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Heritage and identity: The vernacular transformation of De Tjolomadoe

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ABSTRACT

Background: This research paper focuses on the adaptive reuse of the De Tjolomadoe (Colomadu) heritage sugar factory within the field of vernacular architecture. **Methods:** Utilizing qualitative research methods such as in-depth interviews, site observations, and archival analysis, it examines the preservation of industrial heritage through its integration into vernacular architectural practices, yielding insights for sustainable development. **Findings:** The De Tjolomadoe factory, a prominent Indonesian historical and cultural landmark, serves as a compelling case study in adaptive reuse, offering significant findings. Firstly, it illustrates how adaptive reuse effectively preserves cultural identity by seamlessly blending vernacular design elements and traditional building techniques, thereby maintaining a strong connection to its historical and cultural heritage. Secondly, the De Tjolomadoe case exemplifies adaptive reuse as a sustainable development strategy. By utilizing local resources and adhering to vernacular construction methods, the project minimizes environmental impact while generating economic and social benefits for the community. Community engagement emerges as a crucial factor in the success of adaptive reuse projects, as actively involving local communities ensures the authenticity and relevance of such initiatives. Moreover, the transformation of the De Tjolomadoe factory into a cultural destination underscores its substantial economic impact on the region. Similar adaptive reuse projects have the potential to boost tourism, stimulate local economies, and preserve cultural heritage. **Conclusion:** The lessons drawn from the De Tjolomadoe case offer practical insights and principles guiding future adaptive reuse endeavours, emphasizing cultural preservation, sustainability, community participation, and economic viability. **Novelty/Originality of this article:** These findings contribute to the growing knowledge base on the adaptive reuse of industrial heritage sites within the context of vernacular architecture, inspiring and informing initiatives aimed at revitalizing our industrial heritage for future generations.

KEYWORDS: adaptive reuse; De Tjolomadoe; heritage; industrial sites.

1. Introduction

Vernacular architecture, characterized by its use of locally available resources and traditional building systems, holds significant value as a response to climate and a repository of knowledge and values for sustainable built environments (Lavaf-Pour & Meraz, 2023). It is rooted in the natural environment, fulfilling physical, economic, social, and cultural norms, and is a successful axiom in celebrating rituals and indigenous knowledge for enhancing community resilience against natural hazards (Elsayed et al., 2022). Furthermore, vernacular architecture is closely tied to the surrounding landscape, intangible assets, and the people, making it a crucial aspect of heritage and cultural preservation (Aktürk & Fluck, 2022). Using vernacular materials and construction

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techniques is also closely related to bioclimatic zones, emphasizing the relationship between vernacular architecture, locally sourced materials, and sustainable structures (Bottero et al., 2019).

The concept of *modern vernacular* is explored in a variety of contexts. Selvamony (2020) discusses its etymological roots, while Judd (2002) and Copeland (1987) delve into its historical and theoretical aspects. van Hattum (2012) and Fernández (2023) examine the evolution of vernacular languages, with the former focusing on Irish English modal verbs and the latter on the challenges of translating Renaissance texts (van Hattum, 2012; Fernández, 2023). Brunner (2009) and Gavilán (1990) provide a historical perspective, with the former discussing the transition to vernacular language in medieval charters and the latter exploring the concept of verb mood in 17th-century Spanish grammar. Huron & Veltman (2006) offers a cognitive approach, suggesting a historical antecedent to the major/minor system in medieval mode.

In the context of industrial heritage, the preservation and adaptive reuse of industrial sites are crucial, as they are often left to deteriorate despite their importance (Merino-Aranda et al., 2021). The integration of post-industrial heritage in new architecture has been validated by the appearance of new buildings, highlighting the evolving relationship between industrial heritage and contemporary construction practices (Sadhu & Ramesh, 2019). Additionally, the preservation of industrial heritage is linked to the cultural processes of human society, emphasizing the significance of industrial heritage in cultural preservation (Nikolić et al., 2020).

The acceptance and social attachment to vernacular elements are essential in understanding the social acceptance of vernacular architecture, indicating the broader perspective of its cultural significance (Choe & Han, 2021). Furthermore, vernacular architecture's status and value have naturally increased with the change in architectural trends, signifying its enduring relevance and importance. The study of vernacular architecture extends beyond the physical structures to include the adaptation to culture, lifestyle, and climatic conditions, emphasizing the harmonious relationship between climate, architecture, and people.

Vernacular architecture is a valuable resource for sustainable and climate-resilient built environments, rooted in local traditions and materials, as well as closely intertwined with cultural and natural heritage. Its preservation and adaptive reuse are crucial for maintaining cultural identity and promoting sustainable development.

The research question of this paper delves into the heart of the adaptive reuse of the De Tjolomadoe heritage sugar factory within the realm of vernacular architecture. It seeks to unravel the precise strategies and invaluable insights derived from this case study, shedding light on how the preservation of industrial heritage can seamlessly integrate with vernacular architectural practices. Specifically, it addresses the question: "What are the key strategies and lessons learned from the adaptive reuse of the De Tjolomadoe factory, and how can these insights guide and inspire future sustainable development initiatives involving industrial heritage sites?" By focusing on this unique case, the research aims to not only celebrate the success of the De Tjolomadoe project but also provide a blueprint for preserving cultural identity, fostering sustainability, engaging local communities, and stimulating economic growth in future endeavours aimed at revitalizing industrial heritage within the context of modern vernacular architecture.

2. Methods

The research methodology is qualitative in nature, aiming to delve into the historical evolution of industrial sites related to sugar production over specific periods, tracing their temporal and spatial dimensions and the associated technological advancements. This qualitative approach involves an in-depth exploration of historical records, archival documents, and relevant literature to construct a comprehensive narrative of how

industrial sites have adapted and transformed within the context of modern vernacular architecture.

To conduct this research, the study relies on extensive documentary research and data collection from primary and secondary sources. Primary sources may include historical documents, photographs, and records related to industrial sites associated with sugar production. Secondary sources encompass scholarly articles, books, and publications that provide insights into the evolution of these sites and their architectural adaptations. This multi-faceted approach allows for a holistic understanding of the historical development of industrial sites and their integration into modern vernacular architecture (see Table 1 below).

Table 1. Development history of sugar

Year	Location	Important details
4,000 BC	Tropical India and Southeast Asia	Extraction of sugar cane juice and domestication of sugarcane plant.
1st century	India	Invention of cane sugar granules from sugarcane juice.
6th century	Persia	Spread of sugar cultivation and processing to Persia.
7th century	Arab expansion	Introduction of sugar refinement methods to the Arab world.
15th century	West Indies and tropical Americas	Introduction of sugar cultivation to the West Indies and tropical parts of the Americas.
19th – 20th	Global	Development of beet sugar and high-fructose corn syrup.

The research process involves a meticulous analysis of historical data and the identification of key trends, patterns, and innovations in the adaptive reuse of industrial sites. By examining the temporal and spatial aspects alongside technological changes, the study aims to draw valuable lessons for contemporary and future practices in vernacular architecture. This qualitative research methodology provides a rich narrative that contributes to understanding how adaptive reuse has shaped industrial sites within the framework of modern vernacular architecture, offering valuable insights for architectural preservation and sustainable development practices (see Table 2 below).

Table 2. Sugar industry expansion in the new world

Year	Location	Explanation
1501	Hispaniola, Cuba, Jamaica	The first sugar harvest occurred in Hispaniola in 1501. Sugar mills had been constructed in Cuba and Jamaica by the 1520s.
1540	Santa Catarina Island, North Coast of Brazil, Demarara, Surinam	By 1540, there were 800 cane sugar mills in Santa Catarina Island and another 2,000 on the north coast of Brazil, Demarara, and Surinam.
1625	Caribbean Islands (Barbados, Virgin Islands, etc.)	After 1625, the Dutch transported sugarcane from South America to the Caribbean islands, where it was grown in various places, including Barbados and the Virgin Islands.
18th century	Great Britain, Europe, and Caribbean Islands	Sugar became enormously popular during the 18th century. Great Britain, in particular, saw a significant increase in sugar consumption, with sugar becoming a common commodity for all levels of society. Sugar also became an essential ingredient in tea, confectionery, chocolates, jams, and more.
19th century	Cuba, South America, Africa, Pacific Islands, Australia	Sugar production spread to various parts of South America, newer European colonies in Africa and the Pacific, including Fiji, Mauritius, Natal, and Queensland in Australia. It became especially important in Cuba, which replaced Saint-Domingue as the world's largest sugar producer after the Haitian Revolution. In many regions, indentured labour replaced enslaved people, and workers were often shipped from different parts of the world to work in sugar plantations. Cuba retained slavery longer than most Caribbean islands.

The historical expansion of the sugar industry in the New World, as depicted in Table 2, holds several key implications and takeaways. Firstly, it illustrates how the cultivation and production of sugar rapidly spread across various regions, beginning with Hispaniola in the early 16th century and extending to places like Cuba, Jamaica, Santa Catarina Island, Brazil, Demarara, Surinam, and the Caribbean islands by the 17th century. This geographical expansion had profound economic, social, and cultural consequences, as it contributed to the emergence of sugar as a global commodity with far-reaching impacts.

Table 2 highlights the significant role of labour systems in sugar production. Initially reliant on European indentured servants and local Native American enslaved people, the industry gradually shifted toward utilizing African enslaved labour due to resistance to diseases like malaria and yellow fever. The transition from enslaved to indentured labour in the 19th century, with workers from various parts of the world, underscores the global nature of the sugar industry and the complexities of its workforce.

Moreover, the 18th-century surge in sugar consumption, particularly in Great Britain and Europe, points to the industry's profound influence on consumer habits and preferences. Sugar became a common ingredient in various products, marking a significant shift in dietary patterns and lifestyle; see Figure 1 below.

Fig. 1. Arrival sugar to Dutch East Indies
(Museum De Tjolomadoe)

2.1 De Tjolomadoe Museum as a case study

De Tjolomadoe, also known as The Colomadu sugar factory, was constructed in 1862 under the patronage of Mangkunegara IV in collaboration with the Dutch East Indies government. It is approximately 12.7 kilometres from the centre of Surakarta and 58.1 kilometres from Yogyakarta.

Mangkunegara IV enlisted the services of the German architect R. Kampf to design the sugar factory, and groundbreaking commenced on December 8, 1861. The facility was named Colomadu, signifying the "mountain of honey." In its inaugural year, the factory processed sugar cane from approximately 95 hectares of land, yielding around 3,700 quintals of sugar. In 1928, the factory underwent renovation and expansion, resulting in architectural changes to the existing structures and the installation of new machinery from Germany. In 1950, following Indonesian independence, the government assumed control of all sugar factories previously established by the Dutch, including the Colomadu factory. Sugar production continued at this location until 1998.

After two decades of neglect, the government initiated a plan to transform the Colomadu sugar factory into a museum. Initially met with resistance, as the Mangkunegaran Palace claimed rights to the factory's assets, the government eventually proceeded with the revitalization project. In 2018, the Colomadu factory reopened as a museum, featuring the factory building as a central museum area, along with additional facilities such as the

Tjolomadoe concert hall, Sarkara hall, Besali café, and retail spaces. The location of De Tjolomadoe Museum can be seen in Figure 2 below.

Fig. 2. Location orientation map of De Tjolomadoe Museum in Surakarta, Indonesia

3. Result and Discussion

Vernacular architecture, characterized by its regional and traditional features, has gained attention due to its potential for sustainability and cultural significance (Cao et al., 2022). However, there are challenges in integrating vernacular architecture into modern construction practices, leading to a lack of appreciation for its value (Qadri et al., 2019). The sustainability and environmental performance of vernacular architecture have been emphasized in various studies, highlighting its ability to balance human habitation and nature (Vellinga, 2013; Manurung et al., 2021). Additionally, using vernacular architecture involves applying climate-responsive solutions, which have been recognized as products of human ingenuity and intelligence (Motealleh et al., 2018). Despite its potential, there are hindrances to the application of vernacular architecture, such as globalization, urbanization, and socio-economic conditions (Ramaraj et al., 2021). Furthermore, the evolution of vernacular architecture in response to modern trends has been observed, indicating a transformation in its traditional features (Umaru et al., 2022); see the Figure 3 below.

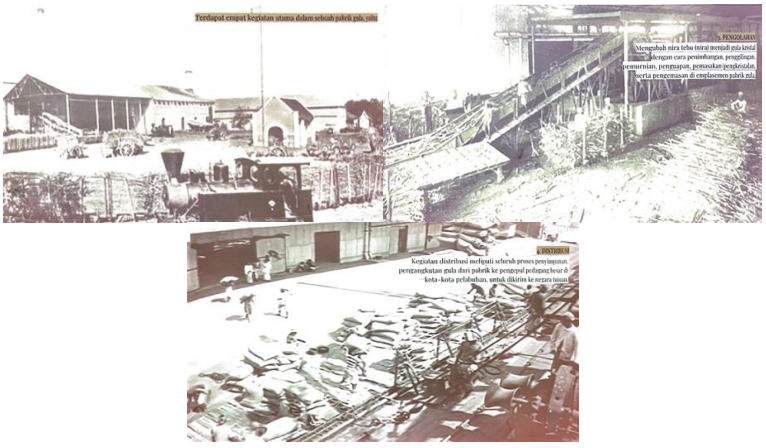

Fig. 3. History of the sugar processing process involving milling, refining and evaporation (De Tjolomadoe Museum)

The relationship between modernism and vernacular architecture has been a subject of interest, with discussions on integrating traditional vernacular elements into modern architectural practices (Lara, 2009). Some scholars have emphasized the importance of vernacular architecture as a source of inspiration for contemporary architects rather than just a tool for the tourism industry (Kütükçüoğlu, 2023). Moreover, the thermal characteristics of vernacular architecture in warm, humid regions have been studied, highlighting its potential for sustainable design (Vakharia & Joshi, 2022). The concept of in-between space in vernacular architecture has also been explored, aiming to clearly understand of its significance in specific regional architectural styles (Manurung et al., 2021).

Vernacular architecture presents a valuable source of sustainable and culturally significant design principles. While challenges exist in integrating vernacular architecture into modern construction practices, its potential for sustainability and its ability to respond to climate conditions make it a subject of continued research and interest in architecture.

The sugar industry, particularly in Java, has a rich history and cultural significance (Nugroho, 2020). This is also true in other regions, such as the Mediterranean (Galloway, 1977), Colombia (Marin-Burgos & Clancy, 2017), Mozambique (Lazzarini, 2016), and Queensland (Irvine, 2012). The industry has undergone significant changes, including the shift from plantations to outgrowers production contract systems (Hartveld, 1996). The archaeological and historical research on early sugar mills in Jamaica provides further insight into the industry's development (Woodward, 2006). These studies collectively highlight the importance of preserving and understanding the heritage of the sugar industry and the need for modern vernacular to connect with this industry.

The sugar factory was established with the intention of modernizing Mangkunegaran's economy to maximize its income. Mangkunegaran initiated agrarian reforms by taking over apanage lands as a starting step. This acquisition involved compensation, with Mangkunegaran providing monetary compensation based on the land's size and fertility level. Additionally, Mangkunegara IV terminated lease contracts with Western private companies.

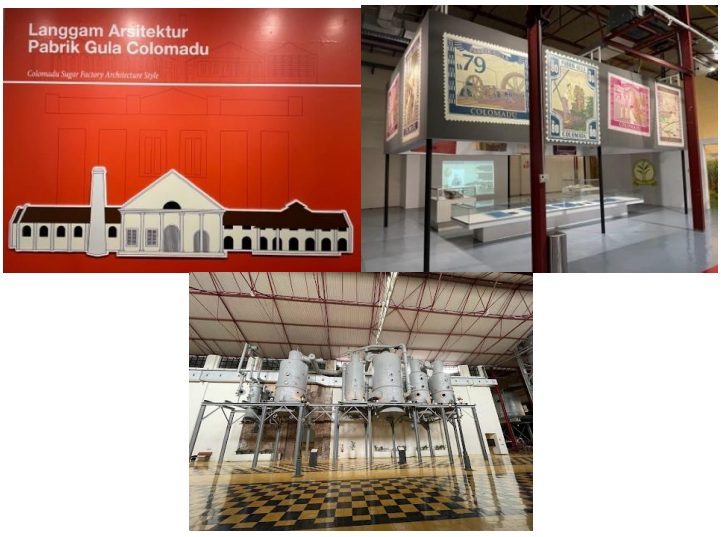

Fig. 4. Architectural and interior style of De Tjolomadoe Sugar Factory Museum

Construction of the De Tjolomadoe Sugar Factory began in 1861, with a budget of ƒ400,000. The funding for the factory's construction came from financial assistance provided by Gupermen and Be Bin Cian, a Chinese mayor of Semarang (Aratuza, 2021). The name "Colomadu," which translates to "honey mountain," was chosen for the sugar factory, although it lacks an official explanation. Nonetheless, in Javanese rulers' traditions, this name carries a hope that the sugar factory's presence would become a means to generate wealth for Mangkunegaran in the future (Fajarwati & Kurnia, 2021); see the Figure 4.

De Tjolomadoe sugar factory was constructed in Krambilan Village, located in Malangjiwan District, north of Kartasura, on a 6.4-hectare area. The process of cultivating sugarcane and rice involved cross-rotation every 18 months. In 1931, the Cengklik reservoir was built to support growth and development (see Figure 4 above). Ardhiati et al. (2020) discusses the transformation of the "De Tjolomadoe" sugar factory into a convention and heritage site, incorporating elements of Industry 4.0 (Ardhiati et al., 2020); see Figure 5 below.

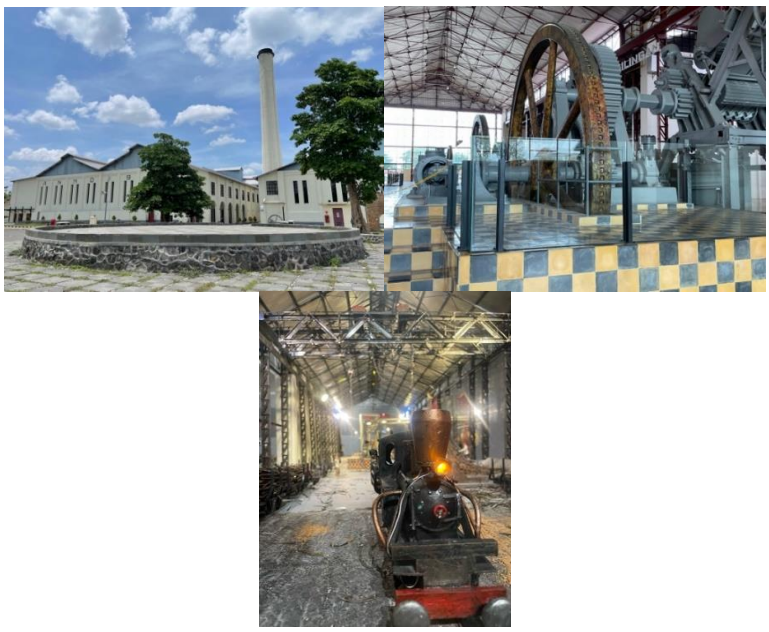

Fig. 5. Modern vernacular using historical props at De Tjolomadoe museum

Monroy & Bartolome (2020) explores the historical and cultural significance of Tlatelolco, while Bouchan & González (2020) focuses on the retreat of Cortés and his indigenous allies. de Aldana (2000) and Oliveira & Araújo (2022) both delve into the construction of national heroes and the reclamation of identity, with the former discussing the transformation of adventurers into national heroes and the latter examining the leadership of quilombola communities. Cheibub & Melo (2010) and Nascimento (2018) both explore the role of tourism in cultural mediation, with the former discussing a youth tourism project in Rio de Janeiro and the latter tracing the travels of Benjamin of Tudela. Lacarra & Grupo Clarisel (2021) provides a historical perspective on the figure of Hernando de Talavera.

The De Tjolomadoe, a historic sugar factory in Colomadu, Indonesia, has undergone adaptive reuse, transforming it into a museum and amusement area (Fajarwati & Ardhiati, 2021). This transformation has led to a shift in the perception of tourists towards heritage tourism at De Tjolomadoe, focusing on its attractiveness as a tourist destination (Kuntari & Lasally, 2022). The adaptive reuse of the heritage building has been studied in the context of sustainable architecture, emphasizing the importance of preserving the building's authenticity while incorporating new functions (Triratma et al., 2023). Furthermore, the revitalization of De Tjolomadoe involved a concept of adaptive reuse, which changed its function from a factory to a cultural centre and commercial area, reflecting a new spirit (Izzati, 2023; Purnomo et al., 2022). The evaluation of the building's authenticity using the Nara Grid instrument highlighted the transformation from a factory to a cultural centre, emphasizing its historical and scientific values (Pitaloka & Yusran, 2019). Additionally, the comparison study between De Tjolomadoe and an imaginary virtual museum revealed similarities and differences in their design, shedding light on the historical heritage-based design of De Tjolomadoe (Ardhiati et al., 2020). Tourists' perception of heritage tourism at De Tjolomadoe emphasized the historical and scientific values as the most valuable aspects,

influencing their decision to visit the site (Kuntari & Lasally, 2022). The identification of green areas in the vicinity of De Tjolomadoe highlighted the importance of sustainable and environmentally friendly practices in the surrounding area (Baqir & Syamsiyah, 2021). Moreover, the influence of social media promotion and reference groups on the decision to visit De Tjolomadoe has been analyzed, indicating their impact on tourists' decisions (Priyanti et al., 2020). The concept of heterotopia has been studied in the context of the Colomadu sugar factory, emphasizing the unique and transformative nature of the museum space (Aratuza, 2021). The adaptive reuse of De Tjolomadoe has been associated with the connection of identity, memory, and social media, creating an ambience of entertainment space rather than an old factory (Fajarwati & Kurnia, 2021). Finally, the analysis of historical significance, tourist attraction, and electronic word of mouth revealed their collective impact on the decision to visit De Tjolomadoe (Susanti et al., 2019). Through critical discourse analysis, the representation of the working class's identity in the material culture of De Tjolomadoe has been explored, connecting past and present human life (Ardhiati et al., 2020).

The heritage of sugar factories holds significant importance in the industrial and cultural landscape. These factories, with their historical, architectural, and functional significance, have become focal points for various studies and initiatives. The identification of sugar factories as industrial heritage involves considerations such as location, age, function, ownership, physical condition, architectural style, and historical events associated with them (Nugroho et al., 2021). Furthermore, the solid waste produced by these factories, such as bagasse, can be repurposed as boiler fuel, showcasing the potential for sustainable practices within the industry (Solikin, 2019). Additionally, the principles of investment attractiveness for the territories of sugar factories' industrial heritage have been proposed, aiming to increase their appeal to potential investors, both public and private (Tsvetkova, 2023).

The conservation and adaptive reuse of sugar industrial heritage have also been explored. For instance, the reuse of the sugar railway network as bicycle routes, walkways, and parks demonstrates a creative approach to preserving and repurposing these historical assets (Wang & Kurose, 2013). Moreover, the adaptive reuse of the Colomadu Sugar Factory has been highlighted as a means to preserve its glorious past and historical significance (Fajarwati & Wulandari, 2020). Similarly, the transculturality through industrial space, as exemplified by the Colomadu sugar factory, emphasizes the importance of preserving the cultural heritage embedded within these industrial sites (Fajarwati & Kurnia, 2021).

The cultural significance of sugar factories as city identity has been acknowledged, with various sites being appointed as city identity, further underlining their historical and cultural value (Hermawan & Sholihah, 2020). Additionally, the transformation of a former sugar factory into a tourist attraction, as seen in the case of The Heritage Palace, illustrates the potential for these sites to contribute to tourism and local economies (Hanifunisa & Swasty, 2020). Furthermore, evaluation of the financial feasibility of restoring and reusing sugar industrial heritage sites has been explored, emphasizing the economic aspects of heritage preservation and reuse (Lee et al., 2018). The heritage of sugar factories represents a rich tapestry of historical, cultural, and industrial significance. From principles of investment attractiveness to adaptive reuse and cultural preservation, these references collectively underscore the multifaceted importance of sugar industrial heritage and the diverse approaches to its conservation and utilization.

4. Conclusions

This research framework offers a comprehensive examination of the relationship between industrial heritage, specifically the sugar industry, and the adaptive reuse of vernacular architecture. It draws on various scholarly studies emphasising the economic, cultural, and sustainable aspects of preserving historical constructions. The framework also addresses the challenges of modernization and globalization that threaten the sustainable

features and local wisdom of vernacular architecture, highlighting the tourism industry's significance.

The research discusses in detail the historical and cultural heritage of the sugar industry, exploring its impact on tourism, public health, and urban development. It emphasizes the need for a balanced approach to preserving this heritage while addressing concerns about industry-funded research.

The concept of adaptive reuse is also explored in the context of vernacular architecture, showcasing its multifaceted benefits in terms of sustainability, cultural preservation, and community engagement. However, it also underscores the potential for unintended consequences, such as gentrification and the erosion of vernacular architecture due to modernization. This research framework provides a solid foundation for further exploration into the adaptive reuse of industrial heritage sites in the context of modern vernacular architecture. It highlights the need for a holistic understanding of historical developments, labour dynamics, and cultural shifts to inform contemporary and future architectural preservation and sustainable development practices.

De Tjolomadoe's case study demonstrates the successful transformation of an industrial heritage site into a museum and cultural centre while preserving its authenticity. This adaptive reuse not only attracts tourists, but also serves as a model for sustainable development and community engagement. The research showcases the evolution and adaptation of the sugar industry in various regions, underlining its economic and cultural value. These insights encompass preserving cultural identity, sustainability practices, community involvement, and economic growth. Overall, the research contributes to the discourse on preserving and repurposing industrial heritage within the realm of modern vernacular architecture, offering a blueprint for future endeavours in this field.

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Author Contribution
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