

DRIVERS OF AND BARRIERS TO ADAPTIVE REUSE OF COLONIAL BUILDINGS IN MALAYSIA

***(FAKTOR PENDORONG DAN HALANGAN PENGGUNAAN SEMULA
BERADAPTASI BANGUNAN KOLONIAL DI MALAYSIA)***

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Abstract

Adaptive reuse of buildings is popular among developed countries when historically significant buildings are being restored in order to preserve their historical significance and use them for a greater cause. On the other hand, adaptive reuse building has not yet gained popularity in developing countries due to a lack of proper research. As the number of historic structures has been dropping daily, people's awareness has started to increase. As the first research problem arises, there is a lack of research regarding adaptive reuse, which is another way of preserving those historical buildings by revitalizing or converting them into a commercial centre for the public, and a lack of research on recommendations for solving the barriers to adaptive reuse on colonial buildings. Hence, the aims of this research are to find the best formulas for converting colonial buildings for suitable uses. Consequently, this research was required to identify the drivers and barriers associated with the adaptive reuse of colonial buildings. A comprehensive literature review was conducted to explore the concept of adaptive reuse, its aspects, drivers, and barriers, and new uses for colonial buildings. While existing literature on developed countries cannot be directly applied to Malaysia, this study fills a gap in understanding adaptive reuse in developing nations. Based on the objectives of the study, this research is expected to identify the drivers and barriers to the adaptive reuse process of colonial buildings. This exploration will come out with recommendations that could be implemented to remove or reduce the impact of the barriers identified. The findings of this research are expected to result in actionable recommendations for mitigating the identified barriers. Hence, the significance of the adaptive reuse process influences the characteristics and not only the benefits but also the potential of the process, which are classified as social, environmental, and economic.

Keywords: *Adaptive Reuse, Drivers, Barriers, Colonial Buildings, Heritage Conservation*

Abstrak

Penggunaan semula beradaptasi bangunan adalah popular di negara maju apabila bangunan yang mempunyai nilai sejarah dipulihkan untuk memelihara kepentingan sejarah mereka dan menggunakannya untuk tujuan yang lebih besar. Sebaliknya, penggunaan semula beradaptasi bangunan belum mendapat populariti di negara membangun kerana kekurangan penyelidikan yang tepat. Memandangkan bilangan struktur bersejarah semakin berkurangan setiap hari,

kesedaran masyarakat mula meningkat. Masalah penyelidikan pertama timbul apabila terdapat kekurangan penyelidikan mengenai penggunaan semula beradaptasi, yang merupakan satu lagi cara untuk memelihara bangunan bersejarah tersebut dengan menyegarkan atau menukarkannya menjadi pusat komersial untuk orang awam, dan kekurangan penyelidikan mengenai cadangan untuk menyelesaikan halangan kepada penggunaan semula beradaptasi pada bangunan kolonial. Oleh itu, tujuan penyelidikan ini adalah untuk mencari formula terbaik untuk menukar bangunan kolonial kepada kegunaan yang sesuai. Sehubungan itu, penyelidikan ini diperlukan untuk mengenal pasti faktor pendorong dan halangan yang berkaitan dengan penggunaan semula beradaptasi bangunan kolonial. Satu ulasan literatur menyeluruh telah dijalankan untuk meneroka konsep penggunaan semula beradaptasi, aspeknya, faktor pendorong dan halangan, serta kegunaan baru untuk bangunan kolonial. Walaupun literatur yang ada mengenai negara maju tidak boleh diterapkan secara langsung ke Malaysia, kajian ini mengisi jurang dalam pemahaman penggunaan semula beradaptasi di negara membangun. Berdasarkan objektif kajian, penyelidikan ini dijangka akan mengenal pasti faktor pendorong dan halangan dalam proses penggunaan semula beradaptasi bangunan kolonial. Penyelidikan ini akan menghasilkan cadangan yang boleh dilaksanakan untuk menghapuskan atau mengurangkan impak halangan yang dikenal pasti. Penemuan penyelidikan ini dijangka menghasilkan cadangan yang boleh diambil tindakan untuk mengurangkan halangan yang dikenal pasti. Oleh itu, kepentingan proses penggunaan semula beradaptasi mempengaruhi ciri-ciri dan bukan sahaja manfaat tetapi juga potensi proses tersebut, yang diklasifikasikan sebagai sosial, alam sekitar dan ekonomi.

Kata kunci: *Penggunaan Semula Beradaptasi, Pendorong, Halangan, Bangunan kolonial, Konservasi bangunan.*

INTRODUCTION

Due to the increasing demand for new construction and the limited availability of land, the inevitable removal of existing structures is anticipated (Hakkinen 2007). As reported by Dean et al. (2016), buildings account for over 30% of worldwide energy consumption, comprising more than a third of global final energy usage and contributing to nearly a quarter of global greenhouse gas emissions. According to Conejos et al. (2015), the notion of adaptive reuse is fast gaining global recognition as a successful technique for improving the built environment's sustainability. As the conservation paradigm shifts from preserving things from the past to utilizing the past in the present, adaptive reuse can be identified as a key conservation approach to recycle previous resources and transform them into experiences in and for the present (Ashworth 2011). Older buildings play a pivotal role in the historical and cultural heritage of the countries where they are situated. Historic structures account for a larger proportion of the global building stock, making it impossible to conserve them all intact (Yung and Chan 2012). To revitalize the physical environment while preserving the inherent value of these historic structures, the practice of adaptive building reuse becomes imperative (Petersdorff et al. 2006). As noted by Ramola (2013), the conservation of physical structures not only contributes to the social and cultural identity of a community but also has far-reaching impacts on its economic and environmental landscape, fostering vibrant communities and shaping the unique character, spirit, and sense of place.

Typically, some building alterations are required to ensure that the building can meet the criteria of the new structure's function as specified by the owner. Conservation, modification, repair, retention, and corrective works were all included in adaptive works. It must be meticulously designed to guarantee that the building's adaptive reuse is completely optimal. Much like in previous times, the preservation of cultural and historical buildings while facilitating their continued use through adaptation remains a significant challenge. Both theoretical and practical discussions surrounding preservation, environmental considerations, historical contexts, reconstruction within historical

settings, and adaptive reuse hold profound significance for individuals engaged in relevant academic theories and for designers immersed in the realms of urbanization, architecture, interiors, or other related perspectives (Cordan et al. 2014). Thus, this should be consistent with the heritage value and should support the understanding of the heritage, giving it new life and social and economic opportunities.

A past researcher said the current building stock is greatly impacted by these redundant buildings. Strategies like "adaptive reuse" (Kincaid 2000), which have shown positive trends, have been used to lessen these effects. This situation's state in developing nations has not yet been examined. Historical structures are demolished with disregard for their socio-cultural and historical significance because of their poor economic values (Smith 2005; Wood and Muncaster 2012). As reported by Latham (2000), by upgrading and improving a building's performance to match contemporary standards and evolving user needs, adaptive reuse preserves as much of the original structure as possible. Emphasizes that even long-lasting structures can lose their suitability for their intended use due to obsolescence and redundancy caused by changes in the demand for their services or a lack of ongoing maintenance. People choose adaptive reuse of the existing building stock due to its affordability, growing energy costs, and the high cost of new structures (Douglas 2006; Kohler and Yang 2007). Numerous studies have been conducted internationally on the adaptive reuse of buildings (Ball 1989, 2002; Bullen 2007; Langston and Shen 2007; Langston et al. 2008; Bullen and Love 2010, 2011; Langston 2012; Hong and Chen 2017), mostly concentrating on the implementation difficulties, design approaches, decision-making, and adaptive reuse possibilities of structures. In contrast to developing nations, developed countries place more emphasis on finding efficient strategies and chances for designing new structures to meet ARB and maintaining the current stock to meet future market needs (Sheffer and Levitt 2010). Developing countries must seek similar possibilities to assure long-term investment in existing building stock, which is currently generally underutilized or abandoned. Such tendencies can provide significant socio-cultural and environmental benefits to local communities.

LITERATURE REVIEW

Adaptive reuse, as defined in the Burra Charter, is the rehabilitation or renovation of heritage buildings or structures for purposes other than their current use (Australian ICOMOS 1999). When a structure can no longer function with its original use, adaptation is the only method to conserve and retain a building's fabric heritage significance (Bullen and Love 2011). As stated by Worthing and Bonds (2008), adaptive reuse enables buildings to maintain their historical significance while meeting the needs of their current occupants. Emphasizes that even long-lasting structures can lose their suitability for their intended use due to obsolescence and redundancy caused by changes in the demand for their services or a lack of ongoing maintenance (Johnson 1996). An ecclesiastical structure can be converted into a commercial structure, a commercial structure can be converted into a residential building, and a residential building can even be converted into an ecclesiastical structure by modifying certain construction components (Bullen and Love 2011). According to Highfield (1987) has outlined the justifications for the adaptive reuse of historic structures, including quick construction timeframes, financial benefits, official permissions, gazette building codes, and the benefits of historical building designs. Adaptive reuse is another way to keep historic structures alive.

Appropriate reuse increases building longevity while lowering waste generated during demolition and carbon emissions (Tan et al. 2018). The best strategy to guarantee that a historic building is still in use is through adaptive reuse (Chandler 1991; Larkham 1996). According to Ab Wahab et al. (2016) if the adaptive reuse work will be more difficult if the historic structures are situated inside the protection zone of a UNESCO World Heritage Site.

CONCEPT OF ADAPTIVE REUSE

One of the critical decisions faced by owners of older structures is whether to opt for reuse or demolition. In today's construction industry, the demolition of existing buildings is regarded as an inefficient utilization of energy and materials (Department of the Environment and Heritage [DEH]

2004). Historically, due to land constraints, the demolition of buildings, disregarding their environmental repercussions, often prevailed over refurbishment and reutilization (Shipley et al. 2006). Graham (2003) advocates restricting the expansion of the existing building inventory to conserve its embedded energy. Binder (2003) asserts that a substantial amount of embedded energy resides in the existing building stock, underscoring the importance of building reuse in waste reduction. The reuse of constructed assets aligns with environmental sustainability by preserving the embedded energy of the original structures (Treloar et al. 2001; Treloar et al. 2000), and adaptive reuse of buildings presents a dynamic alternative aimed at minimizing these concerns (Kincaid 2000).

Aspects in Adaptive Reuse

According to Douglas (2006), adaptive reuse building can be defined as any work done to a structure that alters its capability, functionality, or performance. Adaptive reuse, which derives from building adaptation (Latham 2000), is the process of improving a building's performance to conform to contemporary standards and shifting user needs while preserving the original structure to the greatest extent possible. According to the Department of Environment and Heritage (2004), adaptive reuse building is a process that turns a discarded or ineffective object into a brand-new object that can be used for a different purpose. According to Latham (2000), adaptive reuse should utilize the embedded energy and hidden characteristics of the original building in a sustainable and dynamic way to perform anew.

There are few aspects involved in the process of adaptive reuse of buildings. However, this study discovered that eight are the most useful aspects based on the literature review. A few aspects that were discovered in accordance with the literature review, for instance, financial and economic factors, fall under the same group. Although the terminology is different, the definitions are the same. The physical aspect is the same. It provides the structure with the same aspect.

First and foremost, physical aspects can be done by assessing and modifying the existing structure to ensure its stability, safety, and suitability for the new use. The physical aspect of adaptive reuse plays a pivotal role in the successful transformation of existing structures for new purposes. This multifaceted process involves a comprehensive assessment of the current building, focusing on factors such as structural integrity, safety measures, and suitability for the intended use. Engineers and architects meticulously examine the structure, identifying any weaknesses or deficiencies that may compromise its stability or safety. Remedial modifications are then carefully planned and executed to address these issues, ensuring that the building not only meets contemporary safety standards but also aligns with the specific requirements of the proposed new function. Moreover, sustainability emerges as a paramount consideration in adaptive reuse. By repurposing existing buildings rather than demolishing and constructing a new, valuable resources, embodied energy, and materials are conserved. This sustainable approach aligns with contemporary environmental goals, reducing the carbon footprint associated with new construction and lowering waste generation.

First and foremost, spatial aspect of adaptive reuse underscores the significance of making repurposed buildings accessible and inclusive for all, including individuals with disabilities. In the context of adaptive reuse, the spatial dimension involves thoughtful planning and design to ensure that the adapted structure adheres to relevant accessibility codes and standards. This goes beyond mere compliance; it embodies a commitment to creating spaces that are welcoming and accommodating to people of all abilities. Incorporating features like ramps, wider doorways, elevators, accessible restrooms, and tactile signage not only enhances the usability of the building but also promotes inclusivity and diversity within the community. By embracing these spatial considerations, adaptive reuse projects not only breathe new life into historic structures but also contribute to the creation of more equitable and accessible urban environments, fostering a sense of belonging for everyone.

Secondly, servicing aspect of adaptive reuse embodies the delicate balancing act of repurposing a building for a new function while cherishing and preserving its architectural and historical significance. This aspect encapsulates the heart of adaptive reuse, where the practical meets the

aesthetic and the past harmoniously coexists with the present and future. Servicing involves meticulous planning and creative problem-solving to adapt the building's infrastructure, utilities, and interior spaces to meet the demands of the modern era without compromising its unique character. Architects and designers engage in a careful dance, integrating contemporary functionalities seamlessly into the existing structure while respecting its historical features and maintaining its cultural value. This process showcases the transformative potential of adaptive reuse, where old structures evolve to serve fresh purposes, breathing new life into them and ensuring that their stories endure for generations to come.

Financial aspect of adaptive reuse is a pivotal aspect that underpins the successful execution of such projects. This multifaceted process begins with a thorough assessment of the economic feasibility and financial sustainability of the adaptive reuse endeavour. Researchers and stakeholders delve into meticulous cost estimations, accounting for the expenses associated with both structural modifications and interior renovations. Simultaneously, they explore a spectrum of potential funding sources, including government grants, private investments, and nonprofit contributions, to secure the necessary financial backing. Successful financial planning and execution ensure that adaptive reuse projects not only breathe new life into old buildings but also do so in a financially sustainable manner, promoting their continued relevance and contribution to the community.

Moreover, environmental facet of adaptive reuse represents a vital commitment to integrating sustainable design principles and practices into the transformation of existing structures. This aspect underscores the critical importance of reducing the environmental footprint associated with building projects. Additionally, resource conservation plays a central role in the environmental dimension of adaptive reuse. Materials from the existing structure can often be repurposed or recycled, reducing the demand for new resources and minimizing waste generation. Salvaging architectural elements, reclaiming wood, and reusing fixtures contribute to a more sustainable approach.

In addition, locational aspect in adaptive reuse underscores the importance of preserving and conserving the intrinsic characteristics that make a building's location historically, architecturally, and culturally significant. This facet is deeply rooted in the idea that the physical context in which a structure exists plays a crucial role in its identity and value. When undertaking an adaptive reuse project, meticulous attention is paid to safeguarding the original architectural features of the building. This involves identifying and protecting distinctive elements such as ornate facades, unique structural elements, and decorative detailing that reflect the architectural style and craftsmanship of the period when the building was constructed. The historical components that carry the building's heritage and story are preserved as part of the locational aspect. This may include maintaining original signage, plaques, or artifacts that offer insights into the building's past and its role in the community's history.

The social aspect refers to the active involvement and engagement of the local community and stakeholders throughout the process of repurposing a building or space. By engaging with the community, researchers can gain a deeper understanding of the specific needs and challenges facing the area. For instance, if a vacant industrial building is being repurposed into a community centre, understanding what services or amenities the residents want or lack can guide the transformation. This aspect of adaptive reuse emphasizes the importance of inclusivity, community involvement, and a people centered approach to repurposing buildings. Researchers should actively seek out and incorporate the perspectives and aspirations of the local community and stakeholders to create adaptive reuse projects that are not only architecturally sound but also socially and culturally meaningful.

Finally, legal aspect assumes a pivotal role in the successful transformation of a building or space. This facet involves a meticulous and comprehensive assessment of adherence to pertinent building codes, zoning regulations, and legal requisites applicable to the proposed new use of the structure. It is imperative that throughout the adaptive reuse process, strict compliance with these legal parameters is maintained. This encompasses an in-depth understanding of local building codes, zoning ordinances, and any other legal stipulations governing the specific locality in which the project is situated. It necessitates collaboration with legal experts, architects, and project planners to ensure

that every aspect of the adaptive reuse project aligns seamlessly with the legal framework. Failing to meet these legal obligations could lead to project delays, financial setbacks, or even legal disputes, underscoring the critical importance of thorough legal due diligence in the adaptive reuse process.

In conclusion, the multifaceted aspects of adaptive reuse are intertwined and mutually reinforcing. Ignoring any one of them can jeopardize the overall success of the endeavor. Thus, it is the harmonious integration of these aspects - social, environmental, economic, and legal - that makes adaptive reuse a powerful and sustainable approach to urban development and revitalization. As researchers and practitioners, our continued commitment to understanding and prioritizing these aspects is instrumental in shaping vibrant, inclusive, and resilient communities for the future.

DRIVERS OF ADAPTIVE REUSE

Bullen (2007) classifies adaptive reuse building advantages as social, economic, and environmental, which are frequently interrelated. According to Manewa et al. (2016), adaptive reuse helps to economic, social, and environmental sustainability.

Economic advantages.

According to Shipley et al. (2006), the typical cost savings projected via ARB are between 10 and 12 percent. According to previous studies, it is generally less expensive to adapt an existing structure than to create a completely new structure (Ball 2002; Bullen 2007; Campbell 1996; Douglas 2006; Highfield 2000; Shipley et al. 2006). A study of high-density residential homes in Hong Kong discovered a 9.8 percent rise in property prices following rehabilitation (Chau et al. 2003). Adaptive reuse building gives people a sense of belonging (De Silva et al. 2017).

Environmental advantages.

According to Itard and Klunder (2007), building demolition is not environmentally friendly. According to Bullen (2007) and Johnstone (1995), Adaptive reuse building is highly sustainable since it consumes less material, energy, and transport during building construction, resulting in less environmental pollution. According to Binder (2007), there is a significant amount of embodied energy in the current building stock, and the Australian Green House Office estimated in 1999 that adaptive reuse of a structure may save around 95% of the embodied energy of the building. According to DeSilva et al. (2017), adaptive reuse building ensures the cleanliness and beauty of a city, which provides environmental advantages.

Social advantages.

Bullen (2007) argues that adaptive reuse construction requires more attention since it is a type of urban regeneration that might benefit future generations by safeguarding buildings (DEH 2005). Adaptation is a viable approach to preserving major buildings' embedded cultural and social value (Bullen 2007; Bromley et al. 2005). According to Langston (2008), Bullen (2007), Remoy and Wilkinson (2012), antisocial behaviour is discouraged in cities by adaptive reuse building. Adaptive reuse building investments may considerably improve the living conditions of individuals in underserved areas and communities (Ball 2002; Langston et al. 2007; Langston and Shen 2007). According to De Silva et al. (2017), adaptive reuse building creates cash through commercial activities, saves demolition and other related expenditures, attracts visitors, and encourages businesses to relocate to adapted buildings to show their interests and identities.

Barriers to Adaptive Reuse.

Table 1 summarises the most major impediments and difficulties to adaptive reuse building identified in previous studies. Because the restrictions listed in Table I are also frequent in Malaysia, this research will be critical in identifying the activities required to overcome those limits.

Table 1. Impediments and difficulties to adaptive reuse building

Apects	Barriers	Description
Physical	Decaying structures, outmoded designs, and environmental pollution	Restrictions due to existing floor layouts, number of columns / walls and structural system layouts
Economic	Limits on funding may make adaptive reuse initiatives unviable	Cost issues in terms of conservation needs for heritage buildings, both direct and indirect.
Environment	Environmental impact mitigation in repurposing may face regulatory and cost challenges.	Building owners and the commercial real estate markets have provided scant assistance in making buildings more sustainable.
Technical	Incorporating cutting-edge technology and systems into historically significant buildings.	Modernising systems while conserving historical integrity, which sometimes necessitates the use of specialised skills.
Social	Requiring careful negotiation and community engagement to avoid such issues.	Intangible non-economic values essential to sustain communal life on a daily basis.
Constructional	Non-durable materials.	Compatibility of new materials with existing materials, as well as the availability of local knowledge and tradespeople to carry out restoration work.
Servicing	Modern infrastructure installation and performance enhancements are limited by space constraints.	Optimize space utilization while ensuring the functionality, safety, and efficiency of utilities.
Building codes	Complying to changing building codes might make adaptive reuse projects more challenging.	Building codes, laws, conservation principles, licencing, and planning criteria must all be met.

Because of hurdles and problems are typical in any new circumstance, such as adaptive reuse building, what is necessary is to recognise them accurately and discover the best solutions to overcome them while increasing the advantages to popularise adaptive reuse building internationally.

Colonial Buildings in Malaysia

Colonialism in the modern era Malaysia began in 1511 with the fall of Malacca to the Portuguese. The internal political joust for control in the Malaccan court, as well as pervasive corruption, preceded and may have helped the invasion (Bakar 2020). Colonialism ceased in 1957 with Peninsular Malaysia's independence from the British, and in 1963 for Sabah and Sarawak. Not only did the ethical framework of the indigenous alter, but European colonial armies also faced changes in ethical thinking and religious worldview. The British and Portuguese colonization were separated by over 300 years, and the ethical framework that inspired and drove both would have reflected developments in Europe. The Portuguese ethical framework would still be related to the Catholic theological viewpoint in 1511. The Dutch, who arrived in 1641, are Protestant and would have distinct ethics and values, however, due to Europe's Reformation and Enlightenment movements, which will be discussed further below.

The first English encounter with the Malay Peninsula was in 1786, when Captain Francis Light established Penang. Malacca became permanently British via the Anglo-Dutch Treaty of 1824 (the Dutch traded Malacca with the British for Bencoolen in Sumatra). The Straits Settlements were formed by the union of Penang (1786), Province Wellesley (1800), Singapore (1819), Malacca (1824), and Dinding (1826). In 1874, the British Colonial Office abandoned its policy of non-interference in

Malay affairs and invaded Perak, Selangor, and Sungei Ujong (part of N. Sembilan), appointing a British Resident to supervise its administration. Pahang and the residue of N. Sembilan were eventually merged into the Federated Malay States system. Perlis, Kedah, Kelantan, and Terengganu were formed in 1909 As protected nations, they fell under British administration. In 1914, Johore was also taken over by the British, and the five states were dubbed the Unfederated Malay States, with each receiving a British Adviser (Figure 1).

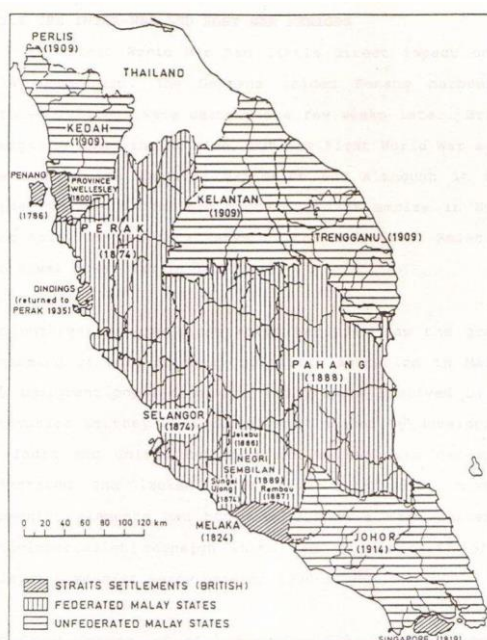


Figure 1. British ruled in the Peninsular (Endut 2010).

During the British Colonial Period, they began to construct structures in important cities such as Georgetown and Kuala Lumpur, to mention a few. These structures usually have distinct design elements that are reminiscent of their own country or another British Empire. These administrative structures include government offices, public works departments, town or city halls, railway stations, and others. The British have developed the following building classifications for administrative buildings:

Government Offices, Sultan Abdul Samad Building.

It was created by a British architect called Arthur Charles Alfred Norman and erected between 1894 and 1897. This structure, which was once the Selangor State Secretariat, now houses the Selangor State Government Treasury, the Federal Treasury, the Attorney General's Office, and the Marriage Registry (Figure 2).



Figure 2. Sultan Abdul Samad Building.

It was influenced by Indo Saracenic architecture style in terms of architectural characteristics as well as materials, since it was constructed completely of exposed red clay bricks. The Indo Saracenic style combines local Indo-Islamic and Indian architecture with Gothic Revival and Neo-Classical forms popular in Victorian Britain. This architectural movement was introduced by British architects in the late nineteenth century during the British Empire in India.

It is a two-story building with a central porch in the middle that acts as a drop-off entry and columns with several smaller domes. (See Figure 3)

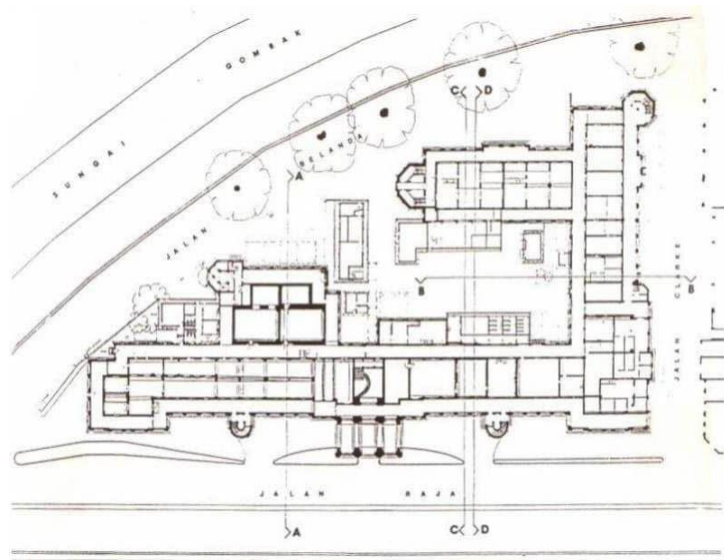


Figure 3. Building Site Plan (Endut 2010).

Symmetry, onion domes, extensive use of arches, overhanging eaves, towers or minarets, harem windows, open pavilion, and domed chhatri are all features of this design. The building's most noticeable feature was its clock tower, which was situated in the centre to create a scenic appearance, standing 41.2 metres above the ground. The clock tower has four faces and is capped with a copper onion dome with a domed-chhatri (Figure 4.5). The structure was widely ringed by several types of arches. The stairways were crowned with two copper onion domes (Figure 4).

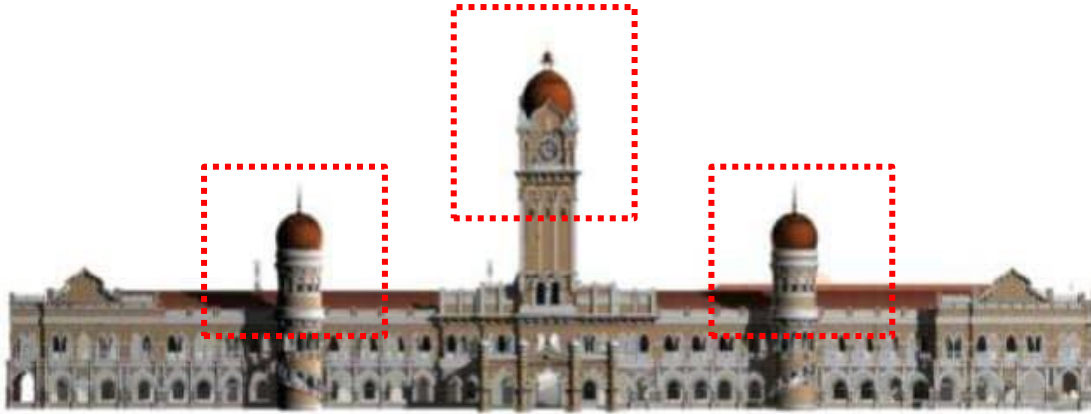


Figure 4. Building façade with onion domes.



Figure 5. The onion dome of the clock tower is crowned by a domed-chhatri.

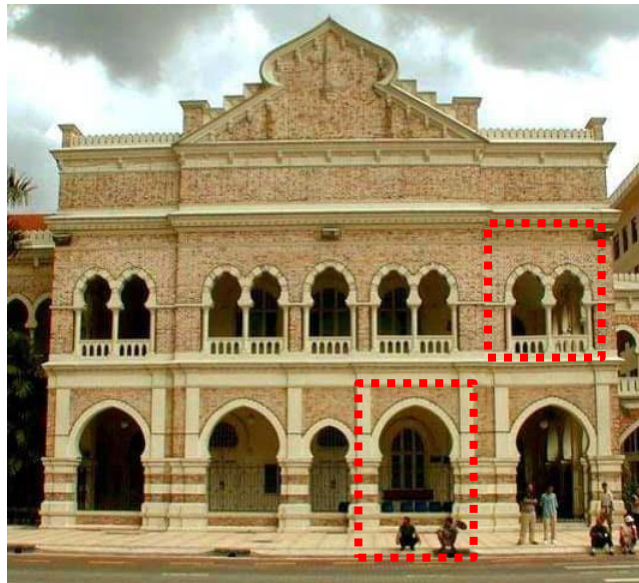


Figure 6. View of the building's side elevation.

Figure 6 portrays paired horseshoe arches on the first level, whereas the bottom floor has a single horseshoe arches. The porch or loggia is flanked by an elliptical arch in the very centre of the façade with Tudor arches in between that are crowned with smaller domes (Figure 6).

Public Works Department Kuala Lumpur Museum Tekstil

A. C. Norman erected this structure in 1896. Originally constructed to house the Federated Malay States Railway Headquarters, it later became the Selangor Public Works Department, and the facade was modified to resemble the neighbouring structures (Figure 7). It is now home to the National Textile Museum.



Figure 7. View of Old Public Works Department (Fieldwork 2010).

It is known as Indo-Saracenic style. It is a two-story structure made of red fair-faced bricks with white banding and plastered bricks (Figure 8).



Figure 8. Red and white banding (Fieldwork 2010).

Figure 9 depicts the octagonal stairways at each corner of the façade, with towers capped by concrete onion domes encircled by smaller domes. The main entrance is made up of two pilasters that are crowned by chhatris, which are elevated onion-shaped domes borrowed from Mughal architecture in India.

Chhatris are a fundamental component of both Hindu and Mughal architecture. The term 'chhatra' refers to an umbrella or canopy. Among the several types of arches in use are:

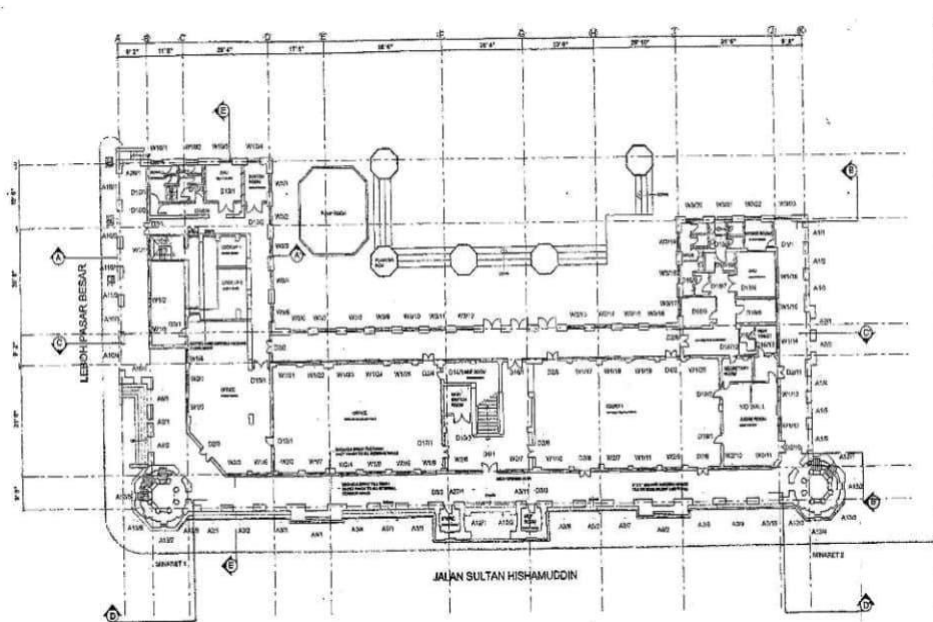


Figure 9. Ground Floor Plan (Anuar 2011).

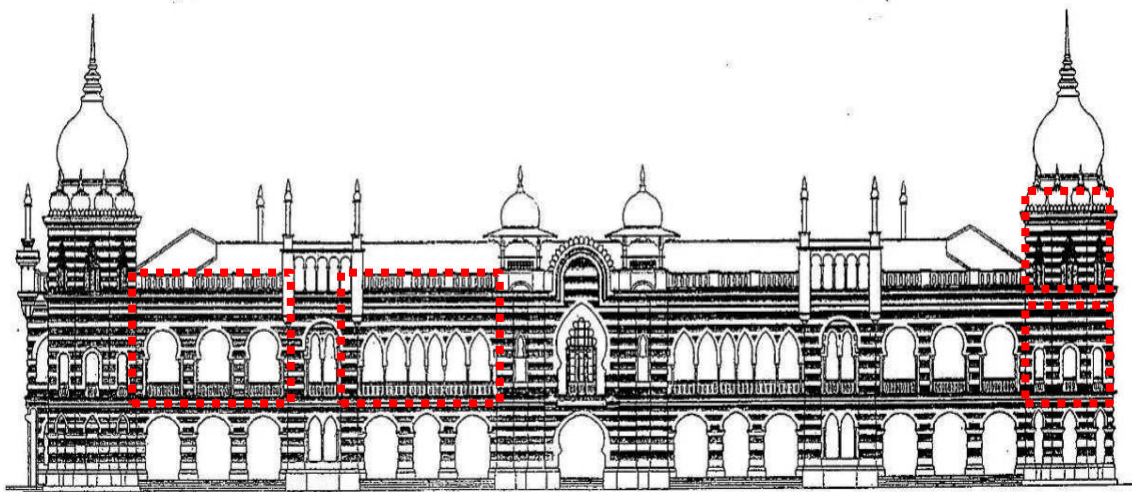


Figure 10. Front Elevation showing horseshoe, pointed, round and 'Shahjahani' arches (Anuar 2011).

Municipal or City Hall George Town's Old Town Hall, Esplanade (1880)

The Penang Municipal Building is the state's oldest (Figure 11). The Governor of the Straits Settlements, Frederick Weld, dedicated the structure. The building's layout includes a front portico, an assembly hall and a ballroom, as well as connecting supper rooms, a performance stage, office spaces and a library (Figure 12). It was constructed in the Western architectural style, with classical arches, columns, pilasters, quoins, ornate components on the roof parapet, and balustrades.



Figure 11. Old Town Hall (Ahmad 2004).

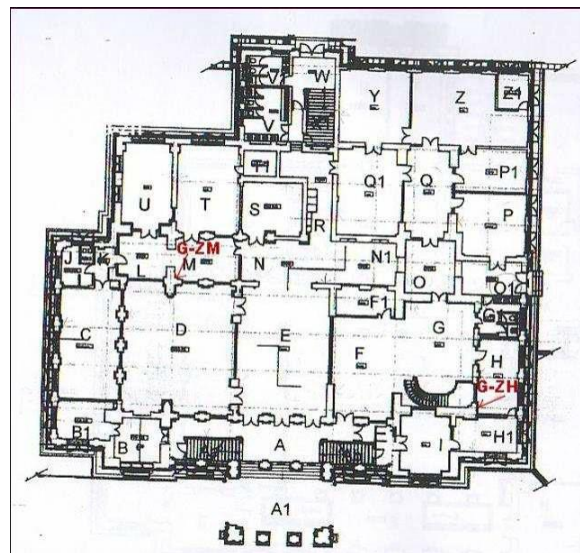


Figure 12. Old Town Hall plan (Ahmad 2004).

This structure had been enlarged multiple times throughout its history to satisfy rising need for internal space, including in 1880, 1903, 1938, 1958, and 1991. Brick, plaster walls, wood flooring and ceiling at the upper level, ornate ironworks at the main entrance, cast iron roof at the back entry,

and plaster renderings at cornices, mouldings, and front parapet walls were used to construct the exterior features (Figure 13).



Figure 13. Plaster renderings at cornices, mouldings and front parapet wall (Ahmad 2004).



Figure 14. Decorative ironworks (Ahmad 2004).

The Kuala Lumpur Railway Station.

A.B Hubback designed this structure, which was finished in 1911 (Figure 16). It had a large terminal structure in front and three platforms serving four railway lines in back.



Figure 15. View of Kuala Lumpur Railway Station

The main structure, which contains a main hall, ticket counters and offices, primarily designed in a mixture of Western and Mughal called Indo Saracenic architecture which dominated by horseshoe and ogee arches, and large chhatris (six originally, with two added later) with so called 'Shahjahani arches' at the corners of the building accompanying smaller variations at the front (Figure 17). In addition to the main station building, a three-storey addition at the north wing was added early in its operation, adopting Westernised vernacular designs with surrounding verandas and segmental arches of various widths. The façade of the station is completely plastered, as opposed to buildings of similar styles that opt for exposed brickwork and painted in light colours (usually white or cream) throughout its service.



Figure 16. View of Chhatris with 'Shahjahani arches.

Railway Administration Structure

This structure was constructed following the completion of the Kuala Lumpur Railway Station in 1917 (Figure 17).



Figure 17. View of the railway administration building.

The building's façade has a sequence of various arches on each storey (Figure 18). The ground story features ogee arches, the first floor features horseshoe arches with triple columns in the centre, and the second floor features double ogee arches with double columns (Figure 19).



Figure 18. View of the façade and the arches.



Figure 19. View of the arches.

Others

Mahkamah Tinggi (the High Court).

Anthony C. Norman, the architect, designed this structure in 1904 (Figure 20). It is also classified as Indo Saracenic architecture, with ogee arches and double columns on the ground level and horseshoe arches and double columns on the upper story (Figure 21). The building's corners are topped by domes.



Figure 20. View of the High Court.



Figure 21. View of the horseshoe and ogee arches.

It may be discovered that all throughout the Western colonisation of Malaysia, the Westerners introduced administrative buildings in Malaysia, beginning with the Dutch *Stadhuis*. During the British Empire's reign from the late 1800s to 1900, they began to construct administrative structures such as government offices, public works departments, city and town halls, railway stations, and others in the Indo-Saracenic style. In their structures, the styles included onion domes, pointed arches, ogee arches, horseshoe arches, many smaller domes, domed *chhatris*, pinnacles, towers or minarets, harem windows, overhanging eaves, and open pavilions.

RESEARCH METHODOLOGY

Methodologies utilised for this research include reviewing past research on adaptive reuse of buildings and evaluating accessible schematics, drawings, and pictures. The methodology used in this research adopted the approach developed by (Kitchenham 2004) and later adapted by Bacca et al. (2004) for a systematic review of the literature, which divides the process into three major phases: planning, doing the review, and reporting the study. A preliminary conceptual analysis process has been added, which is developed from an early approach to the general research problem; this conceptual analysis is carried out from De Zubira's (1996) conceptual mind proposal or analysis and understanding of a specific field of study.

FINDINGS

The findings of this research are expected to result that anticipate deriving from the comprehensive research efforts. These findings will be based on a rigorous examination of various aspects related to adaptive reuse in colonial buildings. The primary goal of this research is not just to identify problems but to go a step further and provide practical, actionable solutions or recommendations. These recommendations will be tailored to address the specific barriers that we uncover during this study. This phrase highlights that the core objective of this research is to find ways to overcome or reduce the obstacles that interrupt successful of adaptive reuse in colonial buildings. This abatement can involve strategies, best practices, or policy recommendations.

This research acknowledges the importance of the adaptive reuse process itself, emphasizing that it plays a critical role in shaping the outcome of these projects. The success or failure of adaptive reuse endeavors hinges on how well the process is executed. We recognize that the adaptive reuse process has a direct impact on the characteristics of the resulting projects. How we approach and navigate the process will shape the nature and attributes of the transformed colonial buildings. Finally, our research examines not only the barriers but also the advantages and possibilities associated with adaptive reuse in colonial buildings.

These benefits and potentials are categorized into three key dimensions: social, environmental, and economic, indicating the multifaceted nature of our analysis. In essence, our research seeks to go beyond mere identification of challenges and aims to offer practical guidance and solutions that can enhance the overall quality and success of adaptive reuse projects in colonial buildings. We recognize the intrinsic value of these historical structures and strive to ensure that their adaptive reuse maximizes their potential benefits across various domains.

CONCLUSION

Finally, our extensive study on adaptive reuse of colonial buildings is motivated by the need to identify and eliminate constraints while maximising the numerous opportunities contained in these ancient structures. We attempt to provide real, targeted advice that go beyond simply identifying the problem. Our dedication extends to acknowledging the critical significance of the adaptive reuse process and understanding how its implementation influences the fundamental essence of renovated colonial structures. To emphasise the complex character of our study, we categorise the advantages and potentials into three dimensions: social, environmental, and economic. Finally, our study aims to improve the quality and success of adaptive reuse initiatives in old colonial structures, preserving their historical relevance while realising their full potential across several areas.

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