the coevolution of cultures with their environment through the means of appropriation of their environment. To inhabit the habitat is to locate a nature reconstruction process of nature from differenced cultural identities. (Leff, 2002, p. 250)

[4] Esta es la cita original en español. ""si bien todo hábitat se configura como territorio, no todo territorio cobra el sentido de un hábitat; y si bien al habitar se territorializa, no necesariamente al territorializar se habita...". (...) "El hábitat, soporte de la vida, lugar donde se asienta el verbo habitar, es el espacio donde se desarrollan las actividades productivas, culturales, estéticas y afectivas del hombre.

The habitat of our interest, therefore, is the one where human beings unravel their sense of inhabitation, this is, where they complex their existence and define their territoriality. (Leff, 2002). This is to detect the distinctive characteristics of inhabiting in the different groups or individuals involved, which implies a critical thought about a globalising conception of the housing unit referring to the ways to build, in relation to the social, economic, spatial, and cultural impact.

The social and economic reality of many people, especially of the least favoured ones, is distant from the discourses that promote the quality of the human habitat and better life conditions. Our current society forgets the purposes of human beings and their realisation in space. Many governors have also lost their social and political commitment, denying the construction of life interactions (Echeverría, 2000) and the weave of spatial-temporary relations that are built every day (Noguera, 2006); an issue that develops socioeconomic networks and territory cohesion from inhabiting in each individual and/or collective subject "situations that are inherent to human dignity" (Echeverría, 2009, p. 24).

Results and results discussion

This section evidences the results of the empirical and projection process developed during one year of academic work. The information is presented in three stages: the first one describes the housing proposals developed in the first semester of work; the second one exposes the identification of the architectonical elements of greater impact in the community of La Danta, through the integration of the design proposals that the general population considered most suitable for their needs; the third stage presents the sensitization process of the project through a basic furniture workshop for the housing unit that brought the community close to the design project in general.

First stage

The initial stage of the project was carried out with the formation of interdisciplinary groups, with the intention of developing three proposals in response to the result of a previous analysis done in the location of the intervention.

The first project, EspaciaDos (see Figure 3), is developed through the design of two mirroring houses, with the intention of generating an urban connection between them through productive activities recognised in the previous analysis of the location that, in response to the climate and cultural conditions, adopt the exterior zone of the house as a space for resting and socialisation in people's daily life.

There is also a proposal for a green wall as an element for architectonical closure that works as a filter for dust particles and as an instrument of identity through vegetation. Based on a real scale model of the closure with concrete block, there is an experiment to confront its efficiency in the field, considering thermal, technical, and aesthetical needs required because of the environment, besides the use of a constructive system and vegetable species that are appropriate for residential use. In addition to this, it is presented as a feasible strategy to improve the inhabitation conditions within the spaces, regarding temperature, lighting, ventilation, and aesthetics (Arboleda, 2018).

Regarding the spatiality of the house, the proposal for the bedroom area and socialisation-productive area is to compose the spaces through storage surfaces, done by self-constructions that offer the possibility to modulate such spaces according to the needs of each family; this as a personalisation tool in a serially constructed project.

The second prototype, GÚA (see Figure 3), poses a particularity, since this prototype is rooted in the solution of an uneven level between two modules; one is flexible and the other is not, considering the access conditions necessary for the house. It uses self-construction elements with local materials, mainly *guadua* (a variety of bamboo); a material used for

inside walls and urban gardens as part of the closure component. These strategies were developed based on the initial premises, mainly contributing to the bioclimatic component. They offer a high degree of thermal comfort and, at the same time, supply large entrances of light and provide durability in terms of space appropriation due to the flexibility available.

The third prototype, Link (see Figure 3), is named as such to express the intention to board the housing unit as a possibility for connection between space and users, and at the same time, among users, their neighbourhood, and the ways to inhabit it. The housing unit is initially made up of two bedrooms, a kitchen, a double purpose area, a bathroom, and a patio (for a garden or as an extension).

The replicability in this project (one of the objectives of the academic exercise) obeys to a previous analysis that identifies the materials, strategies, and constructive techniques existing in the community; aspects which are adopted by the work team and reoriented towards project specifications. The flexibility of this project enables the possibility of expansion towards the backyard area in three different ways: enlarging the built area, small-scale gardens controlled by the user, and area for outdoor relaxation.

Figure 2. EspaciaDos (top), GÚA (middle), and Eslabón (bottom) prototypes

Source: Camila Hernández and Mariana Guzmán (GÚA); Andrés Pacheco and Anna Parra (Eslabón); Claudia Vallejo and Maryelín Botero (EspaciaDos).

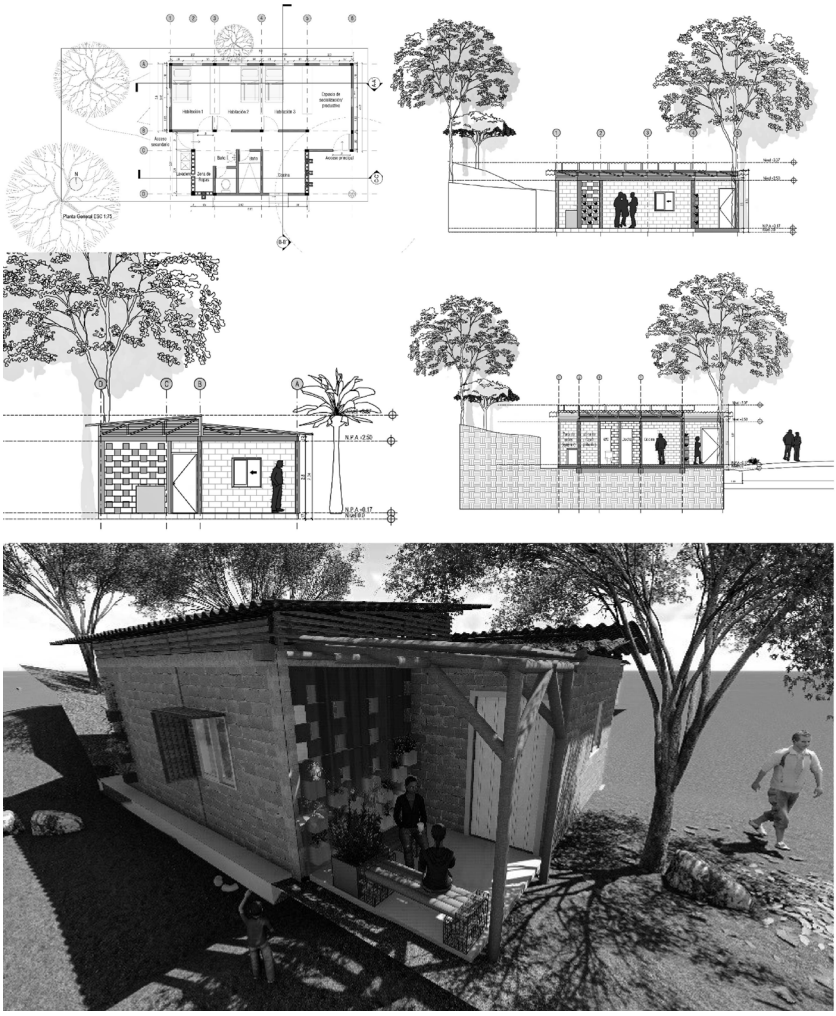
Second stage

After a rigorous analysis of each one of the three projects presented in the previous stage, one of them is selected along with the community to focus all the remaining project process on such idea. According to the selection process, the EspaciaDOS project presents an advantage regarding closure strategies, flexibility in the distribution of indoor spaces, and positioning regarding the collective creation and socialisation area by proposing an interaction mechanism among groups of housing units; a fundamental aspect for the community in general.

After this, the interdisciplinary work teams created in the first stage are restructured as committees: (a) a management committee, to achieve a normative and budget consolidation of the project, under the expected standards with the certification of the Casa Colombia Reference for social interest housing (CCCS, 2016); (b) a committee for entrepreneurship and self-construction of the basic furniture for the housing unit, with various workshops that empowered skills in the production of furniture with local materials; these highlighted the cultural and aesthetical values, considering their local resources as a fundamental factor. Throughout the process, the transforming character and the tools developed were evidenced as part of the social appropriation process; and (c) a Building Information Modeling (BIM) committee, in charge of creating digital design, architectonical, industrial, and engineering simulations, enabling the coordination of all the information developed during the project stage.

There was also an adjustment, verification, and integration process for the chosen design, with the purpose of contributing pertinent strategies adopted from the other prototypes, recognised as valuable in the focus groups with La Esperanza community (Figure 4).

Figure 3. General drawings and imaginaries of the EspaciaDos project



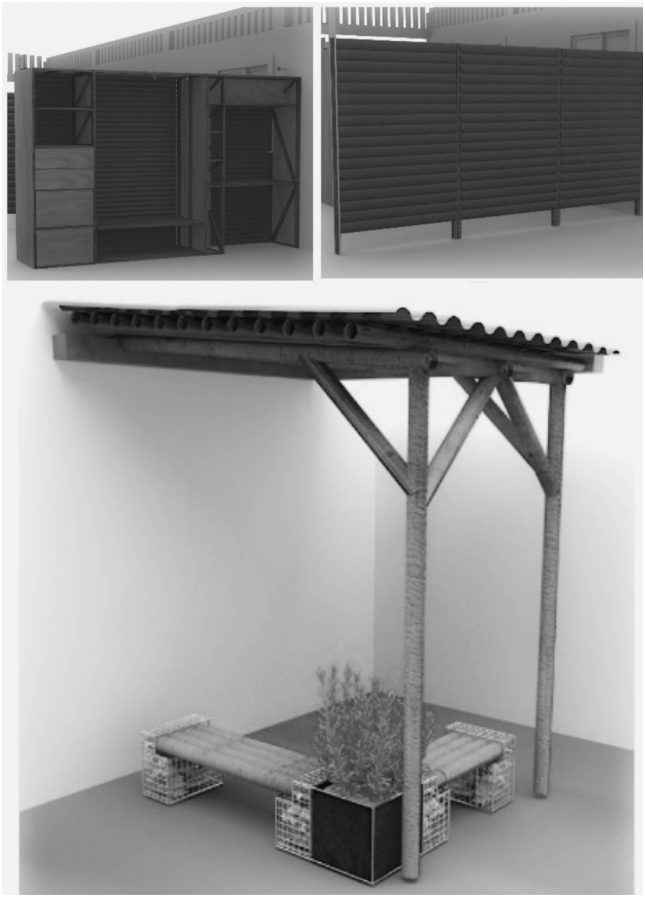
Source: BIM Committee students

Third stage: The self-construction process

Among the design ranges for an economic housing unit with sustainable criteria, there is a proposal for the development of equipment for the domestic habitat, inclusive, sustainable, and cultural, environmental, and economic furniture; based on the information detected in the observation, validation, and verification processes that recognised aspects such as object storage, the need for an outdoor space for the development of socialisation activities, and deficient inhabitation conditions. According to these findings, a series of housing-integrated furniture is proposed:

- Multi-purpose division. It is the first one of the two division proposals for the flexible area of the housing unit; it can be arranged according to the user's requirements (see Figure 5). The idea of this division element results from the need to generate storage spaces, without sacrificing the areas intended for bedrooms, living room, and the productive zone; this is, a proposal to change the conventional concrete block dividing walls for this type of division.
- Simple division. It consists of a 1.20m long x 1.80m high module, made of *guadua* (see Figure 5). The reason for these measurements is the existence of a 1.20m x 1.20m grid of the housing unit design; respecting these measures enables the users to put the modules together to close a space completely.
- A pergola with outdoor bench. It is a cover element made of *guadua*, developed with the purpose of improving the conditions of the socialisation space in the outdoor area of the houses to strengthen collective social bonds. The chair was made of electrically welded screen, *guadua*, and marble (see Figure 5)

Figure 4. Models of the multi-purpose division in context (top), the simple division (middle), and of the Pergola and outdoor bench (bottom)



Source: María Fernanda Castaño, Vanesa Lopera, Manuela Zuluaga, and the self-construction committee.

Once the entrepreneurship and self-construction committee determined the constructive strategies for the elaboration of each prototype, there was a presentation before an interdisciplinary collective to build some real scale prototypes (1:1) through community workshops (see Figure 6), to carry out the necessary modifications for the optimum functioning of the models, and to design the corresponding construction manuals.

Figure 5. Community workshop for the construction of domestic furniture based on the exercise of the students of Industrial Design

Source: material provided by the authors.

Conclusions

This applied research exercise resulted in the development of experimental projects of technological and social innovation with a strong focus on sustainability. We can state that, with this experience, we explored new fields of action for the design, architecture, and engineering practice, by recognising the direct contributions of each discipline, as well as the integration of knowledge solved in the same housing project that responded to the posed questions.

To strengthen and think about housing in key with a sustainable habitat was one of the main objectives of this work; to study the way in which a determined social group weaves its network for the connection of its living space as a proper fact of everyday human life, supported on the social, political, economic, cultural, and spatial dimensions, trying to surpass the material sense that is regularly attributed to the housing unit.

Working for a community in a multidisciplinary manner, in this case for the location of La Danta, enabled a broad understanding of the housing concept and changed the restricted notion that is generally assigned to it. This also enabled us to recognise that the urban, political, and economic standards of the country are unsustainable for the most vulnerable communities, with a low inhabitability as a consequence.

The project achieved to pose an inhabiting solution for the issue on the use of the housing units delivered by the government in an integral and sustainable manner, and in this case, for a zone that was strongly hurt by the Colombian armed conflict (Valdes, 2016). This would suppose a methodological model to discuss the housing residential planning in the post-conflict.

This collective work showed that it is possible to change conceived ideas about the quality of the housing unit that are currently being offered to people, and to be able to offer opportunities for growth of social and urban development of the least favoured communities of the country. Enabling a family to grow along with their house is to contribute to the

sense of belonging implicit in their identity. Therefore, this is a bet for the development of the housing units to form an integrative axis.

References

Ardila V. H., Lalinde, L. F., Rodríguez, M., Villa, A. (2016). Interdisciplinary education: a learning method for a sustainable model of housing. Proceedings of the 11 International Conference on Urban Regeneration and Sustainability (SC 2016) www.witconferences.com. DOI: 10.2495/SC160691

Barrera, G. S. (2004). Diseño con responsabilidad social. Primer Encuentro Nacional de Investigación en Diseño Universidad. ICESI 2004.

Carvajal, G. J., & Balaguera, A. (2015). "Línea base para vivienda de interés social sostenible: caso ciudad de Medellín".

Consejo Colombiano de Construcción Sostenible. (2016). Referencial casa: diseño y construcción de soluciones habitacionales en Colombia. https://www.cccs.org.co/wp/download/referencial-casa-colombia/

Decree No. 1285 of 2015 [Ministerio de Vivienda, Ciudad y Territorio]. Modifying decree No. 1077 of 2015, the only decree for housing, city, and territory sectors in relation to the guidelines for sustainable construction. June 12 of 2015. Retrieved from https://www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=62885

Echeverría, M. C. (Ed.). (2009). *¿Qué es el hábitat?: Las preguntas por el hábitat*. Escuela del Hábitat CEHAP Universidad Nacional de Colombia.

Echeverría, M. C., Cardales, B. J., Arboleda, G. E., Mejía, E. M. (2007). *Habitar ciudad: estado del arte en Medellín 1981-2005*. Escuela del Hábitat CEHAP Universidad Nacional de Colombia.

Follari, R. (1982). *Interdisciplinariedad (los avatares de la ideología)*. Universidad Autónoma Metropolitana-Azcapotzalco.

Gallego, J. C. (2013). *Con el miedo esculpido en la piel. Crónicas de la violencia en el corregimiento La Danta*. Editorial Hombre Nuevo.

Leff, E. (2002). *Saber ambiental, sustentabilidad, racionalidad, complejidad, poder*. Ed. Siglo XXI.

Leroi, G.A. (1971). *El gesto y la palabra*. Universidad Central de Venezuela.

Mi oriente. (2016, August 9). Alcaldía de Sonsón y Argos renovarán la institución educativa rural de la Danta, Sede Jerusalén. https://mioriente.com/paramo/sonson/alcaldia-de-sonson-y-argos-renovaran-la-i-e-r-la-danta-sede-jerusalen.html

Ministerio de Ambiente, Vivienda y Desarrollo Territorial. (2011). *Los materiales en la construcción de vivienda de interés social*. (C. Díaz & J. Ramírez, Eds.). Nuevas Ediciones S.A.

Noguera, A. P. (2004). *El reencantamiento del mundo*. Programa de las Naciones Unidas para el Medio Ambiente. Universidad Nacional de Colombia.

Osorio, J. V., & Ciro, H. (2007) Estructura interna de la guadua y su incidencia en las propiedades mecánicas. *Dyna*, *74*(153), 81-94.

República de Colombia & Fuerzas Armadas Revolucionarias de Colombia Ejército del Pueblo. (2016). Acuerdo General para la terminación del conflicto y la construcción de una paz estable y duradera. http://www.indepaz.org.co/wp-content/uploads/2013/04/Acuerdo_general_para_la_terminacion_del_conflicto_y_la_construccion_de_una_paz_estable_y_duradera.pdf

Resolution No. 0549 of 2015 [Ministerio de Vivienda, Ciudad y Territorio. Resolution ruling chapter one of title seven, part 2, of Decree No. 1077 of 2015, regarding the parameters and guidelines for sustainable construction and adopts this guide to save water and energy in buildings. July 10 of 2015. Retrieved from http://ismd.com.co/wp-content/uploads/2017/03/Resolución-549-de-2015.pdf

Restrepo, C. (2001). El sistema kárstico de la Danta (Sonsón- Antioquia) Colombia. *Dyna*, *78*(169) 239-246.

Rivera, O. (2016). Talleres de diseño colaborativo y hábitat evolutivo: puentes entre la academia y la comunidad. *Bitácora Urbano Territorial*, *27*(1), 55-62. https://doi.org/10.15446/bitacora.v27n1.40143

Valdés, M. F. (Ed.). (2017). *Ciudades sostenibles en el posconflicto en Colombia: Cartagena, Bogotá, Medellín, Bucaramanga*. Fescol. http://library.fes.de/pdf-files/bueros/kolumbien/13432.pdf

Abbreviations

A.U.C.: Autodefensas Unidas de Colombia, Colombian United Autodefense Group (AUC)

FARC-EP: Fuerzas Armadas Revolucionarias de Colombia, Colombian Armed Revolutionary Forces