CULTURE, HISTORY, NATURAL MATERIALS IN ANGOLA: VERNACULAR ARCHITECTURE AND THE POSSIBILITIES FOR MORE SUSTAINABLE CONSTRUCTION

CULTURA, HISTÓRIA, MATERIAIS NATURAIS EM ANGOLA: ARQUITETURA VERNACULAR E AS POSSIBILIDADES PARA UMA CONSTRUÇÃO MAIS SUSTENTÁVEL

CULTURA, HISTORIA, MATERIALES NATURALES EN ANGOLA: ARQUITECTURA VERNÁCULA Y LAS POSIBILIDADES PARA UNA CONSTRUCCIÓN MÁS SOSTENIBLE

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ABSTRACT
This article focuses on the Angolan vernacular architecture and is part of a master's dissertation. As a cultural heritage, understanding vernacular architecture also helps us search for more sustainable construction alternatives. To this end, this article aims to characterize the Angolan vernacular architecture by carrying out a theoretical literature review and a case study in the province of Huíla (Mupalala), Angola, for the cubatas of the Nyaneka-Humbi ethnic group. For this case study, it was imperative to interview local residents in order to understand the cultural aspects of construction, building techniques and materials used. In the end, it was possible to characterize this type of construction and understand possible contributions to propose more sustainable construction.

KEYWORDS
Vernacular architecture; Sustainability; Natural materials; Construction techniques; Angola.

RESUMO
Este artigo tem como foco a arquitetura vernácula Angolana e faz parte de uma dissertação de mestrado. Enquanto uma herança e patrimônio cultural, compreender a arquitetura vernácula nos auxilia também na busca por alternativas de construção mais sustentáveis. Dessa forma, esse artigo buscou caracterizar a arquitetura vernácula Angolana para o que foram realizados uma revisão bibliográfica teórica e um estudo de caso na província de Huíla (localidade de Mupalala), Angola, para as cubatas da etnia Nyaneka-Humbi. Para o estudo de caso foi necessário entrevistar os moradores locais de forma a entender os aspectos culturais da construção, técnicas construtivas e materiais empregados. Por fim, foi possível caracterizar esse tipo de construção e entender eventuais contribuições para a proposição de uma construção mais sustentável.

PALAVRAS-CHAVE
Arquitetura vernácula; Sustentabilidade; Materiais naturais; Técnicas construtivas; Angola.

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RESUMEN

Este artículo se centra en la arquitectura vernácula angoleña y forma parte de una disertación de maestría. Como herencia y patrimonio cultural, comprender la arquitectura vernácula también nos ayuda en la búsqueda de alternativas de construcción más sostenibles. De esta manera, este artículo buscó caracterizar la arquitectura vernácula angoleña mediante una revisión bibliográfica teórica y un estudio de caso en la provincia de Huíla (localidad de Mupalala), Angola, para las cabañas de la etnia Nyaneka-Humbi. Para el estudio de caso, fue necesario entrevistar a los residentes locales para comprender los aspectos culturales de la construcción, las técnicas constructivas y los materiales empleados. Finalmente, fue posible caracterizar este tipo de construcción y entender posibles contribuciones para la proposición de una construcción más sostenible.

PALABRAS CLAVE

Arquitectura vernácula; Sostenibilidad; Materiales naturales; Técnicas constructivas; Angola.

1. INTRODUCTION

This article is part of a master's research project aimed at discovering solutions for more sustainable construction in Angola, based on the principles of the country's historical construction. The research presents Angola's vernacular construction, identifying its characteristics in terms of materials and construction techniques, as well as the local cultural aspects that led to the development of the arrangements and propagation of the construction system. This article focuses on the traditional vernacular architecture heritage that manifests the essence and origin of construction in Angola that is seen as promise for more sustainable construction in the country.

Figure 1: Vernacular architecture in southern Angola, also known as traditional construction *Nyaneka Humbi, (Mupalala- Quipungo-Huíla)*.
Source: Autor.

Figure 1 shows the vernacular construction found in southern Angola. In this case, the building was made of wood available on site, and covered by grass, in the style of pau a pique. There is a difference in the diameters of the trunks in the ceiling elements of those that make up the system of frames and thresholds of the main access door, whose leaf appears to be made of wood (pau-ferro). Also noteworthy is the absence of foundation elements and the contact of the natural material with the ground, which can cause rapid degradation of the structure.

Most of the records of traditional vernacular buildings are found in the southwest (Huíla, Cunene) and north (Uíge and Zaire) of Angola, especially in rural areas, because they cost less to build and the materials are readily available. In general, these constructions, are generally built by the owners of the house (they were self-built) and belong to people who are still very conservative and seek to preserve their cultural traits.

The reason for studying this topic is that in Angola, and particularly in the province of Huíla, there is a high level of poverty among families, making them vulnerable and with limited access to public housing policies due to the high cost of construction. In this context, vernacular buildings appear to be part of the solution, as they are built by local people whose construction techniques are influenced by their geography, climate, traditions, cultures and materials (MISRA, 2016). However, if these buildings were analyzed through the lens of contemporary construction techniques, they could be innovated and improved in order to make them even more sustainable or to lend their characteristics to contemporary construction.

The local population in these regions of Angola have special knowledge of regional characteristics and has developed these techniques through long-term experience (ANNA-MARIA 2009; ZHAI and PREVITALI, 2010).

In Huíla, Angola resorts have been constructed on farms and tourist areas, blending traditionalism and modernism through innovative techniques, however this fusion is not evident when it comes to residential houses, which would be interesting because these innovative practices have an impact on reducing the cost and durability of houses and making them more functional because the owner is directly involved in the construction process. Also because vernacular architecture is directly linked to sustainability. However, vernacular architecture is not employed in Angola as it does not form a component of the urban planning repertoire. It is therefore out of step with the pace of social and technological development. It is essential to save construction techniques, along with revising of procedures to enhance longevity, in conjunction with the possibilities of community participation, seeking to preserve traditions with a minimum of de-characterization.

Librelotto and others (2022) argue that man's building tradition is intrinsically connected to the surrounding environment. For thousands of years, man has used the resources available to him to live. He began with caves and the construction of portable housing, until he became sedentary and used local available materials to build. Earth, stones, fibers, branches and leaves were the most commonly used materials. The techniques of building with earth, for example - including pau a pique, which will be observed in this research - spread globally and examples can be seen in various parts of the world.

This article provides an overview of the construction techniques employed in the village of Mupalala, Huíla,

which is 25 kilometers from the town of Quipungo, in the province of Huíla in Angola, as it strongly preserves vernacular practices in its construction process. The experience of some local and grassroots technicians, familiar with the process, facilitates the search for solutions that can be replicated in other parts of the country, with some modifications and suggestions in order to take advantage of its principles and promote greater longevity. Another reason is the fact that most of the inhabitants of the regions are low-income (poor), making them the target audience of this study in the development of technical conservative and innovative housing solutions based on vernacular architecture and its relationship with sustainability.

2. METHODOLOGICAL PROCEDURES

The methodology used is aimed at answering the research question and consequently fulfilling the general objective: can Angolan vernacular architecture enable more sustainable construction in Angola? This article seeks to answer the question of how the Angolan vernacular architecture is characterized.

In order to achieve this goal, it was applied the literature revising method, identifying the most relevant national and international titles were identified from among the available scientific studies. The revising was followed by a descriptive analysis of a case study of a detached single-family house in the province of Huíla. As a methodological strategy, the following keywords were defined to facilitate the literature search: Vernacular architecture. Sustainability. Sustainable innovations. Buildings. Sustainable houses or dwellings.

The characterization of vernacular architecture in Angola has been done in a theoretical way, taking into account some researchers who have carried out studies on the subject, it is worth mentioning some names such as: Redinha (1973), Daniel (2019) and Dias and Palhares (2015; 2013). In this characterization, fundamental aspects have been presented, such as the formal and design similarities and differences between regions of the country, taking into account cultural, geographical and climatic aspects, as well as the main materials. From a more technical and practical point of view, the project analysis took into account the aspects that define or characterize sustainable construction, such as: the construction system used in the project, its materials and origin, community participation and continuity, costs and policies for participation and housing acquisition, energy efficiency, thermal and lighting comfort.

It should be noted that one of the architects who has developed projects oriented to this reality and with a contemporary modern framework is Francisco Benguela, and one of his projects was the foundation for this research. It addresses fundamental issues such as community participation in management throughout the process of design, construction, and post-construction, as well as cost issues and the use of local materials with low environmental impact.

After the theoretical study, a case study was conducted in the Huíla region to understand the construction features, materials and techniques used. Interviews were conducted with the local community, the research was registered with the ethics committee and the interviewees signed a consent form with full disclosure.

3. STATE OF ART

3.1 From vernacular architecture to sustainability

According to UNESCO, "heritage is the cultural legacy that we have received from the past, that we live in the present and that we will pass on to future generations". Pastor (2003) argues that the knowledge and experience of heritage is important for the affirmation of the community itself and a key factor in the development of a place, both for the economy and for tourism, promoting territorial equilibrium. This practice promotes territorial equilibrium through the cultural offer of heritage protection connected to local sustainability, as it helps to preserve natural resources, enhance the value cultural and natural landscapes in accordance with the well-being of people the transmission of ancestral knowledge and environmental values.

According to the etymological approach confirmed by the Historical Dictionary of the French Language (ROBERT, 1985), vernacular, in architecture, refers to the house of verna, which in Latin means "slave born in the house". Vernaculus means 'native' or 'domestic'. This definition appears in Roman law, in the empire of Theodosius the Great (347-395). Authors such as Illich (2005) and Frey (2010, p. 13) provide a derivation of the term as "vernacular type" meaning

> "Everything that has been worked on, made or created at home and not for sale, but for domestic use. Therefore, what is 'vernacular' has

> no market value. By extension, this definition includes the architecture of a territory and/or of a human group, or ethnic group, that lives there. Vernacular architecture often uses local materials (AA.VV., 1993, p. 4).

Vernacular generally refers to "traditional" or "popular" architecture, as opposed to "academic" architecture. Prompt (2021) describes that "humanity developed building techniques to shelter and protect itself from the weather, and so the specific architecture of each time and place developed, appropriately identified as vernacular architecture. "

Barbacci (2022) explores the concept of vernacular architecture from two prehistoric origins and presents some examples from around the world that represent lessons in sustainability and bioclimatic design. The author introduces Bernard Rudolfsky's concepts that characterize vernacular architecture as architecture without architects: it is asymmetrical and differentiated, as opposed to formal architecture, which is symmetrical and impersonal; it is produced communally and anonymously, with local characteristics; it communicates with its surroundings and is not transferable outside its context; it tends to be durable and its orientation is essential, using the sun and wind to create comfort rather than glass curtains and air conditioning; it coexists harmoniously with animals and, finally, it is a manifestation of the human spirit. The research includes examples ranging from the origins of cave dwellings in Turkey, Cappadocia in the form of underground buildings and cities in the rock, ground dwellings in Tunisia, and bamboo dwellings in Dorze, to more recent constructions such as the cities of Shibam in Yemen, the Ksar in Morocco at Ait-Ben-Haddou, and the Arhuacas villas in Colombia.

The vernacular buildings were designed to maximize the use of local materials. The use of stone, adobe, and wood determined local architectural aspects and employed construction methods that were fully adapted to the environment (PHILOKYPROU et al. 2017; REN 2018). Traditional houses generally refer to time and space in relation to the past, while vernacular houses are less related to time and are more specific to the site.

In general, vernacular architecture is the functional architecture of the local people, which is shaped by the environment, features, climate, local materials, socio-cultural characteristics and traditional technology. It tends to take advantage of local building resources as well as passive and low energy strategies that do not damage the environment but also protect nature (UPADHYAY, YOSHIDA AND RIJAL, 2006; BAŞARAN, 2011; ESIN AND YUKSEK, 2010; SOUSA SANTOS, 2016; SALJOUGHINEJAD AND SHARIF ABAD, 2015).

Vernacular architecture, therefore, is part of human heritage and can be translated as an expression of a community's identity and the value of the natural and traditional environment with which they have produced their own habitat. It is the result of the relationship between man and his environment and directly reflects the ways of inhabiting the territory through knowledge passed down from generation to generation (Gonzalez, 2010).

Today, vernacular architecture is no longer associated with poverty and precariousness as it once was (Barbacci, 2022). For the author, the reassessment of the vernacular brings ethics and sustainability to architecture and becomes potentially promising before threats of climate change, appropriating ecological criteria, systems and technologies integrated with the cultural and natural landscape.

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3.2 Characterization of Angolan vernacular architecture

Angola, similar to whole African continent and due to its impressive territorial extension, has a wide variety of climates, natural resources, landscapes, geology and hypsometry/relief. It has landscapes ranging from tropical rainforest in the north to open forest and savannah in the central plateau and desert in the south.

DANIEL (2019) characterized the Angolan architecture in three predominant architectural typologies, in which they are inextricably linked to the social, cultural and economic transformations that the country has undergone, namely throughout the period of its discovery in the 15th century, alongside with the colonization era,

the civil war and the post-war time up to the present. The three main typologies are classified as

> Vernacular architecture: Houses that are more common in rural areas and have few records in peri-urban and urban areas. They are essentially built with pau-a-pique (ironwood) or adobe walls and thatched (grass) roofs.
>
> Colonial architecture: Buildings constructed during the Portuguese administration in all the capitals of the 18 provinces and the seats of the 162 municipalities, with different styles, formal elements and construction techniques.
>
> Contemporary Architecture: Recent constructions with reinforced concrete structural elements, ceramic brick or concrete block walls and tile roofs, in the center or on the outskirts of urban areas. (Our translation, source: DANIEL, 2019,p. 10)

This research was carried out in the southwestern part of Angola, in the province of Huíla, situated in the easternmost part of the country (about 60% of the territory). This region rises in a series of plateaus with altitudes around 1200 and 2100 meters (WHEELER & PÉLISSIER, 2009, p. 25). The highest point in the country is Morro do Moco, situated in the province of Huambo, at an altitude of 2620 meters. Although it is only one topographical zone, given its size and the fact that it represents a large part of the country, it is necessary to present some variations in the shape and architectural features of the houses in each subdivision of this region.

In the northern part of this zone, the roofs are quite high and sloped to facilitate water drainage due to the large and intense rainfall. It is also common to have a veranda around the entire house, with a width varying around 1 and 1.5 m, and at a level of about 20-40 cm above the ground, whose main function is to protect the living space from the infiltration of rainwater (DANIEL , 2019).

In the central part of this topographic zone, there is a different configuration, where the roofs hardly exceed the limit of the walls, so that the dwelling is exposed to direct solar radiation, because there is a need to cool the dwelling.

In the southern part of this area, the architectural differences in form and construction process are not necessarily due to climate or relief, but rather to cultural aspects. For this reason, most of the dwellings are made up of open spaces as the main zones for cultural, social and recreational activities, with the dwelling being a mere sleeping space.

> Vernacular architecture includes the oldest dwellings of the territory, known as "cubatas", whose construction techniques have been handed down from generation to generation. It is characterized by the common use of organic (vegetable) materials, which evolved in techniques that became quite effective. Thatched roofs (grass), which replaced banana leaves, reflect this evolution, as they allow greater longevity of the construction and waterproofing (DANIEL,2019, p.10 and 11).

Angola is characterized by a great ethnographic heterogeneity, where each ethnic group or subgroup has specific socio-cultural characteristics that differ from one another. However, when it comes to the features of construction and the materials used, there are few differences, since the most commonly used materials - sticks, reeds, thatch, wood, adobe and stone - are easily found throughout the country, although they have different characteristics. José Redinha, in his book "A habitação tradicional Angolana - aspectos da sua evolução" (Traditional Angolan Housing - Aspects of its Evolution), describes the various traditional housing types according to their geographical distribution, ethnography and construction aspects - materials, structure and methods of construction.

The differences in vernacular typologies in the main regions of Angola are quite marked and motivated by the following factors: socio-economic, cultural and environmental, a fact that translates into variations in form, materials, techniques and construction methods from region to region. Table 1, taken from Daniel (2019), shows the basic types of traditional houses identified in the three regions in a schematic and classificatory approach, in terms of their formal characteristics (plan and elevation). The classification criteria used are also based on aspects such as differences and/or similarities in construction methods and materials used.

Thus, in groups I and II, we find dwellings with ephemeral characteristics, used mainly by nomadic peoples such as the Khoisan and the Hereros. They are easily distinguished by their circular floor plan, with walls and roof forming a single element. In group III, the dwellings have been grouped according to their construction system, while in numbers IV and V, the dwellings are clearly similar in terms of their rectangular floor plan and roofs that are larger than the living space, creating shaded areas and additional protection against heavy rains.

Região Sul	Herero	Grupo I: abrigo de terra maciça, estruturalmente construído com varas de madeira	
	Khoisan	Grupo II: Abrigo de capim seco, estruturalmente construído com varas de madeira	
	Ambo e Nhaneca-Humbe	Grupo III: Casas de paredes de troços de madeira verticais, com a cobertura de colmo apoiada nestas	 
Região Norte	Ambundo	Grupo IV: Casas de paredes de adobe cujo telhado de colmo, que se apresenta sempre saliente, é suportado por varas de madeira rústica	
	Bacongo		
	Lunda-Quiocco		
Planalto central	Ganguela	Grupo V: Casa de Pau-a-Pique cujo telhado de colmo, que se apresenta sempre saliente, é suportado por varas de madeira rústica	
	Ovimbundo	Casa de paredes de adobe, com a cobertura de colmo apoiado nestas	

Table 1: Types of vernacular dwelling.
Source: DANIEL (2019) - adapted from Redinha (2009).

Regardless of the differences from region to region, the same traditional constructions can also be identified by their common characteristics. The materials that predominate in Angolan vernacular architecture are those derived from raw earth construction technologies and those of plant origin. Sticks, reeds, thatch (capim), and wood, as well as earth in the form of adobe bricks or pau-a-pique or pau ferro, are traditionally incorporated into building systems.

Stone, being a natural resource with a certain availability and durability, is not sufficiently used in traditional construction (GANDUGLIA M, 2012 and 2013), although it is exceptionally used for the foundations of houses to protect them from the action of water. In general, vernacular houses are small, ranging from 10 to 25 m^2 in area, with more or less rooms, with little importance given to collective interior spaces such as living rooms, with the largest area being used for sleeping, since leisure time is usually spent outside the house. The hot climate creates the need for covered outdoor spaces, which are so widely used by rural communities in Angola and called Jango (gazebo). This is one of the fundamental spaces in traditional housing, as if it were our living room. It is a space for leisure and gathering, characterized by its thatched roof (capim), based on an open wooden structure that allows natural ventilation. It has a simple plan that varies from circular to rectangular, depending on the region of Angola (REDINHA, 1973).

In terms of design references directly applied in Angola, we highlight the project "Urbanization of Quissala, evolutionary houses in the municipality of Huambo, Huambo province, Angola", designed by Grongel Calei, Francisco S. Benguela and DW-HabiTerra S.A (2016). The project aims to provide affordable housing solutions through technologies and construction methods that help reduce the overall cost of the contract, as well as the provision of housing credit products for the marketing of these homes. These homes are targeted at students displaced from other parts of the country with low financial power, as well as the middle and lower end of the market in general.

The architectural plans have been created taking into account the principles of sustainability and the roots of vernacular architecture, where much attention has been paid to the following aspects: evolutionary constructions, community participation, possibilities of obtaining housing loans and natural and regional components and materials.

Evolutionary Constructions - the plans were made in phases, where the company only builds phase 1, which includes 1 (one) common room, 1 (one) bedroom and 1 (one) common bathroom, and delimits the total area of implementation with the future services (Figure 2), thus laying the foundation for families to have the possibility to grow according to a previously prepared plan, avoiding additional project costs, avoiding the risk of building without an architectural plan.

Community Participation - A committee of residents has been created to oversee the management and continuity of the project, with residents actively participating in the subsequent phases of construction and expansion of their own homes and social services (schools, hospitals, shopping centers, electrification systems and water supply, among others).

Housing Credit - HabiTerra S. The promoter of the project has created a housing credit line in partnership with the company KIXI-CRÉDITO S.A. to facilitate the purchase of homes by the target population. This means that to have access to credit, the citizen does not necessarily have to be a civil servant or work in the formal market, a requirement that is quite common in other banking institutions and that has made life quite

difficult for citizens, since a significant majority work in the informal market. What KIXI-CRÉDITO S.A. requires is the proof of financial capacity for this act, a constant and credible income, whether formal or informal, and the suitability of the citizen.

Natural materials and regional components - one of the main materials used is BTC and wood, which reduces the environmental impact, the cost of housing is lower, giving greater openness to community participation in the construction process (Figure 3). The foundation and paving elements use stones with a well-compacted base. In the upper part of the basement (foundation), before laying the first block, a strong mortar of 2 to 3 cm is applied, capable of preventing the rise of capillary water that could bring humidity to the walls. The cellar box (foundation) is filled with properly compacted red earth. The walls are built with compressed earth blocks (CEB) and mortar is applied (the same used to make the blocks). The porch column is made of BTC in square or circular shape. Over the doors and windows, lintels made of U-shaped blocks are placed, reinforced with rebar, and concreted. To allow the transition of the evolutionary phases of architecture, blocks are left protruding where blocks from the other phase will fit. The house does not have a draught system.

The ceiling is made of corrugated zinc sheets, supported on a structure of 60x40mm iron pipes, painted with black and primary color. The window frames are made of solid wood slats, except for the bathroom window, which is glazed. The electrical and hydraulic installations follow the standard with the use of plastic as the basic material.

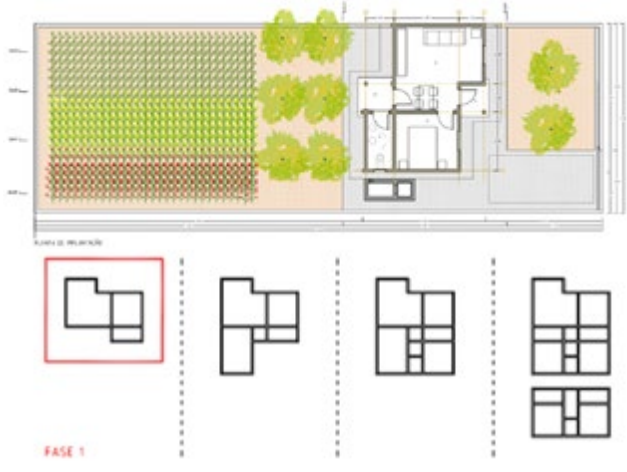

Figure 2: Implementation of the T1-type evolutionary residence on the lot and its respective phases.
Source: BENGUELA (2014).

Figure 3: T1 semi-detached houses.
Source: Authors.

3.3 Assessment and design methods

For vernacular architecture to serve as a reference for more sustainable architecture, two aspects need to be defined: a form of evaluation that allows defining the parameters and criteria that can underlie the architecture, and a design method that is suitable for the association of vernacular with sustainability.

In this sense, based on the study of Angolan vernacular architecture, Alexandre (2016) proposes a multi-criteria design method in his master's thesis. To achieve this, the author establishes four phases: i) mapping the territory in several areas of local diversity; ii) crossing these maps with local materials versus vernacular construction techniques; iii) selection of materials adapted to the light structure - particularly in terms of connection and compatibility and iv) development of the structure according to the criteria of ease of assembly, transport and adaptation of elements to local raw materials.

The application of these phases proposed by Alexandre (2016) will lead to the optimization of a bioclimatic strategy in the design of the space, where geometry and materials can respond effectively; integration of a flexible multifunctional program with local culture; expandable modular construction using the standardization of industrialized materials integrated with local ecological materials; ease of assembly and transport using local labor; reuse and upgrading of components and materials, and the evaluation of the social efficiency of the space.

4. Characterization of the Study Location

The buildings under study are located in the province of Huíla, municipality of Quipungo, commune of Ombo, in the villages of Mupalala-Centro, Mupalala-Banda, Matuunda and Canomila. They belong to the Nyaneka-Humbi ethnic group, whose mother tongue has the same name as the ethnic group. The main activities are family farming, pastoralism and cattle rearing. Most of them have adopted the Christian religion in the last 40 years, with no record of any other religious belief than the one

mentioned above. And the village of Canonila, where the inhabitants are mostly from the Vayemba ethnic group, the result of a mixture between the Nyaneka-Humbi and the Nganguela, have Nyemba as their mother tongue, and their main activity is agriculture and in some cases pastoralism - cattle raising. Figure 4 shows the location of the buildings.

The buildings show similarities from a construction point of view (shapes, techniques, materials), due to the strong cultural link, the proximity of the construction sites, which implies the use of the same material in most cases. The main differences are found in the function, that is, in the process of organization, distribution and location of the buildings in the general plan of the village or Quimbo (Eumbo), where there is a strong cultural connection in this process, obeying a hierarchical distribution of spaces according to function and the order shown in Figure 5.

The general plan has a circular shape, with three accesses, the main or front access being delimited by logs/sticks with a larger diameter compared to the other accesses.

Next to the main entrance, on the right, is the first building/hut belonging to the second wife. Her implementation in this position is due to the fact that it is the second relationship, which, according to the facts, always comes after the Quimbo (Eumbo) is already inhabited, and she does not perform the function of matriarch of the family of this Quimbo.

Next, the food storage buildings are placed between the first wife's hut and the second wife's hut. The first wife's building (Cubata) is in a strategic position, perpendicular to the main entrance, and even though it is further away from this entrance, it has visual power because it is the hut that attracts the most attention. Because it is in this perpendicular position, it is the building/hut that guides the shape of Quimbo.

On the left side, next to the main entrance, is the otchoto (family bonfire, living room, common room or meeting room), which is the noble space of Quimbo, because it is where the transmission of knowledge about the culture (origins, habits and customs) and learning the principles that guide the family, how to protect and care for it. It is also the place where the round table is held, around the campfire, to share and relax after a long day of work in the fields and pastures. The otchoto is mainly attended by men, with women rarely taking an active part.

Next to the otchoto, outside the radius that defines Quimbo, is the corral (otchunda), considered one of the most important places because it is the place where cattle are kept. Cattle are the main and most valuable source of income for the family. The corral has a strong connection with the otchoto, since the caretakers of the corral are men.

Figure 4: General presentation, location.
Source: Authors.

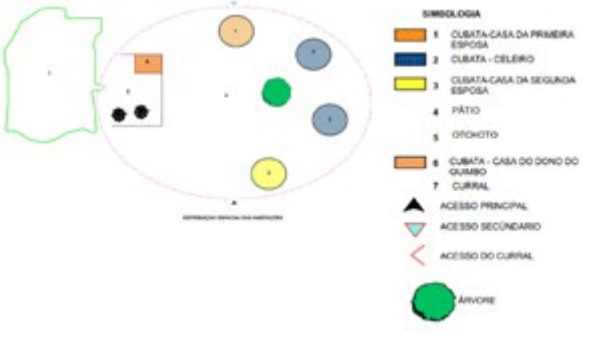

Figure 5: Spatial distribution of a village.
Source: Authors.

5. RESULT: TYPOLOGY AND CHARACTERISTICS OF VERNACULAR CONSTRUCTION

5.1 Construction process

The construction process of buildings (Huts), concerning practices, techniques, materials and the architectural form of the building/hut, are also linked to cultural aspects. Most hut models in these areas are circular in shape with a diameter of approximately 6 meters. With the 4 (four) main areas inside described in figure 6.

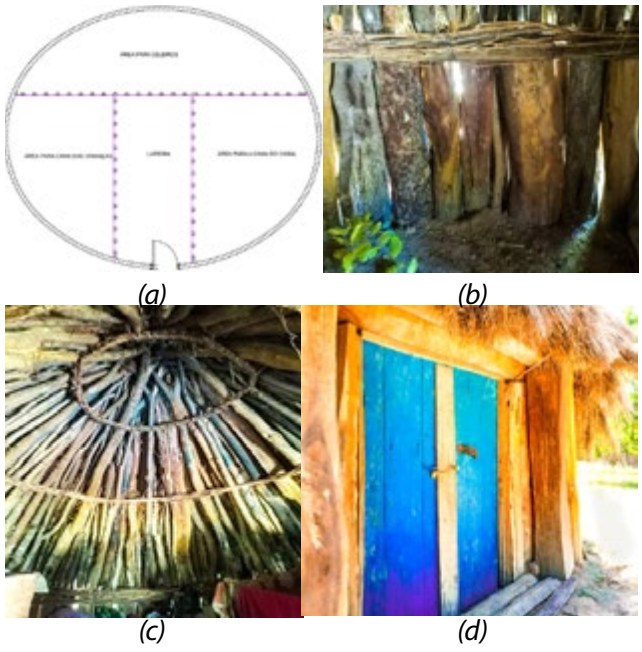

Figure 6: (a) Plan of a cubataa; (b) Walls made of rigid logs driven directly into the ground; (c) View of the top of the roof with intertwining of branches in the form of forks and their ties in wooden ribbons. (d), Door jamb in rigid faux wood trunk.
Source: Authors.

To build a cubata, they start by marking the foundation (tchico), using a rope as a guide, placing it in the center and making a 360° turn to determine the shape and diameter of the hut. The excavation is as thick as the logs that will be used, with a thickness that varies between 20 and 25 cm and a depth of about 30 cm, which is connected to the wall structure.

In the case of wattle and daub cubatas, the log has the double function of being an element of the foundation and also an element of the fencing system (wall). After digging the trench, there is no treatment of the ground to receive the stick trunks, which are simply aligned and placed on the ground.

The walls (*otchijine*) for the *Nyaneka-Humbi* culture are smaller than the roof and are made of wattle and daub. Care is taken in the selection of the logs used to build the walls. The following types of wood are commonly used: *Opako, Omu Kalati, Omungai and Mutontola*. In Portuguese they are called pau-ferro.

After the walls have been placed, leveled and adjusted, the hut is tied up with what is called a lashing strap. Lashing ropes called *olumbala luotchifini* are attached to the strap. *Onongoi* are taken from trees with specific characteristics for this purpose, such as *omuichi and omumpada*, which are of the same species.

In the roof (*okuyambela*) two phases can be considered: the first is the execution of the structure and the second includes the placement of the grass (elephant grass).

The execution of the structure follows a very interesting order, as if there were a structural project guiding the process:

- first, the woods are placed, properly aligned. These are the main structural frames that will support and hold the weight and the structure of the roof. According to villager Caluvi Muholo (2022), these sticks (Ononguji-Vilua) are placed in a 'fighting position'. (This position is understood as the touching of the pointed areas (with fork shapes) of the sticks, which are fixed to each other, until they are in a position of balance and stability. The villagers call this process ononguci vilua (fighting bulls).

Next, the trunks are placed to help the first 6. These do not have a specific number, but are also from the same family as the ironwood. They are placed in a different/opposite position to the first 6 sticks, from bottom to top, i.e. their pointed area (fork) is supported by the two wall straps and has a flattened, semi-rectangular shape, omavulo.

After this stage, other trunks and branches are placed, which are less demanding in terms of structural requirements, but must meet the straightness requirements, be aligned and be of good quality to secure and reinforce the structure. 3 lashing straps with characteristics similar to those on the wall are also placed.

The ridge on the inside of the roof structure is called Okatongolila, while the middle of the ridge on the outside is called Okalilassangi. The grass used to cover the hut is selected for its good quality and is commonly called Elefante grass (which requires a lot of experience).

The frame openings (windows and doors) have an interesting peculiarity where the stick materials placed in the opening have a cultural meaning. The sticks used

as lintels and thresholds are called Otchipamba and Gando, which means protector (element that protects the entrance and exit of the house).

The logs placed in the opening structures are called *Ekungie otchikuil*.

The logs placed in the opening structures are called Ekungie otchikuilo, which means securer or accessor (securing the door and thus the inhabitants of the house).

It can be seen in Figure 6 (d) that there is a double structure, one in the plane of the opening, consisting of a lintel and a threshold - side posts) of solid fake wood, and another structural framed structure, standing out of the plane, consisting of a beam and side posts, also of fake wood.

The threshold, the lower level of the door, is made of wooden planks to pave the entrance (they look curved to me, resulting from the external unfolding of the trunks).

As for the construction process, it is clear that it is always community-based. Everyone participates in the construction of a hut, with the men working directly on the construction (cutting trees, digging, cutting grass, transporting and cleaning), while the women cook the food and carry water. Typically, the villager with the most experience takes the lead. According to villager Kaluvi, Muholo Pequenino (2023) and the others are support staff or assistants.

The head coach is never paid, even though it is not his own home. In other words, in this tribe, no one makes a living from construction because the activity is unpaid and involves collective work. There is a self-help effort to build houses.

There is no direct transmission of the practical ways of building huts, learning is done through curiosity or practice by participating in the construction. The most interested person learns, the maxim is learning by doing. In some cases, certain teachings are transmitted in the Otchoto (concentration fire).

6. CONCLUSIONS

Throughout this bibliographical research, it has been possible to verify that the authors share the same line of thought in terms of concepts, defending that vernacular architecture is directly connected to our roots and ancestry, to the use of materials and specialized local labor, which facilitates execution and consequently cost reduction. As for the case studied in Angola, it is clear that the sustainability aspects associated with the type of construction studied involve the use of natural materials (earth/soil, logs/trunks, wood and grass), at the low level of technology used (without the use of toxic chemical elements or energy incorporated in essentially artisanal materials and construction techniques). In Angola, it was found that vernacular architecture is also linked to the use of local materials and customary practices.

The building tradition is transmitted verbally and empirically where the community is involved in the construction. Community participation is a determinant of the construction process, both in the case under study and in the project references found, where architecture and construction are participatory and evolutionary in terms of adapting to the family life cycle.

However, it was not possible to identify an evolutionary trend and framework that takes into account the constructive culture of the original people in the new urban plans, due to the lack of architectural certification for this type of construction. In the bibliographic search, the keywords helped to find articles in journals that present studies similar to this one, and the methodological strategy of guiding questions also proved to be very effective, since through these questions the theoretical framework and the study design were defined, which in a way led to the achievement of the objective of this research.

Finally, it is clear that cultural aspects are what define the form and layout of houses full of signs, with room for technical improvements in construction without distorting the architecture to increase the durability of the building. There is still room to include aspects related to water, energy and constructive rationalization management.

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