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Material Tectonics Variable Framework: A Study of Tectonic Theory Application in Contemporary Indonesian Architecture Analysis

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A R T I C L E I N F O

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A B S T R A C T

This research identifies and formulates a material tectonics variable framework as an analytical instrument for assessing tectonic quality in Indonesian contemporary architecture. As a subset of broader architectural tectonics, material tectonics focuses on materiality as the primary generator of tectonic expression. Using qualitative approach with comprehensive tectonic theory literature review (Semper, Sekler, Frampton) and descriptive-interpretive analysis on two contrasting Indonesian case studies—Katamama Hotel (andramatin, 2015) and Biophilic Office (Andyrahman Architect, 2021)—the research identifies seven main variables: material honesty, structural expression, construction details, joint articulation, material-form relationship, tactile-visual experience, and constructive narrative. Analysis reveals Katamama demonstrates stereotomic brick tectonics (88.6% score) while Biophilic Office exhibits hybrid tectonic-biophilic wisdom (91.4% score). The framework successfully differentiates contrasting approaches while identifying shared characteristics of Indonesian material tectonics: material honesty as fundamental, local materials as identity markers, valued craft tradition, climate responsiveness, and embedded cultural narratives.

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INTRODUCTION

Contemporary Indonesian architecture faces a paradox between adopting modern construction technology and maintaining local material authenticity and regional identity. Amid digital technology dominance, industrial fabrication, and homogeneous global materials, Indonesian architecture experiences a revival of consciousness toward local materiality as architectural identity former. This phenomenon emphasizes the importance of deep understanding toward material tectonics concept as philosophical foundation in architecture that connects material, structure, construction, and cultural meaning aspects.

Tectonics, derived from Greek "tekton" (carpenter or builder), has been an important discourse in architectural theory since the 19th century. Gottfried Semper (1851) introduced tectonics as the art of assembling or uniting constructive elements, emphasizing that each material has "Stoffwechseltheorie" (material metabolism theory) determining how the material is formed and articulated. Eduard Sekler (1965) expanded tectonic understanding as visual manifestation of structure expressing force and equilibrium conditions, distinguishing between structure (force system), construction (assembly method), and tectonics (visual expression). Kenneth Frampton (1995) developed "critical regionalism" concept placing tectonics as resistance against global architecture culture homogenization, emphasizing "tactile resilience" and multisensory experience importance.

This research specifically focuses on **material tectonics** as a specific dimension of broader architectural tectonics. If architectural tectonics encompasses all constructive expression aspects—from structural systems, spatial organization, construction, to cultural meaning—then material tectonics centers attention on **materiality as the primary generator** of tectonic expression (Semper, 1860-1863). This focus limitation is based on several considerations: (1) Gottfried Semper's thinking emphasizing each material has inherent logic in how it is formed and expressed, (2) Indonesian contemporary architecture context where material tectonics becomes increasingly relevant considering Nusantara local material richness, craft tradition revival, and sustainable practices development, and (3) methodological perspective where material tectonics is more operational for analysis.

Contemporary Indonesian architects such as Andra Matin (andramatin) and Andy Rahman (Andyrahman Architect) have demonstrated strong material tectonics approaches in their works. Andra Matin is known for local material exploration expressed with contemporary precision—Katamama Hotel (2015) uses 1.5 million handmade Tabanan bricks creating monolithic facade with high tectonic quality (ArchDaily, 2016). Andy Rahman, through his biophilic approach, demonstrates innovative material integration—Biophilic Office (2021) combines woven brick patterns inspired by traditional bamboo gedheg with actual bamboo "breathing walls," showing how ancient materials can be reinterpreted in contemporary practice (ArchDaily, 2022; FuturArc, 2023).

However, in Indonesian architectural practice and academic research, material tectonics principles application is often not systematically documented. Tectonic quality analysis of a building tends to be subjective and interpretive

without clear and measurable variable framework. Indonesian architectural criticism focuses more on formal-visual or conceptual aspects, while materiality dimensions, construction details, and tectonic quality are often neglected in deep analysis. This condition creates a gap between tectonic theory (developed mainly in Western context) and Indonesian architectural practice requiring applicable framework for Nusantara local material context.

Previous research on Indonesian architecture has explored relationships between local materials and architectural expression. However, these studies have not provided **operational and measurable variable framework** to systematically analyze material tectonics in Indonesian architectural case studies. Therefore, formulation of variable framework capable of bridging tectonic theory with Indonesian architectural analysis practice methodologically and applicatively is needed.

Research aims to: (1) identify and formulate material tectonics concept variables based on tectonic theory study applicable for Indonesian architecture analysis, (2) develop systematic relationship framework among material tectonics variables as analysis instrument responsive to Indonesian local material context, (3) apply material tectonics variable framework to Indonesian architectural case studies (Katamama Hotel and Biophilic Office) to test validity and applicability, and (4) identify material tectonics characteristics and patterns in Indonesian contemporary architecture through comparative analysis.

THEORETICAL REVIEW

Architectural Tectonics vs Material Tectonics: Conceptual Distinction

This research explicitly distinguishes between architectural tectonics (comprehensive umbrella concept) and material tectonics (specific subset focus). If architectural tectonics encompasses all constructive expression aspects—structural systems, spatial organization, construction, materials, to cultural meanings—then material tectonics centers attention on materiality as primary generator of tectonic expression.

Table 1. Conceptual Distinction: Architectural Tectonics vs Material Tectonics

Aspect	Architectural Tectonics	Material Tectonics
Scope	Comprehensive: structure, material, form, space, culture	Specific: materiality as primary lens
Focus	Holistic constructive system	Material properties and expression
Key Question	"How is this building constructed?"	"How is this material expressed?"
Key Theorists	Sekler, Frampton, Bötticher	Semper, Ruskin, Zumthor
Analysis Scale	Building-wide system	Material-specific quality
Application	Comprehensive building evaluation	Focused material assessment

This focus justification based on: (1) methodological gap—no operational framework for material tectonics analysis exists, (2) observable nature—materials are tangible and measurable, (3) Indonesian context relevance—rich local material diversity, and (4) manageable scope for master thesis research.

Gottfried Semper's Material Metabolism Theory

Semper's fundamental contribution to material tectonics understanding is "**Stoffwechseltheorie**" (material metabolism theory) emphasizing each material has inherent logic determining: (a) how material is formed and processed (working technique), (b) appropriate forms for material characteristics, and (c) natural visual expression for the material (Semper, 1860-1863).

Semper identified four basic techniques based on materials: (1) Ceramics (plastic technique): clay, earthwork—massive, compressive; (2) Tectonics (structural technique): wood, frame construction—tensile, assembly; (3) Stereotomy (masonry technique): stone, masonry—compressive, mass; (4) Textiles (weaving technique): fabric, weaving—tensile, lightweight.

This thinking is highly relevant for Indonesian context possessing material richness with different characteristics: volcanic stone (stereotomic), bamboo and wood (tectonic), clay (ceramic), weaving (textile tradition).

Eduard Sekler's Tectonic Trinity

Sekler (1965) provides crucial conceptual clarification distinguishing three often-interchanged terms:

- **Structure:** Force system and equilibrium conditions (engineering concern)
- **Construction:** Physical assembly methods and processes (technical concern)
- **Tectonics:** Visual expression communicating structure and construction (aesthetic concern)

Sekler emphasizes **tectonics** is the aesthetic-expressive dimension of structure and construction—how architecture **communicates** its structural and constructive logic through visual form, proportion, articulation, and detail.

Kenneth Frampton's Critical Regionalism and Tactile Resilience

Frampton (1995) identifies three tectonic levels: (1) **Ontological level**—fundamental relationship between humans and earth through construction; (2) **Representational level**—how structure is visually represented; (3) **Phenomenological level**—sensory and haptic experience toward materiality.

Frampton emphasizes "**tactile resilience**" importance—architecture's ability to resist reduction to pure image by offering tactile quality and multisensory experience. In visual media dominance era, tactile quality becomes resistance against architecture dematerialization. This concept is highly relevant for Indonesian architecture rich in natural material textures—from rough andesite stone surfaces, teak wood grain, bamboo woven textures, to cool temperature from fired brick.

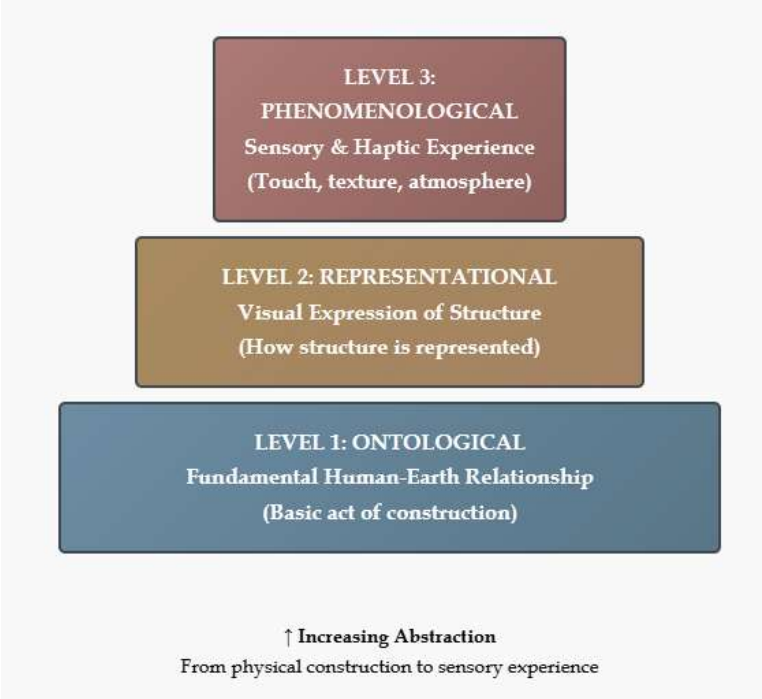

Diagram 1. Kenneth Frampton's Hierarchical Three Levels of Tectonics (Ontological-Representational-Phenomenological)

Material Honesty and Craft Tradition

Material honesty concept roots in John Ruskin's (1849) "The Lamp of Truth" and William Morris's Arts and Crafts movement rejecting false ornamentation and demanding material authenticity. Louis Kahn (1961) states architects must "ask brick what it wants to be," emphasizing understanding and honoring each material's inherent characteristics importance.

In Indonesian context, material honesty principle resonates with vernacular architecture philosophy using local materials according to their natural properties—bamboo for tensile-flexible structure, stone for massive foundation, wood for joinable frames.

Indonesian Contemporary Architects and Material Tectonics

Andra Matin (andramatin) is known for material localization approach—Indonesian local material use expressed with contemporary honesty and precision. Katamama Hotel (2015) uses 1.5 million handmade Tabanan bricks creating monolithic façade with multi-hued texture, combining material honesty with contemporary detail precision (ArchDaily, 2016).

Andy Rahman (Andyrahman Architect) explores low-cost, local, recycled, and reused materials while applying architectural craftsmanship. His practice, particularly evident in Biophilic Office (2021), demonstrates innovation in reinterpreting traditional materials—transforming bamboo gedheg (vernacular wall panels) into woven brick patterns, and utilizing actual bamboo and rattan for "breathing walls" that allow air and light circulation. Andyrahman's work connects to the architectural history of East Java, particularly the brick-based temples (Candi Pari and Candi Sumur) from the Majapahit kingdom era, seeking

to be a "successor" of brick craftsmanship in the contemporary age (FuturArc, 2023; Architonic, 2022).

Table 2. Previous Research and Identified Gaps

Researcher	Focus	Contribution	Limitation
Pangarsa (2008)	Eko Prawoto's work philosophy	Philosophical analysis of local materials	No operational framework
Tjahjono (2010)	Context and social responsibility	Socio-cultural relationships	Less focus on material tectonics
Oxman (2012)	Material-based computation	Material in digital design	Not for built project analysis

Previous research gap shows need for operational and measurable variable framework to systematically analyze material tectonics in Indonesian contemporary architecture—this research fills that methodological gap.

METHODOLOGY

This research uses qualitative approach with interpretive-phenomenological paradigm, viewing architecture as phenomenon understandable through deep interpretation of materiality, construction details, and spatial experience. Qualitative approach chosen because: (1) research nature attempts to understand and interpret abstract concepts (material tectonics) into operational variables, (2) material tectonics complexity involves tangible (physical properties) and intangible (phenomenological experience) aspects, (3) contextual—tectonic quality is highly context-dependent, and (4) exploratory—research area not extensively explored in Indonesian context.

Research Strategy combines: (1) Systematic Literature Review to identify tectonic concept variables from established theories, (2) Descriptive-Interpretive Analysis to apply and validate variable framework on case studies, and (3) Comparative Case Studies to identify material tectonics patterns in Indonesian architecture.

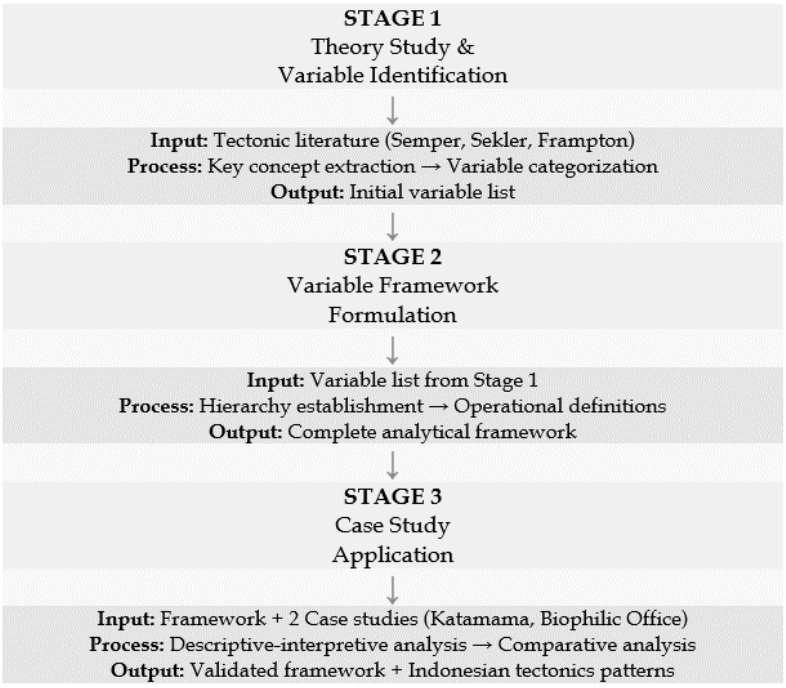

Diagram 2. Research Methodology Flowchart (Stage 1 → Stage 2 → Stage 3 with inputs, processes, and outputs)

Case Study Selection

Two buildings selected with contrasting characteristics for comparative richness:

Case Study 1: Katamama Hotel (2015)

- Architect: andramatin (Andra Matin)
- Location: Seminyak, Bali, Indonesia
- Primary Material: 1.5 million handmade Tabanan bricks
- Area: Large-scale (60 rooms, commercial)
- Characteristics: Stereotomic approach—mass, contemporary precision
- Data Source: ArchDaily (2016), professional photography by Martin Westlake

Case Study 2: Biophilic Office (2021)

- Architect: Andyrahman Architect (Andy Rahman)
- Location: Sidoarjo, East Java, Indonesia
- Primary Material: Woven brick, bamboo, wood, rattan
- Area: 274 m² (office)
- Characteristics: Hybrid tectonic-stereotomic—biophilic integration, craft tradition
- Data Source: ArchDaily (2022), FuturArc (2023), professional photography by Mansyur Hasan, youtube and author.

Table 3. Comparative Justification for Case Study Selection

Aspect	Katamama Hotel	Biophilic Office
Material Type	Heavy (brick masonry only)	Hybrid (brick + bamboo + wood)

Tectonic Type	Stereotomic (mass, permanence)	Mixed (mass + frame)
Approach	Contemporary precision	Biophilic + craft tradition
Scale	Large (60 rooms, commercial)	Small (274 m², office)
Context	Tourist destination (Bali)	Industrial city (Sidoarjo)
Biophilic Integration	Minimal	Extensive (central garden, breathing walls)

Data Collection and Analysis

Data Collection:

- Document study: ArchDaily articles, FuturArc features, architectural publications
- Visual analysis: Professional photography (close-up details, medium shots, wide contexts)
- Material specifications from publications
- Architect statements and design philosophy

Data Analysis:

- Content analysis for theory extraction
- Descriptive-interpretive analysis per variable
- Comparative matrix for cross-case analysis
- Data triangulation: multiple sources, theoretical frameworks, peer review

Trustworthiness Criteria:

- Credibility: Triangulation, peer debriefing
- Transferability: Thick description, clear documentation
- Dependability: Audit trail, systematic methodology
- Confirmability: Reflexivity, data-grounded conclusions

RESEARCH RESULTS

Seven Variables of Material Tectonics Identified

Based on comprehensive tectonic theory review, seven main variables forming analytical framework for Indonesian architecture were successfully identified. Each variable has clear theoretical foundation, structured sub-variables, and observable indicators.

Table 4. Summary of Seven Material Tectonics Variables

No	Main Variable	Brief Definition	Key Theorist	Analysis Level
1	Material Honesty	Authenticity and truth to materials	Ruskin, Kahn	Fundamental
2	Structural Expression	Visual manifestation of structural system	Sekler, Perret	Structural-Constructive

3	Construction Details	Element meeting resolution, craftsmanship	Frascari, Scarpa	Structural-Constructive
4	Joint Articulation	Connection expressiveness	Semper, Kuma	Structural-Constructive
5	Material-Form Relationship	Material properties and geometry correspondence	Semper, Nervi	Formal-Relational
6	Tactile-Visual Experience	Multisensory material quality	Pallasmaa, Zumthor	Phenomenological
7	Constructive Narrative	Storytelling through construction and material	Frampton, Leatherbarrow	Narrative

Hierarchical and Relational Framework

Variables form hierarchical system from fundamental to complex in five levels:

- Level 1 (Fundamental): Material Honesty—non-negotiable basis
- Level 2 (Structural-Constructive): Structural Expression, Construction Details, Joint Articulation—core tectonics
- Level 3 (Formal-Relational): Material-Form Relationship
- Level 4 (Phenomenological): Tactile-Visual Experience
- Level 5 (Narrative): Constructive Narrative—synthesis

Variables also form network of relationships with strong interconnections:

- V1 (Material Honesty) → foundational for all others
- V2 (Structural Expression) ↔ V5 (Material-Form) → dialectic relationship
- V3 (Details) ↔ V4 (Joints) → details are joints
- V1+V3+V4 → V6 (Tactile-Visual) → physical qualities create experience
- All variables → V7 (Narrative) → synthesis storytelling

Diagram 3. Network Diagram of Variable Interrelationships (showing strong and moderate connections among 7 variables)

Katamama Hotel Analysis Results

Overall Tectonic Profile: 31/35 (88.6%) – Excellent. Detailed analysis per variable reveals:

Variable 1 - Material Honesty: 5/5 (Very High). Raw Tabanan brick exposed throughout without concealing finishes. Natural color variation (red, brown, grey) embraced—no standardization. Material continuity from exterior to interior spaces. Compressive nature of brick clearly communicated through thick walls.

Figure 1. Katamama Hotel - Material Honesty Evidence: (a) Close-up natural brick texture, (b) Multi-hued handmade bricks, (c) Interior-exterior material continuity, (d) Thick wall expressing massiveness, Source: Photography by Martin Westlake / ArchDaily 2016

Variable 2 - Structural Expression: 3/5 (Medium). Deliberate structural ambiguity—Semperian approach. Concrete structure likely concealed within brick mass. Monolithic aesthetic prioritized over structural clarity. Trade-off: brick monolith expression vs structural revelation (acceptable design choice)

Variable 3 - Construction Details: 5/5 (Very High). Exceptional craftsmanship—1.5 million handmade bricks assembled with precision. Consistent brick coursing despite handmade irregularities. Sharp corner details and clean openings. Construction logic readable: brick-by-brick assembly.

Figure 2. Katamama Hotel - Construction Detail Quality: (a) Precise brick coursing alignment, (b) Sharp corner execution, (c) Window opening detail, (d) Joint pattern consistency Source: ArchDaily 2016

Variable 4 - Joint Articulation: 4/5 (High). Brick mortar joints as primary expressive element. Joints create rhythm and texture on monolithic façade. Material-appropriate joint treatment accommodating handmade brick variations. Clear hierarchy: prominent facade joints vs subtle interior details

Variable 5 - Material-Form Relationship: 4/5 (High). Orthogonal geometry appropriate for brick masonry. Simple volumes rationalized for efficient brick construction. Thick walls reflect compressive nature of masonry. Strong groundedness—building reads as heavy, rooted, permanent.

Variable 6 - Tactile-Visual Experience: 5/5 (Very High). Rich texture from handmade brick surface imperfections. Multi-hued surface creates visual depth. Dramatic shadow play in Bali's tropical sun. Brick color shifts throughout day (bright terracotta to warm amber). Warm, earthy atmosphere; cool tactile experience.

Figure 3. Katamama Hotel - Tactile-Visual Experience: (a) Rich surface texture inviting touch, (b) Light response at different times of day, (c) Shadow play in mortar joints, (d) Atmospheric interior quality Source: ArchDaily 2016

Variable 7 - Constructive Narrative: 5/5 (Very High). Clear construction story: foundation → brick walls rise → assembly. Narrative of local craftsmanship: 1.5M handmade bricks = months of labor. Cultural narrative:

Tabanan brick tradition connects to Balinese heritage. Climate response: thick brick walls = thermal mass for tropical climate. "Local materials, local hands, contemporary vision" story.
Katamama Synthesis:

- Type: Stereotomic—mass, gravity, permanence
- Material Strategy: Monolithic brick as primary expression
- Approach: Contemporary precision craft with traditional materials
- Strengths: Material honesty, craftsmanship, sensory richness, cultural narrative
- Significance: Demonstrates traditional materials can compete in contemporary architecture when executed with precision, scale, and vision

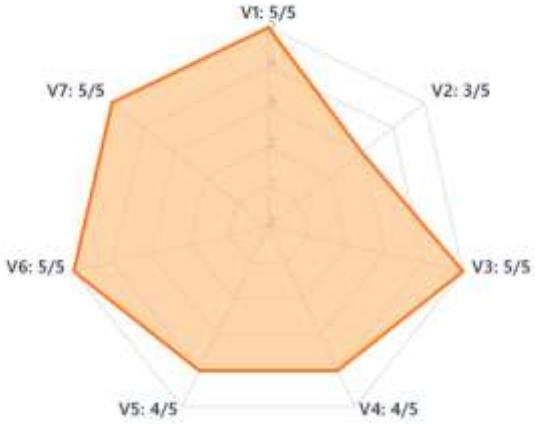

Diagram 4. Katamama Hotel Tectonic Profile - Radar Chart (showing scores across 7 variables: 5-3-5-4-4-5-5), source : author

Biophilic Office Analysis Results

Overall Tectonic Profile: 32/35 (91.4%) – Excellent. Detailed analysis per variable reveals:

Variable 1 - Material Honesty: 5/5 (Very High). Woven brick patterns expose material authenticity without renders. Concrete colum & beam expose, Bamboo and wood displayed in natural expression—no concealment.. Material logic clearly visible: brick for wall mass, concrete frame structure, steel for roof stucure exposed. Bamboo & wood for partition wall. Organic material aging embraced (bamboo silvering, wood patina). Material continuity through breathi ng walls—interior-exterior integration

Figure 3. Biophilic Office – Material Honesty, source : (https://www.youtube.com/shorts/cZ9JN6ky1x4)

Variable 2 - Structural Expression: 4/5 (High). Hybrid structural system: brick load-bearing walls + wood/bamboo frame elements. Ground floor: woven brick patterns still express compressive logic. Second floor: bamboo frame structure visible through breathing walls. Structural hierarchy readable: solid base → permeable upper level. Slight ambiguity where brick patterns are decorative vs structural (intentional design choice).

Figure 4. Biophilic Office - Structural Expression: (a) Exposed Concrete frame structure, (b) Clear column-beam hierarchy, (c) Visible load path, (d) Traditional joinery details, source : photo by author.

Variable 3 - Construction Details: 5/5 (Very High) : Exceptional brick craftsmanship: 13 different woven brick patterns requiring high accuracy, Traditional bamboo weaving techniques (gedheg) adapted to brick construction, Contemporary fabrication: precision in porous brick arrangement, Bamboo lashing and wood joinery details visible and refined, Construction sequence readable: brick base → concrete →bamboo/rastan/wood → roster → garden integration, Innovation: traditional patterns translated to new materials (gedheg → woven brick)

Variable 4 - Joint Articulation: 4/5 (medium High): Brick mortar joints create rhythmic patterns in woven arrangements, Concrete Colum & Beam as sructure, brick as main material expose Bamboo joints with traditional lashing techniques highly expressive, Wood-to-bamboo connections articulated and visible, Steel connections integrated with minimalist aesthetic, Joint hierarchy clear: structural (concrete) → secondary (brick) → tertiary (steel for the roof) → bamboo wood for partitiion, Joints as craft moments—traditional knowledge meets contemporary precision.

Figure 5. Biophilic Office - Joint Articulation: (a) Bamboo lashing with rotan binding, (b) Traditional wood joinery (takik-pasak), (c) Joint hierarchy visible, (d) Material-sensitive connection details,
source : (https://www.youtube.com/shorts/cZ9JN6ky1x4)

Variable 5 - Material-Form Relationship: 5/5 (Very High) : Ground floor: orthogonal brick geometry appropriate for masonry, Second floor: lighter wood/bamboo partition, column steel and frame for the roof stucture allows open plan flexibility. Porous brick patterns optimize natural ventilation (material = climate strategy). Central garden position responds to material properties: brick encloses, plants breathe. Bamboo used flexibility (screens). Form follows material logic: heavy base → light upper → open roof terrace. Strong efficiency: minimal material for maximum biophilic effect

Variable 6 - Tactile-Visual Experience: 5/5 (Very High) ; Rich textural variety: rough brick, smooth bamboo, wood grain, plant softness. Woven brick creates dramatic shadow play—light filters through porous patterns. Bamboo breathing walls create dappled light throughout day. Multi-sensory experience: visual (greenery), auditory (water pond, rustling leaves), olfactory (plants). Cool microclimate from plants + natural ventilation. Haptic invitation: materials encourage, un finish concrete wall mix with brick roughness – fllor wall and ceiling. Strong biophilic connection: direct nature (plants) + natural analogues (organic patterns)

Variable 7 - Constructive Narrative: 4/5 (Medium-High); Construction story readable: Concrete Column & Beam, brick fill → steel frame + wood and bamboo → concrete roof & glass block (light) → garden integration. Narrative of innovation: traditional gedheg transformed into brick patterns, Bambbo anyam & rattan. Cultural narrative: connects to Majapahit brick temple heritage (Candi material). Biophilic narrative: "bringing nature back to workspace" for employee wellness. Sustainability story: local materials + natural ventilation + low-cost approach. Limitation: Narrative less embedded in construction itself compared

to purely vernacular approaches—more conceptual than constructive storytelling. Story is clearer in design intent than in pure material assembly logic.

Diagram 5. Biophilic office Tectonic Profile - Radar Chart (showing scores across 7 variables: 5-4-5-4-5-5-4), source : author

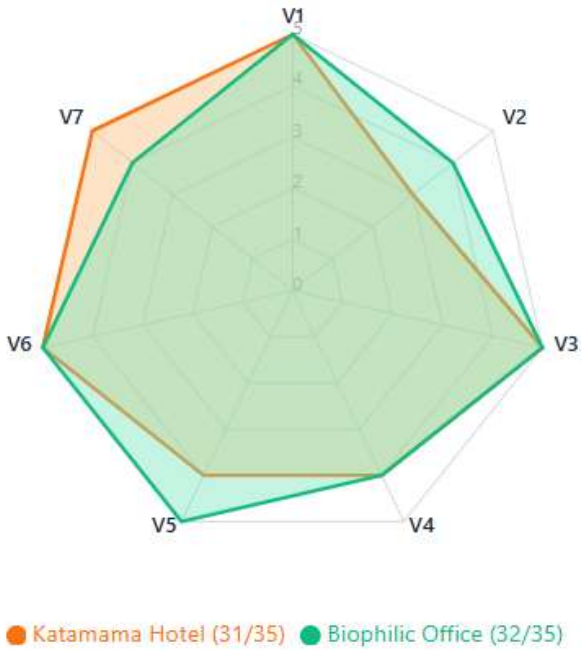

Diagram 6. Comparative Analysis: Katamama vs Biophilic Office, source : author

Biophilic Office Synthesis:

- Type: Hybrid Tectonic-Stereotomic—combines mass (brick) with concrete structure
- Material Strategy: Multi-material integration (brick + bamboo + wood) for biophilic performance

- Approach: Innovation through tradition—reinterpreting vernacular materials/patterns for contemporary biophilic design
- Strengths: Material innovation, craft excellence, biophilic integration, climate responsiveness, cultural connection
- Significance: Demonstrates how traditional materials and patterns can be reinterpreted for contemporary performance (wellness, sustainability) while maintaining craft excellence and cultural authenticity

Key Innovation: Transformation of bamboo gedheg (woven wall) into woven brick pattern—preserving vernacular wisdom (porosity, light/air flow) while updating material durability and contemporary aesthetic.

Table 5. Comprehensive Comparative Matrix: Katamama Hotel vs Biophilic Office

Dimension	**Katamama Hotel**	**Biophilic Office**
Main Material Type	Single material (1.5M bricks)	Multiple materials (brick + concrete + bamboo + wood)
Tectonic Tradition	Expression Pure Stereotomic (mass, permanence)	Expression Hybrid (stereotomic base + tectonic frame)
Construction Logic	Additive masonry	Hybrid: brick base + frame upper + biophilic integration
Structural Expression	Concealed (deliberate ambiguity)	Partially exposed (hybrid clarity)
Detail Quality	Contemporary precision craft	Contemporary + traditional craft fusion
Joint Articulation	Mortar joints (rhythmic pattern)	Multiple: brick + concrete
Form-Material	Orthogonal monolithic mass	Layered: solid base → permeable upper → open top
Tactile-Visual	Rough, warm, heavy, monochromatic variation	Varied textures, cool, light-heavy contrast integration
Atmosphere	Grounded, permanent, earthy	Dynamic, breathing, biophilic wellness
Narrative	Local craft + contemporary precision	Innovation through tradition + biophilic wellness
Cultural Reference	Balinese brick tradition	East Java Majapahit temples + bamboo gedheg tradition
Biophilic Integration	Minimal (material texture only), wood in interior integration	Extensive (central garden, breathing walls brick , bamboo partition & Roaster, plants)
Context	Tourist/Commercial (Bali)	Professional office (Sidoarjo)
Scale	Large (60-room hotel)	Small (274 m² office)
Score	31/35 (88.6%)	32/35 (91.4%)
Assessment	Excellent stereotomic	Excellent hybrid biophilic

Note: Both scores represent excellence in different approaches. Higher score for Biophilic Office reflects successful integration of multiple material systems and biophilic elements while maintaining tectonic integrity.

Shared Characteristics of Indonesian Material Tectonics

From comparative analysis, five shared characteristics identified:

1. Material Honesty as Non-Negotiable: Both projects demonstrate absolute commitment to material authenticity—reflection of Indonesian cultural values valuing truth. No false finishes or material concealment.
2. Local Materials as Identity Marker: Material choice as cultural statement (Tabanan brick = Bali identity; woven brick + bamboo = East Java tradition connecting to Majapahit heritage and vernacular gedheg).
3. Craft Tradition Valued: Both value craftsmanship quality (Katamama: contemporary precision craft; Biophilic: traditional + contemporary craft fusion)—craft tradition remains living practice, not museum artifact.
4. Climate Responsiveness: Both achieve comfort through material strategies appropriate for tropical climate (Katamama: thermal mass; Biophilic: natural ventilation through porous patterns + breathing walls).
5. Cultural Narrative Embedded: Materials carry meaning—social, cultural, environmental narratives communicated through materiality. Both connect to regional heritage while serving contemporary needs.

New Finding: Biophilic Office demonstrates a third path in Indonesian material tectonics—neither pure stereotomic expresion (Katamama) nor pure tectonic (traditional bamboo/wood construction), but hybrid integration where multiple material systems expression (brick, concrete, metal, wood) collaborate to achieve biophilic performance. This suggests Indonesian contemporary architecture is expanding beyond binary classifications toward material system integration for performance-driven design (wellness, sustainability) while maintaining craft excellence.

DISCUSSION

Framework Applicability and Validation

The seven-variable framework proved applicable for analyzing Indonesian contemporary architecture, successfully differentiating Katamama's pure stereotomic approach from Biophilic Office's hybrid strategy while identifying their shared characteristics. Working with secondary data without site visits, the framework provided systematic architectural criticism beyond visual-formal evaluation. The framework demonstrates five key strengths: comprehensive coverage from physical properties to phenomenological experience and cultural meaning; flexibility across different materials, scales, and contexts; theoretical grounding in established tectonic theory; practical utility for designers, critics, and educators; and ability to reveal design trade-offs such as Katamama's structural concealment or Biophilic Office's balance between conceptual innovation and constructive narrative (V7: 4/5).

However, limitations must be acknowledged. Despite clear indicators, scoring involves subjective judgment. Secondary data limits tactile experience

and site observation. Quality standards vary by building type and cultural context. The analysis captures a temporal snapshot rather than longitudinal evolution. Finally, the narrative variable proves most subjective and hardest to measure compared to physical attributes.

Material Tectonics as Cultural Practice

Material tectonics in Indonesian architecture functions as cultural practice beyond technical concern. Material choices assert place-based identity against globalization: Tabanan brick signals Balinese identity while woven patterns evoke Majapahit heritage. The 13 woven brick patterns at Biophilic Office required months of craftsman training, preserving embodied knowledge across generations. Climate-responsive strategies continue vernacular sustainability through thermal mass, natural ventilation, and porous walls. Material honesty and craft quality reflect Indonesian cultural values of authenticity and skilled labor.

Both Andramatin and Andyrahman demonstrate innovation while respecting tradition. Katamama achieves unprecedented brick scale and precision; Biophilic Office transforms gedheg bamboo patterns into brick construction. Their work represents neither nostalgic vernacularism nor acontextual internationalism, but critical contemporary practice grounded in material intelligence, craft tradition, and cultural awareness.

Implications for Sustainable Architecture

Strong correlation exists between tectonic quality and sustainability. Material honesty reduces finishes and material waste. Local materials lower carbon footprints while supporting regional economies. Craft tradition ensures durable construction and extended lifecycles. Climate-responsive design enables passive comfort strategies, reducing operational energy. Biophilic Office demonstrates holistic sustainability encompassing environmental, social, and economic dimensions through integrated material tectonics and biophilic design, improving employee wellness alongside environmental performance. This suggests tectonic excellence is integral to sustainable practice rather than luxury addition.

Material System Integration: Spectrum Not Opposition

Differences between Katamama's stereotomic and Biophilic Office's hybrid approaches represent spectrum points rather than opposition, reflecting Indonesian architectural history encompassing both traditions: stereotomic heritage in stone temples (Borobudur, Prambanan) and tectonic heritage in wooden houses (Joglo, Toraja, Minangkabau). Contemporary Indonesian architecture evolves toward performance-integrated material tectonics driven by cultural authenticity, environmental performance, and social impact. The framework's value lies in recognizing this diversity rather than privileging one approach, providing pluralistic perspective crucial for understanding current architectural richness and future directions. This recognition of legitimate diversity within rigorous evaluation represents an important contribution to architectural criticism.

FURTHER STUDY

Future research should address current limitations and expand framework application:

1. **Multi-case validation study (10-20 buildings)** across different regions, typologies, scales, and periods to build comprehensive Indonesian architecture tectonic quality database. Include more biophilic and hybrid material approaches.
2. **Weighted scoring system development** through research determining which variables most critical for overall tectonic quality, testing different weighting schemes, exploring whether narrative variable (most subjective) should be weighted differently.
3. **Quantitative method integration** supplementing qualitative analysis with material testing (thermal, acoustic, structural properties), computational simulation (daylight, ventilation, comfort), user surveys (biophilic impact on wellness), and economic analysis.
4. **User perception validation** surveying building users to test whether expert-identified tectonic quality correlates with user satisfaction, phenomenological experience, and biophilic wellness benefits.

These future studies would significantly strengthen framework's theoretical foundation, practical utility, and empirical validation while expanding understanding of material tectonics in diverse contexts, hybrid approaches, and biophilic applications.

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