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## Agriculture and Sustainable Tourism for the Consolidation of Peace in Colombia: A Study of Architectural Traditional Techniques

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### CONFERENCE PAPER

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#### Abstract

Nowadays different organizations carry on international cooperation programs to boost relationships with the most disadvantaged parts of the world. These projects allow people and countries to work together for a common aim. They also allow improving knowledge in different fields, sharing information and favouring a mutual exchange between the involved parts. This paper describes a cooperation program carried on between Italy and Colombia. It reports a small part of this experience related to sustainable architecture, the use of natural building materials and vernacular architecture in Colombia. The aim is both to give some theoretical information concerning these themes and to describe the experimental part of this project. It reports the understanding of the population of these issues and the perception of their traditional architecture.

**Keywords:** Cooperation program; Colombian architecture; Bamboo; Rammed earth; Wattle and daub; Adobe.

#### 1. Introduction

The international cooperation program “Agriculture and Sustainable Tourism for the consolidation of peace in Colombia”, funded by The Italo-Latin American Institute (IILA), wants to strengthen peace in Colombia by local development and sustainable tourism. To achieve this goal the program covers a period longer than one year, divided into different steps. One of the first ones consists of training courses dealing with several themes. Some of them concern Colombian architecture, addressing topics such as architectural periods, vernacular techniques, and local building materials. For guaranteeing local development, it is fundamental knowing local resources, history and characteristics of the involved area. For these reasons, this is an important part of the program and grants people to have awareness about Colombian cultural heritage. The training courses also allow looking over people's feeling for these issues. It is another relevant aspect to understand their awareness about current preservation, enhancement, and transmission of cultural patrimony.

#### 2. The Italo-Latin American Institute and Colombia project

IILA is an intergovernmental agency founded by the international conventions signed in Rome on the 1<sup>st</sup> of June 1966 to potentiate the relationship between Italy (Europe) and Latin America. The Member States of the Organization are Italy and twenty Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay, and Venezuela. Since 2007, IILA is an Observer member of the United Nations General Assembly; since 2018, of the EU-CELAC Ministerial Meetings and a special guest at the Ibero-American Summits. IILA focuses its interests in the cultural, scientific, economic,

technical and social fields. Its purpose is to develop and to coordinate research about the Member States, to spread this information and to identify exchange and assistance possibilities. To achieve these goals it organizes meetings, international conferences, exhibitions, and learning courses. It boosts cooperation with the main regional and sub-regional Latin American institutions and the execution of specific projects in collaboration with the European Commission.

Among the several programs carried out by IILA, the ongoing project described in this paper focus on Colombia's local development. It consists of a theoretical part and some practical workshops. One of the first steps, carried out in February 2020, consists of learning courses divided into two modules: farmhouse and architecture. This last one deal with themes related to sustainable architecture such as restoration of buildings for tourism purposes, enhancement of historic centres and improvement of local construction techniques.

The three involved departments are:

- Cauca, a southwestern department consisting on a coastal plain, the Western and Central Cordillera; its capital is Popayán, the city where lessons took place;
- Huila, a southwestern department, adjacent to Cauca; it is a mountain region consisting on Oriental and Central Cordillera; San Agustín archaeological zone and Tatacoa desert are the most famous attractions; the capital is Neiva, city where the learning course was carried out;
- Antioquia, located in the central northwest part of Colombia; it is a mountain region and its capital is Medellin, the second-largest city in the country; Lessons were carried on La Pintada.

Since the three regions have different historical backgrounds, the population have different responses to this cooperation project. Colombia's social and historical problems widely affected Cauca and Antioquia.

The paper describes a detail of the architectural module, dealing only with some of its subjects. It reports only three themes: historical architectural periods in Colombia, the legislation of cities centre and building requalification and vernacular building techniques and materials, an important part of Colombia's cultural heritage.

### **3. Historical architectural periods in Colombia**

Studying historical architectural periods favours understanding Colombian architectural background. Investigating these themes allows knowing not only the styles of historic periods but also traditional construction techniques. Besides, it guarantees to have the awareness of the importance to preserve and enhance cultural heritage. Colombian historical architecture is conventionally divided into four periods [1], summarily described below.

#### *3.1. Pre-Hispanic period*

Pre-Hispanic is the first architectural period. It lasts until the arrival of the Spanish in Colombia in the 16th century. There are not many documents related to this period. For this reason, its origins are unknown. It is necessary to further researches, also considering the characteristics of the indigenous population that still lives in Colombia [2].

According to historical studies, the indigenous population occupied the mountainous territory of the Andean region, the Caribbean coast and the regions near the Rio Cauca. The only archaeological sites are San Agustín, Tierradentro, Pueblito, and Ciudad Perdida. Historical and archaeological researches demonstrate that construction techniques used bamboo (*guadua*), wood, straw, and clayish earth [1].

#### *3.2. Colonial period*

The second architectural period starts with the Spanish colonization and lasts until 1819 when the Colombian Republic was formed. The colonizers introduced a new type of urban city planning: a central square and a grid layout of building blocks and streets. The cities have news religion, civil and military architectures; the distinctive feature of the buildings is the central patio. The Spanish also introduce news building materials that people used mixed with traditional ones. The most known are ceramic brick, stone, wood, adobe and other earthen-based materials [1,2].

#### *3.3. Republican period*

Republican architectural period corresponds to Colombian Independency. During this period (19th century-the beginning of the 20th century), people move to uninhabited areas. Many Colombians start to live in the countryside, founding new towns. City planning changes, urban parks arise, new types of buildings are built, still using the Colonial period's techniques [1].

### 3.4. Modern period

The last architectural period is the Modern one and starts in 1930. It is normally divided into three different phases: First Modernity (1930-1950), Consolidation (1950-1970) and Diversification (1970 – until now).

In the first part of this period, several regions and small cities start to grow. By improving the transports, it is possible to connect previously isolated areas. Thanks to industry and commerce, many towns become bigger and more important. Besides, modern architecture principles reach Colombia giving birth the modern metropolises. This is also the period of the birth of urban plans.

## 4. Colombia legislation of city centre and building requalification

Legislation related to the renovation of the existing buildings is an important issue for sustainable architecture development. This favours requalification avoiding construction of new buildings and guaranteeing the preservation of cultural heritage. Knowing legislation also allows understanding the level of awareness regarding these themes.

Colombian legislation related to urban development, redevelopment of historic centres and cultural heritage is quite advanced compared with other Latin American countries. Nowadays, after several important steps, each urban plan must consider conformation, incorporation, and preservation of public space buildings and works of historical interest. Urban plans can guarantee less environmental impact.

For many years Latin America improves urban and social rehabilitation and redevelopment. For Colombia, these are recent themes [3]. In 1967 “*Normas de Quito*” introduce the guidelines for the requalification of historical centers in Latino America, thanks to the Meeting on Conservation and Use of Monuments and Places of Historical and Artistic Interest [4].

Colombian legislation for heritage enhancement develops in 1959, after the 7th Pan-American Conference. In this year, the law 163/1959 introduces the themes of safeguard of historical centers. It declares as National Monuments several Colombian areas and promotes National Tourism Corporation (*Corporación Nacional de Turismo*) [3].

In 1968 The Colombian Institute of Culture (Colcultura) draws up many inventories for historical centres safeguard, generating a new protectionist vision. At the end of 1980, it proposes the “Policy for historical centres and real estate” (*Política para los centros históricos y el patrimonio inmueble*) that connects cultural heritage preservation with European currents of thought about architecture and cities [4].

The Law 388/1997 collects these fundamentals. It requires that each municipality has an Urban Plan, considering cultural heritage as the fundamental element. It also orders to define the preservation of centres declared as Historical and Cultural Heritage [3]. The Law 397/1997 creates the Ministry of Culture [4]. In these years, Colombia legislation also tries to encourage people’s participation in city centres requalification. These are important initiatives, which relate Colombia urban planning to the preservation of cities considered part of cultural heritage.

The two more recent laws related to urban heritage are 1185/2008 and Decree-Law 763/2009. They introduced the “Management and Protection Plans for historic centres” (*Planes Especiales de Manejo y Protección para los centros históricos*, PEMP). They consider historical city centres not only as a cultural resource but also as an important economic and social one [3,4].

## 5. Colombia vernacular building techniques and materials

Colombian traditional building techniques are an important part of cultural heritage. Since they use natural, local and environmentally friendly materials, they have a low environmental impact. The most customary are bamboo and earth. The best-known traditional building techniques are adobe masonry, rammed earth (*tapia*) and wattle and daub (*bahareque*) [5]. They date back to the pre-Hispanic period, but they are still conserved [6]. Since they use materials available in many parts of the world, it is possible to replicate them, ensuring sustainable architectural development. For this reason, is important to preserve and enhance knowledge of these construction methods.

### 5.1. Bamboo and Guadua construction

Bamboo is widely used as a construction material [7]. It has adequate mechanical properties to be a structural element, as good resistance to humidity and seismic forces [8,9]. It has several beneficial aspects as a good mass-resistance relationship, a fast growth-rate (between 3 and 6 years) and great flexibility that allows the creation of different geometrical shapes. Bamboo is a good building material also because it is easily harvestable, transportable, workable and cheap.

Bamboo grows best in well-watered volcanic and alluvial soils [9]. There are many types of bamboo, at least 1250 bamboo species, located mainly in America, Africa and Asia [8]. The most common species of bamboo in Colombia is *Guadua Angustifolia* Kunth (Fig. 1a). It has always been one of the most used materials in Colombia, especially to build common construction. Native use it for many purposes, not only for construction [9]. Dimensional irregularity of the cross-section restricts its use in large spans structures. *Guadua* laminates are also used and studied [8].

Many people consider bamboo constructions as poor ones [9]. For this reason, the population does not enhance them, with the risk of abandonment. Fortunately, bamboo is regaining importance and several bamboo constructions are famous all over the world. This is also thanks to architects such as Simon Velez, one of the best-known Colombian architect. Starting with the “Pabellón Zeri” project, he restores importance to this building material [10].

### 5.2. Bahareque

Wattle and daub (*bahareque*) is one of the most well-known traditional Colombian technique. It is widely used all over the country, especially in Cauca and in areas close to Rio Magdalena. It was already common during the pre-Hispanic period. It was rediscovery at the end of the 19th and in the 20th century [6]. This construction technique uses several natural materials, guaranteeing a low environmental impact. It may have good earthquake resistance properties: its flexibility generally presents adequate behaviour to support non-axial movements [6,11]. A large part of the course participants lives or owns a *bahareque* house (Fig. 1b). During the lessons, they gave some additional information about this construction technique.

Reeds, sticks and reed interwoven constitute light structures. These are filled with straw, coconut shell, clay and manure [5]. An auxiliary structure allows reinforcing the infill materials, strengthening and completing the structural system. The infill materials also provide thermal insulation and regulate hygrothermal exchanges.

Concerning timber light structures, there are several forms and techniques. The construction system is the beam-pillar frame system. Structural elements have different shapes: a diameter of 12-15 cm the largest, 7-8 cm the smallest. The installation distance between them is about 40-80 cm. [6]. A rendering and plastering mortars of the same clay used as infill material and a limewash made with calcium hydroxide milk are normally used as coatings [11].

Nowadays people do not use this constructive method for new buildings. As stated before, some Colombians consider it a construction method for the poorest people, and they prefer to use “modern” ones. The risk of forgetting information and losing knowledge to build and preserve this type of buildings is high.

### 5.3. Adobe

This construction product used to build masonry has a great diffusion for its easy implementation. The adobe are produced using local earth, an easily available building material. The adobe are lean on each other to produce a masonry. Their size varies according to the possibilities. During colonial periods, they normally were 60 cm x 45 cm x 10 cm, but in many areas nowadays the common size is 48 cm x 24 cm x 8 cm. Several methods permit to adjust them to create the wall: aligning the long side of the adobe with the development of the wall or placing it perpendicularly. Adobe rows can overlap by alternating these two methods. This guarantees a better solidity [11].

### 5.4. Tapia

Rammed-earth (*tapia*) is a widely used construction method in Colombia [5]. In the 17th and 18th centuries, it became a popular method as well as other construction techniques that use earth. Since these are passed on orally, documents that allow their dissemination are rarely available [11].

This construction method consists of using local excavated earth, moistened, placed inside wooden formworks and compacted layer by layer. It is extremely important the controlling its moisture content. This feature plays a fundamental role in construction resistance [11]. Wooden formworks define dimensions of the rammed earth rammed blocks, normally 0.40 m thick, between 1.5 and 2.0 m long and 0.80 m high. After being rammed, layer by layer, until the top, the formwork is dismantled and reassembled in an adjacent position to continue this process. Vertical or diagonal joints allow connecting the different rammed blocks of the wall. Rammed earth does not have necessarily a render and plaster; it can be exposed [12]. Foundations are in concrete or stone masonry [11]. A rammed earth construction is shown in Fig. 1c.

### 5.5. Another example of natural material construction: the wooden cabaña

Since this paper wants to describe several aspects of this international cooperation program, another construction realized by natural materials is described below. It does not use traditional building techniques, but it is an example to achieve interesting considerations.



Fig. 1. (a) Guadua; (b) Wattle and daub house; (c) Rammed earth house

In Antioquia, near to Caramanta, a farm owner is building a small house for tourism purposes. As shown in Fig. 2, he only uses wood, local and natural building materials, with a low environmental impact. This project demonstrates that people start to understand the potential of these constructions. At the same time, it has several technical problems. For example, without properly treating, the fresh wood may have problems related to durability; reused elements, as door and windows, have not been adequately treated. This example highlights that, even if people want to improve sustainable construction techniques, having technical knowledge or consultancy is extremely important.

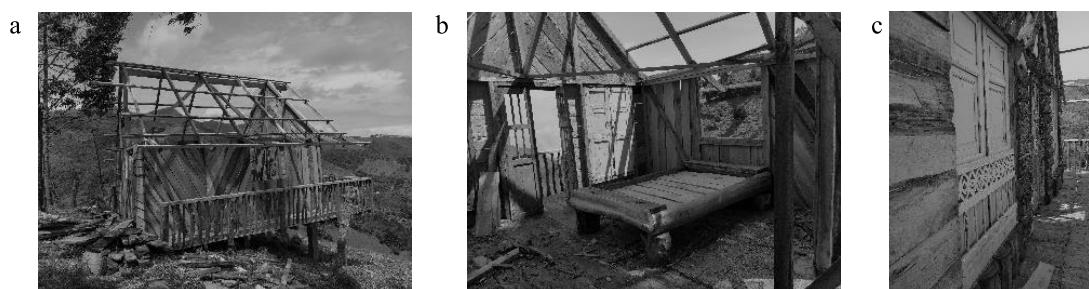


Fig. 2. (a) Wooden house; (b) Interior of the wooden house; (c) Detail of the door and window

## 6. Discussion

One of the most interesting information gained from this experience is people's reactions to these themes. First, most participants do not know anything about legislation related to cultural heritage and urban planning. Since they are involved in a requalification project for touristic purposes, not knowing adequately the laws is a huge problem to deal with.

Considering Colombian architectural heritage, most participants are not familiar with much information. Besides, only very few people consider traditional construction techniques as a part of Colombian cultural heritage. People normally consider them as a "type of building for poor people".

This course certainly helps to understand the potentiality of this information. Participants said that this has been an opportunity to have a greater awareness of their cultural heritage. For example, one of them changed his mind deciding not to tear down his *bahareque* house, but to redevelop it as an important Colombian traditional feature.

## 7. Conclusion

The international cooperation experience favour achieving important conclusions. First, it demonstrates that although media and internet allow everyone to get in touch with different and distant realities, seeing first-hand remains essential.

Considering Colombia legislation related to the renovation of existing buildings, it is possible to affirm that it is quite developed. It is changing to secure the enhancement of cultural heritage and the drafting of urban plans. These involve not only city centres but also rural areas.

To guarantee sustainable development, it is extremely important knowing cultural heritage. Colombian architectural periods and traditional construction techniques are an important part of this. Besides, construction methods use natural materials, available in many parts of the world. They can easily replicate, guaranteeing an environmentally friendly architecture development. For these reasons, it is important to study and disseminate these techniques.

This experience allows figuring out that many people do not appreciate natural building materials. Traditional construction methods are related to poorness. The risk is to lose this knowledge. Nowadays, considering also environmental problems, people have to enhance these techniques. The common idea that perceives the use of natural materials as a poor quality solution can put vernacular architecture at risk. Therefore, it is necessary to consider the important role that social part plays.

The first step to avoid the loss of this important information is learning. It allows understanding, appreciating and valuing cultural knowledge of a country.

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### **References**

- [1] A. S. Roa, *La arquitectura en Colombia en varios tiempos*, Rev. Credencial, 2017.
- [2] S. Arango, *Historia de la arquitectura en Colombia*, Centro Editorial y Facultad de Artes, Universidad Nacional de Colombia, 1989.
- [3] A. Beuf, M. E. M. Delgado, *Colombia Centralidades históricas en transformación*, Centralidades, First ed., Olacchi, pp. 11–24, 2013.
- [4] P. Mondino, S. Gron, L. M. R. Torres, *Camminando sulle Mura. Progetto di valorizzazione delle mura di Cartagena de Indias*, Politecnico di Torino and Pontificia Universidad Javeriana de Bogotá, 2018.
- [5] N. M. Díaz, J. M. L. Velasco, *Arquitectura tradicional colombiana como sistema pasivo de aprovechamiento energético*, Universitat Politècnica de València and Escuela Técnica Superior de Arquitectura de Valencia, 2016.
- [6] C. Sánchez Gama, *La arquitectura de tierra en Colombia, procesos y culturas constructivas*, J. Cult. Herit. Stud., vol. 20, no. 2, pp. 242–255, 2007.
- [7] L. Nunes et al., *Nonwood bio-based materials*, in *Performance of Bio-based Building Materials*, Elsevier, pp. 97–186, 2017.
- [8] L. F. López, J. F. Correal, *Estudio exploratorio de los laminados de Bambú Guadua Angustifolia como material estructural*, Maderas. Cienc. y Tecnol., vol. 11, no. 3, pp.171-182, 2009.
- [9] J. J. Parsons, *Giant American Bamboo in the Vernacular Architecture of Colombia and Ecuador*, Geogr. Rev., vol. 81, no. 2, pp. 131-152, 1991.
- [10] E. S. Delgado, *Actualidad y futuro de la arquitectura de bambú en Colombia*. Simon Velez : “simbol o y busqueda de lo primitivo”, Universidad politécnica de Cataluña, Escuela tecnica superior de arquitectura de Barcelona, 2006.
- [11] L. F. Guerrero Baca, *Arquitectura en tierra. Hacia la recuperación de una cultura constructiva*, J. Cult. Herit. Stud., vol. 20, no. 2, pp. 182–201, 2007.
- [12] J. L. Parracha, J. Lima, M. T. Freire, M. Ferreira, and P. Faria, *Vernacular Earthen Buildings from Leiria, Portugal – Material Characterization*, Int. J. Archit. Herit., <https://doi.org/10.1080/15583058.2019.1668986>, 2019.