

An Adaptive Reuse Approach to the Interior Function Transformation of Kalang Houses in Kotagede

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Abstract

This research analyses the transformation of interior functions in Kalang houses in Kotagede, focusing on Museum Kotagede and Ndalem Natan-Prayodranan. Yogyakarta's historical structures are transforming to accommodate urban development, socio-cultural shifts from kingdoms to governments, and economic demands. The "Analysis of Existing Fabric" model, developed by Misirlisoy and Günce, which encompasses original function, physical characteristics, heritage values, and district requirements, is utilised to explore techniques for enabling heritage structures to accommodate modern use. The research indicates that this model can be applied to heritage buildings to preserve culture and history while supporting economic and tourism potential.

Keywords: adaptive reuse, heritage, transformation, Kalang

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1.0 Introduction

Kotagede, a historic area in Yogyakarta, Indonesia, is recognised for its cultural heritage and architectural monuments, notably the unique Rumah Kalang. These edifices exemplify the affluent period of Javanese traders, showcasing a distinctive amalgamation of indigenous and colonial architectural styles that developed throughout the Dutch colonial era. Nonetheless, changing urban dynamics, population expansion, and heightened tourism demands are compelling these ancient edifices to assume new functional roles, securing their survival and significance in modern society. Adaptive reuse has garnered considerable interest in heritage conservation as a sustainable method for preserving historic structures while fulfilling contemporary functional needs (Bullen & Love, 2010; Rodrigues & Freire, 2017). This method enables heritage buildings to serve as dynamic elements of the urban landscape, rather than static monuments, thereby prolonging their longevity and preserving their cultural significance (Aigwi et al., 2018).

This research aims to investigate the adaptive reuse transformation of interior functions in Kalang houses in Kotagede, specifically examining how heritage conservation principles can be balanced with contemporary functional requirements. The specific research objectives are: 1) to identify the original spatial function and physical characteristics of Kalang houses before transformation; 2) to determine the extent of spatial and functional changes implemented through adaptive reuse strategies; 3) to establish the effectiveness of Misirlisoy and Günce (2016) framework in analyzing heritage building transformation in Indonesian context; 4) to evaluate the preservation of heritage values (tangible and intangible) following functional transformation.

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Fig. 1. Kotagede Museum facade (left) and Ndalem Natan facade (right)
(Source: author documentation, 2024 and 2010.)

This study employs the Analysis of Existing Fabric Model by Mısırlısoy and Günce (2016) to demonstrate how adaptive reuse can serve as a sustainable heritage conservation method, harmonising preservation requirements with modern functional demands (see Fig. 1).

2.0 Literature Review

2.1 Adaptive Reuse

Adaptive reuse refers to modifying a building for a purpose distinct from its original design or most recent function (Bullen & Love, 2010). In heritage conservation, this strategy has evolved from a basic functional approach to a holistic one incorporating cultural, social, economic, and environmental considerations (Plevoets & Van Cleempoel, 2019). Furthermore, Bernardi et al. (2017) highlight the critical role of adaptive reuse in achieving UN Sustainable Development Goals, particularly SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production), positioning heritage conservation within broader sustainability frameworks. Kahvecioğlu and Selçuk (2023) emphasise a growing trend toward interdisciplinary methodologies in adaptive reuse research and identify specific deficiencies in a global bibliometric analysis. These findings underscore the need for further theoretical and practical advancements. Li et al. (2021) highlight the absence of evaluation frameworks in adaptive reuse research and advocate for the use of systematic methodologies that employ multi-criteria decision-making (MCDM) and preference measurement models (PMM) to facilitate more sustainable design choices.

Post-pandemic considerations have introduced new dimensions to the discourse on adaptive reuse. Foster (2020) documents how COVID-19 has accelerated functional obsolescence of certain building types while creating opportunities for innovative reuse strategies that prioritise health, flexibility, and community resilience. This contemporary context is particularly relevant for heritage buildings in tourist-dependent areas like Kotagede, where pandemic-related disruptions have necessitated functional diversification. Sholahuddin (2024) emphasises that interior spaces for low-income communities must be functionally adaptive and socially responsive, prioritising real user needs over aesthetics alone. This aligns with the adaptive reuse of Kalang Houses in Kotagede, where interior transformation should serve new community functions while preserving cultural identity, ensuring the space remains living heritage rather than static preservation. Recent research (Nocca, 2017; Foster, 2020) further develops this concept through the lens of the circular economy, arguing that heritage adaptive reuse should generate cultural, social, and economic value simultaneously while minimising resource consumption.

2.2 Kalang History

The Kalang community has been influential in Javanese history, especially in Kotagede, since the time of Sultan Agung. The Kalang people, recognised for their expertise as artisans, jewellers, carpenters (undagi), and moneylenders, held a pivotal role in local civilisation. The royal court frequently entrusted them with the design of royal jewellery and architectural features (Carey, 2008). The Kalang architectural heritage represents a unique syncretism of Javanese spatial philosophy and Dutch colonial influences, making these structures significant not only as historical artefacts but as embodiments of cultural hybridity and cross-cultural exchange (Widianingtias et al., 2020). Their preservation contributes to maintaining Kotagede's designation as a UNESCO World Heritage tentative list site, with implications for both cultural preservation and sustainable tourism development. Their cultural and social identity is manifested in their domestic architecture, which uniquely integrates traditional Javanese spatial conceptions with Dutch colonial influences. However, contemporary pressures, including urbanisation, inheritance fragmentation, and maintenance costs, threaten the survival of these heritage structures, making adaptive reuse not merely an option but a necessity for their continued existence (Widianingtias & Pramudito, 2020).

3.0 Methodology

3.1 Research Design

This research employs a qualitative case study approach in the Strategic Model of Adaptive Reuse, as formulated by Misirlisoy and Günce (2016), as its analytical framework. This method is appropriate because it enables an in-depth examination of complex heritage transformation processes within their real-world contexts (Yin, 2018; Plevoets & Van Cleempoel, 2019; Bottero et al., 2019). This study concentrates on the Analysis of Existing Fabric phase, encompassing four facets: 1) Original Function, referring to the identification of the initial spatial function based on historical records; 2) Physical Character, concerning the analysis of the physical attributes of space through the interpretation of floor plans, spatial elements, and values that inform the extent to which buildings can be modified without compromising their cultural significance; 3) Heritage Values, understood as historical, aesthetic, or symbolic values derived from prior spatial functions; and 4) Needs of the District, understood as the adaptation of roles to meet district requirements.. This holistic approach aligns with contemporary heritage conservation best practices that advocate for sustainability, community engagement, and cultural continuity (Nocca, 2020).

3.2 Case Selection

Two case studies were selected based on their significance in representing different aspects of Kalang architectural heritage and their successful adaptive reuse implementation: 1) Museum Kotagede represents the transformation from a private residence to a public cultural institution, highlighting the ability of heritage architecture to accommodate educational and cultural purposes; 2) Ndalem Natan-Prayodranan represents adaptive reuse for cultural preservation and community engagement, demonstrating how private Kalang houses can evolve into multifunctional cultural hubs that strengthen identity and tourism. Together, these cases exemplify the dual potential of adaptive reuse: preserving tangible heritage elements while activating intangible cultural values for future generations.

Data collection involved: 1) Historical documentation analysis from the Yogyakarta Cultural Department archives to reconstruct the original narrative of ownership and function; 2) Architectural drawings and spatial configuration studies to assess physical transformations and structural continuity; 3) Literature review of adaptive reuse practices in heritage conservation to situate findings within broader academic discourse; and 4) Visual documentation of current conditions and spatial arrangements, enabling comparative analysis between past and present states. Access to certain historical records was limited due to incomplete archival documentation from the Dutch colonial period. Pre-transformation photographic documentation was unavailable for some interior spaces, requiring reliance on oral histories and architectural drawings for reconstruction of original conditions. This comprehensive methodological approach ensures that both the physical and cultural dimensions of heritage are systematically addressed, while acknowledged limitations inform appropriate interpretation of findings.

4.0 Findings

4.1 Case Study 1: Museum Kotagede

4.1.1 Original Function

Museum Kotagede is located in a structure that once functioned as the domicile of B.H. Noerijah, a Kalang trader with strong affiliations to the Yogyakarta Palace and the Dutch colonial administration. The intact stained-glass windows suggest that the home was constructed in 1913. Following its acquisition by the regional government and a subsequent restoration in 2017, the building was designated a cultural heritage site in 2021 and subsequently converted into Museum Kotagede on December 10, 2021, having formerly functioned as the Kotagede Cultural Heritage Area Secretariat Office (Governor's Decree DIY No. 68/KEP/2023). The existence of this museum is intimately connected to the historical legacy of the Kalang people in Kotagede, which has been recognised since the era of Sultan Agung. The Kalang people were distinguished for their proficiency in jewellery workmanship, carpentry (undagi), lending, and serving vital functions in local civilisation, and were frequently entrusted by the Palace with the role of royal jewellery designers. Their cultural and social identity is manifested in their domestic architecture, which integrates elements of Javanese and Indisch traditions.

4.1.2 Spatial Function Transformation

Figure 2 shows that the unique characteristic configuration of a symmetrical linear axis running from north to south remained unchanged. The linear axis represents a hierarchical space that transitions from private to public areas. The spiritual space in the centre of the house, known as a ndalem, is preserved and utilised for various activities that meet the museum's needs (see Table 1).

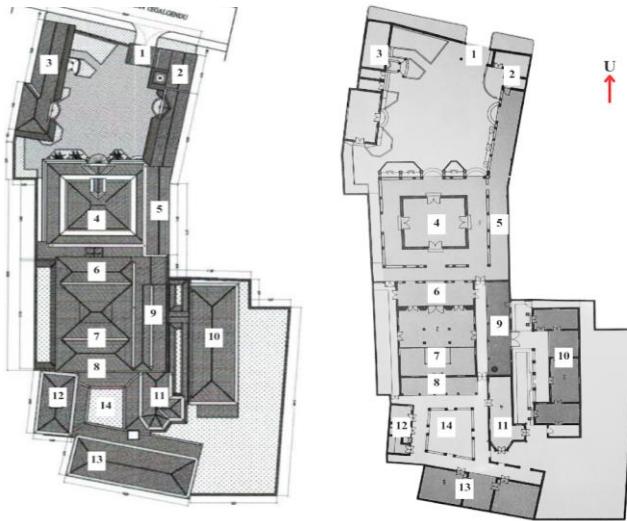


Fig. 2. Floor Plan as a House (left) and as a Museum (right)
(Source: Yogyakarta Department of Culture, 2016–2024)

Table 1: Spatial Function Transformation of Museum Kotagede

No.	Original Residential Function	Current Museum Function
1	Regol: gate and entrance barrier	maintained original function
2	Gandhok tengen depan: storage area	Temporary activity area
3	Gandhok kiwo depan: storage area	Unused
4	Pendhapa: guest reception, open space	Temporary activity area
5	Tratag pendhapa: public transition space	
6	Pringgitan: transition from public to private areas	
7	Ndalem: private family area with sleeping quarters and sacred space	
8	Gadri: dining room	Exhibition area
9	Tratag tengen Ndalem: transition space	
10	Gandhok tengen: service area	
11	Gandhok tengen mburi: service area	
12	Pekiwan: bathroom facilities	Temporary activity area
13	Gandhok mburi: rear building	Exhibition area
14	Bunker: a unique addition not typical of traditional Javanese houses	Preserved as a historical artefact

(Source: Author Documentation)

4.2 Case Study 2: Kalang Houses Ndalem Natan-Prayodranan

4.2.1 Original Function

Ndalem Natan, The Royal Heritage and Natan Art Space, was established by Prayodranan, a merchant of the Kalang ethnicity, in 1857 in Kotagede, located explicitly at Jalan Mondorakan No. 5, RT 07 RW 34, Prenggan, Kotagede, Yogyakarta. During that period, the local populace recognised him as Ndalem Prayodranan. During the 1960s, Ndalem Natan-Prayodranan functioned as a residence and a site for artistic, cultural, and religious events. In the 1990s, the proprietor, Mr Muslim Anwar, started commercializing this building by leasing it for guest accommodations, shows, and weddings. In 2006, a significant earthquake in Yogyakarta caused extensive damage to the house, rendering it unusable. In 2010, the residence was sold and transferred to new proprietors. Mr Nasir Tamara was the final proprietor and, in 2012, commenced the transformation of Natan's ndalem from a residential structure into a commercial edifice for guesthouses, galleries, and a cultural centre in Kotagede. Since 2019, Ndalem Natan-Prayodranan has been recognised as a cultural heritage building by the Mayor/Regent's Decree, Kepwal Number 205 of 2019. Ndalem Natan-Prayodranan exemplifies a traditional Kalang house, featuring Corinthian-Roman columns reminiscent of traditional Javanese architecture. It incorporates vibrant stained glass, typically limited to a small area and affixed to the frame, patterned tiles for flooring and lower wall cladding, and expansive doors and windows (Widianingtias et al., 2020).

4.2.2 Spatial Function Transformation

The spatial concepts of Kalang houses, a unique Javanese house characterised by a symmetrical linear axis running from north to south, have transformed into the Ndalem Natan-Prayodranan. The linear axis represents a hierarchical space, progressing from public to private to service, which is preserved (see Fig. 3). Spiritual spaces in the middle of the house are called senthong; they have not been altered, only some of their functions have changed to serve as a guest house and gallery (see Table 2).



Fig. 3: Floor Plan as a House (left) and as a Ndalem Natan (right)

(Source: Author documentation)

Table 2: Spatial Function Transformation of Ndalem Natan

No.	Original Residential Function	Current Commercial Function
1	Regol: gate and entrance barrier	maintained original function
2	Gandhok tengen: bedroom	Bedroom, guest house, and a batik and art gallery
3	Gandhok kiwo: bedroom	Bedroom-Guest house, gallery (art space and merchandise), and Cafe
4	Pendhapa: open space	Lobby, living room
5	Pringgitan: transition from public to private areas	Dining room - restaurant
6	Ndalem: private family area with sleeping quarters and sacred space (senthong)	maintained original function
7	Gadri: dining room	Dining room - restaurant
8	Tratag Ndalem: transition space	Lounge
9	Pawon: service area	Bedroom, guest house, and kitchen
10	Teras (open space)	maintained original function
11	Pekiwan: bathroom facilities	Bedroom-Guest house

(Source: Author Documentation)

4.3 Physical Character Analysis

Table 3: Physical Character Preservation Analysis of Museum Kotagede and Ndalem Natan

Aspect	Original Condition	Current Condition	
		Museum Kotagede	Ndalem Natan
Building Structure	Pendhapa – atap Kampung Gandok Kiwa, Gandok Tengen – Atap Limasan	Structure maintained	
Materials	Teak wood pillars and roof frame, plain red brick walls	Original materials retained; protective coatings applied	
Flooring	Colonial-style patterned key	Preserved, cleaned, and an anti-slip coating applied	
Ornamentation	Traditional Kalang carvings on pillars, door frames, and ventilation	Unchanged; interpretive labels added	
Spatial Layout	Symmetrically oriented with a north-south linear axis, the zoning ranges from public to private zones.	Maintained; functions adapted.	
Ventilation	Natural ventilation through wooden grilles and window openings	Preserved	
Lighting	Reliance on natural daylight	Artificial lighting	

(Source: Author Documentation)

5.0 Discussion

5.1 Heritage Values Assessment

5.1.1 Tangible Values on Architectural and Contextual Aspects:

This historic residence of the Kalang people is an example of heritage protection that has been transformed into a cultural museum, a Guest House, and a Gallery. Table 3 shows that the original teak wood frame and the unique decorative carvings of Kalang have been

carefully preserved, serving as essential architectural components and cultural artefacts that showcase the traditional craftsmanship of the era's high-art buildings. The museum's five thematic collections—archaeological artefacts, traditional technology, performing arts, customs and daily life, and social movements—are cohesively combined within the framework of original architecture. This configuration fosters an organic dialogue between the building's historical essence and its contemporary cultural purpose, enabling visitors to engage with the building and the narrative it conveys today. The conservation strategy emphasises minor, reversible modifications that respect the building's original character while accommodating its modern use. All alterations are intended to restore the building to its original state while preserving its unique architectural characteristics and ornamental details. This method involves adapting old buildings for contemporary functions while preserving their authenticity. This structure exemplifies the harmonious coexistence between heritage conservation and functional adaptation, building a sustainable paradigm for maintaining cultural identity while meeting the needs of modern society.

5.1.2 Intangible Values on Documentary, Historic, Economic, and Cultural Aspects:

This Kalang House in Kotagede can be a remarkable example of transforming from a private family residence into a vital community cultural institution, expanding its narrative from personal history to collective memory. This transformation meticulously preserves the building's original spatial concepts and traditional hierarchies, guiding the visitor's experience and interpretation. The idea of spatial relationships between public and private areas, ceremonial and individual activities in different rooms, and the social logic embedded in Javanese-Kalang architecture becomes a source of information and experience for visitors as they move through the space and come to understand it. This approach enables the building's layout to serve as a showroom and learning medium, teaching visitors about Javanese society's spiritual and social dynamics through hands-on spatial experiences. As a cultural centre, museums become living archives that preserve the objects and the knowledge systems that underpin them. Traditional craftsmanship techniques, cultural practices, and craft skills that may have been lost can be learned and preserved in these buildings. This building serves as a container and context for this knowledge, where the architecture itself embodies the tradition of high art in the Kalang building. This transformation demonstrates how heritage buildings can showcase their culture while preserving their authentic character, creating a sustainable bridge between the past and the present.

5.1.3 Intangible Values on Symbolic Meaning Aspects:

Rumah Kalang, in its time, was a symbol of the representation and cultural identity of a group of wealthy individuals, including traders and artisans who worked with gold or silver and owned property in the Kotagede area. However, there is a shift in the symbol of social status and wealth identity from the Kalang people to the communal heritage and cultural preservation of the people in the Kotagede area. The transition from a private family home to a public cultural institution marked a shift in historical preservation practices. This practice is a testament to the owner's achievements and a demonstration of the collective cultural contribution of the Kalang people in the modern era. This transition ensures that future generations can enjoy the preservation of traditional buildings, social behaviours, and historical narratives. The decorative elements are preserved in their original splendour, serving as clues to the era's economic prosperity, artistic patronage, and social framework. The decorative elements illustrate how symbolic prosperity and cultural sophistication can be maintained to give modern audiences insights into economic sustainability, tourism, cultural preservation, and communal identity.

5.2 District Needs Assessment

The conversion of the building into a museum and Ndalem Natan-Proyodranan Kotagede has met the requirements of essential district needs as follows: 1) Cultural education offers a public venue representing Kotagede's history and Kalang heritage; 2) Tourism development promotes cultural tourism of genuine Kotagede heritage experiences; 3) Community identity introduces local culture of Kalang's traditions; 4) Economic sustainability facilitates local economy via cultural tourism and other endeavours.

5.3 Comparative Analysis

Learning from the two case studies of the Kalang Kotagede houses, the adaptive reuse solutions are beneficial for cultural preservation and meeting the demands of modern life. Some of the similarities in problem-solving applied are 1) both of the cases maintain the spatial hierarchy and concept of traditional Javanese houses and accommodate new functions; 2) keeping the shape and construction of Javanese buildings, Joglo and limasan, space-forming elements, ornaments, and original materials and minimising additional construction except for reinforcement; 3) preserving cultural practices and group identity as the centre of Kotagede's culture; 4) and providing the possibility to restore this function in the future. Meanwhile, the fundamental difference lies in the transformation of function and management of the two buildings. Adaptive reuse at the Kotagede Museum prioritises public education, tourism, and culture, which are managed by the local government. Instead, Ndalem Natan prioritises building a structure that supports tourism and communal identity and is managed by private individuals.

5.4 Effectiveness of the Misirlisoy and Günce Framework

The case study of the Kalang Kotagede house is an example of successful heritage conservation in Indonesia. The support aspect is the Regional Government's policy in Yogyakarta, which endorses the development of cultural heritage areas that are adaptive to change by designating selected buildings as cultural heritage buildings. The involvement of local communities in heritage conservation decision-making benefits both the community and the local government. Heritage conservation requires specialised expertise and adherence to

specific requirements when renovating cultural heritage buildings—the economic and tourism potential interests the government and local communities in conserving heritage areas.

6.0 Conclusion and Recommendations

This research demonstrates that adaptive reuse strategies successfully transformed Museum Kotagede and Ndalem Natang-Proyodranan while preserving their essential heritage values. The new role, as a museum and commercial space (guest house and gallery), remains in harmony with the cultural values of Javanese-Kalang and the local community. Building conservation techniques demonstrate that the methods and materials employed do not violate building conservation standards. Adaptive reuse methods preserve Kalang houses, which are integral to sustainable urban development, extend the buildings' lifespans, boost tourism, and preserve the culture and identity of the people in Kotagede, Yogyakarta.

This research primarily analysed physical and functional aspects through archival and observational methods. The systematic collection of stakeholder perspectives (local residents, heritage visitors, business operators, and conservation authorities) was limited, potentially overlooking important social and experiential dimensions. Future research should investigate the long-term feasibility of adaptive reuse initiatives, which compare 10 -15 Kalang houses at 5-year intervals, complete the data of structural condition reports, maintenance records, surveys related to visitor and stakeholder satisfactions and functional changes, and provide recommendations for preserving and adapting traditional Indonesian architecture. A comparative analysis with similar historical conservation initiatives in Southeast Asia can yield significant insights for regional heritage preservation methodologies. This method is suitable for analysing heritage conservation that aligns with preservation demands in the modern era, thereby promoting sustainable urban growth and cultural sustainability.

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Paper Contribution to the Related Field of Study

The results of this study validate the applicability of the Misirlisoy and Günce framework in the Indonesian cultural context and documenting successful adaptive reuse strategies specific to Kalang architectural heritage.

References

Aigwi, I. E., Egbelakin, T., & Ingham, J. (2018). Efficacy of adaptive reuse for the redevelopment of underutilised historical buildings. *International Journal of Building Pathology and Adaptation*, 36(4), 385-407. <https://doi.org/10.1108/ijbpa-01-2018-0007>

Bullen, P. A. and Love, P. E. (2010). The rhetoric of adaptive reuse or reality of demolition: views from the field. *Cities*, 27(4), 215-224. <https://doi.org/10.1016/j.cities.2009.12.005>

Bernardi, E., Carlucci, S., Cornaro, C., & Bohne, R. A. (2017). An Analysis of the Most Adopted Rating Systems for Assessing the Environmental Impact of Buildings. *Sustainability*, 9(7), 1226. <https://doi.org/10.3390/su9071226>

Bottero, M., D'Alpaos, C., & Oppio, A. (2019). Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. *Sustainability*, 11(3), 785. <https://doi.org/10.3390/su11030785>

Carey, P. (2008). *The Power of Prophecy: Prince Diponegara and the End of an Old Order in Java, 1785-1855*. KITLV Press.

Foster, G. (2020). Circular economy strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts. *Resources, Conservation and Recycling*, 152, 104507. <https://doi.org/10.1016/j.resconrec.2019.104507>

Kahvecioğlu, B. and Selçuk, S. A. (2023). Adaptive reuse in the realm of architecture: global research trends and gaps for the future studies. *Sustainability*, 15(13), 9971. <https://doi.org/10.3390/su15139971>

Keputusan Gubernur DIY No. 68/KEP/2023. (2023). Penetapan Museum Kotagede sebagai Cagar Budaya. Yogyakarta: Pemerintah Daerah Istimewa Yogyakarta.

Li, Y., Zhao, L., Huang, J., & Law, A. (2021). Research frameworks, methodologies, and assessment methods concerning the adaptive reuse of architectural heritage: a review. *Built Heritage*, 5(1). <https://doi.org/10.1186/s43238-021-00025-x>

Misirlisoy, D. and Günce, K. (2016). Adaptive reuse strategies for heritage buildings: a holistic approach. *Sustainable Cities and Society*, 26, 91-98. <https://doi.org/10.1016/j.scs.2016.05.017>

Nocca, F. (2017). The Role of Cultural Heritage in Sustainable Development: Multidimensional Indicators as Decision-Making Tool. *Sustainability*, 9(10), 1882. <https://doi.org/10.3390/su9101882>

Plevoets, B. and Cleempoel, K. V. (2019). *Adaptive reuse of the built heritage*. London: Routledge. <https://doi.org/10.4324/9781315161440>

Rodrigues, C., & Freire, F. (2017). Adaptive reuse of buildings: Eco-efficiency assessment of retrofit strategies for alternative uses of a historic building. *Journal of Cleaner Production*, 157, 94–105. <https://doi.org/10.1016/j.jclepro.2017.04.104>

Sholahuddin, M. (2024). Interiority Study: Quality of interior rental flats desired by low-income communities in urban areas. *Environment-Behaviour Proceedings Journal*, 9(SI23), 249–255. <https://doi.org/10.21834/e-bpj.v9iSI23.6171>

Widianingtias, M, Pramudito, S, dan Cahyandari, G.O.I. (2020). Identifikasi unsur-unsur arsitektural rumah kalang di Kotagede Yogyakarta. *ARTEKS : Jurnal Teknik Arsitektur*, Volume 5 Issue 1 April : 39-52. doi: <http://doi.org/10.30822/arteks.v5i1.85>

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.