

Living Craft Infrastructure: A Neo-Vernacular Tri-Ethnic Gallery Framework for Makassar

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ABSTRACT

Bugis, Makassar, and Toraja crafts embody material knowledge, social memory, and economic value, yet their exhibition, production, education, promotion, and conservation remain spatially dispersed. This study develops a design framework for an integrated South Sulawesi Handicraft Gallery that represents the three traditions equitably through a neo-vernacular architecture responsive to Makassar's coastal climate. A research-through-design method combined document and literature review, cultural-object mapping, site observation, visitor projection, user and activity analysis, room-program reconciliation, precedent synthesis, and iterative translation of cultural and environmental principles. The internally consistent visitor series rose from 3.50 million in 2022 to 6.29 million in 2025. A linear model projects 15.89 million citywide visitors in 2035; a two-percent attraction capture corresponds to about 317,800 annual or 871 daily visits, supporting an initial peak capacity of approximately 1,000 visitors per day. The reconciled program assigns 14,429.2 m² within a 16,721 m² gross envelope. The design combines a communal plaza, three parallel cultural zones, visible workshops, learning spaces, collection-care rooms, separate logistics, woven shading screens, cross-ventilation, vegetation, and targeted environmental control. The framework positions the gallery as living cultural infrastructure connecting heritage stewardship, experiential learning, artisan visibility, and the creative economy.

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1. Introduction

Indonesia's cultural diversity is expressed through material practices that connect communities to place, history, and social organization. National classification records more than 1,300 ethnic groups, indicating the breadth of cultural knowledge embedded in regional objects and practices [1].

Traditional textiles, carved instruments, bamboo assemblies, ceremonial objects, and tools are not simply finished commodities. They encode decisions about fibers, dyes, timber, sound, bodily technique, social status, ritual use, and intergenerational learning. Museum research increasingly treats textile craft as a field of inquiry, education, cultural heritage, social connection, and empowerment rather than as a decorative category alone [2]. This understanding has architectural consequences: craft cannot be adequately interpreted only through display cases because knowledge is also held in making, handling, narration, performance, and relationships among makers, objects, and audiences.

South Sulawesi provides a strong context for examining this relationship between craft and space. Bugis, Makassar, and Toraja communities have developed distinct but interacting traditions of weaving, musical-instrument making, ornament, and ceremonial use. Bugis silk weaving, particularly Lipa' Sabbe associated with Wajo and Sengkang, is sustained through inherited knowledge of silk preparation, patterning, and manual weaving [3]. Makassar material culture includes Kain Baine and instruments such as Ganrang Mangkasara' and Keso-Keso, where wood, skin, resonance, performance, and oral storytelling converge.

Gandrang remains present through cultural experience and cultural knowledge, including performance, training, and digital documentation [4].

Toraja weaving carries symbolic meanings concerning prosperity, social relations, ritual life, and ancestral continuity [5]. These traditions share a regional setting, but their objects, narratives, protocols, and spatial atmospheres should not be collapsed into one generalized South Sulawesi style.

Craft also has an economic role. Local-wisdom-based enterprises can connect cultural continuity with employment, product development, and regional identity [6] [7]. Indonesia's creative-economy policy framework positions craft as a subsector linking tourism, entrepreneurship, and community benefit [8]. In South Sulawesi, social media has broadened artisans' visibility and encouraged new promotional practices [9], while socio-cultural digital innovation has become important to the competitiveness of traditional craft enterprises in Makassar [10]. Digital reach, however, does not replace direct contact with material processes. A screen can transmit the appearance of a textile, but not fully communicate the duration of preparing thread, the coordination of weaving, the sound of an instrument under construction, or the cultural rules governing motifs.

Much production and learning remains distributed across households, villages, informal workshops, markets, and temporary events. This network is resilient and socially meaningful. In Wajo weaving communities, trust, shared norms, and social networks support enterprise continuity and the transmission of practice [11]. Yet spatial

fragmentation limits systematic documentation, conservation, structured training, research access, and opportunities for visitors to compare traditions. Makassar, as the provincial capital and a gateway in eastern Indonesia, concentrates transport, universities, tourism, commerce, and creative-industry networks. Local evaluation nevertheless identifies continuing coordination and resource constraints in creative-economy implementation. [12] A permanent gallery cannot solve these institutional issues alone, but it can provide an operational platform through which artisans, communities, government, schools, researchers, curators, and enterprises coordinate visible programs. [13] provide a relevant regional precedent through an eco-cultural heritage-center proposal in Gowa that integrates environmental knowledge, cultural imagery, flexible educational and performance zones, and tropical adaptation. The case concentrates primarily on Bugis-Makassar heritage and symbolic cultural-center design. The present study extends this regional discussion by incorporating Toraja representation, visible craft production, collection care, demand modelling, service logistics, and transparent reconciliation of floor-area assumptions. The resulting contribution is an operationally explicit tri-ethnic gallery framework rather than a duplication of an existing cultural-center model.

The museum field also supports a shift from object display to living cultural infrastructure. Contemporary textile practice has challenged inherited separations between art and craft and encouraged museums to make exhibition-making more transparent and inclusive [14]. Community-centered curation shows that representation depends on collaboration, public engagement, social justice, and empowerment rather than on the institutional voice alone [15]. Collection-development research further demonstrates that museums must value intangible heritage and living connections, not only material holdings [16]. For a South Sulawesi gallery, these findings mean that equal floor area is insufficient. Cultural parity must also be embedded in route choice, visibility, interpretive depth, event allocation, language, attribution, and decision-making authority.

Digital interpretation constitutes an additional design layer. Phygital platforms can increase engagement, usability, learning, and accessibility by connecting physical artifacts with mobile and interactive systems [17]. AI-supported virtual assistants can provide personalized and multilingual heritage interpretation, although response latency and voice clarity remain practical limitations [18]. Evaluation of ethnic-minority exhibitions emphasizes that digital tools should be shaped by visitor expectations, museum professionals, and cultural practitioners [19]. Digital archives can also extend curriculum interpretation and access to vulnerable or private collections [20]. The architectural implication is not to replace embodied encounters with screens, but to provide adaptable media infrastructure that extends learning before, during, and after a visit.

The architectural language of the proposed facility must mediate between shared regional identity and cultural specificity. Literal combination of Bugis, Makassar, and Toraja house silhouettes would risk an eclectic image in which recognizable roofs substitute for deeper spatial,

material, and environmental principles. Neo-vernacular architecture offers a more critical approach by reinterpreting local form, hierarchy, material expression, and climate intelligence through contemporary structure and program. Indonesian cases demonstrate that vernacular references can be transformed into new roof systems and architectural expressions rather than copied historically. [21] [22] The continued maintenance of vernacular architecture is also inseparable from the survival of traditional craft knowledge [23].

Three gaps frame the study. First, many craft venues prioritize display or production, whereas fewer integrate exhibition, live making, formal and informal learning, performance, research, retail, conservation, and logistics within one legible sequence. Second, neo-vernacular projects often translate one dominant tradition, leaving equitable representation among several living cultures underdeveloped. Third, architectural proposals frequently present symbolic concepts and room lists without transparent reconciliation among visitor demand, room capacity, gross floor area, site controls, circulation, and collection-care requirements. This study addresses these gaps through an evidence-based design framework for a South Sulawesi Handicraft Gallery in Makassar. It asks how a shared civic structure can support three culturally differentiated routes while remaining climatically responsive, operationally feasible, and adaptable. The contribution is a preliminary research-through-design framework rather than a post-occupancy evaluation

2. Materials and Methods

The study employed architectural research through design. Primary evidence comprised project documentation, architectural drawings, room schedules, visitor records, site observations, precedent analyses, and design visualizations. Relevant literature was synthesized to strengthen conceptual framing and assess the design against current discussions of living museums, community curation, digital interpretation, craft education, conservation, and sustainable architecture. The workflow combined qualitative interpretation and quantitative checking so that cultural claims, operational requirements, spatial decisions, and numerical assumptions could be examined within one iterative process (Figure 1).



Figure 1. Evidence-to-design workflow used in the research-through-design process. Source: authors' analysis

The first stage mapped cultural and operational content. Craft examples were grouped under the three focal traditions identified in the project documentation. The Makassar group included Kain Baine, Ganrang Mangkasara', and Keso-Keso; the Bugis group included Lipa' Sabbe and Kacaping; and the Toraja group included traditional weaving, including Sekomandi/Rongkong references, and Pa'pompang. The grouping does not claim to define an

exhaustive ethnographic canon. Instead, it establishes an initial curatorial structure to be expanded and validated through community participation. For each example, the analysis distinguished finished object, raw material, making sequence, tool use, sound or performance, symbolic meaning, social context, and possible visitor participation. These dimensions were translated into requirements for controlled galleries, semi-open workshops, acoustic demonstration rooms, handling collections, interpretation media, storage, preparation, and supervised learning.

The second stage analyzed demand. The project dataset contained two entries labelled 2022. One reported 1,695,183 domestic and 1,698,535 international visitors; the other reported 3,465,141 domestic and 36,862 international visitors. Because the duplicated year could not be reconciled and the first row did not form a coherent series with subsequent records, it was excluded. The internally consistent sequence used for analysis was therefore 3,465,141 domestic and 36,862 international visitors in 2022; 4,414,465 and 85,614 in 2023; 5,524,000 and 95,596 in 2024; and 6,189,997 and 102,000 in 2025. Domestic and international values were combined to produce annual totals.

Three indicators were calculated. Compound annual growth was computed as $CAGR = (V_{2025}/V_{2022})^{(1/3)} - 1$. An ordinary least-squares linear trend was fitted to the four annual totals and extended to 2035. Linear projection was selected instead of compounding the recent CAGR because the observed period is short and may include tourism-recovery effects; exponential continuation would overstate long-term demand. The projected citywide total was then multiplied by the 2% cultural-attraction capture assumption adopted for preliminary planning. Annual captured demand was divided by 365 to derive average daily attendance. The rounded value of 1,000 visitors per day was interpreted as a preliminary peak-day capacity for testing arrival, toilets, galleries, workshops, food service, parking, and egress, not as a guaranteed attendance forecast.

The third stage assessed two site alternatives within Makassar's coastal development corridor using predefined planning criteria: consistency with spatial policy, urban visibility, access from primary roads, proximity to tourism and commercial destinations, parcel size, landscape capacity, and separation of visitor, bus, service, and emergency movement. The selected 2.0 ha parcel on Jalan Metro Tanjung Bunga in Panambungan, Mariso, is opposite Phinisi Point Mall and connected to waterfront destinations. Environmental analysis considered dominant winds from the west and southeast, seasonal shifts, western solar exposure, road noise, views, pedestrian safety, wind-driven rain, stormwater, and coastal material exposure.

The fourth stage reconciled the spatial program. Detailed room values were re-summed because the original room schedules and summary totals did not fully agree. The resulting subtotals were 5,988 m² for main activities, 4,670 m² for supporting functions, 439.2 m² for management, and 3,332 m² for service and production, totalling 14,429.2 m² of explicitly scheduled space. The reported gross planning envelope was 16,721 m². The 2,291.8 m² difference, or 13.7% of the gross total, was retained as an unallocated preliminary allowance for structure, walls, shafts, enlarged circulation, escape routes, and contingency. A 60% building-coverage

ratio on 20,000 m² permits a 12,000 m² footprint; distributing the gross envelope over two principal floors produces approximately 8,360.5 m² per floor. However, the stated floor-area ratio of 0.4 would permit only 8,000 m² in total, whereas the proposed envelope requires approximately 0.84. Official zoning verification was therefore recorded as a prerequisite rather than assumed.

The fifth stage mapped users, access levels, and adjacencies. Users included visitors, families, school groups, tourists, artisans, instructors, performers, community representatives, researchers, curators, administrators, security staff, cleaners, technicians, and logistics personnel. Activities were classified as public, semi-public, private, or service. Adjacencies were tested at macro, mezzo, and micro scales to maintain operational links while preventing public and collection-handling routes from crossing. The final stage translated evidence into design operations and evaluated successive iterations against cultural legibility, parity among the three traditions, functional integration, circulation clarity, environmental performance, operational separation, and future adaptability. Similar research on craftsmanship museums supports assessing visitor movement and spatial configuration together rather than treating heritage content as independent from circulation [24], while co-design research positions museums as interfaces among artisans, designers, communities, and small enterprises. [25]

3. Findings and Discussion

3.1 Visitor demand and capacity

The normalized visitor series increased from 3,502,003 in 2022 to 6,291,997 in 2025, an absolute increase of 2,789,994 over three annual intervals. The corresponding CAGR is approximately 21.6%. This confirms substantial recent growth but is not compounded to 2035 because it derives from only four observations and may reflect recovery-period conditions. The least-squares trend produces a 2035 planning estimate of approximately 15.89 million citywide visitors. At the 2% planning capture rate, the gallery would receive approximately 317,800 visits per year, equivalent to 871 average daily visits. A rounded target of about 1,000 visitors per day is therefore defensible as an initial peak-day capacity, provided that later design is based on hourly arrival profiles, group sizes, and dwell times rather than annual averages.

Figure 2 distinguishes observations from the planning projection. The projection is a capacity-testing instrument, not a prediction of guaranteed attendance. Actual demand will depend on admission policy, school partnerships, event frequency, curatorial quality, transport access, retail integration, marketing, and governance. The design consequently distributes capacity across a shaded arrival plaza, lobby, introductory gallery, three cultural zones, workshops, performance spaces, café, retail, library, and outdoor areas. Distributed capacity allows different groups to occupy the facility at different speeds and reduces dependence on a single oversized hall. Table 1 summarizes the evidence chain so that the 1,000-person target remains traceable and revisable.

Table 1. Observed visitor data and derived planning metrics

Metric	Value	Planning interpretation
Total visitors, 2022	3,502,003	First year of the internally consistent series
Total visitors, 2023	4,500,079	Observed annual total
Total visitors, 2024	5,619,596	Observed annual total
Total visitors, 2025	6,291,997	Base year for gallery planning
2022–2025 CAGR	21.6%	Recent growth; not compounded to 2035
Linear projection, 2035	15,891,343	Planning estimate from the four-year series
2% gallery capture	317,827 visits/year	Preliminary cultural-attraction share
Average daily demand	Importance items	0.429–0.870
Item–total correlation	871 visits/day	0.778–0.920
Cronbach's alpha	Importance scale	Average, not peak-hour attendance
Rounded peak target	≈1,000 visits/day	Used for preliminary public-space capacity

Note: The duplicated 2022 row in the project dataset was excluded because it could not be reconciled with the internally consistent series.

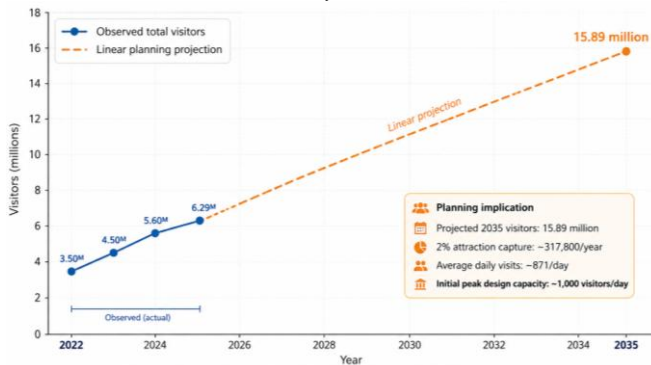


Figure 2. Observed visitors to Makassar in 2022–2025 and a linear planning projection to 2035. Source: authors' analysis.

3.2 Site and environmental response

The selected Jalan Metro Tanjung Bunga parcel combines visibility, direct connection to a major urban corridor, proximity to waterfront and commercial destinations, and sufficient land for a freestanding cultural facility. The same urban exposure produces traffic noise, intense western heat, pedestrian conflict, heavy rainfall, and the need for a clear threshold between the commercial road environment and a slower cultural landscape. The site strategy therefore uses a planted setback, shaded forecourt, separate service entry, controlled drop-off, bus lay-by, and a sequence from urban edge to communal court.

The environmental response begins with orientation and section. Because surrounding buildings are relatively low, the site receives strong solar exposure. Low-angle afternoon sun on western façades is difficult to control through horizontal shading alone. Principal gallery volumes are elongated where possible to reduce east-west exposure, while western surfaces combine deep overhangs, vertical secondary skins, recessed glazing, planted buffers, and shaded transition zones. Dominant winds from the west and southeast support cross-ventilation in covered corridors, workshop edges, café terraces, waiting areas, and the central plaza. Controlled galleries, collection storage, conservation rooms, audiovisual spaces, and selected offices remain mechanically conditioned. This mixed-mode hierarchy uses passive measures to reduce loads around stable interior

cores [26] integrated tropical-responsive façade transformation, IoT, and a Building Automation System in a Makassar smart-building proposal to improve energy efficiency and user comfort. This regional precedent informs the building-system strategy without being used to imply measured savings in the present design. Operable screens, environmental sensors, zoned air-conditioning, lighting control, and occupancy monitoring are proposed as future technical layers, while the primary design remains operable under simpler modes of operation. Because the gallery remains at concept stage, these strategies require energy simulation and post-occupancy validation before performance claims can be made.

Vegetation moderates the arrival sequence, provides shade, filters road exposure, and supports stormwater infiltration. Raised thresholds, permeable landscape, detention areas, protected service entries, and corrosion-resistant fixings respond to the low coastal context. Landscape is not treated as decorative residue: it forms a climatic buffer, outdoor learning area, event setting, and route between the forecourt and central plaza. Quiet functions are placed deeper within the site, while parking, retail edges, and robust public functions occupy noisier perimeter zones. Workshops that generate sound or dust are buffered from sensitive galleries and connected directly to service access.

3.3 Program, zoning, and circulation

Program reconciliation distinguishes assigned space from the gross planning envelope. Main activities account for 5,988 m², supporting functions for 4,670 m², management for 439.2 m², and service and production for 3,332 m². The remaining 2,291.8 m² is identified as a grossing allowance rather than hidden within a subtotal (Figure 3 and Table 2). This 13.7% allowance may absorb walls, structure, shafts, circulation, escape routes, and contingency, but its adequacy cannot be assumed because some room calculations already include circulation percentages. Technical development should prepare room data sheets that separately identify net usable area, departmental circulation, public circulation, structure, envelope, and building support.

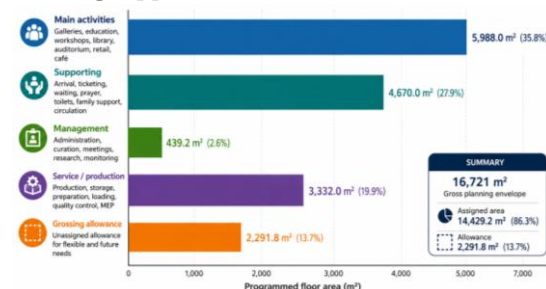


Figure 3. Reconciled distribution of the 16,721 m² gross planning envelope. Source: authors' analysis.

Table 3. Item-level Importance–Performance Analysis results

Program category	Area (m ²)	Share	Representative content	Design implication
Main activities	5,988.0	35.8%	Galleries, education, workshops, library, events, retail, café	Distribute demand; retain adaptable exhibition systems

Program category	Area (m ²)	Share	Representative content	Design implication
Supporting	4,670.0	27.9%	Arrival, ticketing, waiting, prayer, toilets, family support, circulation	Size for group peaks and universal access
Management	439.2	2.6%	Administration, curation, meetings, research, monitoring	Retest against staffing and community-program needs
Service / production	3,332.0	19.9%	Production, storage, preparation, loading, quality control, MEP	Separate public and logistics flows; control fire, dust, humidity
Grossing allowance	2,291	13.7%	Unassigned difference between detailed schedule and gross total	Allocate explicitly to walls, structure, shafts, circulation, contingency
Total	16,721.0	100%	Gross preliminary planning envelope	Requires detailed room data sheets and zoning confirmation

Note. Detailed schedules sum to 14,429.2 m², while the original project schedule reports a gross total of 16,721 m².

The program confirms that the project is not a conventional display museum. It includes arrival and orientation, introductory and historical galleries, material and process interpretation, digital media, temporary exhibitions, classrooms, studios, library functions, co-working, craft workshops, demonstrations, three cultural zones, community rooms, production, retail, cafés, and cultural events. Supporting functions are substantial because the facility must accommodate families and school groups. Reception, ticketing, waiting, prayer rooms, toilets, nursing, first aid, security, children's areas, lifts, stairs, and general circulation must be sized for group peaks rather than treated as residual space. The small management allocation requires retesting against staffing for curation, conservation coordination, education, research, digital production, and community liaison.

Spatial organization follows a layered access model (Figure 4). Visitors enter a shaded civic plaza, pass through lobby and orientation spaces, and reach a shared introductory gallery. From this point, three parallel zones present Bugis, Makassar, and Toraja traditions without requiring visitors to pass through one culture to reach another. The routes reconnect to shared workshops, demonstration rooms, performance, retail, café, and landscape. Semi-public learning spaces are adjacent to, but not embedded within, the main visitor route. Transparent or screened boundaries permit observation while protecting tools, materials, concentration, and safety. Private curatorial and collection spaces connect to galleries through controlled back-of-house doors, and service circulation links loading, inspection, storage, workshops, packing, temporary exhibition, shop replenishment, waste, and mechanical rooms

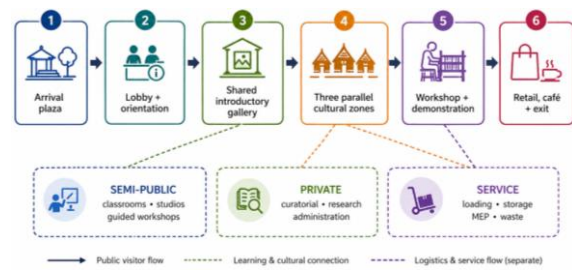


Figure 4. Integrated public, semi-public, private, and service circulation logic. Source: authors' analysis.

This configuration is based on selective permeability. Visitors should understand that research, making, conservation, and logistics sustain the exhibition, but they should not enter hazardous or environmentally controlled areas without supervision. Controlled windows, digital feeds, and guided access make selected processes visible without compromising security. Inclusive visitor experience also depends on legible orientation, choice, seating, family support, quiet areas, and multiple forms of participation. Research with children in galleries shows that belonging is communicated through movement, interaction, and a sense of ownership within the space[27]. The parallel routes and central reference point allow visitors to choose between observation, conversation, making, performance, and reflection rather than follow one compulsory narrative.

3.4 Neo-vernacular translation and cultural parity

The architectural concept avoids assembling three traditional houses into a literal composite. A shared structural order—base, occupied body, protective roof, threshold, and communal edge—draws from the logic of raised vernacular buildings without reproducing one historical silhouette. This common order establishes institutional coherence. Cultural differentiation then occurs through route character, material emphasis, pattern, acoustic condition, interpretive content, and activity. Figure 5 translates each cultural source into design operations and expected performance.

CULTURAL SOURCE	DESIGN OPERATION	ARCHITECTURAL EXPRESSION	EXPECTED PERFORMANCE
Bugis Maritime heritage, old house tradition, navigational culture	Abstract maritime and old-house ordering Integrating linear order, elevation, and orientation	Linear galleries, light-colored edges, woven rhythm Directional flow, linear light, textile-inspired rhythm	Orientation, identity, flexibility Clear sequencing, strong place identity, adaptable spaces
Makassar Communal ethics, performance arts, public gathering	Translate communal and performance culture Turning togetherness and performance into spatial experience	Civic plaza, performance interface, rhythmic screens Flexible open space, engagement edge, perforated shading	Visibility, collective use, public engagement Active participation, cultural visibility, social cohesion
Toraja Spiritual symbolism, ancestral ritual, craft motifs	Reinterpret symbols, geometry and craft motifs Translating meaning, pattern, and hierarchy into space and detail	Layered thresholds, textured timber, sequenced rooms Sequential experience, natural warmth, contemplative scale	Narrative depth, reflection, place attachment Meaningful journey, emotional connection
Shared Tropical climate, shared resources, sustainability values	Synthesize tropical climate intelligence Integrating climate response and passive strategies	Shading skin, cross-ventilation, covered transitions Climate-responsive envelope and comfortable microclimate	Thermal comfort, lower loads, all-weather access Energy efficiency, resilience, inclusive access

Figure 5. Translation of cultural and climatic principles into architectural operations and performance. Source: authors' analysis.

The Bugis zone uses a legible linear sequence informed by maritime orientation and the disciplined order of weaving. Lipa' Sabbe is not enlarged as wallpaper; its interlacing, repetition, and variation inform screens, ceiling modules, display frames, and transitions between textile and musical-instrument content. The boat-like association of Kacaping is abstracted through directional geometry and crafted timber rather than a literal ship interior. The sequence moves from fiber and material to technique, motif, social use, and contemporary innovation, ending at a visible weaving workshop.

The Makassar zone emphasizes encounter, rhythm, and performance. Ganrang suggests the spacing of façade elements and acoustic baffles, while Keso-Keso and Sinrilik support a small controlled demonstration room. Kain Baine is interpreted through material samples, garment context, pattern, and making. This zone opens toward the central plaza and performance interface so that periodic demonstrations animate the civic core. The design does not claim that Makassar culture is inherently more public than the others; it responds to the objects and activities established in the project evidence.

The Toraja zone uses layered thresholds and slower transitions to interpret symbolic motifs and ritual associations. Textile displays require controlled light and sufficient viewing distance, while Pa'pompang supports an interactive acoustic component separated from quieter displays. Timber, bamboo, tactile surfaces, and geometrically transformed patterns create cultural resonance without reproducing a Tongkonan as an interior theme. The sequence emphasizes that motif is embedded in social meaning and technique rather than available as free-floating ornament.

The central plaza unifies the zones as an orientation point, climatic court, event setting, and visual reference. Covered edges support school-group assembly, informal seating, temporary markets, performances, and community installations. Parallel access prevents one tradition from becoming the default gateway to the others. The plaza is therefore both an environmental and a representational device: it produces shared institutional space without dissolving difference. The exterior, workshop, and communal-interior visualizations in Figures 6–8 show restrained massing, visible making, landscape penetration, and warm material character.



Figure 6. Exterior visualization showing restrained massing, a shaded forecourt, and a patterned secondary envelope. Source: author's design



Figure 7. Workshop visualization illustrating visible making, adaptable floor space, and culturally differentiated materiality. Source: author's design



Figure 8. Communal interior showing relationships among landscape, circulation, gathering, and exhibition edges. Source: author's design

[13] demonstrate how eco-cultural architecture can connect tropical adaptation, cultural symbolism, education, performance, and social interaction within a Bugis–Makassar cultural center. The present framework adopts the principle that environmental and cultural design should be integrated but extends it in three ways. First, it avoids a singular iconic source form and instead establishes a shared architectural order. Second, it gives Toraja content an independent parallel route. Third, it links representation to collection care, production logistics, demand analysis, and governance. This comparison distinguishes the proposed framework through its integration of tri-ethnic representation, operational requirements, and environmental response rather than through visual differentiation alone.

Cultural parity remains more complex than symmetrical planning. Representation depends on who selects objects, writes labels, demonstrates techniques, authorizes imagery, receives revenue, and decides what should not be displayed. Community-centered curation requires collaboration and empowerment to shape exhibitions [15], while collection-development work emphasizes identifying absences and valuing intangible heritage [16]. The gallery should therefore establish formal representation for Bugis, Makassar, and Toraja artisans and cultural authorities, with procedures for consent, attribution, payment, rotating displays, intellectual-property protection, and restricted knowledge. Architecture can enable these relationships but cannot replace governance.

3.5 Materials, systems, collection care, and digital infrastructure

The façade translates woven logic into environmental infrastructure. Perforated secondary skins vary in depth and openness according to orientation, view, ventilation, and interior function. Western panels are deeper; north and south panels are more open; workshop edges permit airflow; and controlled galleries limit openings. Pattern is therefore not a uniform decorative layer. Its cultural legibility is strengthened by its work as shade, privacy screen, ventilation filter, and atmospheric mediator. Deep roofs, porous edges, and protected transitions reinterpret tropical vernacular intelligence through contemporary assemblies.

Material selection combines reinforced concrete and steel with timber, stone, textured cementitious panels, metal screens, glass, and locally resonant finishes. Bamboo is proposed selectively for replaceable interior screens, acoustic elements, workshop demonstrations, and landscape structures rather than as an unprotected universal envelope. [28] identifies bamboo's mechanical potential and its applicability across lower, middle, and upper building systems. For the coastal gallery, this evidence supports

selective prototyping rather than automatic structural specification. Species, treatment, moisture, fire performance, connections, salt exposure, maintenance, and replacement cycles should be tested before bamboo is adopted for primary or exposed construction.

Collection care is integrated into architecture rather than added after form-making. Textile conservation research documents risks from unsuitable display, unstable temperature and relative humidity, pollutants, fungi, physical support, and cleaning practices [29]. Costume-display projects further show that visually attractive mannequins can damage garments and must be assessed as conservation devices [30], while diverse body surrogates can improve social equity in display [31]. The gallery therefore requires environmental zoning, filtered and monitored air, integrated pest management, quarantine or inspection space, clean collection routes, compatible supports, and display cases specified for sensitive objects.

The environmental system follows a hierarchy of passive reduction, mixed-mode conditioning, and targeted control. Shading, covered courts, planted buffers, and reduced western glazing lower heat gain before mechanical systems are applied. Galleries and collection rooms use controlled air-conditioning; workshops use natural ventilation, fans, and local exhaust where processes permit; toilets and service rooms use extraction; and transition spaces remain open or semi-open. Fire strategy is critical because the program includes textiles, timber, bamboo, packaging, workshops, and public assembly. Compartmentation, protected escape routes, detection, sprinklers, hydrants, and service access should be developed with the room schedule rather than after the architectural form is fixed.

Digital infrastructure is distributed rather than concentrated in a technology room. Galleries include adaptable power, data, projection, audio, and wireless systems; workshops support process documentation; learning areas connect physical collections to digital archives; and selected collection-care rooms can provide mediated views of ongoing work. Phygital systems can support engagement and learning [17], but they should remain optional and updateable. Digital content must be co-authored, permissioned, version-controlled, and periodically reviewed. AI or recommendation systems should be transparent and voluntary, particularly where voice, image, or visitor data are collected.

The strongest visitor sequence remains physical: encounter an object, observe or hear its making, ask a practitioner, participate under guidance, access deeper interpretation, and purchase an authenticated product when appropriate. Digital channels extend that sequence to schools and distant audiences but should not compete with artisans. Retail likewise requires cultural safeguards. Collection objects, demonstration pieces, commissioned works, and products approved for sale should be distinguished. Provenance, artisan identification, consignment terms, and pricing arrangements should be visible. Co-design can connect museums, artisans, designers, and small enterprises to develop new narratives and products [25], but innovation should complement rather than displace inherited practice.

The framework remains preliminary. The visitor series is short; the 2% capture rate is a planning assumption; cultural

interpretation has not undergone a formal tri-community validation process; and detailed energy, daylight, acoustic, fire, flood, traffic, and financial simulations remain to be undertaken. The original room schedule contains unresolved discrepancies, and zoning controls require official confirmation. These limitations define the next research phase rather than invalidate the framework: participatory cultural review, collection and staffing plans, room data sheets, environmental simulation, business modelling, regulatory confirmation, prototype testing of screens and materials, and eventually post-occupancy evaluation.

4. Conclusion

This study develops a preliminary architectural framework for an integrated South Sulawesi Handicraft Gallery in Makassar representing Bugis, Makassar, and Toraja traditions through a neo-vernacular approach. It responds to a spatial and institutional gap: production, exhibition, education, promotion, research, and conservation remain dispersed, while Makassar's role as a tourism and creative-economy gateway creates an opportunity for a visible regional platform.

The quantitative analysis supports an initial peak planning capacity of approximately 1,000 visitors per day. A linear projection based on the internally consistent 2022–2025 series indicates about 15.89 million citywide visitors in 2035; a 2% capture corresponds to approximately 317,800 annual visits or 871 average daily visits. Program reconciliation identifies 14,429.2 m² of assigned space within a 16,721 m² gross envelope. The 2,291.8 m² difference is retained as an unresolved allowance rather than concealed. A two-storey distribution can satisfy the stated site-coverage assumption, but the stated floor-area ratio conflicts with the proposed area and requires official verification.

Spatially, the framework uses a shared civic plaza and introductory gallery to connect three parallel cultural zones, visible workshops, educational and performance spaces, retail and hospitality, collection-care facilities, and independent service circulation. Architecturally, it avoids literal reproduction of traditional houses. Identity is translated through narrative sequence, craft-derived pattern, material emphasis, communal thresholds, and climatic response. Woven secondary skins, deep overhangs, planted buffers, cross-ventilated transition spaces, and targeted conditioning convert cultural references into environmental work. Regional precedents support three complementary dimensions of this framework: eco-cultural design as a basis for culturally responsive public facilities, tropical smart-building strategies as a pathway toward adaptive environmental control, and bamboo as a material requiring selective, performance-based prototyping. Together, these precedents reinforce the integration of cultural representation, climate response, and material strategy without determining the design outcome.

The resulting gallery is conceived as living cultural infrastructure rather than a static container. Its legitimacy will depend on participation by artisans and cultural authorities, equitable curatorial governance, transparent attribution and revenue, and respect for knowledge that

should not be publicly displayed. The next phase should combine participatory validation with verified zoning, detailed room data sheets, conservation engineering, environmental and safety simulation, traffic and business planning, and an operational model capable of supporting both community benefit and long-term collection care.

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