

Revealing the fundamental essence and tectonic structure of Angkul-angkul architecture through the Delphi method

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received June 02, 2025 Received in revised form Sept, 13, 2025 Accepted November 01, 2025 Available online December 01, 2025</p> <p><i>Keywords:</i> Angkul-angkul Courtyard gate Culture Tectonics Traditional construction</p> <p>*Corresponding author: I Gusti Lanang Agung Nararya Pangjaya Department of Architecture and Planning, Faculty of Engineering, Universitas Gadjah Mada Sleman, Yogyakarta, Indonesia Email: igustilanangagungnararyapangjaya@mail.ugm.ac.id</p>	<p><i>As a courtyard gateway imbued with symbolic significance, the angkul-angkul embodies Balinese cultural and spiritual values while offering a distinctive tectonic expression that merits preservation. This study seeks to uncover the essence and underlying tectonic principles inherent in the construction and architectural articulation of the angkul-angkul, with the aim of elucidating its architectural value within the traditional building system and identifying its primary structural components. Employing a qualitative methodology, the research integrates an extensive literature review with the Delphi method to achieve expert consensus and ensure analytical validation. The results indicate that the angkul-angkul manifests a harmonious balance among aesthetic visual identity, tradition-based construction systems, and philosophical meaning. These values are articulated through six principal aspects: form, dimension, structure, spatial configuration, materiality, and ornamentation. Collectively, these six aspects constitute the fundamental basis shaping both the structural integrity and aesthetic expression of the angkul-angkul. Ultimately, the study's findings establish a structured set of design criteria that can inform and guide future angkul-angkul design practices, ensuring that its ongoing development remains contextually grounded, sustainable, and aligned with local cultural principles.</i></p>

Introduction

The *angkul-angkul* is an architectural element that holds a vital role in the traditional residential structures of the Balinese community. Serving as the courtyard entrance gate, the *angkul-angkul* functions not only as a physical access point but also as a symbolic architectural feature that embodies the socio-cultural and spiritual values of Balinese society (Laskara et al. 2025). Within the context of Balinese architecture, the *angkul-angkul* represents the harmonious interrelationship between humans, nature, and the spiritual belief systems upheld by the community.

One of its most significant architectural characteristics lies in its tectonic quality referring to the structural composition and construction methods that are aesthetically articulated as visual expressions of craftsmanship and cultural meaning.

Over time, the architecture of the *angkul-angkul* has undergone notable transformations influenced by various factors (figure 1). Globalization, advancements in construction technology, and the evolving needs of modern society have served as primary catalysts in shaping the design and construction of *angkul-angkul* (Putri and Maulina 2022; Tantra,

Sukmana, and Sholihah 2023; Wardani 2021). Furthermore, the societal shift toward a more practical lifestyle has encouraged the simplification of both form and construction processes (Wijaya 2017). These transformations present challenges in maintaining the essence and tectonic integrity of the *angkul-angkul*, ensuring that it remains relevant within contemporary architectural practice while preserving its inherent cultural identity (Laskara and Aritama 2023).



Figure 1. The development of *angkul-angkul* architecture

This study centers on identifying the essential characteristics and tectonic principles that serve as foundational guidelines in the construction and architectural articulation of the *angkul-angkul*. The primary objective is to explore the architectural values embedded within traditional construction systems and to elucidate the fundamental physical components that constitute the *angkul-angkul*. This focus corresponds with Bali Provincial Regulation No. 5 of 2005, which underscores the significance of preserving the noble values of traditional Balinese architecture as an integral component of Bali's cultural heritage.

In the context of globalization and shifting lifestyles, there exists a growing risk of diminishing traditional architectural elements that possess deep cultural significance (Nisa and Zahra 2025). Consequently, this research seeks to establish a conceptual framework that provides a fundamental reference for the structured development of the *angkul-angkul*. Such a framework can serve as a guideline for future architectural practices, promoting a balanced

evolution of *angkul-angkul* architecture that remains consistent with Balinese cultural principles while accommodating modern needs. Moreover, this study aims to contribute to the preservation of Balinese architecture and to enrich the broader discourse on Indonesian architectural heritage. The proposed approach also has the potential to serve as a model for the conservation and adaptive development of other traditional architectural forms across Indonesia.

The novelty of this research lies in its structured analytical approach, which specifically emphasizes the tectonic aspects of the *angkul-angkul*. In contrast to previous studies on traditional Balinese architecture that predominantly focus on symbolic and philosophical dimensions at the residential scale, this study examines the *angkul-angkul* through its structural and constructive characteristics. The findings are expected to offer insights for the adaptation of traditional architectural principles in contemporary design applications and to serve as a technical reference for architects in developing *angkul-angkul* designs that preserve cultural essence while responding to present-day architectural contexts.

Methods

Theories as references

The concept of tectonics in architecture has continuously evolved over time. Early scholars such as Kenneth Frampton, Adolf Heinrich Borbein, Karl Otfried Müller, Karl Bötticher, Semper, and Eduard Sekter formulated foundational theoretical concepts on tectonics that, on one hand, refer to structural and engineering design contributing to spatial formation. On the other hand, (Surya, Rudy, and Priyomarsono 2016) argue that tectonics in architecture can be understood as the creative process of designing structural and constructional arrangements that ensure strength and stability while maintaining aesthetic and expressive values.

From the perspective of architectural beauty, tectonics is inseparable from the duality between the functional (rational) aspect of the construction system and the aesthetic (emotional) expression that embodies philosophical meaning. Gomes, Mendes, and Almeida (2022) emphasized that architecture is a discipline where this interrelation

is ever-present; tectonics thus represents the harmonious balance between structural efficiency and emotional expression manifested through visual form.

Architectural tectonics, as the harmonization of structural elements and visual expressions that embody philosophical values, can be observed systematically through several key aspects. Hematang and Ikaputra (2022), in their recent study, delineated tectonics into three primary aspects and one complementary aspect: (1) surface appearance, (2) tectonic process, (3) internal factors, and (4) additional aspects not covered by the preceding three.

The surface appearance aspect conveys construction principles through visual components such as materials, textures, and structural patterns. The tectonic process aspect highlights the dynamic interaction between construction elements during design and execution, encompassing techniques, methods, and craftsmanship. Internal factors refer to the philosophical, spiritual, and symbolic meanings inherent in the building structure that connect architectural principles with local culture. Beyond these dimensions, there remains space for adaptation and interpretive flexibility to ensure that tectonics remains applicable to broader architectural designs without losing its essential meaning.

As a courtyard gateway symbolizing Balinese cultural and spiritual values, the angkul-angkul presents a unique manifestation of tectonics. The theoretical framework described above serves as the foundation for identifying the essential essence and core tectonic characteristics of *angkul-angkul* architecture.

Research method

This research began by examining the thematic focus and methodologies employed in previous studies on *angkul-angkul* and traditional Balinese architecture to identify existing research gaps (table 1). Prior research has generally emphasized symbolic, philosophical, and spatial aspects within the residential context, as well as the development and transformation of traditional architecture. However, few studies have explicitly or structurally addressed the tectonic aspect of *angkul-angkul* as an independent architectural entity.

Table 1. List of previous studies on Balinese architecture and *angkul-angkul*

Previous studies	Focus	Method
Studies on Balinese architecture in general		
(Laskara et al. 2025)	The role of traditional Balinese street-frontage elements in creating and maintaining the identity of Active Street Frontage.	Descriptive qualitative methodology.
(Rahmi 2025)	Changes and continuity of traditional <i>Bali Aga</i> village in response to cultural tourism development and government intervention.	Qualitative descriptive method with a case study approach.
(Luqiana 2024)	Reinterpretation of the <i>Tri Hita Karana</i> philosophy in the context of bamboo architecture in Bali.	Qualitative descriptive method with a case study approach.
(Siswadi and Maharani 2023)	Exploration of the philosophical values underlying spatial organization in traditional Balinese buildings.	Qualitative descriptive method using a phenomenological approach.
(Maharani, Suartika, and Saputra 2021)	The transformation of traditional Balinese architectural elements in contemporary architectural design.	Qualitative descriptive approach based on literature review, interviews, and field observations.
Studies specifically on <i>Angkul-angkul</i>		
(Laskara and Aritama 2023)	The characteristics of form and proportion of traditional <i>angkul-angkul</i>	Mixed-method research approach employing comparative-descriptive analysis through direct observation and literature study.
(Silantara 2023)	Typology of architectural form changes in <i>pamesuan</i>	Qualitative descriptive method using observation and literature review.
(Tantra, Sukmana, and Sholihah 2023)	The transformation of <i>angkul-angkul</i> architecture.	Descriptive method grounded in literature review and field observation.
(Putri and Maulina 2022)	The transformation in the form of <i>angkul-angkul</i> architecture.	Descriptive analysis method applied to field observations and literature review.
(Wardani 2021)	Exploration of various Balinese ornaments applied to the <i>angkul-angkul</i> .	Descriptive qualitative method describing the forms, functions, and meanings of the ornaments.

Previous studies	Focus	Method
(Wijaya 2017)	The transformation in the form of <i>angkul-angkul</i> architecture.	Rationalistic qualitative approach through literature review and field observation.

This study focuses on examining the tectonic aspects of the *angkul-angkul* by integrating a literature review with the Delphi method (figure 2). The combination of these two approaches enables the mapping of the essential and tectonic principles of *angkul-angkul* based on expert consensus while reflectively and critically validating the findings derived from literature.

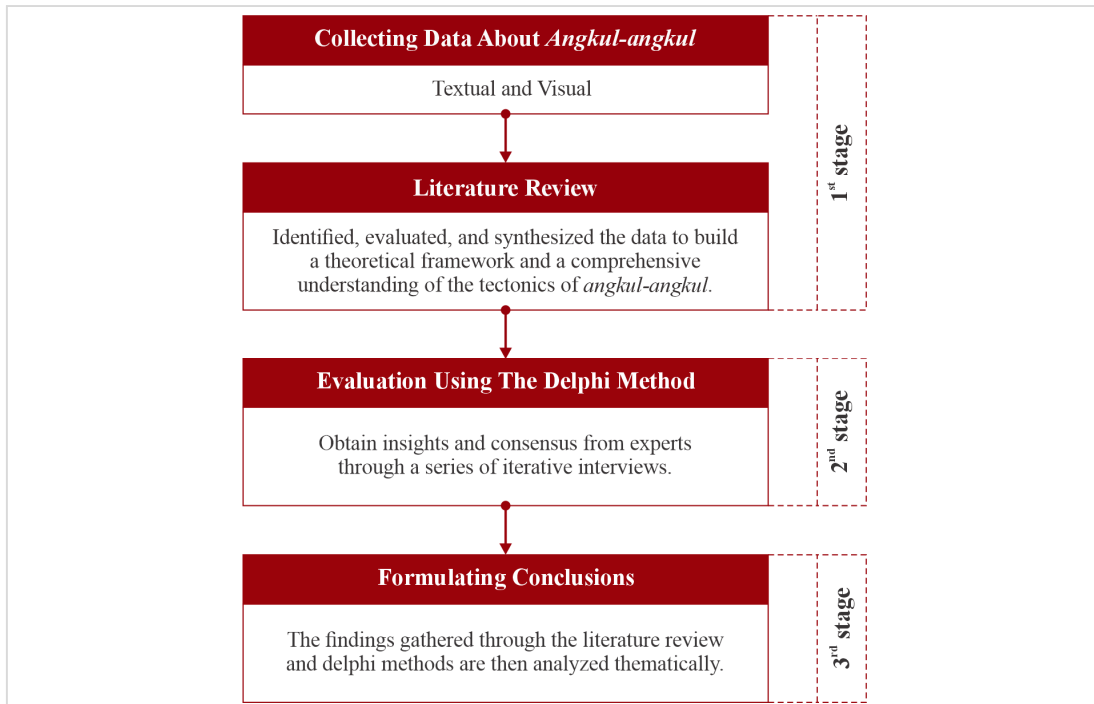


Figure 2. Research framework

The Delphi respondents consist of five experts: one academic specializing in architecture in Bali, one architectural practitioner in Bali, one expert in Balinese spatial planning and culture, and two traditional Balinese architectural practitioners (*undagi*). This composition was deliberately selected to ensure that the chosen experts possess relevant and contextual expertise concerning the architectural elements of *angkul-angkul* in particular and Balinese architecture and its contemporary development in general.

Results and discussion

The theoretical framework of architectural tectonics forms the foundation for interpreting the essence and identifying opportunities for innovation in the tectonics of *angkul-angkul*

architecture. The aspects proposed by Hematang and Ikaputra (2022) serve as the observed variables in this study. The Delphi method involves expert respondents comprising an architecture academic based in Bali (E1), an architectural practitioner in Bali (E2), an expert in Balinese spatial planning and culture (E3), and two traditional Balinese architectural practitioners or *undagi* (E4 and E5).

The results and discussion related to this topic are presented descriptively and thematically, systematically yielding four interrelated themes: (1) the essence of *angkul-angkul* architecture, (2) the core tectonics of *angkul-angkul* architecture, (3) the factors influencing the development of *angkul-angkul* tectonics, and (4) the opportunities for innovation in *angkul-angkul* tectonics. The first two themes are addressed in this study, while the latter two are projected for future research.

The essence of *Angkul-angkul*

Based on the analysis presented in table 2, the experts' views are consistent, aligned, and mutually reinforcing. The *surface appearance* variable, representing the physical manifestation of construction principles through visual elements such as material, texture, and structural patterns, is regarded as a distinctive identity. The experts' perspectives correspond with the findings of Maharani, Suartika, and Saputra (2021), who

assert that the *angkul-angkul* has become a defining architectural identity of Bali. On a more localized scale, yet within a similar context, Pranajaya, Rijasa, and Dewi (2023) emphasized the importance of surface appearance shaped by physical composition (form, size, ornamentation, materials, and construction techniques) in the *Peciren Bebadungan* style, which contributes significantly to the architectural identity of the Denpasar and Badung regions.

Table 2. Delphi results on the theme of the essence of *angkul-angkul*

Variable	E1	E2	E3	E4	E5	Notes
Surface appearance	The appearance of <i>Angkul-angkul</i> can convey the impression or character of a region.	reflects the region, the façade of Balinese architecture, and a representation of its owner.	The form of <i>angkul-angkul</i> as a marker serves as a highly significant identity.	The physical elements of <i>angkul-angkul</i> reflect Balinese traditions or local wisdom.	<i>Angkul-angkul</i> is an iconic identity of Balinese architecture.	Reaching a consensus and reinforcing each other.
Tectonic process	The construction process still employs conventional techniques.	The construction process always refers to traditional customs and culture.	A series of ceremonies and offerings accompany the architectural construction process.	The construction process is inseparable from traditional methods, including a specific sequence of ceremonies.	Traditional guidelines serve as the foundation of the construction process.	Reaching a consensus and reinforcing each other.
Internal factors	The <i>Tri Hita Karana</i> concept is the foundation.	<i>Tri Hita Karana</i> as a contextual reference.	The concepts of <i>Tat Twam Asi</i> , Macrocosm-Microcosm, and <i>Tri Hita Karana</i> serve as philosophical foundations.	<i>Tri Hita Karana</i> is the key philosophy to creating balance and harmony in its architecture.	Concepts derived from <i>lontar</i> (traditional manuscripts) are the foundation.	Reaching a consensus, reinforcing, and complementing each other.

The interaction dynamics among construction elements in the design and building process of *angkul-angkul* including techniques, methods, and craftsmanship are deeply rooted in Balinese traditions and cultural practices. Traditional guidelines remain the primary reference in its architectural tectonics. According to Putra and Wirawibawa (2023), traditional construction principles have long been applied to heritage buildings to achieve sustainability and high artistic value. Moreover, the architectural process is traditionally accompanied by a series of rituals performed at each stage of construction. This practice reflects the Balinese way of life, which is inherently connected to nature and ritualistic customs (Subawa 2024).

Regarding the *internal factors* variable, which emphasizes the interrelationship between architectural principles and local culture through philosophical, spiritual, and symbolic meanings, the experts strongly concur that the *Tri Hita*

Karana concept serves as a fundamental principle. *Tri Hita Karana* is a core philosophy in Balinese life, emphasizing harmony among God (*Parahyangan*), humanity (*Pawongan*), and nature (*Palemahan*). The profound relationship between architecture and local culture demonstrates how Balinese architecture integrates Hindu, Buddhist, and indigenous beliefs, all of which are deeply connected to the natural landscape (Siswadi and Dwiputri Maharani 2023). The interconnection between spirituality, culture, and social values within Balinese society is thus abstracted into the philosophy of *Tri Hita Karana*.

Therefore, the essence of *angkul-angkul* architecture lies in the synthesis of visual identity, tradition-based construction, and underlying philosophical and spiritual values (figure 3). Its distinctive materials, textures, and structural patterns contribute to its visual identity, reinforcing the character of Balinese architecture.

From a constructive perspective, the tectonic process of *angkul-angkul* continues to adhere to traditional principles and is consistently accompanied by ritual practices, reaffirming the inseparable link between architecture and culture.

Beyond its physical form, the *angkul-angkul* embodies the philosophy of *Tri Hita Karana*, serving as a tangible manifestation of Balinese spiritual and cultural values intricately woven into the landscape and daily life of its people.

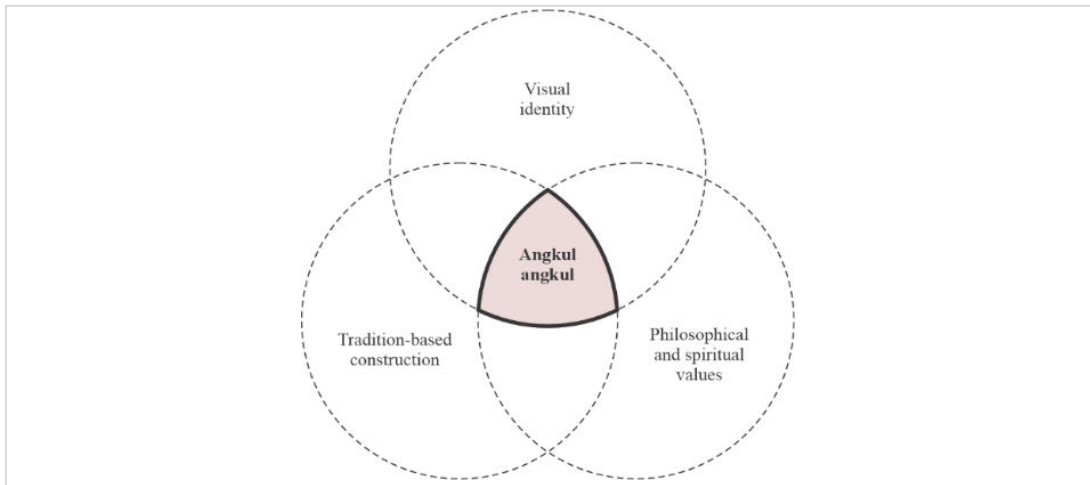


Figure 3. Diagram of the essence of *angkul-angkul*

Core tectonics of *Angkul-angkul*

The next theme concerns the core tectonics of *angkul-angkul* architecture. Based on the results of the Delphi method analysis combined with a literature review (table 3), six main principles were identified as the core tectonic elements of *angkul-angkul* architecture:

(1) the principle of form, (2) the principle of dimension, (3) the principle of structure, (4) the

principle of spatial pattern, (5) the principle of material, and (6) the principle of ornamentation. Expert consensus indicates that each of these principles plays a crucial role in defining the architectural expression of *angkul-angkul*, ensuring it remains rooted in Balinese cultural values while allowing adaptation to modern developments.

Table 3. Delphi results on the theme of core tectonics of *angkul-angkul*

Tectonic Elements	Sources	E1	E2	E3	E4	E5	Consensus
Principle of form	(Laskara and Aritama 2023; Putri and Maulina 2022; Tantra, Sukmana, and Sholihah 2023)	A	A	A	A	A	Experts agreed (A) that the principle of form is the most fundamental basis for creating the highly characteristic structural composition of <i>angkul-angkul</i> architecture.
Principle of dimension	(Dwijendra 2008; Laskara and Aritama 2023; Saraswati 2001; Silantara 2023; Tantra, Sukmana, and Sholihah 2023; Wijaya 2017)	A	A	A	A	A	The dimensional principle is considered vital for determining the proportions of <i>angkul-angkul</i> and complements the principle of form.
Principle of structure	(Dwijendra 2008; Laskara and Aritama 2023; Silantara 2023; Tantra, Sukmana, and Sholihah 2023; Wijaya 2017)	A	A	A	A	A	The principle of structure provides alternative options for the impression to be realized in <i>angkul-angkul</i> .
Principle of spatial pattern	(Dwijendra 2008; Saraswati 2001; Silantara 2023; Wijaya 2017)	A	A	A	A	A	The principle of spatial pattern is closely related to function and the social strata of society.
Principle of material	(Dwijendra 2008; Laskara and Aritama 2023; Silantara 2023; Tantra, Sukmana, and Sholihah 2023)	A	A	A	A	A	Experts reached consensus that material principles emphasize the wise and proportional use of local resources.
Principle of ornamentation	(Laskara and Aritama 2023)	A	A	A	A	A	The principle of ornamentation is an effort to add value and provide a sense of romanticism to the development of art and culture.

The form of *angkul-angkul* is based on the *Tri Angga* principle (the principle of form division), consisting of three main parts (figure 4): *Utama Angga* (head), *Madya Angga* (body), and *Nista Angga* (foot) *Utama Angga* (head), *Madya Angga* (body), and *Nista Angga* (foot) (Laskara and Aritama 2023; Putri and Maulina 2022; Tantra, Sukmana, and Sholihah 2023). Experts agree that this structural hierarchy, rooted in local wisdom and consistently practiced, forms the most fundamental basis for shaping the unique structural composition of *angkul-angkul*. (Maharani, Suartika, and Saputra 2021) further emphasize that the *Tri Angga* concept can even be applied to smaller architectural components within the composition.

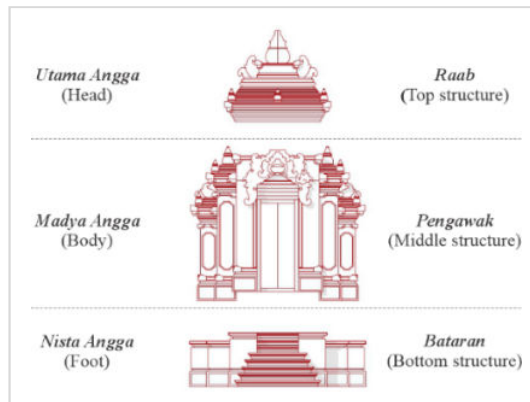


Figure 4. The principle of form based on *Tri Angga*

Traditionally, as stated in the *Asta Kosala-Kosali* lontar, the dimensional principle of *angkul-angkul* is determined based on the anthropometric measurements of the homeowner, particularly the head of the family (Dwijendra 2008; Laskara and Aritama 2023). However, increasing human mobility and changing activities in the modern era have required adjustments to these dimensions to accommodate various objects and circulation needs (Putri and Maulina 2022; Silantara 2023; Tantra, Sukmana, and Sholihah 2023; Wijaya 2017). In response, experts have reached a consensus that the horizontal and vertical dimensional principles, referring to the movement of objects passing through the *angkul-angkul*, constitute essential factors accompanying the principle of form in defining the proportional characteristics of *angkul-angkul*, whether in traditional or contemporary expressions.

Based on its structural typology, *angkul-angkul* is classified into *cecandian* and *makekerep*

types (Dwijendra 2008). The *cecandian angkul-angkul* features a solid structure extending from the base to the top, resembling a temple (*candi*). Conversely, the *makekerep angkul-angkul* exhibits solidity only at its base and body, while its roof is constructed of distinct materials and structural systems, as illustrated in figure 5.

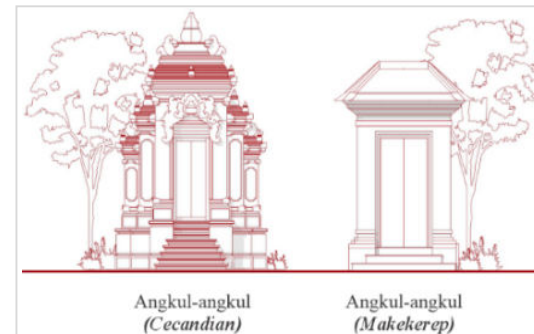


Figure 5. The structural principle of *angkul-angkul*

The structural principle of *angkul-angkul* offers alternatives and flexibility in achieving both visual expression and structural endurance. Experts have agreed that the structural system embedded within the *angkul-angkul* not only prioritizes strength and stability but also accentuates the expressive qualities of materials and the intricacy of joint systems, thereby showcasing the craftsmanship of construction. Alongside advancements in construction technology, this structural principle serves as a fundamental basis for exploring innovative approaches without compromising the architectural identity of the *angkul-angkul*.

With respect to its spatial configuration or forecourt arrangement (figure 6), *angkul-angkul* can be categorized into four distinct types (Dwijendra 2008; Saraswati and Oka 2001). The first type is the *angkul-angkul* with an open yard (*lebuh*). The second features a confined space reminiscent of a frog's mouth (*cangkem kodok*). The third type incorporates *jaba sisi*, a component of the *Tri Mandala* spatial division in traditional Balinese architecture. The fourth type integrates *ancak saji*, one of the mandalas within the *Sanga Mandala* concept.

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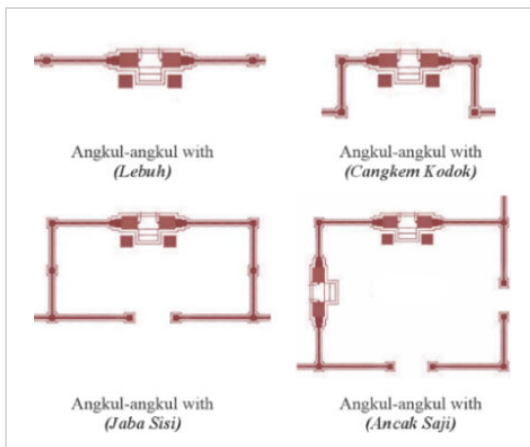


Figure 6. The structural principle of *angkul-angkul*
Source: (Saraswati and Oka 2001)

The construction of *angkul-angkul* predominantly utilizes natural materials such as *tanah polpolan* (clay), *tanah tatalan* (earth blocks), bricks, *paras* (sandstone), coral stone, and river stone (Dwijendra 2008; Laskara and Aritama 2023). The roof coverings may consist of *klangсах* (coconut leaves), *sungi* (rice stalks), *ambengan*, tiles, ijuk (palm fiber), or bamboo (Dwijendra 2008; Silantara 2023). The selection of materials follows the *Desa-Kala-Patra* concept, ensuring adaptation to the specific context of place, time, and culture. This principle provides a foundation for maintaining harmony between architectural preservation and progressive development. In alignment with this concept, experts unanimously assert that material selection should proportionally consider the availability of local resources and the principle of sustainability.

The final component encompasses the principle of ornamentation. Ornamentation in *angkul-angkul* enriches both the aesthetic and symbolic dimensions of Balinese architecture. (Laskara and Aritama 2023) assert that ornamentation signifies the social standing of the owner, a view that aligns with expert consensus. The experts further emphasize that ornamentation serves as a means of value enhancement and romantic expression within the evolution of art and culture. Moreover, ornamentation extends beyond mere carvings, encompassing intricate structural articulations that shape the overall

silhouette and formal character of the *angkul-angkul*.

From the preceding discussion, it can be concluded that the core tectonics of *angkul-angkul* architecture consist of six principal elements: form, dimension, structure, spatial pattern, material, and ornamentation. The integration of these six principles (figure 7) ultimately defines the architectural identity of the *angkul-angkul*, achieving equilibrium among technical performance, aesthetic articulation, and cultural significance.

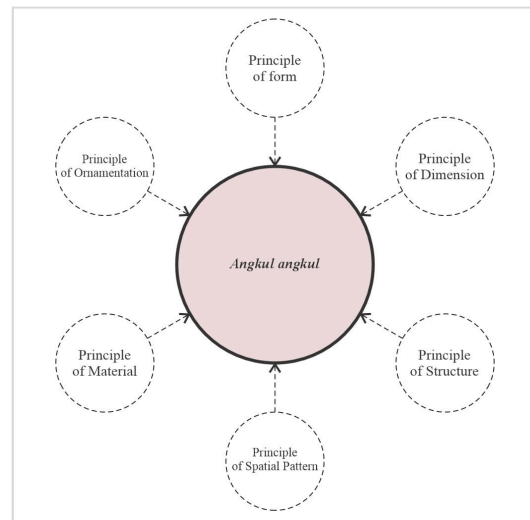


Figure 7. Diagram of the core tectonics of *angkul-angkul* architecture

Conclusions

This study presents a systematic analytical framework grounded in both literature review and the Delphi method, focusing specifically on the tectonic aspects of *angkul-angkul*. The methodological novelty of this research lies in its reflective-critical approach, which synthesizes expert consensus to validate theoretical findings and to recontextualize the fundamental tectonic principles within an applied framework. This approach enables a structured articulation of the traditional construction essence embodied in the *angkul-angkul*.

The *angkul-angkul* epitomizes a harmonious synthesis between aesthetic identity, tradition-based construction, and enduring philosophical values transmitted across generations. From a tectonic perspective, *angkul-angkul* comprises six interdependent principles (form, dimension,

structure, spatial pattern, material, and ornamentation) that collectively define its distinctive structural and aesthetic qualities. Each principle operates synergistically, contributing to a holistic unity that embodies the essence of Balinese architecture. These principles further open avenues for adaptive innovation, preserving local values while accommodating contemporary architectural needs and temporal responsiveness.

Ultimately, this research extends and complements the philosophical framework of *angkul-angkul* proposed by Laskara et al. (2025) by redefining it not solely as a socio-cultural and spiritual threshold but as an architectural entity articulated tectonically a synthesis of visual identity, craftsmanship, and philosophical depth. Theoretically, it formulates a core tectonic framework that deepens the understanding of traditional Balinese construction within the broader discourse of architectural tectonics. It reaffirms tectonics as an analytical paradigm interlinking structure, culture, and meaning. Practically, the findings offer a set of structured design criteria that support the development of contextual and sustainable architectural works rooted in indigenous cultural values.

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Author(s) contribution

I Gusti Lanang Agung Nararya Pangjaya contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.

Harry Kurniawan contribute to the research concepts preparation and literature reviews, data analysis, of article drafts preparation and validation.