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Adaptive Reuse of Vacant Commercial Buildings into Urban Affordable Housing

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ABSTRACT

Due to rapid urbanization and uncontrollable city developments has leads to abandonment and deterioration of old commercial buildings, impacting property values, public safety, and the environment. However, Kuala Lumpur is experiencing a decreasing population rate, with housing either too expensive or in terrible condition, forcing the working class to move to suburb with more affordable housing options. Kuala Lumpur City Hall (KLCH) introduced a project called 'Perumahan Bandar' by using adaptive reuse strategy. Past research has shown that sustainability can be achieved by integrating human needs with the environmental considerations. The purpose of this paper is to identify the opportunities and risks associated with adaptive reuse strategies for converting vacant commercial buildings into affordable housing as a sustainable solution for unoccupied commercial buildings. The method used is multiple case studies and expert interviews to understand the issue of vacant commercial buildings in various contexts and to gather expert opinions on adaptive reuse strategies for addressing empty premises issues in the urban setting. The findings of this paper indicate that the effectiveness of the building adaptive reuse strategy depends on a thorough understanding of its opportunities and risks, which are influenced by the drivers and barriers of the process. The strategy of converting vacant commercial buildings into affordable housing offers a shorter development period, provides sustainable design solution for unused buildings, and enhances community well-being.

1. Introduction

Kuala Lumpur, the capital of Malaysia, spans 242 kilometers with a population of approximately 2.1 million in 2024 and projected to increase to 2.49 million by 2030 (Department of Statistics Malaysia, 2024) [12]. The rapid population growth is forcing cities to undergo a fast pace of urbanisation that demands extensive infrastructure and economic development, which in turn leads to

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environmental degradation and global climate instability (Julnes,2019) [20]. Numerous new buildings are constructed to meet the increasing demands of the economy and population, resulting in a significant impact on the environment. However, Mohamed *et al*. (2017) [26] demonstrated that reusing existing structures can lower carbon emissions and reduce the environmental impact on urban areas as compared to constructing new buildings.

Klarin (2018) [21] highlighted, the core principle of achieving sustainability involves integrating and balancing human needs with environmental considerations. Where else according to the Brundtland Report (1987) [5], sustainability is defined as development that meets the needs of both present and future generations. According to KLCH (2019) [23], buildings contribute to 49% of Kuala Lumpur's greenhouse gas (GHG) emissions, with 10,329 ktCO2 coming from commercial buildings and 2,152 ktCO2 from residential buildings. Conversely, UKGBC (2017) [36] reports that the building sector contributes 40% of carbon emissions and 50% of the energy used in buildings and infrastructure could be avoided through adaptive reuse. Therefore, repurposing existing urban structure is both means of achieving urban sustainability and an effective approach to addressing the city's shortage of affordable housing.

The issue of unoccupied and abandoned properties is becoming a growing problem, impacting the local economy, society, and environment (Branas *et al*., 2012) [4]. Adaptive reuse strategies have been increasingly recognized for their potential to repurpose vacant commercial buildings. However, there remains to be a significant gap in understanding how these strategies address the shortage of affordable housing in urban areas (Myers & Wyatt, 2004) [27]. Robertson (2016) [34] notes that housing in the city is either too expensive or in a very poor condition, forcing the working class to move to the suburbs, where houses are more affordable but require additional costs and time for commuting to work. Existing research often overlooks the opportunities and risks associated with converting commercial properties into affordable housing units, particularly in the context of urban settings where demand and environmental considerations are critical.

Addressing this gap is significant, as it could provide innovative solutions and new insights into optimizing adaptive reuse strategies to achieve dual objectives: alleviating housing shortages and advancing sustainability goals. Therefore, the purpose of this paper is to identify the opportunities and risks associated with adaptive reuse, assess its effectiveness in addressing the issue of vacant commercial buildings, and evaluate its potential as a strategy for providing affordable housing in the city. The purpose of this paper leads to the following three main objectives: 1) to identify the opportunities and risks of applying the adaptive reuse strategy to vacant commercial buildings in the city; 2) to discuss the technical consideration involved in converting commercial buildings into affordable housing; and 3) to investigate the effectiveness of adaptive reuse in dealing with vacant commercial buildings.

2. Literature Review

2.1 Factors of Vacant Commercial Buildings in Cities

Wilkinson (1963) [37] defined vacant buildings as unoccupied residential, commercial, and industrial properties that show signs of abandonment and lack of maintenance by the property owner, potentially jeopardizing public safety and harming the city's image. He also described economically obsolete or vacant shopping malls and retail spaces as greyfields. Additionally, Remøy (2010) [32] characterized structurally vacant buildings as those that have been unoccupied for three or more years and which adversely affect the local economy, environment, and social development. It has been observed that the number of vacant commercial properties is rising globally. This increase is not solely attributable to economic conditions (Johnson *et al*., 2014) [19], but also reflects shifts in public demand and behavior (Remøy, 2010) [32].

The local economy significantly impacts commercial property trends. During economic recessions, filling vacancies becomes more challenging, and rental prices tend to decline (Centre for Economics and Business Research, 2019) [7]. However, Remøy (2010) [32] found that changes in demand and behaviour, along with advancement in technology, are significant contributors to commercial property vacancies. According to Cooper (2013) [9], high streets, once central to business activity, have experienced a decline due to the rise of shopping centers. These large commercial complexes, typically located outside city centers, draw people away from urban areas, leading to a reduction in the city's commercial activities. As a result, many shop owners have been forced to close their businesses or relocate to retail spaces within these shopping centers.

Habitat for Humanity (2021) [13] found that over 20% of retail sales are now attributed to online shopping, reflecting a significant revolution in purchasing behavior. This trend is closely linked to technological advancements and, more recently, the pandemic, which made online shopping a preferred option due to reduced risk of exposure to infection. Office buildings have encountered similar challenges, as shifts in demand and behavior have led to increased vacancies. The COVID-19 pandemic, with its lockdown measures, accelerated the trend toward working from home, leaving many offices and businesses standing empty. Hence, due to slow business activity and high rent costs, many companies have downsized their office spaces or rent shared office spaces (OBeirne, 2020) [28]. Vacant property protection strategies are crucial for ensuring the safety of buildings and their surroundings. Therefore, to effectively address these issues, it is vital to understand the factors contributing to commercial property vacancies and their economic, social and environmental impact on the surrounding context.

2.2 Impacts of Vacant and Abandoned Commercial Buildings

Vacant buildings attract numerous issues, particularly when it remains unoccupied for extended periods without proper management. A lack of economic incentives and effective municipals policies can discourage the maintenance and improvement of vacant properties. Since legal authority is often limited, local authorities frequently need to implement creative strategies to persuade and encourage property owners to take care of their unoccupied properties (Schilling, 2002) [35]. Effective policies and guidelines are crucial for monitoring urban development. However, due to the shifting in public needs and demands, local authorities require to adopt a proactive approach while continually monitor the city's changing landscape. The impact of vacant properties can vary significantly depending on the context, but it typically revolves around three core elements: the economy, the environment, and social deprivation.

According to Schilling (2002) [35], investors usually avoid investing in unprofitable neighbourhoods, leading to declining of property values and reduction of business activities. Han (2013) [15] also found that although the building does not portray visible signs of abandonment, vacant properties can still create negative perceptions among potential buyers, impacting the property values of the entire neighbourhood. As local property values decrease, property tax revenues may also decline, which consequently limit the local government's ability to invest in and maintain the city's environment and infrastructure. Hence, leading to further deterioration and the emergence of additional problems (Accordino & Johnson, 2000) [1].

Socially, unoccupied buildings contribute to social degradation by compromising safety, health, and living conditions. Studies show that over 80 percent of abandoned buildings displayed evidence of illegal activities (Schilling, 2002) [35]. Building vacancies often attract unwanted trespassers, which can lead to undesirable activities such as drug dealing, prostitution, and gang-related crime, which can further undermine community well-being (Branas *et al*., 2012) [4]. Additionally, Cohen *et al*. (2000) [8] also found that structural deterioration in neighborhoods can indirectly cause significant pressure on the community's mental health. Stress and depression are significant symptoms of mental health decline, often resulting from fear of crime and dissatisfaction with one's home environment. Kruger *et*

al. (2007) [22] argue that community's stress also driven by low property values and a lack of job opportunities in the deteriorating neighborhood.

The environmental impacts of property vacancies are closely related with economic and social factors. Neighborhood with high numbers of vacant and abandoned structures pushes investors away but rather attracts negative activities. Vacant properties portray untidy and neglected appearance, which can affect the visual appearance on the neighborhood and contribute to the overall urban blight. Unoccupied buildings often become illegal dumping ground, leading to pollution and attracting pests, which further contributing to environmental degradation. Wilkinson (1963) [37] identified that reclaiming vacant properties can improve local environmental quality, including improvements in air, water, and land conditions, leading to a healthier living environment.

2.3 Opportunities and Risks of Adaptive Reuse Strategy

Urbanisation is a proses driven by rapid population growth, economic opportunities, and improved infrastructure development. However, without effective planning, the migration of rural populations into urban area can strain the existing infrastructure, causing congestions and shortage of housing (Julnes,2019) [20]. As housing demand grows, property prices also increase, worsen the affordable housing issues and contributing to a rise in homelessness. According to Ministry of Housing and Local Government (2019) [25], the maximum price of affordable housing in Malaysia is RM300,000, which requires household income of RM8,333 per month. Consequently, a study by PropertyGuru (2022) [31] found that 51 percent of Malaysians are ineligible for affordable housing schemes and cannot afford to buy a house without financial assistance. Despite this, the number of homeless individuals in Kuala Lumpur continue to rise, primary due to low income (Lia, 2020) [24] which prevents many from affording a place to live. Recognising this issue, adaptive reuse strategies offer a promising solution for both urban sustainability and the shortage of affordable housing by providing cost-effective, safe, and accessible living options.

Oyuce (2000) [30] defined adaptive reuse architecture as the process of repurposing a building's function through design and construction by consider the building's constraints and potential. However, Mohamed *et al*. (2017, p. 151) [26] define adaptive reuse in the context of urban planning as, "Repurposing of a structurally sound building for a new use that reconciles the tensions between the environment, economic development, and equity". The process of building adaptive reuse may not be straightforward, but reclaiming vacant properties through building conversion can offer a chance to create new building character while revitalizing the neighbourhood and enhancing urban sustainability by extending the building's lifespan (Yung and Chan, 2012) [38]. The initiative to repurpose vacant buildings for a new use has received strong support from both national and international governments. However, developers often struggle to make effective development decisions due to a lack of data on existing vacant properties. This includes crucial information such as building dimensions, existing infrastructure, and its accessibility (Myers & Wyatt, 2004) [27].

The implementation of adaptive reuse development has been increasingly popular globally, and the COVID-19 pandemic has further accelerated shifts in socio-economic patterns. Remøy & Van der Voordt (2014) [33] note that this strategy provides new life to the obsolete buildings by leveraging both opportunities and risks. Although different building typology present varying opportunities and challenges, adaptive reuse generally offers shorter development period, lower construction cost, sustainable solution, and improved neighbourhood liveability. Where else, risks associated with adaptive reuse include the building's location, its characteristics, and the existing guidelines and policies.

Due to the nature of the adaptive reuse method, which primarily involves upgrading the existing building structure rather than major construction, the process is generally faster and less affected by the weather condition. This method also reduces renovation cost by requiring fewer workers and less machinery on-site comparing to demolishing and rebuilding new buildings (Ball, 2002) [3].

Additionally, Bullen & Love (2011) [6] stated that building adaptation contributes to urban regeneration by reducing the usage of natural resources through extending the building's life, minimizes material wastage and promoting the reuse of embodied energy. Preserving the historical architecture of a building can enhance its market value while revitalizing the surrounding neighbourhood. Consequently, repurposing an existing building for a new use can meet contemporary needs such as urban housing, creating more job opportunities and preventing city gentrification (Davis, 2019) [11].

Dealing with old buildings often involves unavoidable risks, especially if they have been vacant and unmaintained for a period. These unforeseen risks can be minimised through an initial structural dilapidation assessment and a thorough feasibility study of the building's future typology. Remøy & Van der Voordt (2014) [33] identified two major risks associated with building adaptation: the location of the building and its inherent characteristics, both of which translated into financial risks. However, Overtoom *et al*. (2018) [29] noted that the location of a building undergoing adaptation can influence the return on investment. A building located in a prime area with access to supporting facilities and amenities typically yields higher return on investment for the developer, which can impact housing affordability. Nonetheless, a residential building located in an active area may face risks such as noise and air pollution, which can negatively affect property sales and resident comfort (Remøy & Van der Voordt, 2014) [33].

Additionally, building characteristics is another risk in building adaptation strategies. Developers often find that the drawings and specifications of heritage building are inaccurate or do not match the actual conditions on site (Remøy & Van der Voordt, 2014) [33]. This uncertainty can lead to unforeseen development issues, which may discourage developers from investing in adaptive reuse projects. These issues may arise from the existing structure's incompatibility with the new building function, including problems with the existing floor height and depth, structural dimensions, internal layout, access, or outdated plumbing and electrical systems (Remøy & Van der Voordt, 2014) [33]. Therefore, while building characteristic risks do not make building adaptation unachievable, but more often it affects the development costs.

3. Methodology

This paper explores social science issues related to opportunities, risks, and the effectiveness of adaptive reuse strategies for vacant commercial buildings within the context of urban sustainability. Case studies and expert interviews are the qualitative methods applied in this paper. Hammarberg *et al*. (2016) [14] describe qualitative research method as an exploratory approach that provides a deeper understanding of social sciences issues. The data obtained through qualitative method offers more in-depth insights as compared to quantitative data, which focuses on breadth and statistical analysis. These methods were selected to obtain a comprehensive understanding of the phenomena associated with vacant commercial buildings and to gather expert opinions on adaptive reuse strategies. The case studies provide a basic understanding of the local context and existing issues. The knowledge is then used to frame the interview questions, allowing for detail exploration of expert perspectives on specific theories and concepts. The data obtained from the interviews were then compared with the case study findings to ensure the research outcomes are robust and unbiased, thereby enhancing the quality and rigor of the study.

The paper focuses on case studies from Kuala Lumpur, Malaysia and Leeds, England. These case studies were chosen based on their building typology, site contexts and their impact on urban sustainability. Comparing data across multiple cases helps to validate findings and offers insights into how specific context affect outcomes. Additionally, interviews were conducted with a planning officer from Leeds City Council and a developer from Leeds to understand policies related to a vacant building and to gain insights into adaptive reuse from the developer's perspective.

The data analysis technique implemented in this paper is content analysis, a flexible method for analyzing text data by coding and classifying themes. Content analysis also involves collecting and analysing viewpoints associated with the identified themes (Hsieh & Shannon, 2005) [18]. In this paper, deductive approach was applied, where themes were pre-defined and extracted from the preliminary study. These pre-defined themes then served as the framework for the data coding process (Azungah, 2018) [2]. The factor of the vacant commercial building, the opportunities and risk of adaptation project within the local context, and the effectiveness of adaptive reuse strategies for addressing vacant commercial properties are the themes used for data analysis in the case study and interview methods.

4. Findings and Discussion

Adaptive reuse project in each Kuala Lumpur and Leeds were selected to gain a deeper understanding of building adaptation strategies. The goal is to explore these strategies as potential solution for addressing affordable housing shortage and evaluating their effectiveness in dealing with vacant commercial building. Kuala Lumpur City Hall had introduced a project called 'Perumahan Bandar' (Urban Housing) by using adaptive reuse strategy and was repurposed into an urban affordable accommodation for the young working class. The project was designed to cater the basic living needs of young professionals working in the city center who struggle to afford proper housing. The two blocks of eight-story shop lots is located in the prime area of Kuala Lumpur's commercial district, within walking distance of public transportation and surrounded by essential facilities and services, such as retail stores and health centers. It had identified that the building had been left vacant for over five years following a partial fire. During this period, the abandonment and poor management let to its occupation by trespassers and contributed to various social problems in the area. This, in turn, negatively impacted the market value of neighbouring buildings and posed safety concerns for the city.

Where else, 'The Drapery' was a vacant department store in Leeds City Centre, located in a pedestrianized zone with restricted vehicle access. The project received full planning permission from Leeds City Council in 2021 and is currently being repurposed into 124 units student accommodation on the upper floor and 45,000 square feet of retail space on the basement to first floor. Compared to Kuala Lumpur, building vacancy rates in Leeds was relatively stable until the COVID-19 pandemic hit. However, the pandemic had significantly affected businesses, particularly on the high street, due to the national lockdown. Additionally, the surge in online shopping, driven by technological advancements and the change of shopping behaviour during the pandemic, had led to a sharp rise in vacancy rates. Data collected from the case studies and the interviews are summarized in Table 1 and will be discussed further in this chapter.

Table 1
Summary of the case studies

	Kuala Lumpur, Malaysia	**Leeds, United Kingdom**
Project Name	Perumahan Bandar (Urban Housing)	The Drapery (Urban Students accommodation)
Drivers of Adaptive Reuse	• Location • Public demand • Construction period • Financial consideration	• Legislative Policy • Location • Physical design: Heritage building
Opportunities	• Shorter development process • Sustainable design solution • Enhance urban economy	• Shorter development process • Sustainable design solution • Enhance urban economy
Risks	• Location • Existing building structure • Building guidelines	• Existing building structure
Effectiveness	• Enhance the surrounding economy • Conducive urban living space	• Enhance the surrounding economy

4.1 Drivers and Barriers Influencing the Opportunities and Risks to Building Adaptation

Adapting an existing building for a new purpose is a complex process that requires thorough planning and critical decision-making. Case studies and interviews have revealed that the adaptive reuse of vacant commercial buildings is primarily influenced by the opportunities and risks associated with the process, whereby these aspects are shaped by various drivers and barriers alongside the process, and a thorough understanding of these elements can help maximize the potential outcomes of the adaptive reuse process (Bullen & Love, 2011) [6]. The drivers and barriers of building adaptation can be categorized into five main factors: physical design, location, public demand, financial consideration, and legislative policy (Heath, 2001) [16]. This paper also found that achieving urban sustainability through building adaptation is more effective when these opportunities and risks are understood in advance, as illustrated in Figure 1. Changing building classification requires compliance with new building codes and policies, which can pose challenges for developers by extending the development timeframe and potentially incurring additional costs (Heath, 2001) [16]. Converting a commercial property into a residential building requires developers to comply to planning and building policies, such as building density, parking space, fire safety, accessibility, lighting and ventilation.

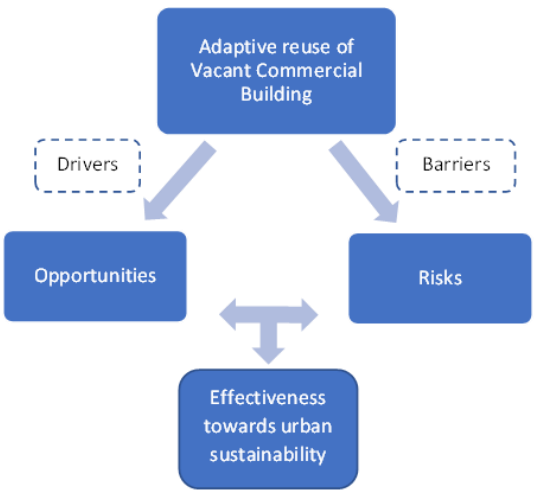

Fig. 1. Interrelation of opportunities and risk of adaptive reuse strategies towards its effectiveness

Leeds' case studies have identified that building adaptation by private property owners is driven by government support. According to an interview with Leeds City Council, the UK government had revised the Permitted Development Rights (PDRs) regulations to address issues related to vacant commercial properties by allowing these buildings to be converted to residential use without applying for building permission (House of Commons Library, 2021) [17]. While this revision aims to increase the availability of housing and promote sustainable development, this approach might negatively impact the overall sustainability of urban areas and reduce the local democracy of rights to the city and could lead to lower-quality housing, as the rapid implementation of changes and reduced oversight from local authorities may result in inadequate scrutiny and regulation (House of Commons Library, 2021) [17]. While changes to planning procedures can encourage adaptive reuse, it is crucial to tailor building regulations to specific modifications to avoid unnecessary costs and maintain safety standards. Compared to the KL case study, KLCH is currently enhancing the regulations for converting commercial buildings into residential use. However, these regulations and guidelines are tied to the existing fire safety requirements outlined in the Fire Department Regulations.

The location of the building is also a significant factor in determining building adaptation. This factor is particularly crucial for residential buildings, which need to be situated in a conducive environment to ensure a high quality of living. Key aspects include accessibility to transportation system, proximity to essential services and facilities, and availability of parking space (Heath, 2001) [16]. Both of the case studies located in the city center, surrounded with supporting facilities and amenities. Transforming a commercial building to a residential requires supporting facilities and services, such as transportation systems and shops within walking distance. In the KL case study, vacant commercial buildings in the city center have often attracted negative activities such as drug abuse and gangsterism. This situation has raised concerns among nearby retailers, negatively affecting their businesses and the overall well-being of the city. Moreover, KL is experiencing a decline in its working-class population due to the high cost or poor condition of housing in the city. Consequently, many working-class residents are relocating to more affordable suburban areas. While the city remains bustling during the day, it becomes quiet and less safe at night. To address this issue, introducing affordable, temporary housing options for young professionals could revitalize the city, enhancing its living environment and increasing night-time activity.

Additionally, the condition and aesthetic aspect of an existing building significantly impact developer's decisions regarding adaptation. To assess these factors accurately, a detailed dilapidation assessment must be conducted to evaluate the building's structural integrity and layout. Many developers hesitate to invest in older buildings due to the uncertainty of returns, as well as the construction costs and safety risks associated with the renovation process (Bullen & Love, 2011) [6]. However, transforming an empty building for a new function is considered as a sustainable alternative to building demolition and rebuilding. It offers a shorter development process, typically involves interior upgrades and minor façade alterations, which are less affected by external factors such as bad weather. Hence, a shorter construction period translates to lower labour and machinery costs. The upgrading work for 'Perumahan Bandar' was completed in just 1 year and 6 months, encompassing architectural, mechanical, electrical, and interior design works. In contrast, constructing a new building would take at least 2 years just for the building works. Despite challenges such as limited working space and unexpected structural conditions, the construction team and contractor successfully overcame these obstacles through effective coordination.

4.2 Effectiveness of Adaptive Reuse Strategies

Assessing the effectiveness of an adaptive reuse strategy is a complex undertaking, as it requires balancing economic, social, and environmental factors that are essential for future generations. The impacts of these strategies may not be immediately visible and often take time to become apparent. Thus, sustainable development must consider intergenerational justice. The evaluation process

involves ongoing monitoring, which is inherently subjective and context-specific, making it difficult to quantify. Three key criteria for assessment, based on livelihood indicators, include social equality, market value, and environmental conditions. In accordance with the right to the city concept, the success of an adaptive reuse initiative is measured by its performance in these three areas.

The success of an adaptive reuse strategy can be revealed through public response and user demand. Positive feedback and an increasing number of building occupants indicate the success of the adaptive reuse strategies implementation. In the KL and Leeds case studies, both vacant commercial buildings were planned for conversion into residential spaces, but they targeted different demographics and addressed distinct urban issues. In KL, the adaptive reuse strategy aimed to attract working-class residents to the city, enhance urban vitality, and reduce night-time crime. The conversion of shop lots into affordable housing received favourable responses from the public and the local community, especially from neighbouring shop owners. This transformation improved the area without causing negative gentrification. Figure 2 illustrates the transformation of the building façade, which significantly contributes to revitalizing the surrounding environment. It has effectively integrated with the local context while helping the city remain adaptable to future developments.

Leeds' adaptive reuse case study involves converting vacant retail spaces into luxury student accommodations. As shown in Figure 3, the vacant retail building portrayed the lifeless city image despite its potential to enhance the area with its historic façade. With numerous universities surrounding Leeds city center, it was recognized that students are the major contributors to local businesses. Moreover, positioning student accommodations near public transportation and universities could promote active travel and decrease reliance on private vehicles. However, while the development of luxury residential properties addresses some economic aspects, it also exacerbates social inequality.

Fig.2. Transformation of vacant commercial building in KL
(*Source: KLCH, 2019*)

The KL case study involves a publicly owned building, in contrast to the Leeds, which is privately owned. This distinction highlights that private developers are often more profit driven. Publicly owned buildings, like the KL case study, are designed to address socio-economic issues by offering affordable and sustainable housing options that address public needs. In contrast, in the Leeds case study, the developer is more focused on meeting the needs of wealthier demographics. Although there are debates about how ownership affects the effectiveness of adaptive reuse method, this paper will not delve into those discussions. It is important to understand that adaptive reuse alone does not fully address urban inequality, as it primarily focuses on individual buildings rather than the entire urban system.

Fig.3. Vacant commercial building in Leeds city center (*Source: CJCT, 2021*)

4.3 Reimagining Affordable Urban Housing Through Adaptive Reuse Strategy

Transforming of affordable urban housing through adaptive reuse strategies offers a sustainable and cost-effective construction solution. This approach requires detailed understanding of occupant safety, building ventilation, and lighting, as each of these factors significantly impact living quality. Referring to KL's case study, the long floor footprint and low ceiling height limit the amount of sunlight entering the space. To optimize ventilation and lighting into each room and area, the wall partitions between rooms and towards the corridor were not built full height (see Figure 4 and 5). In contrast, the Leeds case study introduced a central lightwell, creating an internal courtyard to provide natural lighting to the internal rooms, as shown in Figure 6.

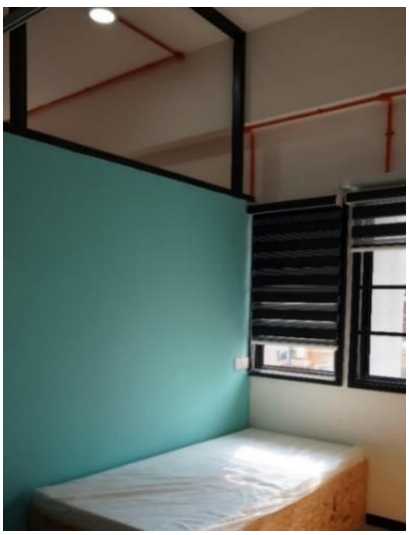

Fig. 4. Partition between the rooms (*Source: KLCH, 2019*)

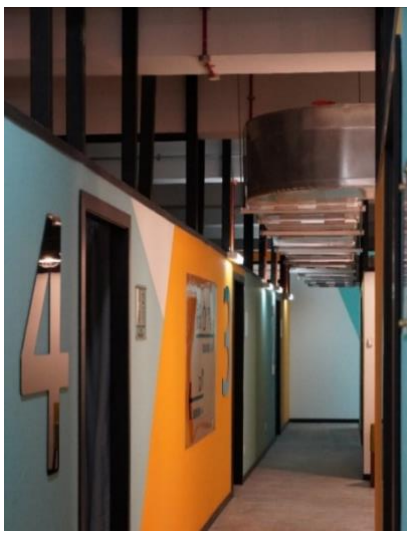

Fig. 5. Partition between rooms and Corridor (*Source: KLCH, 2019*)

A building adaptation strategy offers a sustainable solution for unused buildings by giving structures that were once redundant and vacant a new purpose to the neighbourhood. This method typically involves preserving and enhancing existing structures through upgrades such as interior design improvement or façade treatments. Consequently, it reduces material waste, minimizes transportation use, and involves fewer site clearing activities. Reusing an existing building helps

conserve natural resources that would otherwise be depleted by new developments, which often demands significant amounts of materials, energy, and generates substantial landfill waste and carbon emissions.

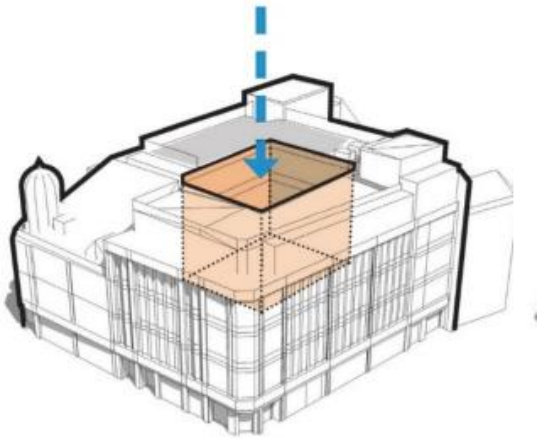

Fig. 6. Introduced lightwell as the center courtyard
(*Source: CJCT, 2021*)

However, reusing old structures may lead to many risks, hence, a detailed condition assessment, or lapidation study must be conducted to evaluate the existing building's condition. Moreover, a feasibility study is necessary to identify the strengths, weaknesses, and risks associated with the proposed adaptation development. In the KL case study, converting shop lots into affordable housing presents challenges, particularly in meeting fire safety requirements, which includes the need for additional fire protected-lobby and additional mechanical ducting. The change in building typology leads to different fire safety standards, as residential fire safety regulations are more stringent than commercial buildings, due to the greater emphasis on occupant safety.

Comparing both case studies, the 'Perumahan Bandar' project provides an urban sustainable and cost-effective solution for affordable housing through adaptive reuse. The accommodation features small living spaces with shared facilities, offered at a rental price of only RM100 per month. In contrast, 'The Drapery,' while also a building adaptation project converting a commercial building into residential use, it is repurposed into luxury student accommodation and does not address the issue of affordable housing shortages in the city.

5. Conclusions

In conclusion, the findings of this paper highlight that adaptive reuse strategies are an effective solution for addressing urban issues related to vacant commercial buildings. These strategies offer a faster development process compared to constructing new buildings. Converting vacant commercial buildings into urban affordable housing not only shortens the development period but also offers a sustainable design solution for unused buildings and enhances community well-being in the urban context. However, it had been identified that the risk and opportunities of adaptive reuse lies within the building's location, existing characteristics, and building guidelines and policies. These opportunities and risks are influenced by the drivers and barriers that come alongside the building adaptation process, in which the barriers can be managed through thorough building dilapidation assessments and feasibility studies.

The effectiveness of adaptive reuse is demonstrated by positive public response, economic growth in the local area, and enhanced social equality. This paper suggests that flexible building and planning policies can support adaptive reuse while minimizing the environmental instability associated with new development. However, the benefits of such transformation may not be immediately visible; they

often take years to become apparent and can impact future generations. Therefore, a comprehensive analysis of the local context, community needs, and potential demands is essential before implementing the transformation of any vacant commercial buildings.

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