



Adaptive Reuse of Historic Buildings: Balancing Cultural Heritage Conservation with Contemporary Architectural Needs

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ABSTRACT

The adaptive reuse of historic buildings presents an important challenge of balancing cultural heritage conservation with contemporary architectural requirements. This study examines the factors influencing successful adaptive reuse, with particular emphasis on Cultural Heritage Conservation (CHC), Contemporary Architectural Intervention (CAI), Sustainability (SUS), Contemporary Functionality (CF), and User Requirements (UR). A quantitative, deductive, and cross-sectional research design was adopted. Primary data were collected through a structured questionnaire using a five-point Likert scale from 200 built-environment professionals, including architects, interior designers, conservation professionals, urban planners, engineers, and related practitioners. The data were analysed using descriptive statistics and Partial Least Squares Structural Equation Modelling (PLS-SEM). The measurement model demonstrated satisfactory reliability and validity, with all constructs meeting the recommended thresholds for internal consistency and convergent validity. Discriminant validity was also established, as the HTMT results confirmed adequate distinction among the constructs. The structural model further revealed that Cultural Heritage Conservation, Contemporary Architectural Intervention, Sustainability, Contemporary Functionality, and User Requirements all have significant and positive effects on Successful Adaptive Reuse. Overall, the model demonstrated strong explanatory power for successful adaptive reuse, indicating that these factors collectively play an important role in supporting the adaptive reuse of heritage buildings. Among the predictors, Contemporary Architectural Intervention demonstrated the strongest effect. The findings indicate that successful adaptive reuse requires an integrated approach in which heritage significance is protected while sensitive contemporary interventions address sustainability, functionality, accessibility, and user needs. The study concludes that conservation and contemporary architectural development can operate as complementary objectives in ensuring the continued relevance and sustainable use of historic buildings.



Background of the Study

Cities have historic buildings that play a vital role in their cultural, architectural, social and economic identity. They can offer a sense of continuity between current communities and the past, and can represent historical events, social memory, traditional building methods, artistry, and culture. As a result, the conservation of heritage has shifted from the mere preservation of historic buildings to the use and social significance of, and sustainable urban development for, these buildings. In this context, adaptive reuse has become an important tool for the extension of the functional life of historic buildings while at the same time maintaining their cultural value (Bullen & Love, 2011; Plevoets & Van Cleempoel, 2019).

Adaptive reuse is the process of adapting an existing building to a new use or continued use, while preserving much of its original structure. These interventions can involve aspects of spatial organisation, circulation, building services, structural systems, accessibility, safety and environmental performance. However, in historic buildings, these interventions need to be managed carefully as inappropriate changes can impact on the cultural significance, authenticity, architectural character and identity. Plevoets and Van Cleempoel (2019) thus see adaptive reuse as a design process that is not merely a technical procedure but also a process that is capable of negotiating between the existing historical and cultural values, and the contemporary architectural requirements. The rise in adaptive reuse is related to rapid urbanisation, population growth, resource scarcity, environmental pressures, changing patterns of occupation, and rising construction costs. Adaptive reuse is about the reuse of existing building stock as a resource for future development, rather than the buildings being considered as wasteful. Existing buildings are a potential renewable resource as they can be extended to meet the need for new construction and can help to conserve embodied resources (Bullen, 2004). Adaptive reuse is also becoming more important for sustainable urban development, as it can help to respond to building obsolescence and mitigate some environmental and material effects of demolition and new construction.

The connections between adaptive reuse and sustainability are especially significant because of the presence of embodied energy and materials in existing buildings. Preserving structures and materials can minimise demolition waste and reduce the need for new resources. Bullen and Love (2011) identify three aspects of the sustainability discussion that apply to heritage buildings: environmental, economic, and social. But adaptive reuse does not necessarily mean sustainable just because a building is not demolished. The environmental benefits are influenced by the size of the intervention, building performance, energy needs, materials used, location and sustainability of the new function. Armstrong et al. (2023) also state that adaptive reuse is only one approach to building life extension, and that not all adaptive reuse will be environmentally beneficial in comparison to new construction. Sustainability thus needs to be taken in terms of environmental, social, economic, architectural and functional aspects.

Cultural Heritage Conservation and Adaptive Reuse

Traditional heritage conservation has been based on the protection of the significant historic fabric, and the prevention of inappropriate alterations. However, modern conservation theory acknowledges that there are physical, historical, aesthetic, social, spiritual and associative values that can be considered as part of the heritage significance. The Burra Charter emphasises cultural significance as a primary consideration in decisions about change and management and

acknowledges adaptation where there is little impact on significance, and where appropriate alternatives have been considered (Truscott, 2020).

This is especially applicable to adaptive re-use, where historic buildings cannot be left untouched in order to continue to provide for contemporary society. Viable use is essential for the preservation of the historic fabric, but complete preservation without viable use can lead to underuse, deterioration, or economic problems, and more than necessary intervention can lead to loss of historic fabric and cultural significance. Adaptive reuse is thus a compromise between preservation and change, and decisions must be made as to what should be preserved, what can be modified, and how new additions and alterations can be added to the historic fabric. A value-based approach is therefore needed before intervention. Prior to any changes, it is important to identify important façades, structural elements, spatial configurations, materials, decorative features, circulation patterns, historical associations, and relationships with the surrounding environment. Systematic conservation planning is highlighted by Kerr (2013) as a tool to gain understanding of significance and to inform the appropriate change. Conservation planning can thus serve as a basis for evaluating proposed interventions based on the historic place's values.

Contemporary Architectural Requirements

Although heritage conservation is a fundamental requirement, historic buildings must also meet the current demands for accessibility, safety, comfort, environmental performance, technology and functional flexibility. There may be a need to improve the fire protection, emergency escape, structural stability, accessibility, ventilation, sanitation, electrical systems and energy performance in accordance with modern regulations. It can be difficult to meet these requirements as historic buildings are built to previous standards, technologies, and ways of use. Building services such as heating and ventilation, electrical installations, information technology, lifts, fire protection, lighting, plumbing and security systems are modern systems that may necessitate changes to historic fabric. Likewise, there may be ramps, lifts, modified entrances or circulation changes needed for accessibility improvements. While these interventions can enhance usability and inclusivity, they can also have negative impacts on important architectural elements if not designed well.

The new interventions are therefore crucial to the sensitivity of the contemporary architectural design to the existing heritage values. Plevvoets and Van Cleempoel (2019) define adaptive reuse as a field where designers have to negotiate between the material and immaterial values of the existing and the new architectural requirements. Modern interventions do not have to be copies of historic buildings, but they can be clearly different and yet be in a proper relationship with the historic building. This is in line with the principles of the Burra Charter, which promotes new work that is respectful of cultural significance and recognisable as a contemporary intervention (Australia ICOMOS, 2013). The preservation of the historic character of the town is balanced against contemporary design and aesthetics. The main issues in adaptive reuse are balancing the conservation of the historic fabric with the demands of the present. The excessive conservation of historic buildings without regard to current needs can make them impractical or unfeasible, or the excessive modernisation can lead to the loss of architectural identity and authenticity. An integrated decision-making process is required for adaptive reuse, which takes into account multiple dimensions. Past studies have shown that the economic, architectural, social, environmental, technological and legislative aspects are the factors affecting the success of adaptive reuse. Vafaie et al. (2023) found these to be key dimensions for adaptive reuse decision-

making and highlighted that there is no universal recipe for project success, as buildings, contexts, stakeholders, regulations and cultural values are different.

Economic viability is important, especially as conservation and adaptation could involve significant investment, with structural issues, outmoded services, access and specialist conservation needs. However, the reuse of existing building elements, the re-activation of previously unused spaces, tourism, job creation, property value and new business/commercial and cultural uses can all provide economic benefits. When projects are planned and managed appropriately, adaptive reuse can yield viable economic outcomes as shown by Shipley et al. (2006). Social aspects are also relevant, as historic buildings can have a social function and play a role in the identity and sense of place of the community. By continuing to use them, historic environments can continue to be active rather than static monuments. Bullen and Love (2011) emphasise that heritage buildings can provide important social and cultural benefits in addition to economic value. Adaptive reuse can thus contribute to social continuity where new uses are suitable to community needs and heritage values.

Adaptive Reuse as a Sustainable Architectural Strategy

As sustainable development becomes a more important priority, the significance of adaptive reuse continues to rise. The construction industry uses a lot of energy and raw materials, and demolition produces a lot of waste. The reuse of existing buildings offers an alternative solution and can be achieved by the reuse of existing resources and the addition of new functions through the careful management of interventions. Adaptive reuse can thus help to foster a more circular approach to the built environment by prolonging the lifespan of buildings and materials. There is growing awareness of the link between adaptive reuse and the principles of the circular economy. The preservation of cultural values, reduction of material consumption, stimulation of economic activity and better use of existing resources are some of the benefits of heritage adaptive reuse (Foster, 2020). But sustainability must not be only about energy efficiency. Where significant historic fabric is to be retained, there may be a conflict with the need to undertake extensive technical interventions to enhance the technical performance. The sustainable adaptive reuse should therefore take into account the environmental performance as well as the cultural, social, economic, architectural and functional values.

Research Problem

Although adaptive reuse has become accepted, it is difficult to find the right balance between conservation of the heritage and the demands of the modern building. Historic buildings vary in age, construction technology, architectural style, cultural value, physical condition, location and original use. Therefore, the type of intervention in one building might not be appropriate for another. There may also be differing opinions among stakeholders about the acceptable level of change. An added challenge is the regulatory requirements, as historic buildings may be conserved and at the same time meet current access, safety, energy efficiency and other building requirements. This type of regulatory conflict has been recognised as a significant obstacle to heritage adaptive reuse. In addition, while many factors have been identified from previous studies as being associated with adaptive reuse success, each of these factors is not necessarily significant for every project and context (Vafaie et al., 2023). Empirical studies are thus required to better understand the perception of built-environment professionals of the relationship between conservation and contemporary architectural intervention.

Rationale and Significance of the Study

The significance of this study is that it considers adaptive reuse in the context of the relationship between cultural heritage conservation and current architectural needs. The study is not about conservation versus modernisation, but about the possibility of sensitive contemporary interventions that can help to continue the use and preservation of the historic building. The study has implications for architects, interior designers, conservation professionals, urban planners, heritage authorities, policy makers, developers and other built environment practitioners. To help professionals identify factors that contribute to successful adaptive reuse, they can create interventions that honour the historic character while enhancing functionality, accessibility, sustainability, and user experience. It is also very topical in the context of developing urban areas where the pressures on historic buildings from urban development, changing uses, poor maintenance and modernisation are particularly strong.

The study thus explores the effect of Cultural Heritage Conservation (CHC), Contemporary Architectural Intervention (CAI), Sustainability (SUS), Contemporary Functionality (CF) and User Requirements (UR) on Successful Adaptive Reuse (SAR). The research aims to identify the factors that lead to successful and sensitive adaptive reuse by quantitatively analysing perceptions of built-environment professionals. Overall, the study is based on the proposition that historic buildings should not necessarily be preserved as static objects. They may, on the contrary, be better sustained if they are adapted to modern requirements with care, and without sacrificing the cultural values which make them significant. Adaptive reuse can thus create a space where heritage conservation and architectural innovation, sustainability and social use can converge (Plevoets & Van Cleempoel, 2019; Armstrong et al., 2023).

Literature Review

Adaptive reuse is an important method of the conservation and ongoing use of historic buildings. Adaptive reuse is the extension of the life of historic buildings by providing new uses for them while maintaining important architectural and cultural features. Architectural, environmental, economic and social advantages of adaptive reuse have been noted in the literature, but may sometimes be in opposition to current needs. Adaptive reuse is defined by Bullen and Love (2011) as the process of retaining existing buildings whilst meeting new functional needs. Recent studies have also shown that the interconnection of architectural, structural, socio-cultural, economic, environmental, legal, authentic, management and functional aspects is necessary for the success of heritage adaptive reuse (Vafaie et al., 2023).

Concept of Adaptive Reuse

Adaptive reuse is the process of reusing a building for a new or changed purpose while preserving key physical features and characteristics of the building. It is especially important for historic buildings as ongoing use can mitigate the threats of abandonment, deterioration, and demolition. Bullen and Love (2011) state that adaptive reuse is an alternative to demolition, as existing buildings can adapt to new social and economic demands. Plevoets and Van Cleempoel (2019) define adaptive reuse as an architectural discipline that is based on dialogue between existing heritage values and contemporary interventions. It is thus not only a technical renovation, but also a design process in which architects interpret the existing buildings and decide on the forms of change. The balance of continuity and transformation is therefore

essential to adaptive reuse – too much preservation can limit contemporary uses, too much intervention can diminish historical identity and significance.

Heritage Conservation and Cultural Significance

The basic principles of adaptive reuse are established by heritage conservation, as it is through the historic building that architectural materials, spatial arrangements, craftsmanship, cultural associations and historical memories are found, which make it significant. Conservation, then, must not only be given to the physical fabric, but also to the cultural significance of the place. The Burra Charter also highlights the need to consider cultural significance in conservation decisions and the possibility of adaptation where it does not needlessly undermine the significance (Truscott, 2020). This principle acknowledges that change might be required if a historic building is to be used for current purposes. The conflict between the values of heritage and the needs of the present day is also a key concern in adaptive reuse, as Bullen and Love (2011) argue. Therefore, before intervening, it is necessary to conduct a conservation assessment to identify key architectural and cultural features and to ensure that these are conserved.

Contemporary Architectural Intervention

A key element of adaptive reuse is the contemporary architectural intervention, as historic buildings increasingly need to meet the expectations of the modern world for safety, accessibility, comfort, technology, environmental performance, and functional flexibility. Partitions, circulation systems, lifts, mechanical services, lighting, fire protection, accessibility and structural strengthening are some of the new interventions. Plevoets and Van Cleempoel (2019) suggest that adaptive reuse needs to be negotiated between the existing building and the new requirements. The main difficulty is to ensure the introduction of modern facilities without unnecessary damage to the important historic fabric. New additions do not always have to be copies of historic architecture; it is possible to make new and innovative architecture without being historically inaccurate. The Burra Charter also encourages new work that is respectful of the cultural importance of a place (Truscott, 2020). Therefore, when well-planned and sensitively applied, contemporary architectural intervention can be a complement to conservation.

Adaptive Reuse and Sustainability

Sustainability is a key factor in adaptive reuse as it can minimise demolition, retain materials and embodied resources, and reduce some of the environmental impacts of new building. Bullen and Love (2011) state that adaptive reuse can play a role in environmental sustainability by prolonging the life of a building and decreasing the need for replacement buildings. In addition, Foster (2020) links the concept of adaptive reuse of cultural heritage with that of the circular economy, stating that cultural heritage buildings can play a role in the cities' sustainability by retaining materials, reducing waste, and preserving cultural values. But the reuse should not be assumed to be sustainable. The environmental outcomes are related to the level of intervention, energy usage, building services, materials and long-term use. Sustainable adaptive reuse, therefore, must have a more holistic life cycle approach that takes into account the environmental performance in addition to the heritage, social, functional and economic values.

Economic and Social Dimensions

Economic viability is an important factor to consider as historic buildings could need specialist conservation, structural repairs and the upgrading of building services. Meanwhile, adaptive reuse can breathe new life into underutilised buildings, draw in investment, boost tourism and jobs and help to regenerate the broader urban area. The social dimension is also significant as historic buildings can be a part of the community identity, collective memory, and sense of place. Ongoing use helps communities to keep in touch with their history and adapt to current uses. Foster (2020) points out that there is an opportunity for broader social and economic benefits from extending the useful life of cultural heritage buildings. Adaptive reuse should therefore be assessed in a multi-dimensional manner that takes into account the financial viability, as well as cultural, social and functional aspects.

Factors Influencing Successful Adaptive Reuse

It has been shown in recent literature that successful adaptive reuse is multi-dimensional. Vafaie et al. (2023) conducted a systematic review of 72 studies to determine the categories that affect successful adaptive reuse of heritage buildings, which were divided into 10 categories: architectural, structural, socio-cultural, economic, environmental, energy, authenticity, legal, management, and functional. This is especially important as architectural compatibility is not the only factor that can be used to measure project success. Architectural character can be maintained in a project, but it may be an economic failure, while a very functional project can deliver contemporary facilities, but lack authenticity or cultural value. An effective adaptive reuse, therefore, involves a holistic evaluation of conservation, architectural intervention, sustainability, functionality, user needs, economic considerations, legal issues and social values.

Despite the extensive research conducted on adaptive reuse in case studies, conceptual studies and systematic reviews, more empirical studies are needed to gain insight into the perceptions of built-environment professionals about the balance between cultural heritage conservation and contemporary architectural needs. Previous studies have shown environmental, economic, social and architectural advantages, and recent systematic studies have revealed several factors that are linked to the success of adaptive reuse (Vafaie et al., 2023). But comparatively little has been done to quantitatively analyse the perceptions of architects, interior designers, conservation professionals, urban planners, engineers and other practitioners on the relative importance of heritage conservation and contemporary architectural needs. The interdependencies between heritage sensitivity, present intervention, sustainability, functionality, user needs and successful adaptive re-use, in particular, need to be explored empirically.

This study aims to fill this gap by studying adaptive reuse with an integrated framework of Cultural Heritage Conservation (CHC), Contemporary Architectural Intervention (CAI), Sustainability (SUS), Contemporary Functionality (CF), User Requirements (UR), and Successful Adaptive Reuse (SAR). The study does not view conservation and contemporary adaptation as conflicting goals, as evidenced by the fact that several factors interact in the process of successful adaptive reuse of heritage (Vafaie et al., 2023). Adaptive reuse is a key tool that has been identified in the literature for historic buildings' relevance and continued use. It can help in cultural conservation, environmental sustainability, economic regeneration and social continuity. But the balance between the historic fabric and contemporary needs must be carefully managed in order to achieve a successful adaptive reuse. These elements should therefore be

considered together, as they are all part of the heritage significance, authenticity, architectural intervention, functionality, sustainability, accessibility, economic considerations, legal requirements, and user needs. It has been suggested in the literature that neither full preservation nor full transformation is a satisfactory solution. Rather, adaptive reuse must be sensitive and evidence-based, balancing the need to preserve important heritage values with the ability for historic buildings to meet today's needs. This serves as the theoretical basis of the present study, which investigates the balance between the conservation of cultural heritage and the current architectural needs in successful adaptive reuse, in an empirical manner.

Methodology

The research method used in this study is quantitative research, which is used to analyse the relationship between cultural heritage conservation and the current needs of architecture in the process of reusing historic buildings. The quantitative method is used because the study aims to gather quantitative data from built-environment professionals and analyse their perceptions of conservation, architectural intervention, sustainability, functionality and successful adaptive reuse (Creswell & Creswell, 2023; Saunders et al., 2011). The study uses a deductive approach of research that involves the identification of concepts and relationships from the literature and the development of measurable variables, and then the testing of the variables using empirical data (Saunders et al., 2012). The cross-sectional research design is used because data are obtained from the respondents at one time. This design can be used to gain an overview of the perceptions of professionals about current practice and challenges in adaptive reuse (Bryman, 2012; Saunders et al., 2011).

The intended audience includes architects, interior designers, conservation professionals, urban planners, engineers and other built-environment professionals with experience, professional knowledge or academic experience with historic buildings and adaptive reuse projects. A non-probability purposive sampling technique is used to make sure that the respondents know about the research topic. When participants are deliberately selected due to their characteristics or knowledge related to the research objectives, the technique used is purposive sampling (Etikan et al., 2016). Convenience sampling can also be used when direct access to appropriate professionals is limited, to help in the distribution of questionnaires. Convenience sampling is a sampling technique that involves selecting participants who are easily available to the researcher, but may not allow for generalisation of the results (Etikan et al., 2016; Saunders et al., 2011).

Primary data were gathered using a structured questionnaire, which was designed based on themes and variables identified from the literature review. The questionnaire is based on a 5-point Likert scale, which ranges from 1 = strongly disagree to 5 = strongly agree. Likert-type scales are commonly used in quantitative social research to quantify respondents' attitudes, perceptions and agreement with statements (Likert, 1932; Boone & Boone, 2012). The instrument addresses important dimensions relevant to adaptive reuse, such as cultural heritage conservation, architectural intervention, contemporary functionality, sustainability, accessibility, user requirements and perceived success of adaptive reuse. The questionnaire is pretested with a small number of the relevant respondents to test ambiguous wording, to clarify the wording, and to evaluate the appropriateness of the measurement items, before the main survey. Pilot testing is beneficial in highlighting the possible issues that may arise in the design of questionnaires and to

enhance the quality and clarity of the research instrument prior to the actual collection of data (Saunders et al., 2012).

Data collected are analysed using the Statistical Package for the Social Sciences (SPSS), and in the case of multiple constructs, Partial Least Squares Structural Equation Modelling (PLS-SEM) is used using SmartPLS. Respondent characteristics and overall perceptions are summarised using descriptive statistics such as frequencies, percentages, means and standard deviations. Reliability and validity analyses are performed to ensure the quality of the measurement instrument. Internal consistency is measured by Cronbach's alpha, and composite reliability is measured by factor loadings and average variance extracted (AVE) (Hair et al., 2021). To test discriminant validity, the heterotrait–monotrait (HTMT) ratio is used, which is regarded as an effective discriminant validity test in variance-based structural equation modelling (Henseler et al., 2015). Path coefficients, t-values, p-values and coefficients of determination (R^2) are analysed to assess the strength and significance of the relationships between the study constructs where structural relationships are hypothesised (Edeh & Khojasteh, 2023).

Ethical concerns are adhered to during the research process. There is no compulsion to participate; respondents are told the purpose of the study, and confidentiality and anonymity are ensured. The analysis does not need any personally identifying information. The procedures follow the basic requirements of ethical research: informed participation, protection of participants, confidentiality and respect for participants' rights (Creswell & Creswell, 2017; Saunders et al., 2012). The methodology thus offers a systematic empirical approach to the study of the possibilities of the integration of heritage conservation principles and current architectural requirements in adaptive reuse projects.

Results and Discussion

This chapter provides the findings of the empirical research on the adaptive reuse of historic buildings and the relationship between the conservation of cultural heritage and the needs of contemporary architecture. The study examines the built-environment professionals' (architects, interior designers, conservation professionals, urban planners, engineers, and others) perceptions. The chapter first introduces the demographic characteristics of the respondents, then descriptive statistics, reliability and validity assessment, discriminant validity, collinearity assessment and the results of the structural model. The results are then compared with the literature regarding adaptive reuse, heritage conservation, architectural intervention in the present, sustainability, functionality and user needs. The analysis seeks to identify if there is a possibility of sensitive contemporary interventions in harmony with the historic and cultural values.

Respondents' Demographic Characteristics

The demographic characteristics of the respondents give an idea of the professional background of the respondents included in the study. The sample includes professionals from the built environment (architecture, conservation, interior design, planning, engineering and others).

Table 1: Demographic Characteristics of Respondents

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	126	63.0
	Female	74	37.0
Age	20–29 years	52	26.0
	30–39 years	78	39.0
	40–49 years	45	22.5
	50 years and above	25	12.5
Professional background	Architect	74	37.0
	Interior Designer	32	16.0
	Conservation Professional	28	14.0
	Urban Planner	24	12.0
	Engineer	25	12.5
Professional experience	Other built-environment professional	17	8.5
	Less than 5 years	42	21.0
	5–10 years	61	30.5
	11–15 years	49	24.5
	More than 15 years	48	24.0
Total		200	100.0

Demographic results show that the respondents are from a variety of professional backgrounds and experience. The highest number of professionals are architects (37%), interior designers (16%) and conservation professionals (14%). There are a significant number of respondents with over 10 years' experience, indicating that the sample is likely to contain individuals with extensive experience in architectural and built-environment-related issues.

Descriptive Statistics

Descriptive statistics were used to find the overall perception of respondents on the major dimensions of adaptive reuse. The constructs studied are Cultural Heritage Conservation (CHC), Contemporary Architectural Intervention (CAI), Sustainability (SUS), Contemporary Functionality (CF), User Requirements (UR) and Successful Adaptive Reuse (SAR).

Table 2: Descriptive Statistics of Study Constructs

Construct	Mean	Standard Deviation
Cultural Heritage Conservation	4.18	0.61
Contemporary Architectural Intervention	4.05	0.66
Sustainability	4.12	0.63
Contemporary Functionality	4.09	0.65
User Requirements	4.01	0.69
Successful Adaptive Reuse	4.15	0.60

The results show that the mean scores of all constructs are relatively high, ranging from 4.01 to 4.18. The mean score of Cultural Heritage Conservation was the highest ($M = 4.18$), which

shows that respondents are very aware of the importance of the cultural and architectural value of historic buildings in adaptive reuse. The mean score for Successful Adaptive Reuse was also high ($M = 4.15$), indicating that respondents generally believe that the strategy of adapting buildings is important for the long-term relevance of historic buildings. The lowest mean score ($M = 4.01$) was for User Requirements, but this was still relatively high. This discovery suggests that the needs of the users in the present day are deemed to be significant and should be met, but without altering the historic fabric of the building.

Measurement Model Assessment

The reliability and validity of the measurement model were first examined, and then the hypothesised relationships were analysed. Cronbach's alpha and composite reliability were used to assess internal consistency reliability. Hair et al. (2021) suggest that values greater than 0.70 are acceptable for well-developed research instruments.

Table 3: Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Cultural Heritage Conservation	0.901	0.925	0.714
Contemporary Architectural Intervention	0.887	0.916	0.687
Sustainability	0.895	0.922	0.704
Contemporary Functionality	0.879	0.912	0.676
User Requirements	0.884	0.914	0.681
Successful Adaptive Reuse	0.908	0.932	0.733

The results show good reliability for all constructs. The Cronbach's alpha values are between 0.879 and 0.908, which is above the recommended value of 0.70. The internal consistency of the composite reliabilities is between 0.912 and 0.932, which provides further support for adequate internal consistency. The AVE values are between 0.676 and 0.733, which is higher than the minimum value of 0.50 recommended. Thus, the measurement model has good convergent validity.

Discriminant Validity

The HTMT criterion suggested by Henseler et al. (2015) was used to test the discriminant validity. If the values of HTMT are below 0.90, it means that the constructs are sufficiently different from each other.

Table 4: HTMT Discriminant Validity

Constructs	CHC	CAI	SUS	CF	UR	SAR
CHC	—					
CAI	0.782	—				
SUS	0.741	0.793	—			
CF	0.713	0.804	0.786	—		
UR	0.695	0.762	0.748	0.775	—	
SAR	0.821	0.817	0.809	0.836	0.798	—

The HTMT results show that all values are below 0.90. The highest correlation is 0.836 between the two variables of Contemporary Functionality and Successful Adaptive Reuse. The results here show sufficient discriminant validity, that is, that the constructs measure conceptually different aspects of adaptive reuse.

Collinearity Assessment

To check for multicollinearity among the predictor constructs, the variance inflation factors (VIF) were checked. VIF values less than 5 are acceptable (Edeh & Khojasteh, 2023).

Table 5: Collinearity Statistics

Predictor	VIF
Cultural Heritage Conservation	2.184
Contemporary Architectural Intervention	2.612
Sustainability	2.348
Contemporary Functionality	2.497
User Requirements	2.275

The VIF values range from 2.184 to 2.612. Multicollinearity is not a serious concern in the structural model since all values are well below 5.

Structural Model Results

The structural model was tested to identify the relationships between the independent variables and successful adaptive reuse. The proposed model is based on the premise that heritage conservation, contemporary architectural intervention, sustainability, functionality and user needs are all factors in successful adaptive reuse.

Table 6: Structural Model and Hypothesis Testing

Hypothesis	Relationship	β	SD	t-value	p-value	Decision
H1	CHC $\rightarrow$ SAR	0.286	0.071	4.028	0.001	Supported
H2	CAI $\rightarrow$ SAR	0.312	0.069	4.522	0.001	Supported
H3	SUS $\rightarrow$ SAR	0.241	0.078	3.090	0.002	Supported
H4	CF $\rightarrow$ SAR	0.267	0.074	3.608	0.001	Supported
H5	UR $\rightarrow$ SAR	0.198	0.081	2.444	0.015	Supported

The results of the structural model show that all five hypothesised relationships are statistically significant. Successful Adaptive Reuse is positively and significantly related to Cultural Heritage Conservation ($\beta = 0.286$, $p < .001$), which supports H1. The most significant effect is found for contemporary architectural intervention ($\beta = 0.312$, $p < .001$), which is consistent with H2. Other significant positive factors are Contemporary Functionality ($\beta = 0.267$, $p < .001$), User Requirements ($\beta = 0.198$, $p = .015$) and Sustainability ($\beta = 0.241$, $p = .002$).

Table 7: Coefficient of Determination

Endogenous Construct	R ²
Successful Adaptive Reuse	0.671

The R^2 value of 0.671 suggests that the combined effect of the factors of cultural heritage conservation, contemporary architectural intervention, sustainability, contemporary functionality, and user requirements accounts for about 67.1% of the variance in Successful Adaptive Reuse. This is significant in terms of the explanatory power and suggests that the variables chosen offer a meaningful explanation for successful adaptive reuse.

Discussion

Cultural Heritage Conservation and Successful Adaptive Reuse

The results show that there is a highly positive association between cultural heritage conservation and adaptive reuse ($\beta = 0.286$, $p < .001$). This indicates that the maintenance of the cultural, historical and architectural attributes of historic buildings is a key element of successful adaptation. Significant historic features are likely to be better preserved in buildings that retain their historic character when subjected to conversion to contemporary uses.

This is in line with Bullen and Love (2011), who state that adaptive reuse offers the possibility of retaining heritage buildings and meeting new needs. It also reflects the principles of the Burra Charter, which highlight the importance of cultural significance in guiding decisions on adaptation (Australia ICOMOS, 2013). This result suggests that adaptive reuse cannot be taken as the transformation of an old building into a new purpose. Rather, the design process needs to be guided by the conservation of significant heritage attributes.

Contemporary Architectural Intervention and Successful Adaptive Reuse

The highest path coefficient in the model was for Contemporary Architectural Intervention ($\beta = 0.312$, $p < .001$). The result suggests that the quality and sensitivity of contemporary architectural interventions are especially significant in the process of achieving a balance between conservation and contemporary needs when it comes to adaptive reuse. The discovery aligns with Plevoets and Van Cleempoel (2019), who define adaptive reuse as a design process that entails negotiation between the existing heritage values and new architectural needs. New functions can be integrated in historic buildings by contemporary interventions like circulation improvement, new services, accessibility, strengthening of structures and spatial modifications. These interventions must be suitably designed to prevent unnecessary damage to important historic fabric, however. This finding thus bolsters the main thesis of this study, which is that contemporary architecture does not pose a threat to heritage conservation if interventions are well planned and are integrated with the existing building.

Sustainable and successful adaptive reuse.

Successful adaptive reuse was also found to have a strong positive correlation with sustainability ($\beta = 0.241$, $p = .002$). This means that there is an important part of adaptive reuse that involves the environment. Demolition waste can be minimised by retaining existing structures, and historic buildings can be upgraded to enhance their environmental performance. The result is in line with Foster (2020), who states that adaptive reuse of cultural heritage buildings can be part of circular economy strategies, keeping existing materials and prolonging the life of the building. The discovery does not, however, indicate that sustainability can only be defined as energy

efficiency. Environmental performance is a key component of sustainable adaptive reuse, along with cultural, social, functional and economic aspects.

Contemporary Functionality and Successful Adaptive Reuse

Contemporary Functionality has a significant positive effect on Successful Adaptive Reuse ($\beta = 0.267$, $p < .001$). This means that historic buildings need to be able to be used for new purposes if they are to be used in the future. Buildings which are not able to comply with the present day requirements for circulation, safety, accessibility, services, comfort and spatial flexibility may be underused or abandoned. So, all modifications should not be prevented by conservation. Rather, the question is what elements are of high heritage value and what areas can allow for functional changes. The discovery aligns with the overall adaptive reuse literature, which highlights functional suitability as a key determinant of adaptive reuse success (Vafaie et al., 2023). The new use, therefore, must be compatible with the physical attributes and cultural values of the existing building if a successful project is to be achieved.

User Requirements and Successful Adaptive Reuse

User Requirements also show a strong positive correlation with Successful Adaptive Reuse, with a β value of 0.198 and a p value of .015. This is the weakest relationship in the model, but is still statistically significant. The discovery indicates that the requirements and expectations of modern users should be taken into account when making decisions on adaptive reuse. Accessibility, comfort, usability, safety and functionality, however, cannot be overlooked in historic buildings, which are ultimately intended for continued use by humans. Meanwhile, user needs need to be met sensitively, without compromising heritage values unnecessarily. This discovery reinforces the notion that adaptive reuse is a balance between the needs of the existing heritage and the needs of modern society. Conservation should not be a goal in itself but rather an objective that is achieved through the creation of spaces that are culturally meaningful, functional and accessible.

The overall results show that adaptive reuse is successful when it integrates the needs of contemporary architecture with the need for heritage conservation, not in the sense of giving priority to one dimension at the expense of the other. All five independent variables were statistically significant in predicting successful adaptive reuse, with contemporary architectural intervention being the strongest predictor. The results corroborate the conceptual stance presented in the literature review. Adaptive reuse should not be considered as a binary option between maintaining historic buildings in their original form and transforming them for new uses. Rather, it's a method of controlled modification. Heritage conservation sets the values that must be safeguarded, and contemporary architectural intervention sets the ways in which buildings can serve in evolving social and technological settings.

The high R^2 value of 0.671 is another indication that the mix of conservation, architectural intervention, sustainability, functionality and user needs are good predictors of successful adaptive reuse. It is a multidimensional outcome that aligns with the recent systematic literature that has identified architectural, socio-cultural, environmental, economic, legal, authenticity, management and functional aspects as interconnected factors in heritage adaptive reuse (Vafaie et al., 2023). The results, therefore, indicate that an integrated conservation-design approach is the key to successful adaptive reuse. The first step is for architects and conservationists to

determine the cultural value and vulnerable features of a building. Contemporary requirements should then be introduced by interventions which minimise the unnecessary loss of historic fabric but enhance usability, accessibility, sustainability and performance. This can enable historic buildings to be alive and functioning components of modern cities, instead of isolated monuments. In general, all five hypotheses were confirmed. The results show that adaptive reuse is most successful when historic significance is preserved, and contemporary architectural interventions, sustainability, functionality and user needs are integrated through sensitive design strategies. The results thus support the thesis that the conservation of heritage and the development of new architecture can be complementary rather than conflicting goals.

Conclusion and Recommendations

The study demonstrates that adaptive reuse is an effective method for achieving a balance between the conservation of historic buildings and the contemporary architectural needs. The results show that cultural heritage conservation, contemporary architectural intervention, sustainability, contemporary functionality and user requirements are all positive factors for successful adaptive reuse. Of these, contemporary architectural intervention was the most significant, suggesting that the quality and sensitivity of new design interventions are particularly important in the transformation of historic buildings for contemporary use. The results also show that conservation and modernisation are not mutually exclusive goals. Rather, historic buildings can be preserved as cultural icons, architectural expressions, and historical resources while providing for contemporary uses, access, safety, environmental quality, and expectations. The significant explanatory power of the structural model also suggests that the interplay of these factors offers a valuable foundation for understanding successful adaptive reuse. Adaptive reuse should be considered a carefully managed process of change, in which important historic fabric is preserved, and in which appropriate contemporary interventions are made to ensure the ongoing relevance, function and sustainability of historic buildings.

The study results should be used to inform the design of adaptive reuse interventions for historic buildings, and to inform the detailed assessment of the cultural and architectural value of a historic building before designing any intervention. Historic areas, space arrangements, materials, decoration, structural features and significant façades should be identified and protected at appropriate levels. Any contemporary interventions should be designed sensitively to meet the needs of the present day, and to be responsive to the contemporary requirements with minimal impact on the historic fabric. Conservation authorities and policy makers should develop clear guidelines that enable appropriate adaptation while preserving key heritage values. Sustainability should also be integrated into adaptive reuse projects by retaining and reusing existing materials, enhancing energy efficiency if possible, minimising building waste and thinking about long-term building performance. The designers should ensure that contemporary functions are not imposed on historic buildings, but that they are compatible with the spatial and structural qualities of the historic buildings. The needs of users should be taken into account from the beginning of the design process, such as their accessibility, safety, comfort, usability and flexibility. It is also suggested that there should be collaboration between the architect, conservation specialists, engineers, planners, building owners, authorities and users, as adaptive reuse is a matter of architectural, technical, cultural, economic and social considerations. Finally, future adaptive reuse projects should adopt an integrated decision-making approach in which heritage conservation, contemporary architectural innovation, sustainability, functionality, and

user needs are evaluated together. Such an approach can help ensure that historic buildings remain active, useful, and culturally meaningful while contributing positively to the sustainable development of contemporary cities.

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