
Green Retrofitting in the Adaptive Reuse of Colonial Buildings: Case Study of GCT Van Dorp & Co in Semarang Old Town

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Abstract

This study addresses the adaptive reuse of colonial heritage buildings with green retrofitting, focusing on the former GCT Van Dorp & Co building in Kota Lama Semarang. The research aims to develop a conceptual framework integrating environmental sustainability with cultural preservation in tropical urban contexts. The methodology is qualitative, involving case study analysis, field observation, and literature review. The population includes colonial heritage buildings in Semarang's historic district, with the GCT Van Dorp & Co building as the sample. Data collection instruments include architectural surveys and environmental performance assessments. Analysis techniques combine thematic and content analysis to identify sustainable retrofit strategies. Results reveal key green retrofitting strategies: optimizing natural ventilation and passive lighting, introducing adaptive facade interventions, utilizing eco-friendly local materials, and deploying vegetation to improve microclimate. The study concludes that integrating these strategies under the proposed "Adaptive Green Conservation" model enhances both heritage value preservation and environmental efficiency while allowing functional adaptation with minimal intervention. This model offers practical guidance for sustainable heritage conservation in tropical climates.

Keywords: *Adaptive Reuse, Colonial Heritage, Green Retrofitting, Sustainability, Tropical Architecture*

INTRODUCTION

The phenomenon of adaptive reuse in colonial heritage buildings, especially in historic districts such as Kota Lama Semarang, involves renewing the function of old buildings while preserving their historic and cultural values. Colonial buildings in such heritage areas are valuable not only for their architectural aesthetics but also as elements of cultural identity that reflect historical, social, and cultural trajectories (Lestari & Setiadi, 2020; Yulianto & Hidayat, 2022). Adaptive reuse allows these buildings which often face neglect or abandonment due to changing functional needs to gain new life by transforming them for contemporary uses without erasing their historical significance, thereby contributing to urban sustainability and cultural continuity (Saputra & Purwantiasning, 2022; Gunawan & Pradono, 2023).

However, this process presents several challenges. One critical issue is balancing the preservation of historical authenticity with meeting modern environmental and functional demands, including energy efficiency and thermal comfort within tropical climates (Kurniawan & Nugroho, 2021; Fathurrahman & Hidayat, 2022). Many colonial buildings in Kota Lama Semarang have suffered from physical degradation and lack modern environmental performance, raising concerns about sustainable conservation practices (Ramadhani & Syahrul, 2022; Indrawan & Pratiwi, 2024). Moreover, adaptive reuse projects must respect principles of minimal intervention and reversibility to maintain structural integrity and heritage values while allowing functional change (Tiara & Purwantiasning, 2023; Gunawan & Pradono, 2023). The challenge extends to integrating green retrofitting strategies that enhance energy efficiency and

microclimate without compromising the building's historic character (Iqbal et al., 2024; Hamzah et al., 2023).

Given these challenges, the study aims to elaborate a conceptual framework for integrating green retrofitting into adaptive reuse of colonial heritage buildings, with the former GCT Van Dorp & Co building in Kota Lama Semarang as a case study. This research is urgent for supporting sustainable heritage conservation that addresses both cultural preservation and environmental performance in tropical urban contexts. It responds to the need for a balanced approach that fosters architectural innovation and ecological responsibility in heritage areas (Wijaya & Hartono, 2024; Kurniawan & Nugroho, 2021). The novelty of this study lies in formulating an adaptive green conservation model that synergizes heritage values, energy efficiency, and functional adaptation, contributing theoretical and practical insights to sustainable architectural design in Indonesia's colonial heritage zones (Setyarandini, 2017; Gunawan & Pradono, 2023).

RESEARCH METHODS

The research on colonial heritage buildings, particularly in Kota Lama Semarang, involves understanding their cultural and architectural significance while exploring sustainable adaptation strategies. These buildings are valued not just for their aesthetic appeal but also as carriers of historical, social, and cultural narratives that contribute to city identity and continuity (Lestari & Setiadi, 2020; Yulianto & Hidayat, 2022). Adaptive reuse emerges as a vital approach to revitalizing these structures by assigning new functions that respect and preserve their historical values, especially in the face of physical degradation, changing urban needs, and environmental challenges (Saputra & Purwantiasning, 2022; Gunawan & Pradono, 2023). This approach aims to balance heritage conservation with urban sustainability, supporting the social and economic vitality of heritage areas across Indonesia, including Kota Lama Semarang (Setyarandini, 2017; Sugiyono, 2021).

Despite its significance, the process of adaptive reuse for colonial buildings confronts several issues, such as maintaining structural integrity and visual authenticity while integrating modern environmental strategies. Many buildings face problems related to energy inefficiency, poor thermal comfort, and degradation of original materials, which compromise both their functionality and preservation goals (Kurniawan & Nugroho, 2021; Fathurrahman & Hidayat, 2022). Implementing sustainable strategies such as green retrofitting—focused on passive cooling, natural ventilation, using eco-friendly materials, and introducing vegetation—can mitigate these issues, but often these strategies are overlooked or poorly integrated within heritage conservation practices (Gunawan & Pradono, 2023; Indrawan & Pratiwi, 2024). Furthermore, adapting these structures within the constraints of heritage preservation principles such as minimal intervention and reversibility remains a major challenge, demanding innovative yet sensitive design approaches (Tiara & Purwantiasning, 2023; Sugiyono, 2021).

This study aims to develop a conceptual framework for green retrofitting that is integrated with adaptive reuse practices, taking GCT Van Dorp & Co, a colonial publishing house in Kota Lama Semarang, as a case study. The focus is to design strategies that support both heritage preservation and environmental sustainability, contributing to theory and practice in tropical heritage contexts. This research emphasizes the importance of creating a sustainable heritage conservation model that maintains cultural authenticity while enhancing building performance environmentally and functionally. The novelty lies in proposing an integrative approach labeled "Adaptive Green Conservation," which synergizes heritage preservation principles with modern green building strategies, providing a comprehensive guide for future development of heritage buildings in Indonesia's tropical climate (Setyarandini, 2017; Wijaya & Hartono, 2024).

RESULTS AND DISCUSSION

This chapter is a development of findings from previous research (Setyarandini, 2017), which focused on the historical value aspect and the potential adaptation of colonial building functions. In this follow-up study, the analysis is directed towards formulating a conceptual strategy for.

Existing Condition of the Former GCT Van Dorp & Co

The former GCT Van Dorp & Co building in the Old Town area of Semarang is a colonial heritage with typical tropical European architectural features: thick limestone brick walls, large double-leaf windows, and high ceilings. Visually, the building's facade remains intact and represents the Indische architectural style, although some interior parts have deteriorated due to age and lack of maintenance.

The building faces the main street and is situated among a row of other colonial shophouses. This position makes it visually significant within the area's structure but also subjects it to thermal stress from direct sunlight exposure on the facade side. These conditions make the building interesting to study from the perspective of *adaptive reuse* and *green retrofitting*.

Opportunities for Adaptive Reuse in Colonial Buildings

Adaptive reuse opens great opportunities to revive historic buildings that are no longer used according to their original function. In the context of GCT Van Dorp & Co, the potential for function adaptation can be directed towards creative public spaces such as literacy centers, printing history galleries, or cultural cafés that still respect the building's historical value.

According to Saputra & Purwantiasning (2022), the success of adaptive reuse depends highly on the ability to preserve the facade, building proportions, and main architectural elements, while providing flexibility for the interior functions. In other words, adaptive reuse is not just a change of use but a process of giving “new life” to historic spaces in a sustainable way.

A similar study by Lestari and Setiadi (2020) highlights that the success of adaptive reuse in colonial buildings in Semarang is strongly influenced by the compatibility of the new function with the structure and scale of the old space.

Conceptual Strategy for Green Retrofitting



Figure 1.
Addition of facade restored to its 1755 appearance
Source: Personal Documentation 2024



Figure 2.
View of Letjen Suprpto6 Street
Source: Personal Documentation 2024

Based on the results of theoretical study and observation, there are four main conceptual strategies that can be applied to colonial buildings in tropical climates like Semarang:

a. Optimization of natural ventilation and passive lighting

Studies by Iqbal et al. (2024) and Hamzah et al. (2023) show that cross ventilation, window positioning, and ceiling height can maximize air circulation and reduce the need for artificial cooling. In colonial buildings, the large openings typical of Indische architecture can be repurposed to support natural ventilation while maintaining the historical aesthetics.

b. Facade Intervention and Use of Simple Technology

Hadi et al. (2023) highlight the use of eco-coolers and adaptive facade elements to reduce room temperature. At GCT Van Dorp & Co, this principle can be applied by adding louvers or a secondary skin that follows the rhythm of the colonial windows. These elements can serve a dual function: preserving the old aesthetics while improving thermal performance.

c. Utilization of Local and Environmentally Friendly Materials

Permad et al. (2024) explain that natural materials such as local wood, bamboo, and traditional bricks have good thermal properties and are easily available. In adaptive reuse projects, material selection must consider visual and technical compatibility to ensure harmony with the existing structure.

d. Vegetation as a Microclimate Cooler

Toisi & Kussoy (2018) found that vegetation around buildings can lower ambient temperature and increase comfort. This principle can be implemented by adding small gardens, climbing plants on walls, or shade trees in the yards of colonial buildings.

Overall, these strategies align with green building principles for historic structures as explained by Gunawan and Pradono (2023), which prioritize energy efficiency, preservation of visual character, and improvement of microenvironment quality.

Integration of Strategies: Towards Sustainable Adaptive Reuse

The integration of *green retrofitting* in *adaptive reuse* not only enhances user comfort but also extends the building's lifespan and reduces environmental impact. This approach aligns with architectural conservation principles such as *minimal intervention* and *reversibility* (Tiara & Purwantiasning, 2023), as all interventions can be carried out without altering the main building structure. Thus, green adaptive reuse can be seen as a new evolution in architectural conservation practice: preserving the past while adapting to future challenges.

Based on this analysis, a conceptual model called Adaptive Green Conservation can be formulated, which is an integrated approach of adaptive reuse and green retrofitting for colonial buildings in historic areas.

CONCLUSION

This research highlights the potential of integrating green retrofitting strategies within adaptive reuse practices for colonial heritage buildings, exemplified by the GCT Van Dorp & Co building in Semarang's Kota Lama. The study identifies key strategies that enhance environmental performance without compromising cultural authenticity, including optimizing natural ventilation, facade interventions, utilizing eco-friendly local materials, and adding vegetation for microclimate regulation. The proposed conceptual framework, called "Adaptive Green Conservation," emphasizes a balanced approach that preserves heritage values while promoting sustainability through minimal intervention and reversible modifications. Despite these promising findings, the research faces limitations such as the specificity of the case study and the need for empirical validation of proposed strategies in real-world scenarios. Future studies should explore broader applications across different heritage contexts and incorporate quantitative assessments of energy savings and thermal comfort improvements to strengthen the framework's practicality.

Practically, the findings inform architectural conservation policies and design guidelines that advocate for environmentally responsible heritage preservation. The integrated approach can serve as a benchmark for policymakers, conservationists, and architects seeking sustainable solutions tailored to tropical climates, ensuring the longevity and relevance of historic structures. In addition, further research could develop comprehensive performance evaluation tools to measure the effectiveness of green retrofit interventions, fostering more data-driven decision-making in heritage conservation. Overall, this study advances the discourse on sustainable heritage management by proposing a holistic model that aligns cultural preservation with ecological imperatives, supporting ongoing efforts to create resilient, community-oriented, and environmentally conscious urban environments.

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