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Dynamic Canvas of Gondangdia: Integrating Deconstructivism and Kinetic Facades in Contemporary Art Museum Design

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A B S T R A C T

Jakarta's rapidly expanding contemporary art scene faces a critical shortage of exhibition spaces capable of accommodating new media and interactive installations. This study investigates the integration of deconstructivist and kinetic architectural principles to design a Contemporary Art Museum in Gondangdia. Utilizing a qualitative descriptive methodology, the research analyzes micro-climatic variables, urban transit nodes, and morphological transformations. The findings reveal that fragmenting the Betawi *pucuk rebung* motif produces a non-orthogonal deconstructivist mass that serves as a provocative urban landmark. Simultaneously, an automated kinetic facade applied to the skylight dynamically mitigates tropical solar radiation while optimizing daylight. This integration successfully transforms the museum into a performative, climate-responsive entity, satisfying the technical demands of modern exhibitions and enriching Jakarta's urban fabric.

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INTRODUCTION

Jakarta's rapidly expanding contemporary art scene, supported by 24.180 active artists and 12.090 art enthusiasts, urgently requires specialized exhibition spaces capable of accommodating complex new media art and large-scale installations (Pemprov DKI Jakarta, 2025). The Gondangdia district presents a strategic location for this facility due to its highly accessible Transit-Oriented Development (TOD) infrastructure and proximity to the Cikini, an arts hub in Jakarta (Institut Kesenian Jakarta, 2020). However, rapid developer-driven gentrification has increasingly obscured the area's historical colonial identity with monotonous, highly standardized commercial high-rises (Sondakh, 2019).

To disrupt this rigid urban fabric, Deconstructivist architecture provides a non-rectilinear, fragmented intervention that inherently establishes a striking urban landmark (Silitonga et al., 2023). Beyond urban aesthetics, the design must navigate Jakarta's severe tropical climate, which features intense, year-round solar radiation (Kwa & Sari, 2022). While previous deconstructivist museum designs in Indonesia have successfully applied spatial fragmentation, they predominantly relied on static forms lacking environmental adaptability (Asnawi, 2017; Prakasa et al., 2021). Addressing this gap, the integration of Kinetic Architecture presents an advanced solution where the building envelope physically transforms to mitigate thermal loads while optimizing diffuse natural daylight (Elmokadem et al., 2018).

Therefore, this research aims to conceptualize a Contemporary Art Museum in Gondangdia that holistically synthesizes deconstructivist massing with an automated kinetic facade. This integration seeks to fulfill the technical spatial demands of modern exhibitions, create a provocative architourism destination, and deliver a highly climate-responsive architectural entity.

LITERATURE REVIEW

Deconstructivist Architecture Theory

Deconstruction originated as a complex philosophical framework introduced by the French philosopher Jacques Derrida. In its linguistic and philosophical context, deconstruction involves dismantling the underlying structures, traditions, and cultural assumptions of a subject to expose inherent contradictions and uncover hidden, marginalized possibilities (Ashadi, 2019). Derrida viewed architecture not merely as a utilitarian or technical endeavor (techne), but fundamentally as a "way of thinking that manifests in space." He argued that traditional architectural practice has historically been constrained by a rigid "archi-hieratical" dominance, wherein building materials and forms are subordinated to strict hierarchies of power, absolute symmetry, and a teleological demand that form must always predictably follow functionIf your work is quantitative, please provide previous research that agrees or rejects your proposed hypothesis.

Pioneering architects such as Peter Eisenman, Bernard Tschumi, and Daniel Libeskind successfully translated Derrida's abstract theories into the physical realm of architecture. They focused heavily on the concepts of "presence" and "absence" (trace), seeking to represent the unrepresentable in built form. The aesthetic realization of deconstructivism involves deliberately disrupting the stability, purity, and predictability of the building mass. The core principles of deconstructive architecture, as outlined by Ashadi (2019), include instability, disorder, impurity, disharmony, fragmentation, conflict, fluidity, metaphor, distortion, contextuality, and extreme visual contrast. In practice, by applying the principle of fragmentation, a unified, recognizable geometric shape is intentionally broken down, shattered, and reassembled into a non-orthogonal, fluid composition. This process defies traditional structural expectations, creates dynamic spatial tension, and demands active cognitive engagement from the observer (Sharma et al., 2023).

Kinetic and Interactive Architecture

Kinetic architecture signifies a paradigmatic shift from static, monolithic structures toward dynamic, adaptive systems capable of performance-based transformation. The concept was first formally defined by William Zuk and Roger H. Clark in 1970 in their seminal work "Kinetic Architecture," where they described an architecture capable of adapting to changes through built-in technologies that respond to a set of acting pressures (Elmokadem et al., 2018).

With advances in computational design, Fox (2016) categorized kinetic control systems into a specific hierarchy of complexity. These range from basic internal controls (such as simple mechanical hinges) and direct controls, to highly advanced adaptive responsive indirect controls powered by predictive algorithms, neural networks, and machine learning. Within this expanded theoretical framework, kinetic architecture is further subdivided into specialized concepts:

a. *Intelligent Architecture*, which emphasizes real-time monitoring, regulation, and optimization of building systems (e.g., HVAC, lighting, security) to enhance energy efficiency and operational performance.
b. *Interactive Architecture*, which establishes bidirectional feedback between occupants and the built environment, enabling walls, floors, and surfaces to function as responsive, sensor-embedded interfaces.
c. *Responsive Architecture*, which allows the building envelope to autonomously modify its form, orientation, or material properties based on live environmental data, often emulating bionic or biomimetic behaviors (Elmokadem et al., 2018).

Kinetic Facades in Tropical Climates

In tropical regions markedby high solar irradiance and humidity, kinetic facades represent an advanced evolution of the Double Skin Facade (DSF) system (Dewi et al., 2020). Conventional DSFs classified as Buffer, Extract Air, or Twin Face systems rely on fixed glazing and static shading elements to mitigate thermal transfer. However, kinetic screens introduce mechanical movement to these layers. Moloney (2011) categorizes kinetic facade movements into four primary mechanical typologies: Translation (linear displacement along a single axis), Rotation (pivoting around a fixed point), Scaling (expansion or contraction of component dimensions), and Material Deformation (alteration of intrinsic material properties) (Dharmatanna et al., 2024).

By utilizing these kinetic mechanisms, a building can dynamically regulate solar radiation. This real-time adaptability not only minimizes the energy-intensive cooling loads required by HVAC systems but also ensures that delicate contemporary artworks are protected from direct ultraviolet exposure, all while maintaining high-quality, diffuse natural daylighting within the deep floor plates of the exhibition halls (Arfian & Setiawan, 2024; Kwa & Sari, 2022).

Integration and Conceptual Framework

The integration of deconstructivism and kinetic architecture presents a highly synergistic synthesis of visual dynamism and functional, environmental responsiveness. Deconstructivism employs advanced digital modeling to generate complex, fragmented geometries that evoke a sense of arrested motion or suspended transformation. By introducing literal, mechanical kinetic movement into these fragmented surfaces, the architecture transcends passive aesthetics. The building physically interacts with the environment, fulfilling the deconstructivist mandate of instability and continuous transformation, while utilizing kinetic intelligence to maintain the highly controlled microclimate required for contemporary art preservation (Dąbrowska-Żółtak & Szalwa, 2025).

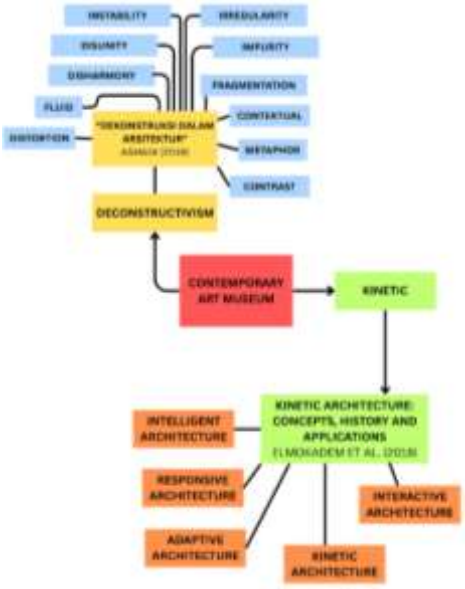

Figure 1. Conceptual Framework: Integrating Deconstructivism and Kinetic Architecture for Jakarta's Urban and Climatic Context

Source: Author

METHODOLOGY

This research employs a qualitative descriptive methodology, which is recognized as highly effective for phenomenological investigations in architectural, urban design, and social contexts (Abdussamad, 2021). The architectural design process follows a rigorous, systematic workflow originating from problem identification, site selection, primary and secondary data collection, comprehensive analysis, and culminating in the formulation of actionable design solutions based on the procedural guidelines established by the Indonesian Institute of Architects (IAI) (Widyaningrum, 2018).

Primary data was collected through direct, extensive field observations at the selected project site on Jl. M.H. Thamrin, Gondangdia. This field research included detailed micro-climate mapping (recording topography, solar orientation, shadow casting, and prevailing wind patterns), contextual urban mapping of the Transit-Oriented Development (TOD) radius, and visual documentation of the surrounding architectural character to understand the existing aesthetic baseline. Furthermore, a comparative physical field study was conducted at the Galeri Nasional Indonesia in Jakarta to empirically observe spatial standards, visitor circulation patterns, and lighting techniques utilized in local heritage-adapted art spaces.

Secondary data was gathered through extensive literature reviews concerning deconstructivist architectural theory, kinetic facade mechanics, tropical building physics, and standard museum programming metrics. To directly inform the design translation, multiple architectural precedent studies were critically analyzed:

Jewish Museum Berlin (Daniel Libeskind): Examined for its use of narrative voids, spatial disorientation, and psychological impact of non-orthogonal geometries.

Figure 2. Jewish Museum Berlin
Source: Archdaily; Studio Libeskind

Heydar Aliyev Center (Zaha Hadid Architects): Analyzed for its fluid, curvilinear massing and dissolution of conventional boundaries between floor, wall, and roof.

Figure 3. Heydar Aliyev Center
Source: Archdaily

Al-Bahr Towers (Aedas Architects): Studied for its algorithm-driven, origami-inspired kinetic shading system and integration of PTFE membranes.

Figure 4. Al-Bahr Towers
Source: Archdaily

Museum MACAN (ARKdesign): Evaluated for its spatial programming, environmental controls, and operational model as a leading contemporary art venue in Jakarta.

Figure 5. Museum MACAN
Source: Museum Macan

Data analysis was structured across three escalating scales: macro-analysis (geographic context and zoning regulations), meso-analysis (transport connectivity and urban nodes), and micro-analysis (climatic conditions, acoustics, and functional spatial requirements). Findings from this multi-scalar evaluation directly informed the schematic and detailed design phases.

RESEARCH RESULT

Macro and Meso Site Analysis: Urban Context and Accessibility

The selected site is strategically located on Jl. M.H. Thamrin, Gondangdia, Central Jakarta, occupying a total land area of 4,500 m². The site is bordered by high-density urban infrastructure: Lippo Thamrin to the north, Menara Indonesia Satu to the south, the Cideng canal to the west, and the primary arterial road (Jl. M.H. Thamrin) to the east. According to Jakarta's Detailed Spatial Plan (RDTR), the zone is designated for high-intensity commercial and cultural use. Regulatory parameters include a Building Coverage Ratio (KDB) of 55% (maximum footprint: 2,475 m²), a Floor Area Ratio (KLB) of 7.0 (total allowable floor area: 31,500 m²), a minimum Green Area Ratio (KDH) of 20% (900 m²), and a Basement Coverage Ratio (KTB) of 60% (2,700 m²).

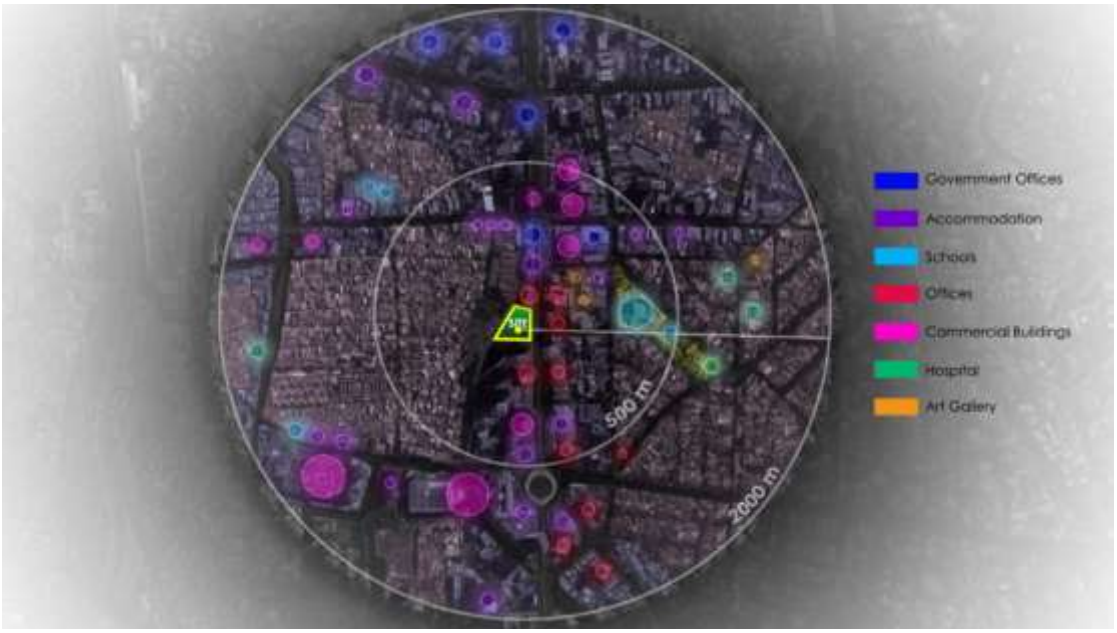

Figure 6. Map of Transit Nodes and Linkages in Gondangdia Area
Source: Author

Figure 7. Map of Transit Nodes and Linkages in Gondangdia Area
Source: Author

At the meso scale, the site lies within a high-activity Transit-Oriented Development (TOD) zone. Within a 500-meter radius, the area is dominated by commercial towers and office complexes, causing high-intensity pedestrian and commuter flows during working hours. Crucial public transit infrastructure, including the Gondangdia Commuter Line Station, the Sarinah Transjakarta Busway shelter, and the Bundaran HI MRT station, are all accessible within a 5 to 15-minute walking radius. This exceptional multimodal accessibility ensures that the museum can function effectively as an integrated public cultural space rather than an isolated destination.

Micro Analysis: Climatology and Environmental Constraints

Climatological analysis utilizing Meteoblue and the Meteorology, Climatology, and Geophysical Agency (BMKG) data provides the environmental parameters that the building must negotiate. The microclimate is characterized by high ambient temperatures and intense direct solar radiation, a critical factor for facade design (Table 1).

Table 1. Microclimate Profile of Jakarta Detailing the Severe Solar and Thermodynamic Loads Acting Upon the Building Envelope

Climatic Variable	Average Value / Characteristics
Average Daily Temperature	28°C - 32°C
Humidity	~75% (AQI)
Prevailing Winds	West and Southwest (10 - 20 km/h)
Driest Period	June - August (<2 mm rainfall)

Crucially, the solar path analysis indicates intense, direct solar radiation impacting the site throughout the day. Because the site's primary facade is oriented eastward toward Jl. M.H. Thamrin to capture maximum urban visibility, this massive elevation is subjected to severe morning and midday solar heat gain. Consequently, a robust, highly responsive shading strategy is mandatory to maintain indoor thermal comfort, protect the artwork, and prevent the HVAC systems from operating at unsustainable loads.

Morphological Transformation: Deconstructivist Massing

The museum's primary form is derived from the *pucuk rebung* (bamboo shoot) a symbolic motif in Betawi batik representing growth, resilience, and dynamic energy. A four-petal configuration extracted from this pattern undergoes rigorous deconstructivist manipulation.

Through systematic application of fragmentation, distortion, and angular displacement, the original symmetrical composition is fractured into intersecting, non-orthogonal volumes. The resulting massing rejects axial or radial symmetry, producing a dynamic collision of planes, walls, and roof facets. The envelope functions as a continuous, undulating surface, deliberately dissolving Cartesian distinctions between floor, wall, and ceiling. This jagged, complex morphology serves as a spatial metaphor for contemporary art—multifaceted, interpretively ambiguous, and perpetually evolving.

Figure 8. Basic Form of Betawi *Pucuk Rebung* Motif
Source: Author

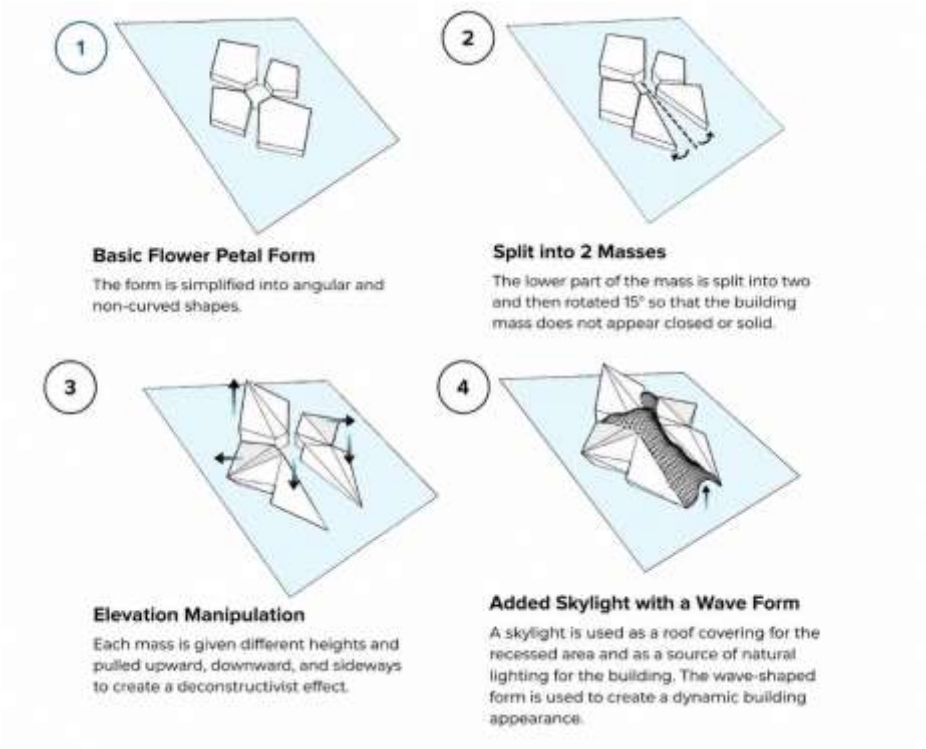

Figure 9. Deconstructive Morphological Transformation of the Betawi *Pucuk Rebung* Motif
Source: Author

Kinetic Facade Implementation and Mechanics

To reconcile the expansive, fragmented skylights with tropical solar intensity, a kinetic facade system was implemented on the central roof and eastern elevation. The design draws direct inspiration from the responsive, origami-based mashrabiya modules of Al-Bahr Towers in Abu Dhabi (Shahin, 2019).

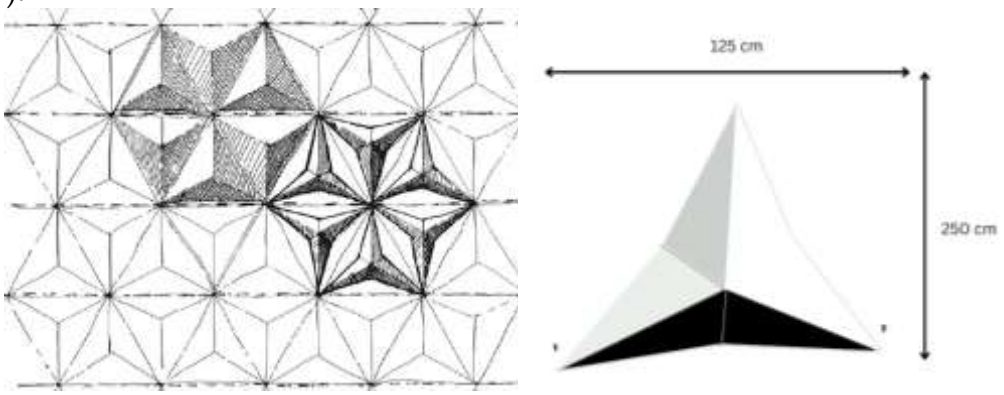

Figure 10. Detailed Mechanical Breakdown of the Al-Bahr Towers-Inspired Kinetic Module Applied to the Museum's Skylight
Source: AHR; Author

The system comprises modular triangular units (125 cm × 250 cm), constructed with lightweight extruded aluminum frames and clad in Ethylene Tetrafluoroethylene (ETFE) membranes. ETFE was selected over glass due to its superior flexibility, enhanced thermal insulation, and minimal weight—approximately 1/100th that of standard glazing—making it structurally viable for rapid mechanical actuation.

Each module is actuated via hydraulic-pneumatic linear actuators controlled by a centralized Building Management System (BMS). Operating under responsive indirect control logic (Fox, 2016), the BMS processes real-time data from external sensors monitoring solar radiation, surface temperature, and wind speed.

Under low solar intensity (early morning or overcast conditions), the actuators retract the modules into a flat, open configuration, maximizing penetration of diffuse natural light and reducing dependence on artificial lighting. As solar radiation exceeds predefined thresholds, the BMS triggers sequential deployment: modules unfold into a three-dimensional, umbrella-like geometry. This scaling action significantly reduces the Solar Heat Gain Coefficient (SHGC) by casting dynamic shadows over glazed areas while preserving partial transparency. At night, the system retracts fully, allowing interior gallery lighting to illuminate the ETFE surface, transforming the building into a luminous urban landmark.

DISCUSSION

The architectural synthesis presented in this research extends significantly beyond mere formal or aesthetic experimentation; it directly addresses critical urban, cultural, and environmental imperatives specific to the contemporary reality of Jakarta. The findings demonstrate that architecture can simultaneously function as a cultural icon and a highly calibrated environmental machine.

Deconstructivism as an Urban Catalyst

Within the Gondangdia sector and the broader Jl. M.H. Thamrin corridor, the architectural landscape is dominated by repetitive, rectilinear corporate forms, a physical manifestation of what Derrida termed "archi-hierarchical" order, where design is subordinated to capitalist efficiency and standardized construction (Ashadi, 2019). The introduction of a deconstructivist massing strategy disrupts this visual homogeneity.

The *pucuk rebung*-derived, non-orthogonal form refuses passive integration into the skyline. Instead, it asserts a bold, confrontational presence, dominating key visual axes from major roads. This formal disruption performs a sociocultural function: it democratizes access to art by making the building itself the first encounter with contemporary artistic expression. The stark formal contrast not only establishes the museum as a destination for architourism but also initiates a dialogue with Jakarta's colonial heritage. Its proximity to preserved landmarks such as Cut Meutia Mosque and Tugu Kunstkring Paleis underscores the city's layered, evolving identity (Ashari, 2017; Salim & Hendrassukma, 2023).

The Thermodynamics of Kinetic Responsiveness

While deconstructivism provides the conceptual and aesthetic foundation, kinetic architecture ensures environmental viability. Many glass-clad cultural buildings in tropical climates rely excessively on energy-intensive HVAC systems to counteract solar heat gain (Kwa & Sari, 2022). Static shading devices, such as fixed louvers or brise-soleil, offer limited effectiveness, as they cannot adapt to the equatorial sun's variable azimuth or transient cloud cover (Taslim & Widiastuti, 2024).

By implementing a sensor-driven, adaptive responsive kinetic facade over the skylights and eastern elevations, the design achieves dynamic thermodynamic equilibrium between daylight harvesting and thermal deflection (Fox, 2016). The translation of invisible environmental data into physical, mechanical movement allows the ETFE-clad modules to act as a living, breathing epidermis. During peak solar radiation hours (typically 11:00 AM to 3:00 PM), the automated scaling and folding of the modules block direct thermal transmittance.

Critically, this system shields light-sensitive artworks, paints, digital media, and chemical substrates from UV degradation. Simultaneously, it ensures deep-plan galleries receive controlled, glare-free daylight, enhancing visual comfort and enriching the phenomenological quality of the space (Dharmatanna et al., 2024).

The Synthesis of Performative Architecture

The profound success of this design lies in the conceptual harmonization of two seemingly disparate architectural theories. Deconstructivism, by its very geometric nature, implies instability, tension, and a state of "frozen movement." It suggests a building caught midway through an explosion or a collapse. By integrating physical, mechanical kinetic elements directly onto this fragmented envelope, the illusion of movement becomes literal and tangible.

The building is no longer a passive, static container for art; it is a performative, interactive machine that breathes, shifts, and articulates in rhythm with the changing weather and the passage of time (Dąbrowska-Żółtak & Szalwa, 2025). This integration perfectly fulfills the programmatic mandate of a contemporary art space—it is adaptive, provocative, and deeply engaging. It offers an immersive spatial experience that prepares the visitor's mind for the unconventional art housed within, an experience that simply cannot be replicated within the confines of conventional, orthogonal architecture.

CONCLUSIONS AND RECOMMENDATIONS

The design of the Gondangdia Contemporary Art Museum successfully reconciles the need for a technologically advanced exhibition facility with the imperative for a transformative urban aesthetic in Jakarta's central business district. Through the systematic integration of deconstructivist form and kinetic responsiveness, the project transcends conventional cultural typologies.

The deconstructivist reinterpretation of the *pucuk rebung* motif produces a distinctive, non-orthogonal mass that disrupts the visual homogeneity of surrounding commercial towers, establishing a new cultural landmark. Concurrently, the automated, origami-inspired kinetic facade effectively mitigates tropical climatic stressors, regulating solar gain, protecting artworks, and minimizing mechanical cooling loads—all while sustaining optimal daylighting. The open-plan spatial layout further supports the flexible, large-scale demands of contemporary, digital, and new media art.

Based on these findings, it is recommended that urban planners, developers, and architects in tropical metropolitan regions adopt integrated kinetic systems. Moving beyond passive sustainability, adaptive facades offer a data-informed, high-performance strategy for enhancing energy efficiency without sacrificing the bold formal expressions required for culturally significant architecture.

ADVANCED RESEARCH

Further research is recommended to quantitatively assess the energy efficiency and thermal performance of buildings resulting from the implementation of kinetic facades, as well as to evaluate the durability of the materials and the mechanical mechanisms of the facades under tropical climatic conditions in Gondangdia.

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