ASEAN Journal on Science and Technology for Development

Volume 41 | Number 3 Article 6

October 2024

Innovative Integration Of Modern Facade Design With Traditional Bubungan Tinggi Facade: Towards a Sustainable Home

Nursyarif Agusniansyah
Department of Architecture, Faculty of Engineer, University of Lambung Mangkurat, Indonesia, arsitekminimalis@gmail.com

Gusti Novi Sarbini
Department of Architecture, Faculty of Engineer, University of Lambung Mangkurat, Indonesia

Recommended Citation

Agusniansyah, Nursyarif and Sarbini, Gusti Novi (2024) "Innovative Integration Of Modern Facade Design With Traditional Bubungan Tinggi Facade: Towards a Sustainable Home," *ASEAN Journal on Science and Technology for Development*: Vol. 41: No. 3, Article 6.
DOI: https://doi.org/10.61931/2224-9028.1598
Available at: https://ajstd.ubd.edu.bn/journal/vol41/iss3/6

ARTICLE

Innovative Integration of Modern Facade Design With Traditional Bubungan Tinggi Facade: Towards a Sustainable Home

Nursyarif Agusniansyah*, Gusti N. Sarbini

Department of Architecture, Faculty of Engineer, University of Lambung Mangkurat, Indonesia

Abstract

This study investigates the transformation of Bubungan Tinggi, a traditional Banjar house with a high roof, into a modern home through the integration of modern facade design with traditional Bubungan Tinggi facade elements. Bubungan Tinggi is a monumental artifact in South Kalimantan representing the collective memory of the Banjar community with its distinctive typology and anatomy. With its unique typology and anatomy, this particular building has evolved into an iconic structure that symbolizes the collective memory of the Banjarese people.

This study uses a qualitative approach with design experiments to explore the integration of facade design, new form, and contemporary design principles. This research aims to showcase the versatility of the Bubungan Tinggi design in modern architecture by exploring different transformation models. By applying various techniques and approaches, the study provides insights into how this traditional Banjarese character can be adapted for new house designs. The Bubungan Tinggi's transformation process reveals characteristics in its fundamental components, which are distinguished by their geometric objects. Experimental design is the methodology employed in this study. This methodology shows that a variety of transformation models may be carried out by introducing and identifying the Bubungan Tinggi, observing objects in case studies, using transformation techniques and their application, and creating transformation models.

The findings highlight the potential of blending traditional architecture with modern innovations to create sustainable, smart, and culturally sensitive housing solutions. This research produced a variety of modeling results that illustrated new interpretations of bubungan tinggi's in modern house design. The incorporation of traditional elements like the bubungan tinggi in modern house design can help preserve cultural heritage while also creating unique and innovative architectural solutions.

Keywords: Traditional house, Design, Model, Transformation, Bubungan Tinggi, Modern house

1. Introduction

Bubungan Tinggi, a traditional house from South Kalimantan, is an architectural form rich in cultural and historical values. This house is known for its high symmetrical roof (Fitriani, 2016), which serves not only an aesthetic function but also a practical one in coping with the local climate. However, with the advancement of time and changing societal needs (Asih, 2018), there is a significant challenge in preserving the authenticity of this traditional house while integrating modern

Received 10 May 2024; revised 17 July 2024; accepted 18 July 2024.
Available online 18 October 2024

* Corresponding author.
E-mail address: arsitekminimalis@gmail.com (N. Agusniansyah).

https://doi.org/10.29037/2224-9028.1598

elements to meet current functional and aesthetic needs. The Bubungan Tinggi is a relic of the Banjar region's past and shows the sophistication of construction techniques at that time (Juwita, 2017). This work is monumental and should be remembered. The Bubungan Tinggi has characteristics that need to be preserved and replaced with modern buildings, such as houses.

Previous research has extensively discussed the preservation of traditional architecture or the partial modernization of traditional houses (Bakri, 2017). However, there has been a lack of studies specifically exploring the integration of modern facade design with the traditional Bubungan Tinggi facade to create sustainable smart homes. This study aims to fill this gap and develop an innovative transformation model. One way to preserve the traditional Bubungan Tinggi in modern design is by incorporating its high roof feature into contemporary architecture. By studying the transformation model of the Bubungan Tinggi, architects can adapt its unique elements into modern house designs while still maintaining its cultural significance (Kurniawan, 2018). This fusion of traditional and modern elements can create a harmonious balance between preserving heritage and embracing innovation in architectural design. By combining traditional aesthetics with contemporary functionality (Mardiani, 2017) and environmental considerations, architects can create truly unique and impactful designs that stand the test of time.

Traditional houses can be conserved in modern design by incorporating traditional architectural elements, materials (Harahap, 2018), and techniques into modern structures (Hutabarat, 2020). This can help preserve cultural heritage and maintain a connection to the past while still meeting contemporary needs (Ismail, 2019) and standards. However, it is important to ensure that the conservation process is done carefully to maintain the authenticity and integrity of the traditional house (Altieri et al., 2015). Designs can be made contextually by visual use to get characteristics. Will obtain cultural heritage links in the design (Malegiannaki & Daradoumis, 2017). The traditional form must be preserved but in a new form.

Traditional materials can definitely be modernized through innovative design approaches and technology integration. By combining traditional craftsmanship (Nugraha, 2019) with contemporary techniques (Pratama, 2018), new and exciting possibilities can be explored in creating products that are both rooted in heritage and relevant to modern lifestyles (Suryani, 2019; Utami, 2023; Utomo et al., 2021). This fusion of tradition and modernity can help preserve cultural heritage (Wahyuni, 2018) while adapting to changing times (Widodo, 2017). It also allows for the continuation of traditional skills and knowledge in a contemporary context, ensuring their relevance and sustainability for future generations (Handayani & Yuliani, 2019).

Modern materials can be made new but the process can cause significant changes in the original design and functionality of traditional structures. New material can be used (Kamal et al., 2004; Lee & Park, 2018). New shapes are obtained from specific design elements that reflect cultural character. These include traditional patterns, colors, materials, and motifs with an effort to integrate elements of architectural style and symbols (Ferretti et al., 2014). Symbols can give more value because they are easily perceived by building observers. Used on a specific scale that's easy to interpret (Evans et al., 2006). Symbols are used for communication, indoctrination, and transmission of cultural knowledge from generation to generation (Udechukwu, 2019).

Cultural heritage can be integrated into modern design through the concept of inter-locality (Couvelas, 2019). This effort to preserve the monumental building with restoration, rehabilitation, and conservation in the architectural heritage (Besana, 2019). New materials have been introduced into traditional construction processes (Bratec Mrvar and Gašperič, 2023; Gülkan and Langenbach, 2004). Architecture reflects heritage by embodying historical values and identity associated with monuments. The perception of society plays a crucial role in determining what is considered cultural heritage. The transition from new-build to reuse developments has implications for architectural education, requiring knowledge of both physical qualities and values embodied by buildings (Doğan, 2020; Clarke et al., 2019).

A house is called a case because it is a private building (a building owned by an individual). Although this private property is different, it is hoped that this transformational concept can help homeowners who want to emphasize the local identity and character of the Banjar area. This application is based on the transformation process of the character Bubungan Tinggi. Transformative thinking requires transferring the value/importance of high-rise buildings to modern house architecture, with, of course, new features. In other words, without deformation, high ridges will lose their shape over time.

Bubungan Tinggi's transformation is expected to take new forms, rather than being eclectic and monotonous. During transformation, the shape changes due to changes in architectural features are preserved, but the typological features of the

anatomical form, which are especially important, are preserved. Transformation means changing and adapting the features of a new form of construction. The conversion attempts to complete the application of the form. The bubungan tinggi shape has been changed to a new shape containing the old elements. Geometric (semantic-semiotic) and architectural models are used as design methods.

1.1. Bubungan Tinggi

Bubungan Tinggi is a type of traditional house typical of the Banjar region and was originally intended as the residence of the kings and princes of the Banjar kingdom. However, the effort to change the shape of previous buildings seems to be very strong, especially in modern buildings, especially in South Kalimantan, and traditional buildings with many visible variations, including roof shapes. We are trying to adopt the Banjar style. Although the building features do not fully incorporate the original architectural form and have undergone a process of change in combination with today's architectural styles, they still reflect the local character (Anhar, 2010).

The characteristics of Bubungan Tinggi as vernacular architecture have a special form in that they give a particular meaning and emphasis to the features of Banjar architecture (Anhar, 2010). This can be expressed in terms of physical systems, including architecture and the use of materials.

Typologically, Bubungan Tinggi has special characteristics. It is the existence of Anjung, a spatial pattern formed on the left and right sides of the Bubungan Tinggi building. The roof shape is characterized by an upward slope, with the main body raised upwards by approximately 60–70°. It represents a symbol of noble spirit, and the similarity of the architectural forms of various traditional Banjars is characterized by the presence of symmetrical masses found on the facades of buildings. The spatial pattern visible from the outside of the building is the presence of foundations.

It represents a symbol of noble spirit, and the similarity of the architectural forms of various traditional Banjars is characterized by the presence of symmetrical masses found on the facades of buildings. The spatial pattern visible from the outside of the building is the presence of foundations.

1.2. Bubungan Tinggi character processing

The shape of the Bubungan Tinggi can be edited by reduction, modification, addition, or deviation (Anhar, 2010). In modern buildings, it is used as a variation in design and room decoration, but its form usually involves a process of imitation (eclecticism). However, changes may result in simplifications and adjustments. Mistakes in applying traditional design principles often result in designs not being as useful as expected (Mentayani & Muthia, 2017).

The transformation of traditional values in today's architecture raises issues such as the ideological contrast between original and modern architecture (Raptis et al., 2019). The concept of representation tends to be superficial (artificial) because it only satisfies visual perception. The uniqueness of traditional architecture can be explored through the way it expresses “codes” in the form of symbols and meanings (Widiastuti, 2014).

The value transformation carried out by Bubungan Tinggi is based on the presentation of “novelty,” that is, the connotative consideration that includes functional, visible, and empathetic aspects that provide the audience with new reading opportunities. It means presenting a new format with impressions, collective memories, images, and metaphors. Transformation into new codes occurs through interpretation, reinvention, and even deconstruction.

One of the design techniques is to use geometry, as shapes are commonly used in architecture. In other words, it is a geometry that plays with building facades in two or three dimensions. Each geometry has a different meaning for the user of the architectural object. And this geometry creates variations, combinations, dimensions, and heights in interesting ways (Pertiwi & Mahendra, 2017). The existence of a shape is based on the geometric order that determines its shape. Geometric typology helps us understand historical documents about architecture. A technique to handle changes in shape is decomposition. New ways of separating and combining existing shapes and using structural strategies in different configurations to create new unity and order are being explored (Nugraha, 2019). His one strategy of geometric transformation is to borrow and separate traditional elements. Shapes can be separated, and each separation has original properties, but also different properties (Jacqueline, 2016).

To support the geometric transformation process, architect Eisenman's various techniques (rotation, translation, embossing, and following) were used. Rotation is a technique that rotates design elements by a specific angle. Displacement is a displacement technique used to create unconventional shapes. The impact caused when a foot hits the ground and

the change in the shape of the ground are called footprints. Traces are related to printing, and traces remain visible even when the created object is not present (Mubarrok, 2016a).

Eisenman uses geometric search methods to transform architecture into a meaningless (semantic) order (hence the desire to transform architecture (Mubarrok, 2016b). In this way, we attempt to free architectural form from the constraints of its structural function sense. That is, elements that are architectural elements such as form, function, structure, place, meaning, etc. can be described as texts, but non-texts are those that do not exist (the presence of traces is not of the original; traces are always refers to something that is not original.

This research aims to showcase the versatility of the Bubungan Tinggi design in modern architecture by exploring different transformation models. By applying various techniques and approaches, the study provides insights into how this traditional Banjarese character can be adapted for new house designs. The identified research gap is the lack of holistic studies integrating modern facade design with the traditional Bubungan Tinggi facade. Most previous studies focused on preserving traditional elements or applying modern technology separately. Therefore, this research aims to bridge this gap by developing a transformation model that combines these two aspects. The latest utility of this research is to provide housing solutions that are not only energy-efficient and environmentally friendly but also respect and preserve local cultural heritage. By integrating smart technology and sustainable materials into traditional facade design, it is expected to create sustainable smart homes adaptable to future needs.

2. Methods

The research conducted is qualitative research in the form of design experiments, described descriptively, and presented in a three-dimensional design model. The research stages are 1) Introduction and identification of the Bubungan Tinggi, 2) Observation of the case study object, 3) Transformation approach, 4) Application of transformation techniques, 5) Model of transformation results, finally 6) Conclusions and suggestions. The introduction and identification of the Bubungan Tinggi through literature research is used to identify elements that can be transformed. The transformative approach is applied to address the geometric nature of the Bubungan Tinggi, using typology and anatomy mainly derived from the characteristics of the roof shape. To determine the character of the Bubungan Tinggi in the transformation process, a geometric analysis of the typical shape of the Bubungan Tinggi was conducted. The resulting geometric character is expected to be its own meaning and become a collective memory of Bubungan Tinggi even though the shape of modern houses has changed. Observation of the case study objects was carried out by selecting modern houses that underwent changes. The selected house objects are those that have a certain mass form and can be deformed, such as roof elements, to include elements of the Bubungan Tinggi type. The selected modern house buildings are considered to represent several common conditions, such as narrow plots with 1 (one) building area, corner (hook) plots with 2 (two) building areas, and wide/free plots with certain mass forms. At the implementation stage, the transformation technique is carried out by generating initial ideas about the transformation concept to be implemented. There will be many initial concepts. These concepts are implemented using geometry techniques, especially tracing and other advanced techniques. Next, a 3 (three) dimensional transformation model is tested. Only successful concepts will be continued. At the model stage, it is expected that the transformation results will take a new form in the form of a variation of the Bubungan Tinggi transformation concept in modern houses.

3. Result and discussion

3.1. Bubungan Tinggi's character

Bubungan Tinggi, a traditional house from South Kalimantan, is an architectural form rich in cultural and historical values. This house is known for its high symmetrical roof, which serves not only an aesthetic function but also a practical one in coping with the local climate. However, with the advancement of time and changing societal needs, there is a significant challenge in preserving the authenticity of this traditional house while integrating modern elements to meet current functional and aesthetic needs.

Previous research has extensively discussed the preservation of traditional architecture or the partial modernization of traditional houses. However, there has been a lack of studies specifically exploring the integration of modern facade design with the traditional Bubungan Tinggi facade to create sustainable smart homes. This study aims to fill this gap and develop an innovative transformation model.

This transformation was carried out by analyzing the conceptual study of the Bubungan Tinggi object. Bubungan Tinggi's stand against the different types

of traditional Banjars is a great part of defining the era. This made Bubungan Tinggi the mascot of the Banjar region (Fig. 1). Psychologically and as a source of memory, the memory of Bubungan Tinggi would eventually be linked to the memory of the Banjar region. It states that Bubungan Tinggi is a collective memory and provides a conceptual foundation. This basic ideological concept forms the collective memory of the Banjar people. Although it is far from the village, its shape reminds of Bubungan Tinggi.

The presence of Bubungan Tinggi in its current location is a masterpiece of a destruction site (artifact). As a legacy that shapes the times. The several states and forms of Bubungan Tinggi that are still preserved, protected, and part of the cultural heritage serve as a reference for the basic forms to be conceptually treated. Bubungan Tinggi is famous for its towering roof shape. And this roof shape is easy to visually understand in both three-dimensional (3D) and two-dimensional (2D). This 3D-to-2D formation, or referring to a 3D shape when viewed in 2D, is a way to memorize and trace a known shape. According to various research data, there is always one dominant and unchanging (similar) element in several variations of Bubungan Tinggi. It is the towering roof of. The characteristics of Bukittinggi can be analyzed by describing its geo metric structure using typology (Fig. 2). The roof part is divided into several elements. Get basic geometric shapes.

The analysis of Bubungan Tinggi shapes continues by creating basic geometric shapes in a spatial typology. Multiple spatial geometries or elements called “anjungs” appear (Fig. 3).

Additionally, a geometric analysis of the main roof was performed after trying to explain the spatial typology with several geometric shapes. The aim is to preserve the impressive and monumental basic shape of the Bubungan Tinggi roof (Fig. 4).

Bubungan Tinggi's towering roof features a geo metric pattern in the form of an inverted V-shaped peaked roof. This character is a trademark of Bubungan Tinggi. This image aims to become a symbol that gives meaning and significance to the users of the building in relation to Bubungan Tinggi and forms a collective memory.

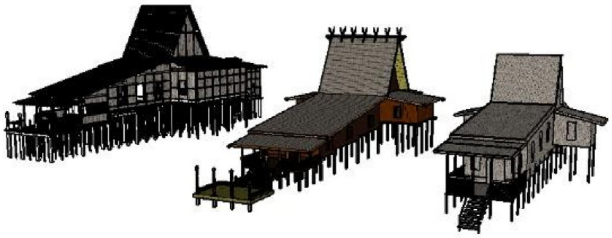

Fig. 1. Bubungan Tinggi.

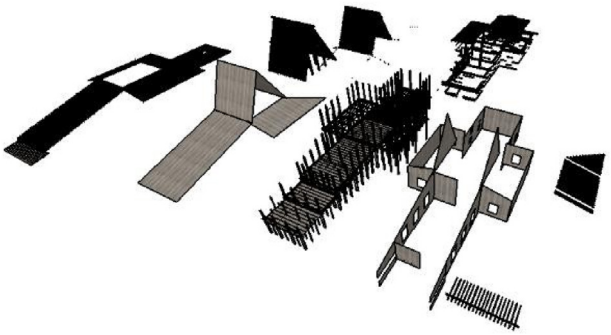

Fig. 2. Bubungan Tinggi elemental breakdown.

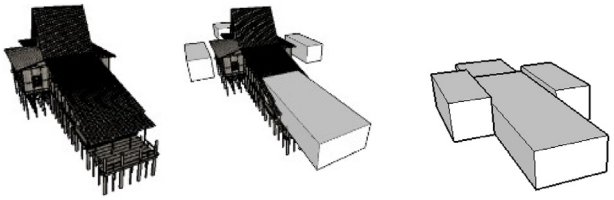

Fig. 3. Bubungan Tinggi typology in geometry.

Deconstruction techniques allow us to decipher geometric symbols by separating existing configurations and finding new ways to combine them to create a new unity and order. Shapes can be separated with different properties while retaining their original properties. The importance of the Bubungan Tinggi shape in this process of change lies in its “rising” form.

3.2. Conceptual study

Bubungan Tinggi, with its striking high roof, symbolizes the social status and cultural identity of the Banjar community. This house is usually made from durable and robust ulin wood. The symmetrical design and distinctive ornaments on Bubungan Tinggi reflect the Banjar community's philosophy of a harmonious and balanced life. These unique architectural elements offer significant potential for combination with modern facade design. The primary challenge is how to maintain the traditional essence of Bubungan Tinggi while adding modern features that can enhance the house's comfort, energy efficiency, and functionality.

The original concept for this transformation was to geometrically apply Bubungan Tinggi's character elements using tracing techniques. Figs. 5–9 are variations of the different concepts applied. As shown in Fig. 5, the visual appearance of the Bubungan Tinggi geometry can be obtained through

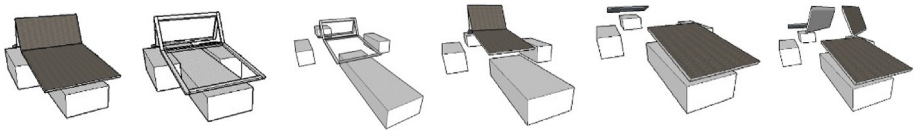

Fig. 4. Roof geometry of Bubungan Tinggi.

2D or 3D facades and 2D or 3D side views. In Fig. 6, the concept of Bubungan Tinggi transformation features is treated by separating (split ting) the building blocks by accentuating their shapes and with an aggregation pattern corresponding to the Bubungan Tinggi typology obtained by performing. Some concepts that can be used for geometry, especially for Bubungan Tinggi roof forms: example corner-to-corner shaped elements, half shapes, or full shapes (Fig. 7). Further concepts include splitting, rotation, flipping, tilting (stretch ing), optical illusion, 3D printing on 2D, and negative mass.

The transformation process can be done by emphasizing (stressing) some characteristics of the shape, as in the concept of Fig. 8. The transformation is also based on the unique idea of modifying the shape to better express its characteristics.

The form of the Bubungan is shown in Fig. 9. The characteristic of the roof will dominate, giving rise to the idea of some new variations.

3.3. House transformation

House transformations were carried out to emphasize the shape and character of Bubungan Tinggi. Various samples were taken from house buildings, and these samples were analyzed to support the changes. The samples taken for support were uniquely designed houses and new shapes and styles with two floors to maximize the results of the changes. House buildings usually have a roof, so this becomes the foundation in the renovation process. The right and appropriate house for the alteration test is the house that continues at the analysis stage.

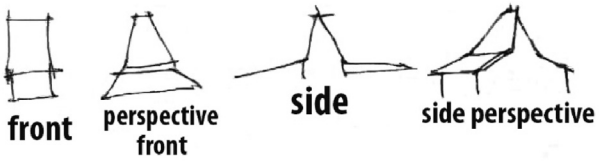

Fig. 5. Visual view of Bubungan Tinggi geometry.

The initial concept was derived from several sketches of the conversion model. This concept was then analyzed using three-dimensional processing. The resulting target transformation model is a final model with a new formation that is different from the two (2) original forms, both traditional and modern, but this new form still shows the characteristics of each character in a balanced manner. Visually, there should be a picture, image, or impression that it is a new form, but its characteristics can appear and show its origins. Both visually, in terms of shape or geometry, and also in terms of materials. In buildings, of course, the functional aspects and even the style of the building are important. An analogy that can explain this is when there is a marriage between two people who come from the local area (adat) and someone who comes from outside the region or even internationally. For example, a Banjar and a European. Each has certain characters and characteristics that are very different. These two people come from different origins and cannot be physically related to each other. But when there are other forms, such as the birth of one's own child, then of course new characters can emerge, but

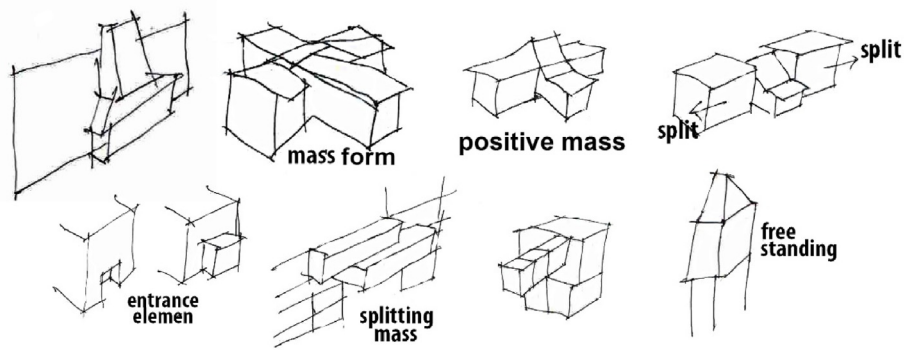

Fig. 6. Form processing.

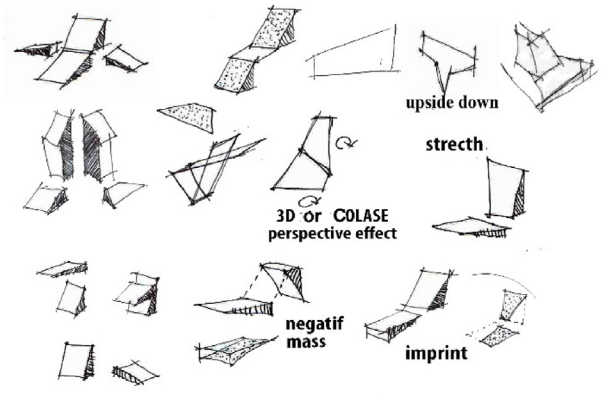

Fig. 7. Geometry transformation technique.

the child still has the elements of the character, which come from both sides simultaneously in proportion. Some characters come from one parent, and others come from the other parent. However, it is clear that the origin of the character is still strong. For example, the skin color traits of the elders in the area and the nose shape traits of other sages.

The essence of Bubungan Tinggi was tried to be integrated into the form by using 3D processing building techniques. The treatment is done by using the main figure of the Bubungan Tinggi to explore the changes in the settlement. There are two (2) concepts attempted in addressing the form, namely: adding a modern form to the Bubungan Tinggi model and incorporating the character of the Bubungan Tinggi into the modern form. These two (2) concepts are expected to produce a transformation model (Fig. 10).

Concept A tried to build a modern house in the Bubungan Tinggi building. By maintaining the geometric shapes on both sides, it was found that the modern building has a different character, so the traditional Bubungan Tinggi building cannot necessarily be changed. In contrast, Concept B applies the process of building Bubungan Tinggi, which is not necessarily closed to the construction of modern houses. So in concept C, we can combine the two sides of the concept, both modern buildings and the Bubungan Tinggi, with a balanced

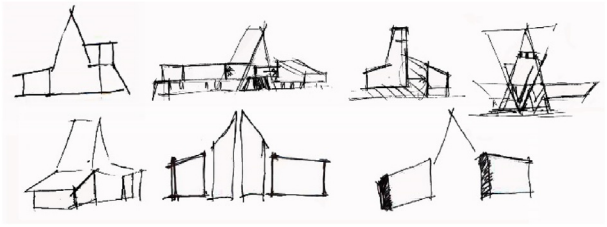

Fig. 9. Mass processing technique.

Fig. 10. Initial concept of transformation in a house.

proportion of both sides. This means that the complement mix-substitution transition process between traditional and modern is part of the transformation process.

3.2. Transformation model of house design

The application of conversion has been investigated on several house models, i.e., houses on small or narrow lots become 1 building area, corner (hook) lots become 2 (two) building areas, and open or large lots become visible. Massing can be viewed from various angles. The first is to examine large plots and corner plots with large land areas (Figs. 11–13). This is to gain flexibility in the trans formation process. In this case study, we hope to get a good transformation model.

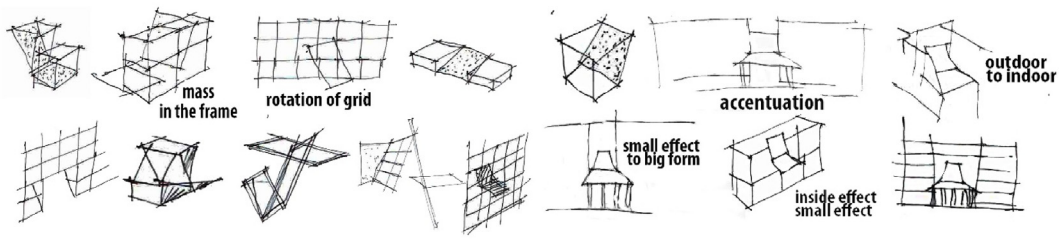

Fig. 8. Accentuation technique.

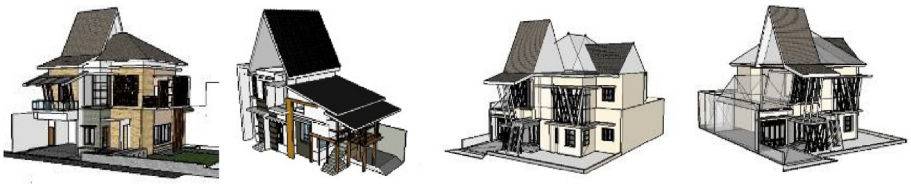

Fig. 11. House transformation model of corner lot 1.

Fig. 12. House transformation model of corner lot 2.

Fig. 13. Transformation model of a wide/free plot house.

The second is an exploratory study of the application of transformation on a single narrow frontage (Fig. 14). The geometry of the Bubungan Tinggi shape, i.e., the shape of the roof, is displayed with a rotation technique so that visually the focus is on the shape (focal point). You can see the results based on the results of some of the models above. About the process of transforming Bubungan Tinggi into a modern house.

3.2.1. Smart facade buildings on narrow lots

One transformation model involves adapting core Bubungan Tinggi elements into narrow lots by integrating smart facades. This model demonstrates how traditional architecture can be enhanced with modern technology to improve functionality and sustainability.

The modern facade design, while retaining traditional elements such as distinctive wood carvings and high roof shapes, creates a unique and harmonious impression. The use of sustainable materials like composite bamboo and recycled wood not only enhances aesthetics but also contributes positively to the environment.

3.2.2. Sustainable facade buildings on corner lots

Another transformation model focuses on creating buildings that integrate core Bubungan Tinggi elements while adapting them to the unique challenges and opportunities of corner lots. This model uses sustainable materials such as bamboo composites, recycled wood, and energy-efficient insulation to create eco-friendly and culturally sensitive housing solutions.

The facade design, which combines traditional elements with modern technology such as solar panels and rainwater harvesting systems, shows how sustainability principles can be applied in traditional architecture. The integration of smart facades which can enhance energy efficiency and occupant comfort.

3.2.3. Innovative transformation model on large lots

The final transformation model involves large lots, allowing greater flexibility in integrating smart fa cades and sustainable materials. This model

Fig. 14. Narrow plot house transformation model.

demonstrating how traditional architectural forms can be adapted to meet modern sustainability goals. This innovative facade design not only retains traditional elements such as wooden ornaments and high roof shapes but also integrates modern technology to improve energy performance and occupant comfort. The use of sustainable materials like recycled ulin wood and energy-efficient insulation shows a commitment to sustainability principles.

3.3. Integration of modern facade design with Traditional Bubungan Tinggi facade

In the transformation model, the character of the Bubungan Tinggi is visible through the change in the shape of the roof. This shape stands out in 3D with angular blocks and wide plots with different mass forms. However, the narrow plots had to go through a reversal process to accentuate the Bubungan Tinggi character. Modern houses use the latest materials as their structure, such as reinforced concrete and brick walls, but wood is no longer used as the main structure.

The Bubungan Tinggi character set as the main element of the transformation is adapted to its function. Geometric shapes can be processed and new functional elements can be incorporated. On large lots where buildings have a free mass form, it is possible to support such treatment. However, processing is limited to very narrow lots. Techno logically using modern materials. The use of more diverse materials can be studied on large construction mass plots.

The "towering" character of Bubungan Tinggi is maintained by several technologies (related to items). Elements of today's lifestyle are incorporated, but the character of Bubungan Tinggi remains. The transformation of the Bubungan Tinggi by introducing a distinctive geometric character, namely its rising character, and the final form does not seem eclectic, because the typology of regional houses that tend to be massively symmetrical is not visually applied. For large lots, this is supported by appropriate shape processing.

4. Conclusions and suggestions

The results of the integration of modern facade design by applying various techniques and approaches, the study provides insights into how this traditional Banjarese character can be adapted for new house designs. The Bubungan Tinggi's transformation process reveals characteristics in its fundamental components, which are distinguished by their geometric objects. The findings highlight the potential of blending traditional architecture with modern innovations to create sustainable, smart, and culturally sensitive housing solutions. Its produced a variety of modeling results that illustrated new interpretations of bubungan tinggi's in modern house design. The incorporation of traditional elements like the bubungan tinggi in modern house design can help preserve cultural heritage while also creating unique and innovative architectural solutions.

The transformation of Bubungan Tinggi into modern homes through the integration of modern facade design with traditional facade elements offers various possibilities for retaining core elements while adapting them to contemporary needs. The design experiment methodology used in this research provides a systematic approach to achieving this transformation. The transformation models created in this research show that it is possible to combine traditional architecture with modern innovations to create sustainable, smart, and culturally sensitive housing solutions. Further research should explore additional case studies and refine transformation techniques to enhance the integration of traditional and modern elements.

Authors' contributions

NA developed the formulation, carried out the experiments, supervised the entire research, conceptualized the research, conducted the data collection, interpreted the data analyses, interpreted the result, reviewed the findings and edited the manuscript. GNS reviewed the research findings, edited, and contributed to the manuscript. All authors have read and approved the final manuscript.

Declaration of Generative AI and AI-assisted technologies in the writing process

There are specific AI technologies or tools used, like Quillbot to improve English grammar, Elicit and Scispace to find the latest references. AI was employed in the writing process.

Funding

This research was financially supported by University Lambung Mangkurat Research Grant Year 2021.

Conflict of interest

There are no conflicts of interest. All authors don't have any financial interest on this article.

Acknowledgment

The researchers thank University Lambung Mangkurat.

References

Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development, 35*(3), 869–890. https://doi.org/10.1007/s13593-015-0285-2. Springer Science and Business Media LLC.

Anhar, Pakhri (2010). *Inventarisasi arsitektur Banjar*. Banjarmasin: Universitas Lambung Mangkurat Press.

Asih, S. W. (2018). Preservation of traditional Banjar architecture: Bubungan tinggi. *Jurnal Arsitektur Nusantara, 10*(2), 115–128.

Bakri, S. H. (2017). Eco-friendly building materials in the context of sustainable architecture. *Jurnal Teknologi Lingkungan, 15*(3), 289–303.

Besana, D. (2019). Cultural heritage design: Theories and methods for the project complexity management. *EGE-Expresión Gráfica en la Edificación, 11*, 31. https://doi.org/10.4995/ege.2019.12864. Universitat Politècnica de València.

Bratec Mrvar, R., & Gašperič, P. (2023). Traditional and modern cartographic materials for geography teaching: From Blaž Kocen to the present. *Acta Geographica Slovenica, 63*(2). https://doi.org/10.3986/ags.11625. The Research Center of the Slovenian Academy of Sciences and Arts (ZRC SAZU).

Clarke, N., Kuipers, M., & Stroux, S. (2019). Embedding built heritage values in architectural design education. *International Journal of Technology and Design Education, 30*(5), 867–883. https://doi.org/10.1007/s10798-019-09534-4. Springer Science and Business Media LLC.

Couvelas, A. (2019). Modern architecture and cultural heritage. In *Communications in computer and information science* (pp. 117–128). Springer International Publishing. https://doi.org/10.1007/978-3-030-12960-6_8.

Doğan, H. (2020). Perception of the modern movement in architecture as cultural heritage. *Art History & Criticism, 16*(1), 65–78. https://doi.org/10.2478/mik-2020-0004

Evans, D. G., Bowick, L., Johnson, M., & Blenkhorn, P. (2006). Using iconicity to evaluate symbol use. In *, Vol. 4061. Lecture notes in computer science* (pp. 874–881). Springer Berlin Heidelberg. https://doi.org/10.1007/11788713_127.

Ferretti, V., Bottero, M., & Mondini, G. (2014). Decision making and cultural heritage: An application of the Multi-Attribute Value Theory for the reuse of historical buildings. *Journal of Cultural Heritage, 15*(6), 644–655. https://doi.org/10.1016/j.culher.2013.12.007. Elsevier BV.

Fitriani, R. (2016). Philosophy of traditional Banjar architecture: Design and cultural values. *Jurnal Kebudayaan, 8*(4), 234–247.

Gülkan, P., & Langenbach, R. (2004). The earthquake resistance of traditional timber and masonry dwellings in Turkey. In *Paper presented at the 13th world conference on earthquake engineering, vancouver, B.C., Canada*. https://www.iitk.ac.in/nicee/wcee/article/13_2297.pdf.

Handayani, N., & Yuliani, R. (2019). Strategi Dinas Perdagangan dan Perindustrian Kota Banjarmasin dalam pengembangan industri kecil menengah. *Jurnal Studi Ekonomi, 10*(2), 142–156. https://core.ac.uk/download/pdf/327227619.pdf.

Harahap, N. (2018). Construction techniques of ulin wood in traditional kalimantan architecture. *Jurnal Ilmu dan Teknologi Kayu Tropis, 13*(2), 112–127.

Hutabarat, M. S. (2020). Sustainable design in modern architecture. *Jurnal Riset Arsitektur, 18*(3), 178–192.

Ismail, Z. (2019). Application of smart home systems in the Indonesian housing context. *Jurnal Teknologi dan Rekayasa, 14*(2), 95–107.

Jacqueline. (2016). Perbandingan karya arsitek wrigt dan gehry lewat nilai aljabar dan geometri. In *Makalah IF2123 Aljabar Geometri Informatika ITB Semester I Tahun 2015/2016, Bandung*.

Juwita, E. (2017). Adaptation of traditional Banjar architecture in modern home design. *Jurnal Desain dan Lingkungan, 11*(1), 67–79.

Kamal, K. S., Wahab, L. A., & Ahmad, A. C. (2004, November). Climatic design of the traditional Malay house to meet the requirements of modern living [Paper presentation]. In *The 38th international conference of architectural science association ANZAScA, Launceston, Tasmania*. https://archscience.org/wp-content/uploads/2014/08/ANZAScA2004_Kamal.pdf.

Kurniawan, D. (2018). Sustainability in architecture: Case study of recycled material-based homes. *Jurnal Teknik Sipil dan Lingkungan, 15*(4), 321–335.

Lee, J., & Park, J. (2018). Phase change material (PCM) application in a modernized Korean traditional house (hanok). *Sustainability, 10*(4), 948. https://doi.org/10.3390/su10040948. MDPI AG.

Malegiannaki, I., & Daradoumis, T. (2017). Analyzing the educational design, use, and effect of spatial games for cultural heritage: A literature review. *Computers & Education, 108*, 1–10. https://doi.org/10.1016/j.compedu.2017.01.007. Elsevier BV.

Mardiani, S. (2017). Aesthetics of traditional Banjar architecture. *Jurnal Seni dan Desain, 12*(2), 102–115.

Mentayani, I., & Muthia, P. R. (2017). Menggali makna arsitektur vernakular: Ranah, unsur, dan aspek-aspek vernakularitas. In *, Vol. 6. Temu Ilmiah Ikatan Peneliti Lingkungan Binaan Indonesia* (pp. I109–I116). Ikatan Peneliti Lingkungan Binaan Indonesia. https://doi.org/10.32315/ti.6.i109.

Mubarrok, N. Z. (2016a). *Dekonstruksi dalam arsitektur: Perancangan City Hotel dengan makna batik kawung sebagai referensi desain*. Master's thesis. Institut Teknologi Sepuluh Nopember https://repository.its.ac.id/399/3/3213207011-Master_Theses.pdf.

Mubarrok, N. Z. (2016b). 'Displacement': Kriteria dekonstruksi Peter Eisenman. *Jurnal Arsitektur Komposisi, 11*(3), 149–164. https://doi.org/10.24002/jars.v11i3.1238

Nugraha, A. (2019, September). Perkembangan Pengetahuan dan Metodologi Seni dan Desain Berbasis Kenusantaraan: Aplikasi Metoda ATUMICS dalam Pengembangan Kekayaan Seni dan Desain Nusantara. In *Seminar Nasional Seni dan Desain 2019* (pp. 26–33). State University of Surabaya. https://www.neliti.com/publications/289171/perkembangan-pengetahuan-dan-metodologi-seni-dan-desain-berbasis-kenusantaraan-a.

Pertiwi, L. Y., & Mahendra, A. S. (2017). Geometri sebagai pengaruh dalam desain bentuk jalur sepeda. *Jurnal Sains dan Seni ITS, 6*(2). https://doi.org/10.12962/j23373520.v6i2.27354. Lembaga Penelitian dan Pengabdian kepada Masyarakat ITS.

Pratama, A. (2018). Transformation of traditional to modern architecture: Bubungan Tinggi case study. *Jurnal Arsitektur dan Perencanaan Kota, 14*(1), 34–48.

Raptis, G. E., Fidas, C., & Avouris, N. (2019). Do game designers' decisions related to visual activities affect knowledge acquisition in cultural heritage games? An evaluation from a human cognitive processing perspective. *Journal on Computing and Cultural Heritage, 12*(1), 1–25. https://doi.org/10.1145/3292057. Association for Computing Machinery (ACM).

Suryani, I. (2019). Principles of sustainable design in contemporary architecture. *Jurnal Desain dan Inovasi, 13*(3), 145–158.

Udechukwu, G. I. (2019). The significance and use of cultural symbols in contemporary African society: Igbo symbols as a paradigm. *Mgbakoigba: Journal of African Studies, 8*, 110–116. https://api.semanticscholar.org/CorpusID:197843120.

Utami, N. W. A. (2023). Implementasi konsep arsitektur tradisional Bali dan prinsip sustainable desain (Kasus: Bangunan pengelola showcase Mangrove TAHURA Ngurah Rai). *SARGA: Journal of Architecture and Urbanism, 17*(2), 57–67. https://doi.org/10.56444/sarga.v17i2.823. UNTAG Semarang.

Utomo, P. K., Sari, D. P., & Saptaningtyas, R. S. (2021). (Re) Interpretasi arsitektur tropis: Kajian teoretis tentang determinasi arsitektur vernakular dan regionalisme. *SADE: Jurnal Arsitektur, Planologi dan Teknik Sipil, 1*(2), 63–68. https://doi.org/10.29303/sade.v1i2.16. Universitas Mataram.

Wahyuni, E. (2018). Renewable energy technology in home design. *Jurnal Energi dan Lingkungan, 15*(2), 78–91.

Widiastuti, I. (2014). Transformasi nilai-nilai tradisional dalam arsitektur masa kini: Transformasi makna pada arsitektur asli daerah. In *Seminar Rumah Tradisional-PUSKIM* (pp. 1–16). Bandung. (Widiastuti, Indah. (2014). Transformasi makna pada arsitektur asli daerah dalam tampilan visual arsitektur. In Seminar Rumah Tradisional, Bandung, PUSKIM, 19 November 2014 https://www.researchgate.net/publication/306094378.

Widodo, B. (2017). Thermal analysis of buildings with recycled materials. *Jurnal Fisika Bangunan, 14*(2), 123–137.