# Rethinking Multicultural Resilience through Digging4Data and Heritage-Based Infill Design: The Case of Peunayong Market District, Banda Aceh

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## Abstract

The Peunayong market district in Banda Aceh presents a critical urban paradox: an organic, multicultural heritage marketplace that has operated since the seventeenth century, yet now stands in contrast to contemporary governance metrics designating Banda Aceh as an intolerant city. This study examines how architectural history research, when integrated with adaptive infill design, can address the district's socio-spatial fragmentation caused by recent market relocations (2019) and heritage vandalism (2025). Employing the Digging4Data methodology, this study draws on historical cartography and photography, spatial documentation of eight heritage sites, and structured interviews with 6 key informants, including local community leaders and long-term vendors, to identify the historical mechanisms that sustain multicultural resilience in Peunayong. The analysis reveals three enduring resilience factors: (1) modular spatial configurations, (2) robust cross-ethnic merchant networks, and (3) persistent material cultural symbols. Based on these findings, eight context-responsive infill design prototypes are proposed and directly validated through participatory focus group discussions to ensure alignment with contemporary community needs. This study argues that multicultural identity is a dynamic, living heritage asset. The main scholarly contribution is an evidence-based framework for integrating heritage conservation into post-disaster urban recovery, demonstrating that sustainable revitalization requires participatory spatial design and policy mechanisms that prioritize community-generated resilience over centralized displacement.

**Keywords**: *Digging4Data, Heritage Preservation, Infill Design, Multicultural Heritage, Urban Recovery.*

## Abstrak

Kawasan Pasar Peunayong di Banda Aceh menghadirkan sebuah paradoks perkotaan yang krusial: sebuah pasar warisan multikultural yang berkembang secara organik dan telah beroperasi sejak abad ke-17, namun saat ini sangat kontras dengan indikator tata kelola kontemporer yang menggambarkan Banda Aceh sebagai kota yang tidak toleran. Studi ini mengkaji bagaimana penelitian sejarah arsitektur, ketika diintegrasikan dengan desain ruang adaptif, dapat mengatasi fragmentasi sosio-spasial di kawasan tersebut yang disebabkan oleh relokasi pasar baru-baru ini (2019) dan vandalisme warisan (2025). Dengan menggunakan metodologi Digging4Data, penelitian ini memanfaatkan kartografi dan fotografi sejarah, dokumentasi spasial delapan situs warisan, serta wawancara

terstruktur dengan enam informan kunci, termasuk pemimpin masyarakat lokal dan pedagang lama, untuk mengidentifikasi mekanisme historis yang mendasari ketahanan multikultural di Peunayong. Analisis ini mengungkapkan tiga faktor ketahanan yang bertahan lama: (1) konfigurasi spasial modular, (2) jaringan pedagang lintas etnis yang kuat, dan (3) simbol-simbol budaya material yang bertahan lama. Berdasarkan temuan-temuan ini, diajukan delapan prototipe desain pengisian ruang yang responsif terhadap konteks, yang telah diverifikasi secara langsung melalui diskusi kelompok terfokus partisipatif guna memastikan kesesuaiannya dengan kebutuhan masyarakat saat ini. Penelitian ini berpendapat bahwa identitas multikultural merupakan aset warisan budaya yang dinamis dan hidup. Kontribusi akademis utama dari penelitian ini adalah kerangka kerja berbasis bukti untuk mengintegrasikan pelestarian warisan budaya ke dalam pemulihan perkotaan pasca-bencana, yang menunjukkan bahwa revitalisasi berkelanjutan memerlukan desain spasial partisipatif dan mekanisme kebijakan yang mengutamakan ketahanan yang dibangun oleh masyarakat daripada pemindahan yang terpusat.

**Kata Kunci**: *Digging4Data, Preservasi Cagar Budaya, Infill Design, Cagar Budaya Multikultural, Pemulihan Perkotaan.*

## Introduction

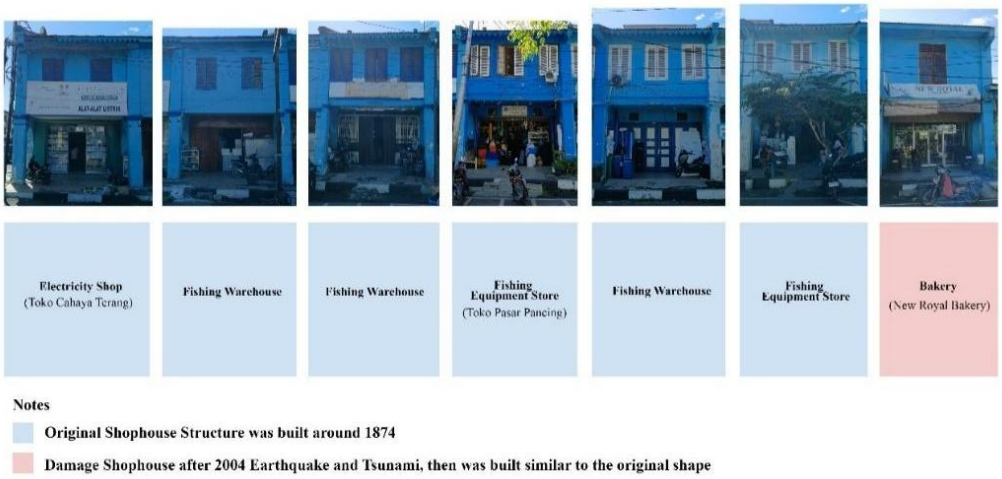
Heritage markets, both globally and within Southeast Asia, are increasingly threatened by rapid urban modernization and top-down development policies. These spaces, historically characterized by mixed-use functions and informal commerce, operate as vital social infrastructures where diverse ethnic, religious, and cultural groups interact daily. However, modern urban governance often views these traditional marketplaces as inefficient, informal, or incompatible with contemporary spatial planning, resulting in their systematic relocation or marginalization. This phenomenon results in severe socio-spatial fragmentation, displacing not only the physical market infrastructure but also the informal economic networks, social cohesion, and multicultural coexistence that these historic spaces have sustained for centuries.

The Peunayong district in Banda Aceh serves as a compelling manifestation of this global phenomenon and occupies a unique position in Indonesian urban history as a space of multicultural cohabitation for over three centuries. The district's etymology, derived from the Acehnese phrase "*Peu Na Jong*?" ("Is there a junk ship?"), underscores its origins in cross-cultural maritime commerce, negotiation, and diaspora settlement (Fadhil & Putri, 2025). Its architectural heritage, featuring nineteenth-century Southern Chinese-style shophouses alongside Acehnese markets and government administrative structures, physically embodies this layered, multicultural history. However, Banda Aceh’s contemporary profile presents a stark paradox. Recent evaluations, such as the SETARA Institute’s Index of Tolerant Cities, consistently rank the municipality among the least tolerant in Indonesia regarding religious and cultural matters, placing it 91st out of 94 cities in 2024 (Yosarie et al., 2024). This officially designated intolerance aligns with aggressive urban modernization policies, notably the 2019 relocation of Peunayong's primary traditional markets to the centralized Al Mahirah Integrated Market, 3.5 kilometres away, thereby effectively abandoning

historic structures such as Pasar Kartini and drastically reducing the operational capacity of Pasar Keberagaman.

Additionally, in January 2025, the district's most famous cultural landmark, a wall located at the corner of Ahmad Yani Street, was vandalized. The mural featured a *Cakradonya* Bell, traditional *Barongsai* dancers, and Acehnese-Chinese men shaking hands as a symbol of historical unity. The damage was exacerbated by commercial signs that obscured the historic shophouses where the mural is located. A survey conducted in July 2024 shows that this mural was still intact before the vandalism. The January 2025 vandalism epitomizes the ongoing erosion of the district's multicultural identity and physical heritage.

Figure 1.
The Oldest Surviving 19th-Century Shophouses in Ahmad Yani Street, Peunayong




Source: Authors' collection (2025)

Figure 2.
The Mural at the Corner of Jalan Ahmad Yani: the Initial Condition (Sofyan, 2022); b. After Being Vandalized


Source: Authors' collection (2025)

Despite the urgency of these urban challenges, current academic frameworks exhibit notable limitations in addressing the multifaceted decline of multicultural heritage sites. First, heritage conservation studies focus on the physical preservation of buildings and aesthetic authenticity rather than on safeguarding the social relations and informal economies that sustain them. Second, while urban resilience literature is extensive, it frequently emphasizes physical and institutional recovery from environmental or infrastructural disasters rather than the maintenance of multicultural economic networks under the slow-onset pressure of top-down modernization. Third, infill design studies typically prioritize visual and morphological compatibility with historic contexts, often neglecting the potential of infill architecture to restore social memory and build community resilience. Finally, systematic methodologies like Digging4Data have primarily been used for historical and archival documentation rather than integrated as generative tools for participatory revitalization design.

Consequently, a significant research gap exists at the intersection of historical documentation, spatial design, and social resilience. There is a lack of operational frameworks capable of translating the historical mechanisms of multicultural coexistence into actionable architectural interventions that can counteract contemporary urban fragmentation. Specifically, it remains unclear how the spatial and social factors that historically sustained multicultural marketplaces can be empirically abstracted from archival data and repurposed to inform adaptive infill strategies in actively contested or abandoned heritage districts.

To address this gap, this study investigates the potential of integrating systematic historical mapping with adaptive design to revitalize heritage markets as resilient, functionally essential environments. The main research questions are twofold: (1) In what ways do historical and spatial patterns in Peunayong's deserted marketplaces reveal persistent resilience factors? Furthermore, (2) How can historical features and multicultural principles be incorporated into revitalization design initiatives? By addressing these questions, the study establishes its primary novelty: it integrates the Digging4Data methodology with infill design to reinterpret heritage markets not as obsolete infrastructure, but as critical spaces of multicultural resilience. The study demonstrates that multicultural resilience emerges not only from formal tolerance policies but also from dynamic spatial configurations, robust cross-ethnic economic networks, and persistent cultural symbolism. This article contributes to heritage studies by demonstrating how historical documentation can be translated into context-responsive infill design strategies. It also extends the concept of multicultural resilience by situating it within spatial practices, merchant networks, and symbolic heritage rather than treating it merely as a social attitude or a policy discourse.

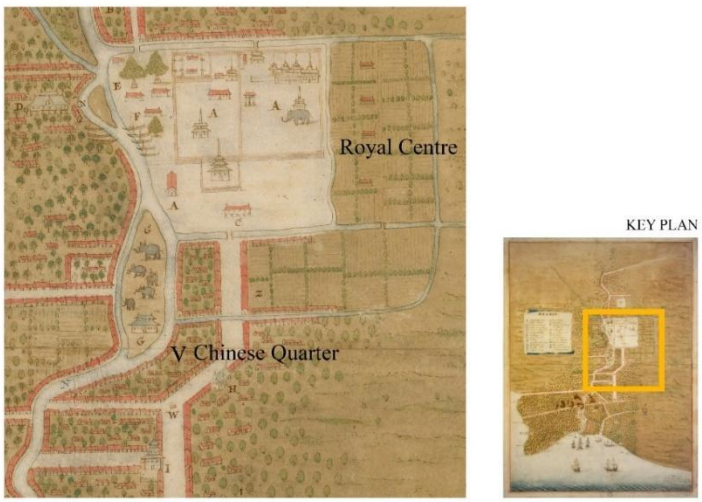
## Literature review

### Historical Foundations of Peunayong's Multicultural Character

The historiography of pre-modern and early modern Aceh, particularly as documented by Anthony Reid and subsequent scholars, establishes Peunayong's origins not as a planned settlement but as an organic outcome of sultanate-merchant relations and diaspora settlement patterns. Travel accounts from the early 1600s by English navigator John Davis (1599) and French explorer Francois Martin (1602) noted three big trading fields in Banda Aceh (Lombard, 2007). One of these fields is in Peunayong, where merchants from around the world traded high-value goods such as Indian cotton textiles, Chinese porcelain, and spices (Fadhil, 2020; Lombard, 2007). The permanence of these operations depended upon the sultanate's granting of residential and commercial privileges to foreign merchants, a practice that reflected both economic strategy and diplomatic accommodation.

The relocation of Peunayong's Chinese population from the coastal settlement at Ulee Lheue to the current inland location near the royal center likely occurred during the reign of Sultana Safiyat Al Din (r. 1641-1675), following a period of Chinese expulsion under Sultan Iskandar Thani. Contemporary informants and archival correspondence suggest that the inland relocation served dual purposes: it allowed the sultanate to supervise foreign commerce more closely while permitting Chinese merchants and craftspeople to resume their economically vital activities (Reid & Ito, 1999). This pattern, characterized by forced relocation alongside protected commercial status, occurred repeatedly in the 1700s and 1800s, establishing a standard for multicultural living with the state's assistance (Reid & Anggraeni, 2010).

Figure 3.
Detail of the 1645 Map of Banda Aceh by Arnold de Vlaming Showing the Chinese Quarter in Relation to the Royal Centre—Additional Notations by Muhammad Naufal Fadhil.




Source: Biblioteca Medicea Laurenziana, (1645)

Records from merchants in the seventeenth and eighteenth centuries indicate that Chinese craftspeople, such as carpenters, furniture makers, and painters, worked on a seasonal basis, creating items on demand and then selling them. This pattern of skilled craft production combined with retail commerce lasted into the twentieth century. Informants stated that the *Warkop* Jurong Merpati (Jurong Merpati coffeehouse) has been in operation since the 1950s, serving as a notable example of this merchant tradition. Vihara Dharma Bhakti, recognized as the oldest Buddhist temple in Banda Aceh, was initially established in 1878 at Pantai Cermin in the Ulee Lheue coastal area. Due to severe coastal erosion threatening the old Chinese enclave, the temple was relocated to its current location in Peunayong in 1936. It occupied a building that previously served as a Hokkien Association Inn, a temporary shelter for newly arrived Chinese immigrants managed by local families. Contrary to political narratives, the temple was rebuilt between 1977 and 1978 primarily because the original wooden structure had become damaged and weathered; it was replaced with the permanent reinforced concrete structure seen today (Fadhil & Putri, 2025). This trajectory illustrates how religious and business institutions helped Peunayong maintain its multicultural identity across various historical periods.

**Urban Modernization and the Rupture of Multicultural Space**

The scholarly literature on heritage preservation in post-conflict urban contexts identifies a persistent tension between modernization objectives and cultural continuity (Vale & Campanella, 2005). Post-tsunami reconstruction in Banda Aceh (following the 2004 Indian Ocean earthquake and tsunami) and subsequent municipal governance have consistently prioritized infrastructure modernization and economic efficiency over heritage conservation. The decision to move the market in 2019 is a good example of this trend. It was primarily based on the need for spatial efficiency and vendor consolidation, and it treated Peunayong's market function as a separate economic activity rather than as part of a social infrastructure that has been in place for hundreds of years (Hillman, 2011).

This utilitarian approach has had socially disruptive effects. Vendors who had been doing business at Peunayong for decades had to choose between relocating 3.5 kilometres away to the new central market (Al Mahirah Market) and losing customers or staying where they were and being labelled as informal vendors. Some traders chose to relocate, which negatively affected their socio-economic conditions due to the loss of regular customers (Bahgia, 2023). Instead of relocating their businesses, some continued to operate only in the morning at a reduced capacity, while others ceased business altogether. This result is very different from what has happened in the past. The Chinese people relocated from Ulee Lheue to Peunayong in the early 1900s, preserving the community's spatial coherence and merchant networks. The 2019 move, on the other hand, broke up these networks without giving the new site the same level of social infrastructure.

Recent research on community-led revitalization has demonstrated that heritage-cantered programs are most effective when they prioritize stakeholder engagement, preservation of cultural traditions, and the introduction of new initiatives incrementally rather than designing infrastructure from the top down (Mamula-Seadon & McLean, 2015; Ngulube et al., 2024). The 2011 Festival Peunayong is a good example of what can be done in a specific area. Late Mayor Mawardy Nurdin and Vice Mayor Illiza Saaduddin Djamal (in office: 2007-2014) organized it as part of the "Visit Banda Aceh Year 2011" initiative. The three-day festival featured lampion (traditional lantern) installations along Jalan Ahmad Yani, dragon boat races on the Krueng Aceh River with twenty-five teams, decorated boat races with twenty-two teams, and cultural parades showcasing Acehnese and Chinese heritage. Concurrently, the Yayasan Hakka Aceh (Hakka Foundation) initiated the construction of the permanent roof structure at the alley in Pasar Kartini, intentionally selecting the name "Pasar Keberagaman" (Diversity Market) over the Western-derived term "Chinatown" proposed by city authorities, thereby asserting local, inclusive terminology for the space (Fadhil & Putri, 2025). This example demonstrates that culturally based, participatory interventions can be effective in engaging people and promoting environmental care.

## Method

### Research Design and Study Area

This study employs a qualitative case study approach combining historical-spatial analysis (Digging4Data) and design-based research (Infill Design) to address the socio-spatial fragmentation of heritage marketplaces. At the first stage, the research applies the Digging4Data framework, a methodology designed to integrate archival research into adaptive reuse, shifting it from a generalized historical documentation tool into an operational framework for participatory urban revitalization (Akihary et al., 2016). The method, then well known as a toolkit, provides architects, planners, and policymakers with a heuristic approach to researching the built environment, spanning from VOC structures to 1940s modern planning (c. 1620–1950), to effectively integrate historical analysis into the adaptive reuse of shifting urban economic centres (Syahid & Wigati, 2023; Wulandari & Rahmy, 2021).

Recent scholarship emphasizes the importance of systematic methodologies in heritage conservation research. Studies on Indonesian heritage documentation emphasize the crucial role of comprehensive data collection systems in developing sustainable conservation plans, particularly for "living monuments," where original drawings often fail to accurately reflect current conditions (Suryaningsih & Purwestri, 2013). The Digging4Data framework addresses this challenge by establishing reproducible protocols for creating built documentation that serves as a reliable baseline data for conservation planning.

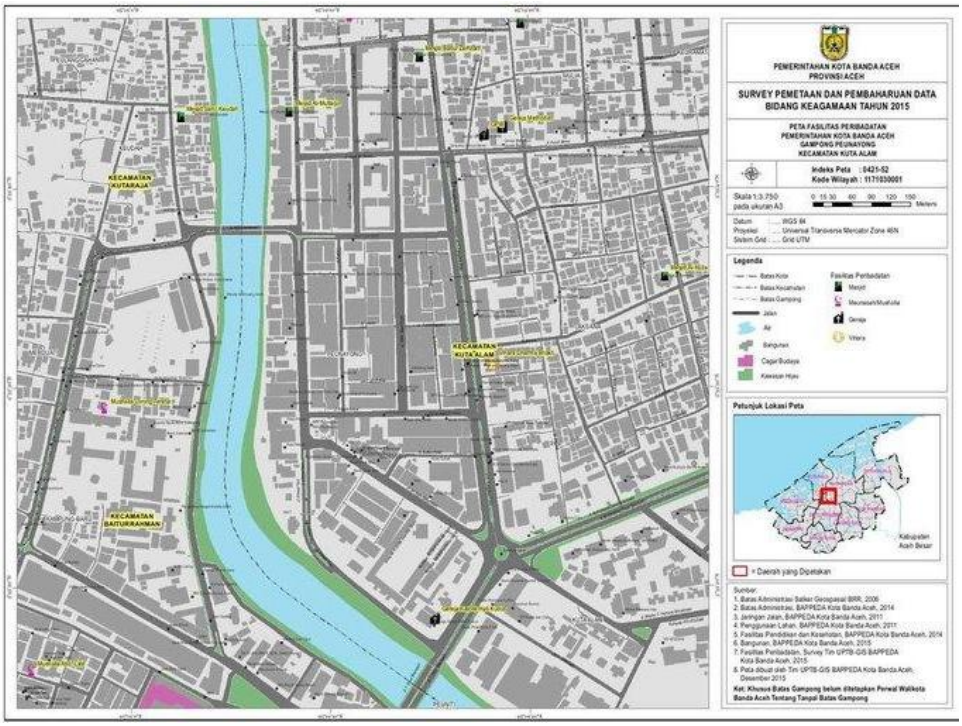
After obtaining historical data, the research uses the Infill Design method, which involves the planned addition of new buildings to vacant or underutilized sites, informed by cues from the surrounding heritage fabric (Sotoudeh & Abdullah, 2013). It provides a design framework that balances heritage authenticity and modern functionality (Gharebaglou et al., 2019; Milojković et al., 2025). Infill approaches work at a smaller scale, allowing for minor changes that respect existing social patterns, material vocabularies, and spatial hierarchies (Demiri, 2013; Gharehbaglou & Ardabilchi, 2021). This is different from large-scale demolition and reconstruction. There are four conceptual approaches on a spectrum: literal replication of historical forms, invention within inherited stylistic parameters, a referential approach that abstracts historical principles for contemporary expression, and intentional opposition that consciously contrasts with heritage context (Shahriar et al., 2023a). Choosing between these methods depends on site conditions and stakeholders' preferences.

In heritage markets, infill strategies are beneficial because informal, distributed vending networks require flexible spatial configurations rather than consolidated infrastructure (Brady & Mohanty, 2013; Watson, 2009a). Modular pavilions, mobile vendor carts with retractable awnings, elevated boardwalks, and networked gathering spaces can be utilized for various types of events at different times of day, such as morning markets, evening social gatherings, and weekend cultural events (Fang & Wu, 2025). Heritage markets can be both economically useful and socially important spaces, as they can be used in various ways and incorporate historical examples into their design and materials.

Design concepts were developed iteratively through multiple rounds of stakeholder input and feedback. Initial design hypotheses derived from Digging4Data findings were presented to respondents and community leaders during focus group discussions conducted during the field survey period. This participatory refinement ensured that design prototypes responded to both empirical historical evidence and contemporary community needs. Eight conceptual designs were developed through sketching and digital three-dimensional modelling, with each prototype addressing specific site conditions and functional demands identified during field documentation.

The study area is located within the administrative boundaries of Peunayong in Banda Aceh (Figure 4). The rationale for selecting this site lies fundamentally in its multicultural history. As depicted in Arnold de Vlaming's 1645 archival map, Peunayong was strategically positioned as the Chinese Quarter (Fadhil & Putri, 2025). Today, despite modern urban pressures, the area still possesses tangible and intangible multicultural traces that offer critical empirical data on historical and contemporary resilience.

Figure 4.
Map of Peunayong, Banda Aceh



Source: Unit Pelaksana Teknis Badan (UPTB) GIS Banda Aceh, (2015)

**Data Sources**

To construct a comprehensive historical narrative and formulate responsive infill design interventions, the data sources were strictly categorized into four primary streams:

- Archival data: Including early colonial maps (e.g., De Vlaming's 1645 map), historical photographs (from KITLV and Wereldmuseum repositories), colonial administrative documents, and historical literature concerning Banda Aceh's urban development.
- Field data: Direct building observations, architectural photography, and spatial mapping of current market conditions.
- Interview data: Primary qualitative accounts gathered from local community leaders, long-term vendors, heritage actors, and local government representatives.
- Design data: Iterative architectural sketches, digital 3D models of infill prototypes, and feedback obtained from Focus Group Discussions (FGDs).

Primary qualitative data were collected from exactly six key informants. Informants were selected using purposive sampling criteria, specifically requiring deep historical knowledge of the area,

extended occupational tenure in the market, or formal administrative roles within the Peunayong community. The recruitment process involved initial outreach through the local village administration, followed by snowball sampling to identify deeply embedded heritage actors. Table 1 details the informant profiles.

Table 1.
Informant Profiles

| Informant Code | Category/Role | Rationale for Selection |
|---|---|---|
| Informant A | Long-term vendor | Possesses more than 20 years of operational experience; provides insight into commercial spatial adaptation. |
| Informant B | Village Head (*Keuchik*) | Provides local government perspective, administrative context, and knowledge of spatial policies. |
| Informant C | Hakka Foundation Representative | Key heritage actor; holds extensive knowledge of the multicultural history of Chinese-Acehnese and institutional continuity. |
| Informant D | Head of Dharma Bhakti Foundation | |
| Informant E | Local Elderly / Resident | Supplies rich oral history and intergenerational memory regarding Peunayong's socio-cultural shifts. |
| Informant F | Head of Village Youth Association | Represents the contemporary community perspective and addresses intergenerational spatial needs. |

Source: Authors' fieldwork

**Data Collection Techniques**

The field observation schedule was conducted intensively throughout July 2025. Observations took place on both weekdays and weekends, operating from 8:00 AM to 5:00 PM to capture the varying temporal rhythms of market activity. The spatial mapping and observation covered eight specific sites: Pasar Keberagaman, Pasar Kartini, Gang Kuta Alam Roastery, Gang Pustaka Esa, Gang Warkop Jaya, Rex Culinary Centre, Jalan Ahmad Yani Mural Plaza, and Pasar Kuliner. The observed variables included building deterioration levels, informal vendor spatial configurations, and public space utilization.

Qualitative interviews used a structured approach guided by predefined interview guides. The procedure involved visiting each informant at their residence or place of business for primary interviews, followed by a collaborative Focus Group Discussion (FGD) held at the *Komunitas* Hakka Aceh Hall. During these sessions, data were recorded directly via manual notetaking during the interview, followed by audio recording to ensure accuracy and capture nuanced oral histories.

**Data Analysis and Validity**

Data analysis was conducted using a multi-layered approach. Qualitative interview transcripts were analyzed thematically to identify recurring patterns of social and economic resilience. Archival and observational data were synthesized through spatial-historical mapping to track morphological changes in the built environment from the colonial era to post-tsunami reconstruction. Crucially, the final phase of analysis used a design translation matrix that systematically linked the abstracted historical findings to the generation of the eight proposed infill design prototypes.

To ensure rigorous data validity, the study employed several academic protocols: source triangulation (cross-referencing oral histories against physical archival blueprints), member checking (presenting interview summaries to informants for confirmation), peer review within the research team, and systematic cross-checking of archival hypotheses against current field evidence.

**Research Ethics**

Strict research ethics protocols were maintained throughout the data collection phase. Explicit informed consent was obtained from all six informants prior to interviews and audio recordings. Where requested by vulnerable participants, anonymity procedures were enforced to protect personal identities. Additionally, formal permission for visual documentation (photography and mapping) of private shophouses and community spaces was secured from building owners and village authorities.

**Methodological Output**

The integration of these techniques directly informed the study's empirical and design results. Table 2 outlines how specific data sources were analytically processed to generate tangible methodological outputs.

Table 2.
Methodological Output Matrix

| Data Source | Data Type | Analytical Function | Output |
|---|---|---|---|
| Historical maps (e.g., 1645 De Vlaming) | Archival data | Tracing spatial continuity and origins of ethnic quarters. | Historical phase mapping. |
| Vendor & Actor Interviews | Oral history | Identifying cross-ethnic social networks and historical coping mechanisms. | Identification of core resilience factors. |
| Field photos & site visits | Spatial documentation | Identifying physical deterioration and current spatial utilization gaps. | Specific site selection and infill design needs. |
| Focus Group Discussion (FGD) | Design validation | Testing spatial feasibility and cultural appropriateness with the community. | Revised, community-validated infill prototypes. |

## Result

Applying the Digging4Data methodology, this study triangulated archival records, literature, historical photography, spatial documentation, and structured interviews with six key informants (including the village head, Hakka Foundation representative, a long-term vendor, a culinary manager, local youth, and an elderly resident). The empirical analysis yielded five primary findings regarding the historical mechanisms of multicultural coexistence and their translation into spatial revitalization strategies.

**Finding 1: Historical Phases of Peunayong's Multicultural Urban Formation**

Historical and archival synthesis reveals that Peunayong's multicultural spatial framework developed across two formative periods prior to contemporary disruptions.

1. **Pre-colonial Cosmopolitan Exchange (16th–17th Centuries):** John Davis's 1599 notes explicitly identified three major trading fields in Banda Aceh, one of which corresponds to present-day Peunayong. Francois Martin's 1602 account provides specific details regarding the merchants operating from these sites, enumerating traders from Nagapattinam, Gujarat, Kanyakumari, Calicut, Sri Lanka, Siam, Bengal, and China (Lombard, 2007; Reid & Anggraeni, 2010). These merchants remained on site for approximately six months annually, occupying temporary structures or rented quarters, transacting in high-value commodities (Indian cottons, Chinese ceramics and silks, spices), and facilitating indirect exchange between Asian and European commercial networks.

   This era is encoded in the district's toponym; oral histories trace "Peunayong" to the Acehnese phrase *"Peu Na Jong?"* ("Is there a junk ship?"). Rather than merely a linguistic anecdote, this etymology serves as direct evidence of early maritime trade memory and a foundational local cosmopolitan identity forged through cross-cultural negotiation (Fadhil & Putri, 2025). Alternative etymologies circulate, some linking the name to "*Pemayung*" because it has become an umbrella (shelter or refuge) for foreign peoples. Another popular story originates from "*Pedayung*" because many boat rowers resided in the village (Arif, 2008).

   The sultanate facilitated this cosmopolitan exchange through deliberate policy. Sultan Iskandar Muda (r. 1607-1636) granted commercial and residential privileges to foreign merchants, including formally designated spaces for Chinese settlement distinct from European trading posts (Lombard, 2007). The incentive structure underlying this arrangement was straightforward: foreign merchants brought goods, taxes, and diplomatic prestige while requiring minimal state investment in infrastructure (Sher Banu A. L. Khan, 2015). The sultanate's regulatory role

primarily consisted of granting spatial rights and adjudicating commercial disputes, rather than providing public amenities or infrastructure (Sher Banu A. L. Khan, 2015).

Arnold de Vlaming's 1645 map depicts the Chinese Quarter situated near the royal center, a strategic relocation from the earlier Ulee Lheue coastal settlement. This repositioning reflected both political oversight (keeping foreign merchants within the sultanate's visual and administrative purview) and practical accommodation (enabling overland commerce and reducing the Chinese community's vulnerability to maritime hazards). Historical evidence emphasises that during the pre-colonial era, multicultural coexistence was sustained organically through temporary spatial accommodations and high-value mercantile exchange, facilitated by minimal state intervention.

2. **Colonial Adaptive Continuity (Late 19th–Early 20th Centuries):** The subsequent two centuries witnessed the gradual formalization of Peunayong's spatial organization as part of the colonial segregation system known as the *Wijkenstelsel* (quarter system). By the late nineteenth and early twentieth centuries, the district had developed into a structured settlement with defined shophouse blocks, multiple neighborhood subdivisions, and institutional anchors (Jasman et al., 2025). The Vihara Dharma Bhakti, established at Ulee Lheue in 1878, relocated to Peunayong in 1936 following coastal erosion, a pattern that also affected Vihara Dewi Samudera (established 1947, relocated 1957) (Fadhil & Putri, 2025). These relocations demonstrate both the durability of institutional commitment to the district and the ongoing threat posed by environmental factors (coastal erosion) that require an adaptive response.

Figure 5.
Wooden Shophouses and Huts in the Chinese Camp of Koetaradja, Peunayong.

Source: (KITLV, 1883)

Oral histories and historic photography describe specific material and social practices that characterized colonial-era Peunayong. Traditional wooden construction (attributed to early regulatory frameworks) gradually yielded to brick and concrete, though specific structures, particularly the oldest *ruko* (stacked shophouses) on Jalan Ahmad Yani and Jalan Kartini, retained original or near-original wooden frames into the late twentieth century (Dewi et al., 2022; Jasman et al., 2025; Muftiadi et al., 2025). Within these structures, mixed-ethnicity merchant networks operated with minimal formal coordination (Dewi et al., 2022). Colonial-era resilience was achieved through spatial contiguity and the establishment of permanent cultural institutions (such as Vihara Dharma Bhakti, which was relocated to Peunayong in 1936), thereby anchoring the community physically despite changing political regimes.

Figure 6.
Children (Left) Playing Between the Wooden Shophouses in the Market Street of Peunayong

Source: Wereldmuseum (between 1915 and 1925)

**Finding 2: Contemporary Fragmentation After Market Relocation (Post-2004 Period)**

The 2004 tsunami constituted what Banda Aceh residents repeatedly characterize as a "rupture" dividing historical memory into before and after (Fadhil & Putri, 2024). While the tsunami directly destroyed much of Banda Aceh's coastal infrastructure, its indirect social effects upon Peunayong proved equally consequential. Reconstruction funding flowed toward consolidated and modernized infrastructure rather than the repair of social and commercial networks (Fadhil et al., 2025). Field observations conducted in July 2025, combined with informant interviews, reveal severe socio-spatial fragmentation following post-tsunami modernization efforts and the 2019 municipal market relocation. Specific observational indicators demonstrate this decline:

1. Spatial Conditions: Pasar Kartini is entirely abandoned, in structural deterioration, and operates only as an informal waste collection and parking site.

Figure 7.
Pasar Kartini Abandoned Building and Waste Accumulation, July 2025

Source: Authors' collection, (2025)

2. Operating Hours and Vendors: Pasar *Keberagaman* currently operates at a fraction of its historical capacity, opening strictly from 6:00 AM to 10:00 AM, with vendors storing portable tables under tarps for the remainder of the day.

3. Resident and Informant Responses: Interviews with the six informants confirmed a pattern of economic and cultural erosion. Informant A (a vendor with 30 years of experience) reported significant declines in daily customer traffic following the 3.5-kilometer relocation of the main market. Furthermore, the vandalism of the iconic Sino-Acehnese mural on Jalan Ahmad Yani in January 2025 was cited by Informant F (Youth Association Head) as evidence of declining municipal stewardship over multicultural assets. Contemporary top-down modernization and relocation policies have fractured the spatial proximity necessary for multicultural merchant networks, transforming Peunayong from a thriving living heritage site into a fragmented and underutilized district.

Table 1.
Synthesis of Peunayong's Historical Phases and Urban Patterns

| Historical Phase | Key Spatial Feature | Social Network | Cultural Symbol | Vulnerability | Resilience Factor |
|---|---|---|---|---|---|
| Pre-colonial | Trading fields, seasonal structures, docks. | Global maritime merchants, organic trade. | "Peunayong" toponym (Maritime memory). | Seasonal fluctuations; sultanate expulsions. | Flexible spatial accommodation. |
| Colonial to Early 20th C. | Standardized *ruko* (shophouses), continuous alleys. | Kinship/credit ties, mixed-ethnicity guilds. | Vihara Dharma Bhakti, wooden architecture. | Coastal erosion, colonial oversight. | Adaptive relocation maintaining social contiguity. |

| | | | | | |
|---|---|---|---|---|---|
| Post-2004 to Present | Abandoned markets (Pasar Kartini), vandalized murals. | Scattered vendors, reduced local foot traffic. | Obscured murals, empty heritage buildings. | Top-down market relocation (2019). | Community-led spatial modularity. |

**Finding 3: Three Enduring Resilience Factors**

By cross-referencing archival continuity with contemporary survival mechanisms, the Digging4Data analysis empirically identifies three core resilience factors that have historically sustained Peunayong:

1. Modular Spatial Configuration

   Evidence from 1930 KITLV photographs (figure 8) showing the Basket Shop at the Kutaraja market (Banda Aceh), most likely in Peunayong. Baskets were displayed not only inside the shop but also at the front, on wooden display tables. Figure 9 confirms that the basket shop is located next to a market stall in the Peunayong area.

Figure 8.
Basket Store in the Proximity of a Market in Koetaradja

Source: KITLV, (c.1930)

Figure 9.
Market Buildings in Peunayong, With a Wooden Display Table Underneath

Source: Wereldmuseum, (Between 1925-1932)

The wooden display table style mirrors the current practices observed in July 2025 (Figure 10), in which vendors use portable tables and retractable awnings in Pasar Keberagaman. Some of them have also made tables out of aluminum and iron, which can easily be covered with a cloth or a plastic sheet when not in use. This spatial modularity allows vendors to adapt to economic shocks without requiring permanent structural changes.

Figure 10.
The Wooden Display Table at Peunayong's Keberagaman Market, as Shown in July 2025

Source: Author's Collection, 2025

2. Robust Cross-Ethnic Merchant Networks

Archival literature and current field data confirm that Peunayong relies on trust-based, cross-ethnic credit and kinship relations rather than formal institutional support. For example, Informant C (Hakka Foundation) and Informant E (Elderly resident) detailed the history of Warkop Jurong

Merpati (operational since the 1950s), explaining how it survived the 1960s suppression of Chinese identity by adapting its signage while retaining its interior cultural networks, serving as an ongoing hub for Sino-Acehnese interaction.

3. Persistent Cultural Symbolism

Visual documentation confirms that material symbols are vital for social cohesion. The 2011 Festival Peunayong explicitly utilized traditional lampions, dragon boat races, and the naming of "Pasar Keberagaman" to assert local, inclusive identity. The recent mural vandalism demonstrates that when these symbols are obscured, the spatial legibility of multiculturalism rapidly degrades.

**Finding 4: Translation of Resilience Factors into Infill Design Principles**

To systematically bridge the empirical findings with architectural intervention, the three resilience factors were translated into specific design criteria. These criteria dictate that successful revitalization must not rely on aesthetic reproduction but rather on the operationalization of historical social mechanisms. The required design principles include: (a) Spatial Flexibility (accommodating shifting vendor demographics), (b) Restoration of Economic Networks (providing low-cost, mixed-use nodes), (c) Protection of Cultural Symbols (integrating multi-ethnic motifs into infrastructure), and (d) Activation of Public Space (extending temporal use into evening hours).

Table 2.
Translation of Resilience Factors into Infill Design Prototypes

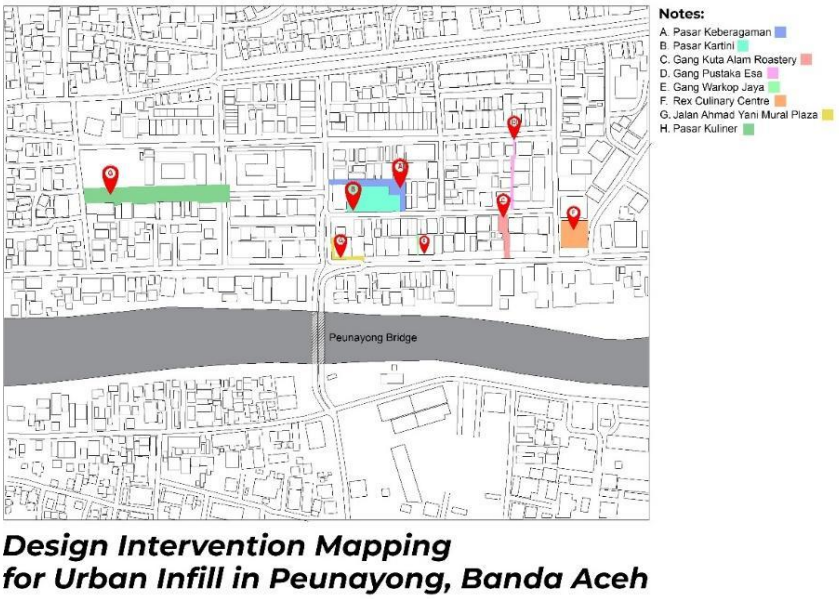
| Resilience Factor | Empirical Evidence | Design Principle | Related Prototype |
|---|---|---|---|
| Modular Spatial Configurations | 1930 photos of wooden portable display tables; 2025 field observation of portable tables at Pasar Keberagaman. | Spatial Flexibility: Use lightweight, transparent structures that allow multiple daily uses without heavy demolition. | Idea 1: Pasar Keberagaman Pavilion; Idea 6: Kuta Alam Roastery Hub. |
| Robust Cross-Ethnic Merchant Networks | Interviews detailing trust-based networks at Warkop Jurong Merpati; historical mix of crafts and retail. | Restoration of Economic Networks: Create mixed-use clusters supporting informal commerce, culinary arts, and pedestrian gathering. | Idea 2: Pasar Kartini Cultural Cluster; Idea 3: Pasar Kuliner Boardwalk; Idea 8: Rex Culinary Centre. |
| Persistent Cultural Symbolism | 1915 photos of children in alleys; 2011 lampions; 2025 documentation of mural vandalism. | Protection of Cultural Symbols: Embed inclusive motifs, protect historic facades from traffic, and institutionalize mural corridors. | Idea 5: Ahmad Yani Mural Plaza; Idea 7: Gang Warkop Jaya Corridor; Idea 4: Gang Pustaka Esa Playway. |

**Finding 5: Eight Proposed Infill Prototypes**

Based on resilience factors identified through Digging4Data analysis and contemporary spatial assessment, eight infill design prototypes were developed to address specific site conditions while

respecting historical character and community preferences. The design approach employed the "referential" or "associative" methodology within the spectrum of infill strategies: rather than literally replicating historical forms, the designs abstract enduring principles (modularity, social gathering, commercial flexibility) and express them through contemporary materials and techniques responsive to current functional demands and environmental conditions.

Figure 11.
The Map of Infill Design in Peunayong




Source: Authors' collection, (2025)

Prototype development proceeded iteratively. Initial design hypotheses were sketched based on historical analysis and field observation, then presented to respondents during focus group discussions conducted in July 2025. Respondents provided feedback regarding functionality (whether specific designs accommodated their commercial or social needs), cultural appropriateness (whether designs respected community identity), and implementation feasibility (whether designs appeared realistic given current municipal capacity and community resources). This participatory input was incorporated into refined versions, resulting in eight concepts that strike a balance between historical responsiveness and contemporary pragmatism.

1. Pasar Keberagaman Pavilion: Replaces opaque roofing with transparent tempered glass inspired by 1883 spatial lighting, utilizing ACP columns with Acehnese and Chinese lantern motifs to facilitate flexible vending.

Figure 12.
Infill Design of Pasar Keberagaman

Source: Authors' collection, (2025)

2. The Pasar Kartini Cultural Cluster reactivates an abandoned building into a tiered, mixed-use hub for traditional food vendors and artisans, directly addressing the loss of economic networks identified by vendor informants.

Figure 13.
Infill Design of Pasar Kartini Cultural Centre

Source: Authors' Collection, (2025)

3. The Pasar Kuliner Boardwalk Network implements historic shophouse window patterns onto contemporary structural columns, paired with nightly pedestrianization to revive the evening economy.

Figure 14.
Infill Design of the Pasar Kuliner Boardwalk Network

Source: Authors' Collection, (2025)

4. Gang Pustaka Esa Child-Safe Playway: Responds to 1915 archival photos of intergenerational alley use by enclosing the corridor with weather-protective glass and interactive heritage murals.

Figure 15.
Infill Design of Gang Pustaka Esa Child-Safe Playway

Source: Authors' Collection, (2025)

5. Jalan Ahmad Yani Mural Restoration Plaza: Pedestrianizes the corner of the oldest surviving 19th-century shophouse, providing a buffer against vehicular damage while physically restoring the vandalized Sino-Acehnese handshake mural.

Figure 16.
Infill Design of Shophouses on the Corner of Jalan Ahmad Yani

Source: (Authors' collection, 2025)

6. Gang Kuta Alam Roastery Hub: Formalizes informal spill-out seating into a dual-sided culinary corridor, utilizing minimal construction to maintain existing horizontal merchant networks.

7. Gang Warkop Jaya Mural Corridor: Institutionalizes an open-air cultural gallery by installing a transparent canopy that protects existing culinary murals from the weather while establishing a dedicated social node.

8. Rex Culinary Centre: Reverses post-tsunami dormancy by installing architectural lighting and an open-air amphitheater, empirically grounded in the site's historic lineage as a premier Tamil-established entertainment venue.

## Discussion

### Extending Theories of Heritage Resilience: Markets as Social Infrastructure

The findings from Peunayong necessitate a conceptual shift in how urban heritage resilience is theorized. Traditional conservation literature has often prioritized the structural stabilization of historical monuments and institutional recovery over the community's living dynamics. However, the empirical trajectory of Peunayong demonstrates that true multicultural resilience is not a passive artifact; rather, it is actively embedded within everyday spatial practices and robust cross-ethnic merchant networks (Watson, 2009b).

This aligns with contemporary urban scholarship that reconceptualizes heritage markets not merely as transactional economic spaces, but as vital "social infrastructure" (Latham & Layton, 2019). In Peunayong, the modular spatial configurations of traditional shophouses historically served as the

physical scaffolding for trust-based kinship and credit relations. When the 2019 municipal decree relocated these vendors to the distant Al Mahirah Integrated Market for spatial efficiency, it fundamentally ruptured this social infrastructure. The displacement of informal marketplaces inherently destroys the microscopic social contracts, shared memory, and inter-ethnic daily negotiations that form the bedrock of community resilience (Mele et al., 2015). Therefore, extending theories of living heritage requires municipal frameworks to explicitly protect informal economic networks alongside the physical buildings they occupy (Poulios, 2014).

**Infill Design as Cultural Repair in Comparative Southeast Asian Contexts**

To counteract this socio-spatial fragmentation, the eight proposed infill design interventions, such as the Pasar Keberagaman Pavilion and the Pasar Kartini Cultural Cluster, operate explicitly as forms of *cultural repair*. Referential infill design abstracts historical principles (e.g., modularity and mixed-use gathering) and translates them into contemporary architectural solutions, allowing fractured communities to physically and socially reclaim abandoned heritage districts (Shahriar et al., 2023b).

This community-driven, micro-intervention approach provides a critical counterpoint to the heritage-led regeneration models seen elsewhere in Southeast Asia. For instance, in UNESCO World Heritage sites like George Town (Penang) and Melaka, historic multicultural landscapes were successfully preserved structurally, but often triggered aggressive gentrification that displaced traditional trades in favor of boutique tourism (Khoo & Woo, 2024). Similarly, the revitalization of Singapore's historic ethnic quarters (such as Kampong Glam and Chinatown) has been critiqued for heavily sanitizing informal, organic market spaces to align with top-down state narratives (Yeoh & Kong, 1994). In contrast, the infill strategy proposed for Peunayong prioritizes dual occupancy and the protection of existing informal vendors, such as the minimal-intervention Gang Kuta Alam Roastery Hub. By utilizing adaptable design frameworks, these prototypes ensure that architectural intervention facilitates everyday multicultural coexistence rather than staging it exclusively for external consumption.

**Critical Risks: Commodification, Displacement, and Decorative Symbolism**

Despite the potential of adaptive infill design, it is imperative to critically evaluate the inherent risks of heritage-led urban revitalization to avoid excessive architectural optimism. Implementing physical upgrades in abandoned districts like Peunayong frequently acts as a catalyst for rising property values. There is a substantial risk that the successful execution of projects like the Pasar Kuliner Boardwalk or the Rex Culinary Centre could inadvertently price out the long-term vendors they intend to support, replicating the severe gentrification and community displacement crises currently observed in Hoi An, Vietnam, and Semarang's Old City (Ngo & Creutz, 2022; Rukayah et al., 2023).

Furthermore, while the restoration of cultural symbols, such as the vandalized Sino-Acehnese mural on Jalan Ahmad Yani, is crucial for spatial legibility, there is a distinct danger that multicultural symbolism will become purely decorative. If the municipality installs Chinese lanterns and aesthetic facades without providing inclusive economic support to vendors who use those spaces, multiculturalism becomes commodified, resulting in a superficial "Disneyfication" of heritage (Gotham, 2005). To prevent this, infill design must be strictly coupled with progressive urban governance, including rent controls for heritage commercial spaces and legal protections for informal street vendors. Ultimately, architectural intervention can only repair the physical container of heritage; sustaining Peunayong's living multicultural resilience requires structural economic support and a fundamental shift in municipal tolerance policies.

## Conclusion

The empirical investigation of Peunayong’s historic market district reveals that multicultural coexistence is sustained not merely by top-down tolerance policies, but through three enduring resilience factors: modular spatial configurations, robust cross-ethnic merchant networks, and persistent cultural symbolism. Through the systematic application of the Digging4Data methodology, this study mapped how these mechanisms successfully absorbed shocks across pre-colonial cosmopolitan exchange, colonial-era adaptive continuity, and post-2004 disaster recovery, before being recently fractured by the 2019 municipal market relocation and contemporary heritage vandalism. To address this socio-spatial fragmentation, the research translated these empirical findings into eight context-responsive infill design prototypes. These architectural interventions demonstrate how abstract historical resilience principles can be operationalized to repair physical heritage and support the daily activities of informal vendors, successfully distinguishing observed historical mechanisms from proposed conceptual design solutions.

This study advances theoretical and methodological frameworks within Southeast Asian heritage studies. Theoretically, the article expands the concept of living heritage by demonstrating that multicultural resilience must be understood and protected through everyday spatial practices, informal economic networks, and symbolic heritage, rather than treating historic districts merely as passive architectural artifacts. Methodologically, the research proves that the Digging4Data framework can evolve beyond its traditional role in archival documentation into an active, design-oriented heritage strategy capable of generating site-specific urban interventions. Within the broader Southeast Asian context, these findings provide a precise counterpoint to the dominant heritage-led regeneration models, such as those observed in Penang and Singapore, which frequently sanitize informal market spaces and displace traditional trades. Instead, this study offers an evidence-based,

community-driven framework for urban recovery that explicitly prioritizes the socio-economic retention of local vendor networks.

Practically and socially, municipal governments can use these findings to inform community-based revitalization planning that actively reopens spaces for cross-ethnic and intergenerational interaction. To move these designs from conceptual proposals to executable urban policy, a prioritized implementation framework based on feasibility and community impact is required:

- Phase 1: Immediate Governance and Protection (High Feasibility): Establish a collaborative governance board involving the Hakka Foundation, village authorities, traditional vendors, local artists, shophouse owners, and residents. Formally designate Peunayong as a heritage revitalization zone to immediately protect historic shophouses, murals, temples, market alleys, and culinary heritage sites.

- Phase 2: Economic and Social Activation (Medium Feasibility): Enact policies that allow dual-market functions, ensuring traditional markets can legally operate alongside new centralized markets. Develop pedestrian heritage corridors around Jalan Ahmad Yani and Pasar Keberagaman, and institutionalize the Festival Peunayong as an annual heritage-economy program.

- Phase 3: Financial Mechanisms and Physical Infill (Complex Feasibility): Provide rental incentives to retain long-term vendors and cultural economy actors. Create municipal micro-grant schemes dedicated to facade restoration, mural maintenance, inclusive signage, and the construction of the communal infill prototypes proposed in this study.

Despite its contributions, this study is subject to several methodological and practical limitations that inform future research directions. First, the reliance on a single-case design (Peunayong) and a limited number of key informants restricts the immediate generalizability of the socio-spatial findings to other historic cities. Second, the proposed infill interventions remain strictly conceptual; they have not undergone economic implementation testing, cost analyses, or structural engineering reviews. Consequently, there is currently no longitudinal behavioral impact assessment to verify how these spatial modifications will empirically affect vendor incomes or daily cross-cultural interaction rates. Future research must address these gaps by conducting quantitative economic assessments of the proposed micro-grant schemes, testing the pilot infill structures *in situ*, and expanding the methodology into a comparative analysis across multiple Southeast Asian historic market districts to validate the scalability of the resilience framework robustly.

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