

Adaptive Future of Abandoned Dutch Colonial-Era Sugar Factories in Java

Endy Yudho Prasetyo

Delft University of Technology, Delft, The Netherlands, e.y.prasetyo@tudelft.nl

Abstract

After reaching its peak in the 1930s, the Dutch-modernized sugar industry in Java declined, leading to the abandonment of numerous factories. Of an estimated 231 factories constructed between the 1830s and 1950s, only 45 remained operational, while the rest had been repurposed, demolished, or abandoned. Their legacy, though rooted in colonial exploitation, is also intertwined with local histories of livelihood and attachment, where these complexes once served as socio-economic anchors that shaped Java's landscapes and communities. This study investigates the potential for adaptive reuse of these abandoned sites, repositioning them as active agents of cultural memory, community revitalisation, and sustainable urban futures rather than as passive remnants of colonial industry. Through a combination of literature and archival research, as well as field surveys, the study examines how the architectural, spatial, locational, and social characteristics of these sites reveal potential for transformation. The findings reveal that viewing these factories through an architectural lens, rather than a purely historical one, exposes their latent capacity for reuse, which is grounded in their scale, spatial adaptability, strategic location, and enduring community ties.

Keywords: Adaptive Reuse, Dutch Colonial-era Sugar Factories, Industrial Heritage.

Introduction

Thirty years after the decline of the VOC (*Vereenigde Oost-Indische Compagnie* or Dutch East India Company) and the establishment of direct colonial rule in 1800 (Kurniawan 2014), Dutch administrators sought new strategies to address the country's financial crisis caused by costly wars (Fasseur et al. 1994). To extract profit from the colony, the Dutch government introduced a new system, the Cultivation System (*bet Cultuurstelsel*), in 1830 (Tegegn and Dhont 2023). It required the indigenous people to pay taxes in agricultural goods rather than money (Sambas et al. 2024). Among these goods, sugar was particularly significant (Fasseur et al. 1994). The system transformed sugar into a major export commodity and a central driver of colonial revenue, leading to the establishment of numerous factories across Java (Dell and Olken 2018).

Between 1800 and the 1950s, an estimated 231 factories were built (Nugroho 2020). Broader political and economic events shaped the trajectory of Dutch colonial-era sugar factories in Java. Rapid expansion under the Cultivation System and the Agrarian and Sugar Laws of 1870 (Tegegn and Dhont 2023), contraction during the Great Depression (Gordon 1999), disruption in the Second World War (Tegegn and Dhont 2023), and finally, transformation

under Indonesian nationalisation after 1957 (Knight 2000). Since then, the industry has continued to decline due to outdated infrastructure and changing policies; by 2019, only 45 factories remained operational (Nugroho 2020).

Based on fieldwork observations, Dutch colonial-era sugar factories in Java exist in varying conditions, ranging from sites that are no longer traceable to those that remain operational. In addition, several factories have been successfully repurposed, while many others remain abandoned, leaving extensive spatial, material, and cultural assets at risk of loss. As examples of adaptive reuse begin to emerge, it becomes increasingly important to understand what makes these sites capable of transformation, as such reuse may represent the most promising future for these abandoned factories. This study, therefore, asks: What architectural potentials of the abandoned Dutch colonial-era sugar factories in Java enable their adaptive reuse as a future direction?

Research Background & Methods

Historical industrial buildings and complexes have gained worldwide attention as candidates for adaptive reuse in recent decades. Scholarship in industrial-heritage transformation has demonstrated that such sites carry spatial, cultural, and environmental value that can be activated through new programs (Plevoets and Cleempoel 2019; Oevermann 2019). Furthermore, heritage buildings are increasingly seen as drivers of economic, cultural, and environmental sustainability through adaptive reuse efforts despite ongoing conservation–development tensions (Bullen and Love 2011). Notable precedents include the Tate Modern in London (2000), the Songshan Cultural and Creative Park in Taipei (2011), and the LocHal cultural center in Tilburg (2019). More recently, the Belval campus in Luxembourg (2015) demonstrates how entire industrial districts can be reimagined for education, research, and culture.

In Java, only a few Dutch colonial-era sugar factories have undergone adaptive reuse, such as the De Tjolomadoe Cultural Heritage Complex in Karanganyar (2017), the Banjaratma Rest Area in Brebes (2017), and the Heritage Palace in Solo (2018). Beyond these, only a few initiatives have materialized, leaving most sites abandoned despite their comparable potential to international precedents where similar structures have generated cultural and urban value. These examples reveal the inherent adaptability of the factories' architecture. Their robust structures and spacious configurations offer the capacity to host new programmes while retaining their historical character. Although the potential of many sites remains untested, their architectural and historical significance suggests that abandoned Dutch colonial-era sugar factories in Java deserve renewed attention.

This study examines these architectural potentials through archival research, literature review, and fieldwork documentation. The archival investigation, conducted primarily in the Netherlands, consulted two primary sources: the Leiden University Library, which holds the Royal Netherlands Institute of Southeast Asian and Caribbean Studies (KITLV) collections, and the National Archives in The Hague. The materials include maps, technical drawings, production records, and historical photographs, providing insight into the spatial and structural context of the factories. The literature study drew on materials from the TU Delft and Leiden University libraries, as well as selected online repositories, to provide complementary information on the industrial and technical background of the sugar industry.

Fieldwork was conducted to assess the present architectural condition and spatial organization of twenty-three factories across Java. Documentation included photographs, sketches, and field notes, supported by photogrammetry using smartphones, cameras, and drones to produce accurate and cost-effective 3D digital models of the sites.

Historical & Architectural Context

The introduction of the Cultivation System in 1830 marked a turning point for Java's sugar industry (Knight 2000). The industry had developed under Chinese influence (Tegegn and Dhont 2023) but was expanded by the Dutch into a state-controlled enterprise oriented toward export (Fasseur et al. 1994). By the mid-nineteenth century, liberal opposition in the Netherlands had criticized forced cultivation and state control (Fasseur et al. 1994). The criticism led to the enactment of the Agrarian Law (*Agrarische Wet*) and the Sugar Law (*Suikerwet*) in 1870, which abolished the Cultivation System and opened the sector to private and foreign investment (Tegegn and Dhont 2023).

Between 1880 and 1930, the sugar industry experienced rapid expansion (Knight 2013). At its peak in the 1930s, Java was the second-largest sugar exporter after Cuba (Knight 2013), deeply embedding the industry in the island's economy and built environment (Gordon 1999). The factories were designed to maximize production efficiency through large-scale architecture and integrated spatial organization (Wasino et al. 2019).

Based on fieldwork observations, Dutch colonial-era sugar factory complexes were characterized by a main production hall that housed most of the manufacturing process,



Fig. 1. Sugar Factory's position in Java and the railway connection 1910 (KITLV - <http://hdl.handle.net/1887.1/item:2012669>) ("Kaart Der Suikerfabrieken, Spoor- En Tramwegen van Java En Madoera | Digital Collections," n.d.)

with tall chimneys for boiler ventilation. Additional buildings contained supplementary machinery, storage, and infrastructure for water management and transport, often connected to regional rail networks.

Structurally, the main production halls employed modular metal trusses and columns to achieve wide, unobstructed spans for machinery and workflow, qualities that now offer flexibility for adaptation. The halls were typically covered with metal roofing incorporating clerestories for daylight and ventilation. In smaller buildings, including housing and workshops, roofs were supported by wooden framing. Brick masonry was used extensively for perimeter walls, façades, and chimneys, and was occasionally combined with metal framing and cladding, depending on function and scale.

The Dutch colonial-era sugar factories in Java were closely integrated with their surroundings (Knight 2013) through proximity to agricultural land, irrigation systems (Daniels 1996), and rail networks (Fig. 1). Each factory operated within a designated procurement zone connected to nearby villages and fields (Bosma and Knight 2004). Extensive irrigation infrastructure, including canals and reservoirs, ensured a steady water supply (Daniels 1996), while narrow-gauge railways linked the factories to major ports such as Surabaya and Semarang (Knight 2013). This integration between production facilities and landscape generated distinctive spatial relationships that continue to define the architectural setting of these complexes.

Current Condition of the Factories

At its peak during the colonial period, Java’s sugar industry formed one of the world’s most extensive networks of industrial complexes (Galloway 2005). It was distributed across the island with density increasing toward the east, where cultivation made expansion more favourable (Fasseur et al. 1994). Over time, the number of active factories sharply declined, and only a small fraction of these once numerous complexes remains in operation (Tegegn and Dhont 2023). Based on fieldwork observations, the Dutch colonial-era sugar factories in Java can be classified into four categories, as summarized in the table below.

Category	Description	Examples Sugar Factories (SF)
Ruin / Blended	Much of the original structure has disappeared or merged with newer constructions but remains traceable through ruins or fragments in the landscape.	Tanjoengsari SF, Rogojampi SF, Gumuh SF, Gempol SF
Abandoned	Retain major buildings and site boundaries but stand without maintenance or active use.	Watoetoelis SF, De Maas SF, Tasikmadoe SF, Tjepet SF, Gondang Winangoen SF, Bangak SF, Jatibarang SF, Soemberharjo SF, Kersana SF, Karangsoewoeng SF, Jatiwangi SF
Operational	Remain active, with industrial operations still taking place on site.	Pangkah SF
Reused / Adapted	Factories that have been fully or partially repurposed.	De Tjolomadoe SF, Banjaratma SF, Soekowidi SF, Bedadoeng SF, Tanjoengtirta SF

As illustrated by various stages of decay observed across sites during fieldwork, the

Table 1. Classification of Dutch Colonial-Era Sugar Factories in Java (Fieldwork Observation)

abandonment of these factories poses structural and cultural threats. Many have suffered vandalism and looting, with machinery components and building materials stripped for resale, as seen at De Maas, Tjepet (Fig. 2), and Jatiwangi, where the main production halls now stand empty, with original machinery removed. Others show progressive structural deterioration, with roofs collapsing, walls crumbling, and overgrown vegetation. This condition was observed at Kersana and Gempol, leading to the loss of historical fabric and authenticity.

Beyond physical risks, neglect of these complexes also means the loss of opportunities for social and spatial revitalisation. Before closure, factories such as Olean hosted cultural events during the milling season, a tradition once common among many sugar factories, strengthening community engagement and shared identity. Some sites have since seen local initiatives to repurpose remaining buildings, such as at De Maas, where parts of the former storage area have been adapted into a community sports hall, and at Tanjoengsari, where former workers' housing has been converted into residences. Although limited in scale, informally executed, and often lacking legal recognition, these efforts demonstrate that abandoned factory sites retain architectural and social value for their surrounding communities.

Findings

The following findings derive from archival, literature, and fieldwork investigations. The investigation reveals critical gaps in academic attention and opportunities embedded within the factories.

During the archival and literature investigation, it was difficult to obtain sources discussing the architectural aspects of the factories, such as spatial organisation, design intent, or material expression. Most references focus on history, the colonial sugar industry, its economic dimensions, and social impacts, regarding them as functional shells for industrial activity or artefacts of colonial history, with little attention to the building itself as an object of spatial and design inquiry. This tendency may reflect a broader perception of industrial buildings as purely utilitarian constructs, contributing to the lack of architectural interpretation and limited understanding of these factories as works of design.

While the literature shows limited engagement with the architectural dimension, on-site investigations reveal otherwise. Fieldwork and typological studies show that the factory's scale and spatial organisation offer potential for transformation. The factories' generous interior volumes, continuous spans, and modular construction, especially in the main



Fig. 2. Tjeper SF main production hall (Author's field survey, 2024)

production buildings (Fig. 2), were designed to accommodate the linear flow of machinery and materials. After production ceased and machinery was removed, these halls became open shells that no longer imposed the logic of the production line. On some sites,

fragments of equipment remain, suggesting potential to retain selected machinery to preserve the factories' industrial identity and spatial character. On others, complete removal maximises usable space. This calibration between preservation and clearance represents a possible strategy for future adaptation.

In addition to spatiality, the material condition of the factories plays a role in determining their adaptive potential. The persistence of these structures demonstrates the durability of their construction. Although many show deterioration, most masonry walls remain intact. Fieldwork also revealed that, in most sites, roofs have partially or fully collapsed, a condition that makes their preservation unfeasible for safety reasons. Nevertheless, with proper strategies, the remaining structures provide a strong foundation for rehabilitation.

Beyond internal spatial qualities, the factories' broader settings reinforce their relevance for reuse. Their positioning within the local and urban context contributes to their significance. As part of an integrated industrial network, their proximity to rail lines, roads, and irrigation paths that served logistical and production needs now situates them advantageously within expanding urban regions. These factories once stimulated the growth of surrounding neighbourhoods through workers' housing and supporting facilities, and many have since become anchors within the urban fabric, with settlements continuing to develop around them long after production ceased.

This physical and contextual significance is interrelated with a social dimension that shapes how these sites are perceived and used. The research highlights the factories' social and community associations. Even after abandonment, these sites hold collective memory for local communities. Field observations revealed that informal uses, such as markets, playgrounds, or gathering spaces, persist within or around abandoned compounds. Recognizing these social dimensions emphasizes that adaptive reuse will not only restore the physical structure but also reconnect communities with their historical landscapes, integrating memory and daily life.

Discussion

This study proposes a repositioning of Dutch colonial-era sugar factories in Java within architectural discourse. These factories have long been viewed as remnants of colonial industry, valued for their historical or economic significance but rarely for their architectural quality. It reframes their significance in spatial, structural, and material terms by approaching them as architectural objects rather than industrial relics. Their monumental scale, rational spatial order, and material endurance reveal a form of industrial architecture that, though born of exploitation, has outlived its system and now stands as a framework for contemporary use. The factories' spatial quality invites a broad spectrum of new programmes and the application of contemporary design tools and planning instruments that could test multiple scenarios before committing to fixed interventions. Introducing these tools clarifies how reuse can move beyond conceptual appreciation toward implementable transformation.

The findings highlight opportunities to align industrial heritage development with contemporary sustainability and social revitalisation agendas. Adaptive reuse of these complexes can extend the life cycle of existing structures, reduce material waste, and reconnect communities to spaces that once served as economic and social hubs. These factories may again serve as collective anchors, not static monuments of the past but adaptable frameworks for future use.

Despite their potential, efforts to adaptively reuse these factories face challenges. Partly, as mentioned, the lack of literature acknowledging them from a design perspective. In that regard, his study initiates and enriches that discussion by offering a structured reading of the factories as spatial and typological resources. This study unfolds the existing reality of the sites, providing a basis for more informed and balanced interventions by documenting and interpreting these conditions.

Conclusion

The study highlights the dual condition of Dutch colonial-era sugar factories in Java as historically significant yet critically endangered. Once central to the island's industrial and social landscape, these complexes now face decline, with most abandoned, improperly repurposed, or lost to redevelopment. Their deterioration reflects not only material decay but also conceptual neglect. This research underscores the need to recognise these factories as integral components of Indonesia's architectural heritage, deserving study and thoughtful transformation.

By situating the factories within the realm of architectural discourse, the study contributes to the growing field of industrial heritage in Indonesia while aligning it with global inquiry of adaptive reuse. It reframes them as architectural objects rather than historical artifacts. Through archival, literature, and fieldwork analysis, four key attributes are identified that define their continuing relevance: scale that enables flexible adaptation, material persistence, strategic location, and enduring community ties.

The findings call for an integrated approach to the future of these sites that bridges design, policy, and community engagement. Future research should further develop its architectural reading, building on the foundation of existing historical studies. Through architectural recognition and careful transformation, these structures can evolve from industrial remnants into active agents of Indonesia's architectural and cultural future.

Bibliography

- Bosma, Ulbe, and Roger Knight. "Global Factory and Local Field: Convergence and Divergence in the International Cane-Sugar Industry, 1850–1940." *International Review of Social History* 49 (1), 1–25, 2004.
- Bullen, Peter A., and Peter E.D. Love. "Adaptive Reuse of Heritage Buildings." *Structural Survey* 29 (5), 411–21, 2011.
- Daniels, Christian. "Agro-Industries: Sugarcane Technology." In *Science and Civilisation in China*, vol. 6. Cambridge: Cambridge University Press, 1996.
- Dell, Melissa, and Benjamin A. Olken. "The Development Effects of the Extractive Colonial Economy: The Dutch Cultivation System in Java". *The Review of Economic Studies* 87, 164–203, 2020.
- Fasseur, Cornelis, Ary Kraal, and R. E. Elson. *The Politics of Colonial Exploitation: Java, The Dutch, and the Cultivation System*. Edited by R. E. Elson. New York: Cornell University Press, 1994.
- Galloway, J. H. "The Modernization of Sugar Production in Southeast Asia, 1880-1940". *Geographical Review* 95, 1–23, 2005.
- Gordon, Alec. "The Agrarian Question in Colonial Java: Coercion and Colonial Capitalist Sugar Plantations, 1870–1941". *Journal of Peasant Studies* 27, 1–34, 1999.

- Kaart Der Suikerfabrieken, Spoor- En Tramwegen van Java En Madoera. Leiden: Universiteit Leiden Digital Collections, 1920 (ca.).
- Knight, G. Roger. "The Sugar Industry of Colonial Java and Its Global Trajectory". *Southeast Asia Research* 8, 213–238, 2000.
- Knight, G. Roger. *Commodities and Colonialism: The Story of Big Sugar in Indonesia, 1880-1942*. Leiden: Brill, 2013.
- Kurniawan, Hendra. "Dampak Sistem Tanam Paksa terhadap Dinamika Perekonomian Petani Jawa 1830-1870". *SOCLA: Jurnal Ilmu-Ilmu Sosial* 11, 155–167, 2014.
- Nugroho, Purwanto Setyo. "Identifikasi Pabrik Gula Sebagai Industrial Heritage Di Jawa". *ARSITEKTURA* 18, 119–130, 2020.
- Oevermann, Heike. "Good Practice for Industrial Heritage Sites: Systematization, Indicators, and Case". *Journal of Cultural Heritage Management and Sustainable Development* 10, 157–171, 2019.
- Plevoets, Bie, and Koenraad Van Cleempoel. *Adaptive Reuse of the Built Heritage: Concepts and Cases of an Emerging Discipline*. London: Routledge, 2019.
- Sambas, Rizki Fadilla, et al. "Kebijakan Antara Van Den Bosch Dengan Thomas Stamford Rafless". *AR-RUMMAN: Journal of Education and Learning Evaluation* 1, 169–172, 2024.
- Tegegn, Dagm Alemayehu, and Frank Dhont. "The Downhill Journey of the Java Sugar Economy in the Netherlands Indies (Later Indonesia) from the Late 19th Century to the Mid-20th Century". *Cogent Arts & Humanities* 10, 1–15, 2023.
- Wasino, Endah Sri Hartatik, and Nawiyanto. "From Royal Family-Based Ownership to State Business Management: Mangkunegara's Sugar Industry in Java from the Middle of the 19th to Early 20th Century". *Management & Organizational History* 14, 167–183, 2019.