The Design of Tropical Homes in Focus of Climate Conditions

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Abstract The topic I would like to address in this paper is about the design of tropical homes with a specific focus on climate conditions, construction, and design elements. In fact tropical areas deal with different circumstances such as heat, humidity and heavy rainfall. All these extreme challenges can occur at the same time. For this reason it requires to plan these houses carefully to get the perfect protection for any weather extreme. In order to counteract the problems there are several solutions you can perceive during the planning phase. One key proposed solution involves strategic placement on the property. Orienting the longer sides of the house toward the north and south minimizes direct sunlight exposure. This helps to maximize natural ventilation and reduce heat gain inside the house. Another critical factor contributing to effective ventilation is cross-ventilation, achieved by situating windows and doors on opposing sides of the house. This arrangement facilitates the flow of air, reducing internal temperatures. Another aspect of the ventilation is the roof structure. Having openings in the roofs, helps to release hot air which accumulate in the top of the building. A further aspect you can do with the roof is to plan a roof overhang so that it protects walls from heavy rainfall and protects openings from sunlight. By integrating these design principles, you can create a house that is comfortable, resilient, and well-suited to the unique conditions of tropical regions.

***Index Terms— climate, cross-ventilation, design, extreme weather*.**

I. Introduction

In this assignment I want to show off the importance of a thoughtful planning about buildings in tropical areas. Tropical houses are exposed to several extreme weather conditions such as heat, humidity and heavy rainfall. In fact of these circumstances you need to plan protective measures to guard the building against the flood, the humid weather and the extremely heat. In the following assignment I will show off measures to protect the building against these extreme challenges and how to avoid mistakes during the planning phase and to build a house which lasts a long time and resists these weather conditions.

In this paper, my primary focus will be on the ecological aspect. Given the escalating impact of climate change, the frequency of extreme weather events is on the rise, making it increasingly crucial to protect houses and buildings against these extremes. Consequently, I will elaborate on the measures in detail and propose recommendations for further protective actions.

Already during the planning phase mistakes can be avoided by correctly aligning the building on the property or having the correct roof-structure to protect the walls against heavy rainfall and spend shade in front of windows and doors so that the building does not heat up as much inside. In connection to this, it is important to add that the foundation of a building is also an essentiell measure to protect the building against the flood. By having stilts you avoid that the flood soaks up the walls and mold cannot be developed. Also the construction materials or materials on the outside and the insulation have a major impact of the durability and pleasant climate on the building.

In light of the increasingly extreme weather conditions, whether characterized by heavy rainfall, high humidity due to persistent rains, or extreme drought and heat, I have encountered the following research question:
How should a tropical house be designed to withstand any form of extreme weather conditions while providing a comfortable living climate and ensuring longevity?

II. Literature Review

To compose this work, I initially sought a comprehensive understanding of what defines a tropical home and its architectural structure. I delved into its components and the significant features that characterize such a residence. Additionally, I sought an overview of the origins of the tropical home and the external influences that have enduringly shaped its essence.

Over the years, Indonesia has been significantly

influenced by a multitude of events, and these influences are distinctly reflected in the vernacular tropical home. Cultural, historical, and geographical elements introduced through colonization, missionary activities, and trade have profoundly influenced the architectural culture.

In a classical tropical home, houses play a central role within a fabric of social bonds, traditional laws, and religions that interconnect the village residents. The house serves as the pivot for the family and community, forming the starting point for numerous activities of the inhabitants. The village community constructs its own houses, with each resident contributing individually, or resources are pooled to collaboratively create a structure. The traditional longhouse is elevated on stilts with a steep roof and a substantial gable.

Illustrated here is the Batak Rumah, constructed on stilts to protect against floods. The steep roof facilitates efficient water drainage even during heavy rain, preventing the infiltration of rainwater into the interior. Many traditional buildings in Indonesia are elevated on stilts to guard against heavy rain and flooding. Additionally, the Batak Rumah serves as a central place in the community, allowing multiple families to reside in separate sections within the long rectangular structure.

Despite these advantages, the number of Batak Rumah buildings is experiencing a decline. This can be attributed to the colonial era, during which the Dutch deemed these traditional houses unsanitary and approached associated religious practices with skepticism. During the colonial period, vernacular tropical homes were dismantled and replaced with newly constructed buildings influenced by Western design. Western construction techniques were applied, replacing traditional houses with structures made of bricks and corrugated metal roofs. Sanitary facilities were introduced, and improved ventilation techniques were implemented.

Since gaining independence in Indonesia, this process has been halted, and the preservation of traditional construction methods has been promoted [1].

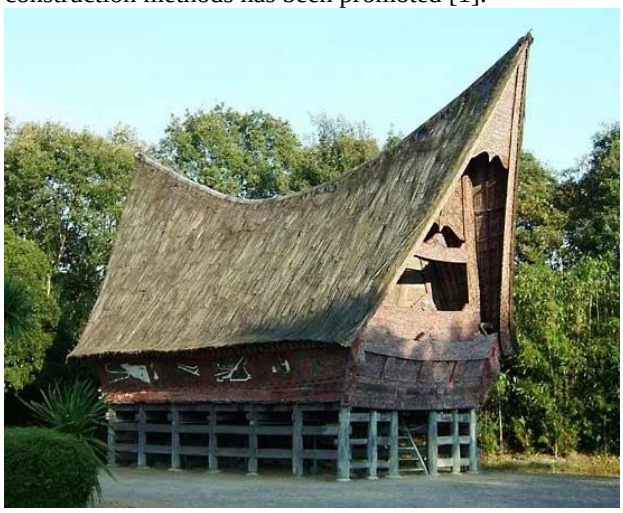

Figure 1. Traditional Construction Method

The Bahay Kubo, a traditional Filipino house, is renowned for its simple construction and adaptability to the tropical environment. The construction of the Bahay Kubo is grounded in natural materials, with bamboo playing a central role in the structure of the house, utilized for frames, walls, and various components. The incorporation of bamboo not only facilitates a stable construction but also underscores the sustainability of the building process [2]

A characteristic feature of the Bahay Kubo is its elevated structure. The house is often raised on stilts or posts, not only providing protection against floods but also allowing better ventilation beneath the building. The open floor plan of the house promotes natural air circulation, a crucial aspect for maintaining a comfortable temperature inside, particularly in the warm and humid climate of the Philippines.

Figure 2. Bahay Kubo

The walls of the Bahay Kubo are often constructed with bamboo grids or woven bamboo poles, offering both a degree of privacy and facilitating airflow. The roof is traditionally covered with Nipa palm leaves, providing lightweight protection against rain and intense sunlight.

Another noteworthy aspect of the Bahay Kubo is its adaptability. Many Bahay Kubo structures can be easily disassembled and transported to another location. This flexibility not only reflects the mobility of the residents but also signifies a cultural connection to a lifestyle closely intertwined with nature and the rhythms of the environment [3].

In urban areas, modern materials and construction techniques can be integrated with the traditional architecture of the Bahay Kubo, while in rural areas, the preference for traditional materials often endures.

In a manner similar to the Batak Rumah and the Bahay Kubo, the traditional Vietnamese stilt house is often elevated to provide protection against floods, animals, and humid conditions. The choice to construct stilt houses arose from the fact that many Vietnamese villages are situated along riverbanks, which are prone to frequent flooding during the rainy season. A distinction from the other two mentioned structures is that these stilt houses are elevated up to 2.20 meters above the ground [4].

Figure 3. Rumah Batak

In essence, it can be stated that tropical homes share a similar structure and exhibit common features and architectural elements. These elements often include:

A. Nature-oriented architecture:

Tropical houses are characterized by a harmonious integration into their natural surroundings. Spacious windows, terraces, and open floor plans establish a connection between residents and the surrounding nature, creating a seamless transition between indoor and outdoor spaces. The architecture of tropical homes seeks to create a symbiotic relationship with the environment, promoting a sense of unity between the built space and the lush tropical landscapes that surround it [5].

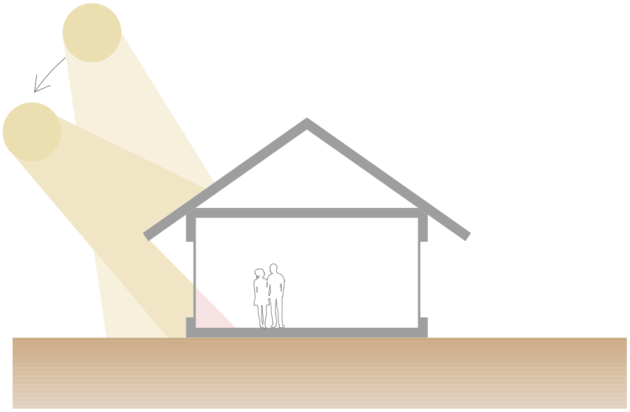

Figure 4. Rhythm of the environment

B. Roof overhangs and terraces:

Considering the intense sunlight and periodic heavy rainfall in tropical regions, many tropical houses are designed with generous roof overhangs and covered terraces. These architectural elements serve not only as aesthetic features but also fulfill a highly functional role.

The expansive roof overhangs provide effective protection against intense sunlight by minimizing direct sunlight penetration, helping to keep the interior of the building cool and preventing overheating [6].

In this example, it becomes evident that a roof overhang is highly effective in blocking direct sunlight. Its functionality extends across various times of the day, as it significantly mitigates intense sun rays depending on the sun's position. This protective mechanism plays a crucial role in preventing direct sunlight from infiltrating indoor spaces, thereby averting undesirable heating. Not only does this prevent unwarranted overheating, but it also reduces energy consumption for cooling, as indoor spaces do not heat up as rapidly [7]

Additionally, these overhangs serve as efficient protection against heavy rainfall, turning outdoor spaces and covered terraces into usable areas throughout the year. These protected outdoor areas extend the living space outdoors and create a seamless connection between the interior and exterior of the house. This design unity is not only functional but also allows residents to enjoy the beauty of the surrounding nature regardless of climatic conditions [6].

C. Materials:

Due to the prevailing warm climatic conditions in tropical regions, the selection of lightweight materials is crucial. This not only enhances energy efficiency but also facilitates effective ventilation to keep the interior pleasantly cool. Commonly used materials meeting these requirements include natural resources such as wood and bamboo. These materials not only provide an ecologically sustainable option but also contribute to creating a harmonious connection between the structure and its surrounding nature. Their lightweight properties facilitate adaptation to climatic variations and promote an airy, comfortable living atmosphere [8].

D. Ventilation and cooling:

The architectural design of tropical houses often focuses on maximizing natural ventilation to achieve a pleasant indoor environment. This approach is achieved through careful planning and arrangement of architectural elements. Large windows, strategically placed ventilation slots, and open floor plans are integral to this design [9].

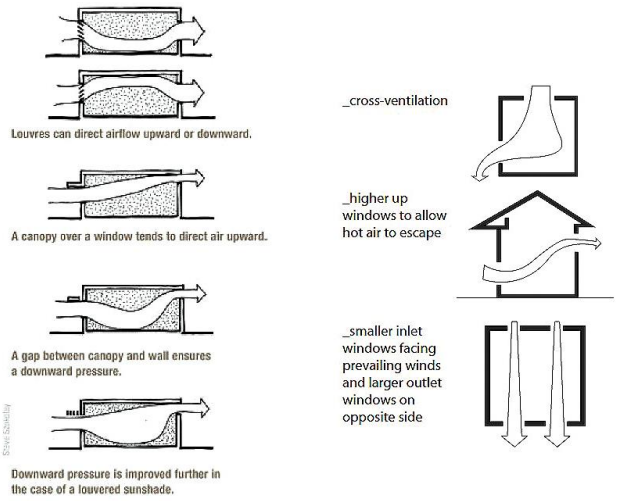

Figure 5 Ventilation

The illustrated figure (4) demonstrates how simple

architectural elements can direct and modify airflow within a building. Awnings, for instance, can guide airflow and redirect it in various directions within the building. Additionally, the airflow can be manipulated by adjusting the tilt angle of louvers upward or downward to ensure optimal cross-ventilation. Another example is the implementation of a narrow opening on the windward side and a larger opening on the opposite side to maximize air exchange, resembling the Venturi effect.

The utilization of this effect in conjunction with the wind can optimize the ventilation of a building. By creating a narrow opening on the windward side, the wind is allowed to flow through this opening, gaining speed. On the opposite side of the building, where a larger opening is positioned, the wind slows down, resulting in an increase in pressure and thus facilitating efficient air exchange. This measure contributes to maximizing the influx of fresh air.10 Additionally, ventilation slots in walls or roofs are cleverly positioned to ensure efficient airflow. These slots may be designed to intake cooler air or expel warmer air, depending on climatic requirements [9].

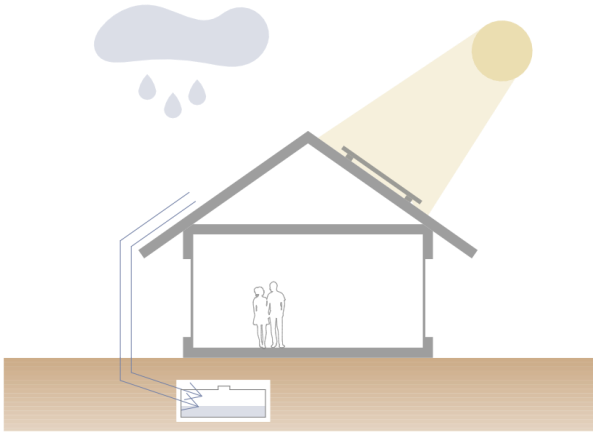

Figure 6. ventilation and cooling

E. Adaptation to climate:

The architectural design of tropical houses is highly sensitive to the specific climatic challenges prevalent in tropical regions. Considering the high temperatures, frequent and intense precipitation, and elevated humidity, a careful selection of materials, colors, and architectural elements is made to ensure an optimal living environment [11].

Material selection plays a crucial role in meeting climatic conditions. Lightweight, thermally conductive materials such as wood and bamboo are often preferred, not only for their natural aesthetics but also for effective heat insulation.8 These materials can adapt to temperature fluctuations while providing a pleasant surface that remains cool in hot weather. Color selection is also significant, influencing heat reflection and absorption. Light shades are preferred as they tend to reflect sunlight, thereby reducing building overheating and contributing to a comfortable indoor environment [11].

F. Sustainable practices:

In the pursuit of environmentally conscious living, tropical homes often incorporate sustainable practices in their design and construction. Rainwater harvesting, solar panels, and energy-efficient appliances are commonly integrated into the architectural plans. The symbiosis between the house and its natural surroundings extends to a commitment to minimize environmental impact, making use of renewable resources and reducing reliance on non-renewable energy sources.

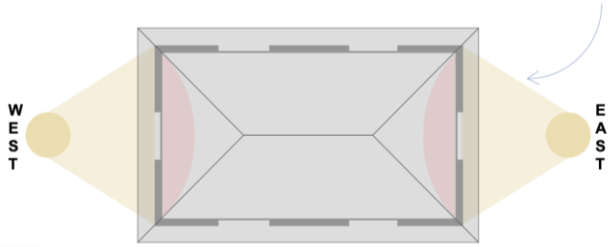

Figure 7. orientation of the sun

An ecologically sustainable approach is manifested through the integration of water storage tanks or solar panels into the construction project. These innovative systems enable the collection of rainwater during heavy rainfall events, which can then be utilized as an alternative water supply during dry periods. The collected volumes of water from the tanks not only serve as an alternative water source for daily needs but also provide a sustainable solution for irrigating green spaces and plants. This multifunctional use helps minimize the consumption of precious drinking water and ensures that the ecological impact on local water resources is reduced [12].

G. Integration of local culture:

Tropical homes often reflect the local culture and traditions of the region in their design. The architectural elements should draw inspiration from indigenous building practices, incorporating cultural motifs and materials that resonate with the local identity. This not only adds a unique aesthetic dimension to the house but also reinforces a sense of place and community.

H. Innovations in tropical architecture:

As the understanding of sustainable living evolves, so does the innovation in tropical architecture. Architects and designers are experimenting with cutting-edge technologies and materials to enhance the efficiency and comfort of tropical homes. The implementation of renewable energies, particularly through the installation of solar panels, constitutes a central component of sustainability. By integrating solar panels, not only is the demand for conventionally generated electricity reduced, but also a sustainable energy source is harnessed [13].

Another focus lies on the application of systems for saving drinking water and rainwater storage. These measures contribute to sustainable water management and the reduction of ecological pressure on local water sources. The collected rainwater can serve not only as an alternative

for water consumption within the building but also as a resource for irrigating green spaces and garden [14].

Tropical homes represent a fusion of nature, culture, and sustainability in architectural form. Their design principles not only respond to the challenges of the tropical climate but also celebrate the beauty of the natural environment. From the strategic placement of windows to the choice of materials, each element serves a purpose in creating a harmonious and functional living space. As the world grapples with environmental concerns, the principles embedded in tropical architecture provide valuable insights into creating homes that not only shelter but also coexist with nature in a mutually beneficial manner. The evolution of tropical architecture continues to inspire a global conversation on sustainable and mindful living, transcending geographical boundaries to influence the future of residential design [15].

III. METHOD

During the planning phase, it is crucial to consistently address the extreme weather conditions prevalent in tropical regions. The impacts of climate change further intensify these weather fluctuations, underscoring the necessity for houses in tropical areas to be designed to effectively respond to such conditions. Consequently, adherence to fundamental principles in the planning of houses in tropical regions is imperative. These principles encompass the proper orientation of the building on the property, implementation of passive ventilation within the structure, insulation against heat, selection of materials for walls and roofing, the design of the roof structure to provide protection against direct sunlight, and the incorporation of external landscaping to prevent rainwater from adversely affecting the building during heavy downpours [15].

IV. RESULT AND DISCUSSION

A. *Orientation on the ground*

During the planning of a tropical house, consideration can be given to the orientation of the building with respect to cardinal directions.

In essence, it is essential to note that the shorter sides of the building should be oriented towards the east and west, as opposed to the longer sides. This orientation minimizes sunlight exposure from the east and west, given that the evening sun from the west can be particularly intense and hot on the building. Since the evening sun has a lower angle of incidence, it would result in the building heating up more in this orientation. However, consideration during the construction of houses in tropical regions should not be limited to sunlight exposure alone.

The direction of the prevailing winds is also a critical factor that should not be overlooked. Efforts should be made to allow as much wind as possible to flow through the building to create a comfortable indoor climate. Therefore, rooms requiring optimal ventilation should be oriented to capture the prevailing winds [15]. For this reason, spaces where thermal comfort plays a crucial role, such as bedrooms, should be positioned on the windward side. Additionally, a significant portion of the windows should be shielded from direct sunlight, without compromising the entry of natural light and the optimal flow of prevailing winds [16].

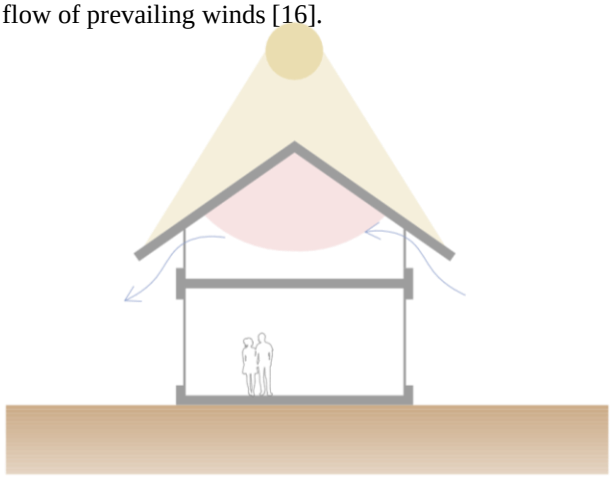

Figure 8. Orientation of the Ground

B. *Natural ventilation*

The natural ventilation of tropical houses relies on various architectural features aimed at maximizing natural airflow while ensuring indoor comfort.

Cross-ventilation and airflow in tropical houses are facilitated by different elements that promote natural air exchange. The positioning of openings, such as windows or doors, is crucial to ensure effective cross-ventilation and airflow. To achieve cross-ventilation in a room, at least two windows or openings should be positioned opposite each other to guarantee air movement. Additionally, the choice of windows or doors is crucial. Casement windows are good examples of such openings as they allow almost 100% fresh air to pass through, whereas sliding windows often allow less than 50% air passage. It is also advantageous to provide openings near the roof to allow the warm air accumulating at the top to escape. Simultaneously, this facilitates the intake of cool air through the lower windows, creating a stack effect.16

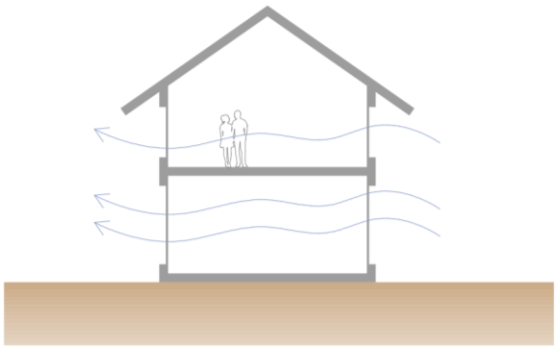

Figure 9. Natural Ventilation

In the stack effect, there is an exchange of air between warmer air rising to the upper part of the building and cooler air being drawn in from below. This air exchange occurs due to thermal differences in air density. In warm

regions, the air outside the building is warmer, causing the air to rise to the upper part of the building. As the air encounters the cooler interior, it cools down and descends to the ground. This exchange of warm to cold air creates a circulation of air, known as the stack effect [17].

C. Choice of material

In tropical areas, preference is given to lightweight materials for house construction. Additionally, predominantly local building materials and traditional construction techniques are utilized in tropical regions, as they are adapted to the specific climatic conditions. Sustainability also plays a crucial role in the selection of building materials for constructing tropical houses.

Conversely, concrete walls are less commonly employed in the construction of tropical houses due to their tendency to absorb a significant amount of heat during the day and release it into the space at night. Therefore, concrete walls should always be equipped with sun protection, despite offering certain advantages. The durability of concrete against winds and floods, as well as its resistance to mold, provides several benefits in humid areas and regions prone to hurricanes. If concrete walls are used, overhangs, privacy screens, or vegetation should shield the walls from direct sunlight [8].

D. Roof-construction

In tropical regions, the roof is most exposed to sunlight and heat. Therefore, it is advisable to use light-colored and reflective roofing materials that transmit less heat and partially reflect sunlight.

This example illustrates a double-roof system consisting of two layers. The two roof layers are separated by an air gap, with the upper layer shielding the lower layer from direct sunlight. This construction prevents the lower roof layer from heating up excessively, thereby reducing the amount of heat entering the interior of the house.3
Furthermore, houses in tropical regions often feature steeper roof slopes, allowing accumulated heat to be dissipated far away from occupants. Another advantage of steep roof pitches is their ability to quickly divert rainwater during the rainy season, preventing water from pooling on the roof. Overhangs provide additional protection against direct sunlight and shield against water ingress during heavy rain. This design allows windows to remain open, ensuring continued cross-ventilation [18].

Additional examples demonstrate the use of reflective coatings to protect houses from heat and minimize internal heating. In the 1970s, the city of Almerìa in southern Spain began painting the roofs of greenhouses with white lime. This practice enhanced sunlight reflection, preventing the surroundings and the buildings from heating up excessively. Another means to counteract interior heating are green roofs. Toronto was the first city in North America to establish guidelines for green roofs. Roof surfaces must be greened above a certain size and capable of storing water during heavy rain to protect the city from overheating. Similarly, Los Angeles has responded to climate change since 2014 by promoting "cool roofs," where roofs are constructed with light-colored materials that reflect sunlight [19].

Figure 10. Roof material

E. Landscaping

The landscaping or outdoor area of tropical houses is a crucial component of any building. The outdoor space can provide shade and protection from direct sunlight. Additionally, during heavy rainfall, trees and vegetation quickly absorb the rainwater, safeguarding the grounds from erosion [15].

In many tropical homes, you will find edible plants that contribute not only to aesthetic appeal but also serve practical purposes. Fruit trees are often a common feature, providing shade and yielding fresh fruit for processing or immediate consumption.

F. Elevated foundation

Tropical houses are often constructed on stilts for both structural and ecological reasons. Elevating the structure creates a space underneath that promotes air circulation. This is particularly crucial in tropical regions, where effective ventilation is necessary to control humidity and establish a comfortable climate within the tropical house. 1,4Additionally, the stilts serve to protect the building during floods and heavy rain, preventing water damage. Elevating the structure safeguards it from the adverse effects of flooding and helps prevent harm to the overall structural integrity. Flooding can indeed lead to soil erosion and damage to buildings. By constructing the tropical house on stilts, the risk of structural damage due to direct contact with water and its pressure is reduced. Particularly vulnerable during heavy rain are the walls, which can incur water and moisture damage if not adequately protected.1,4

G. Changes and recurrence of traditional construction methods

Over the years, traditional construction methods in for example in Jakarta, Bangkok or in Manila have undergone significant transformations, primarily influenced by various factors. A key aspect of this change lies in technological advancements that introduced innovative building materials

and modern construction techniques, partially replacing traditional architectural styles. Materials such as concrete, steel, and glass have gained increasing prominence, while traditional building materials like wood, clay, and bamboo have often taken a backseat [20].

Globalization and the accompanying cultural exchange have also played a substantial role in reshaping traditional construction methods. As urbanization has progressed, there has been a demand for more efficient construction processes, leading to the replacement of traditional houses with more modern structures in many urban areas. Simultaneously, environmental awareness has intensified, and the fight against climate change has heightened interest in sustainable construction methods. Some regions are increasingly turning to traditional building techniques based on natural resources, demonstrating enhanced energy efficiency [20].

In the cities mentioned above, efforts are being made to preserve and protect traditional construction methods as significant components of cultural heritage. Restoration projects, educational initiatives, and awareness campaigns are being implemented to safeguard the uniqueness and history of traditional building practices [21].

Figure 11. traditional construction

V. RESULTS AND DISCUSSION

In the planning phase for houses in tropical regions, the focus is on addressing the challenges posed by extreme weather conditions, exacerbated by the impacts of climate change. To effectively respond to these conditions, several fundamental principles must be adhered to.

Firstly, proper orientation of the building on the property is crucial. The shorter sides should face east and west to minimize exposure to intense sunlight. Additionally, consideration should be given to prevailing winds, with rooms requiring optimal ventilation positioned on the windward side. Shielding windows from direct sunlight while maintaining natural light and airflow is also emphasized. Natural ventilation plays a pivotal role, facilitated by architectural features promoting air exchange. Cross-ventilation is achieved through strategically positioned openings such as windows and doors. The stack effect, driven by thermal differences in air density, further enhances airflow within the building. Material selection is paramount in tropical areas, favoring lightweight, locally adapted, and sustainable materials. Concrete walls, while durable, are cautioned against due to their heat-absorbing nature, necessitating proper sun protection [8].

Roof construction recommendations include the use of light-colored, reflective materials and a double-roof system to reduce heat absorption. Steep roof slopes aid in heat dissipation and rainwater diversion, complemented by overhangs for additional protection. Landscaping is integral to outdoor spaces, providing shade and protection from direct sunlight [18]. Trees and vegetation play a vital role in absorbing rainwater, preventing erosion during heavy rainfall. Elevated foundations are advocated for structural and ecological reasons. Raising the building creates a space underneath that promotes air circulation and protects against flood damage during heavy rain. In conclusion, the comprehensive planning and design of houses in tropical regions necessitate strategic considerations in orientation, ventilation, material selection, roof construction, landscaping, and foundation design. These principles collectively address the challenges posed by extreme weather conditions and climate change, ensuring resilient and sustainable housing in tropical environments.

To return to my initial question concerning the design of a tropical home and the necessary features for a comfortable indoor climate, it becomes evident that traditional construction methods have proven their effectiveness. This approach combines numerous features to adapt to increasingly extreme climatic conditions. These include lightweight materials for external cladding, effective natural ventilation through cross-ventilation and large openings, and optimized utilization of natural resources. These elements not only create a pleasant indoor climate but also offer protection against the challenges of a changing climate.

However, what measures could be improved and enhanced in light of current construction progress to ensure the longevity of a tropical home? A variety of innovative approaches could contribute to increasing the sustainability of traditional tropical houses. One option is to implement new technologies, such as the installation of solar panels for autonomous power supply. This serves not only as an environmentally friendly alternative but also as a means to achieve energy independence for the home [18].

Another approach lies in the use of modern, ecological building materials with improved insulation properties, contributing to more efficient regulation of the indoor climate. Through this measure, the energy demand for heating or cooling could be reduced, leading to a more sustainable energy balance. Additionally, water storage and collection systems could be integrated to store rainwater during heavy rainfall. This would allow residents to rely on the collected water reserves even during dry periods, ensuring a more economical use of the precious resource of water [13].

To optimize air circulation, modern ventilation systems could be introduced to support traditional cross-ventilation and ensure a comfortable indoor climate. To guarantee accessibility, planning for barrier-free access could be a meaningful solution. This enables people with limited mobility to comfortably use the houses [11].
Despite these improvement suggestions, it is crucial to consider local culture and environmental influences to ensure the preservation of the characteristics and traditions of tropical houses. This way, modern innovations can seamlessly merge with the rich cultural history and traditional construction culture to promote sustainable development.

VI. Conclusion

How should a tropical house be designed to withstand any form of extreme weather conditions while providing a comfortable living climate and ensuring longevity?

In the course of my ongoing research for the paper, it has become clear to me that tropical houses possess a deeply rooted and multifaceted tradition. This tradition has been subject to various external influences over time, including the impacts of colonization and the consequent Western influence on the tropical architectural culture. These changes have not only influenced the aesthetic appearance of tropical houses but have also modified their structural elements and functional aspects. The interaction with Western architectural styles not only reflects a cultural exchange but also illustrates how the architecture of tropical houses has adapted to changing cultural trends throughout history.

Over the centuries, the design of traditional tropical houses has proven its worth, showcasing characteristic features that enable them to withstand extreme weather conditions successfully. The persistent heat, high humidity, and increasing heavy rainfall significantly impact these buildings. Nevertheless, traditional tropical houses are well-equipped to face the effects of extreme weather conditions, thanks to thoughtful construction measures such as cross-ventilation, generous roof overhangs, careful material selection, and a well-designed outdoor area around the building. In this way, a tropical house, through its proven construction, creates a harmonious and resilient environment for its residents, meeting the demands of today's environmental challenges.

Modernizing according to current standards could further enhance the resilience of tropical houses. However, it is essential to ensure that the characteristic features and the traditional aura of the building are preserved. Any measures should be taken with consideration of fundamental factors to avoid altering or even losing the unique tradition and distinctive character of such a structure.

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