The Relevance of Adaptability of Museums

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Abstract:
Museums are continuously threatened by challenges, primarily related to inefficiencies and the threat of extinction in favour of other developments. Given that they are critical mediums for preserving and ensuring the sustainability of culture, history and heritage, efforts to salvage the dilemma must continue. As a solution to similar challenges in other contexts such as housing and office design, the concept of adaptable design has been proposed. Consequently, this paper attempts to unravel the relevance of adaptability in museum design and operation. To support this aim, forty (40) out of 123 relevant peer-reviewed articles were carefully selected from databases such as Scopus, Google Scholar and the Covenant University Repository and reviewed comprehensively. This review was conducted using a thematic analysis of the selected literature, with key themes drawn out and used as the basis for recommendations in line with the research objectives. The issues such as funding, rapid urbanization, social and political factors as well as the opportunities for adaptability as a design strategy in museums were drawn out. Prioritizing user requirements by designers and planners in implementing adaptability, advocacy for more lenient codes for museum construction, and areas for further research was recommended.

Keywords: **Adaptability, Adaptable Buildings, Museums, Museum Adaptability, Sustainability.**

1. Introduction

Buildings are required, for the entirety of their lifespans, to accommodate various changes. These changes range from varying user requirements and environmental changes to evolved legal constraints and the need to upscale building performance. According to Orlove[1], adaptability describes the capacity of a system to adapt to changes in climatic conditions by modifying actions at various levels (individual, community, regional and national) in a bid to reduce risks and explore beneficial opportunities and outcomes. These changes, which most of the time, occur at unanticipated speeds and forms, flag the need for buildings to be responsive and proactive to changes to maintain and preserve their utility [2], [3]. This need becomes even more pertinent in contexts where land availability is a key constraint, and where reconstruction and construction of new buildings are challenging. The concept of adaptability is not new to the general body of knowledge and has been explored in various contexts with relevant information drawn [4], [5], [6], [7]. However, a major roadblock to the utility of the concept is the almost perpetual inability to predict what exactly these changes might be. These changes, according to Askar [3] and Sholanke et al[8], are influenced by several factors including social (e.g., users' preferences, cultural values, availability of materials, etc), environmental (e.g., natural disasters, climatic change, etc), technical (e.g., the need to adopt new technology to optimize performance) economic, legal (e.g., regulations and policies) as well as interests of stakeholders.

Museums hold significant relevance in today's society as spaces for culture, education, and social change. They are regarded as relevant institutions that serve as repositories of knowledge and culture, providing educational and social benefits to both individuals and society [9]. By function, museums are crucial determinants in the sustainability of culture and heritage, hence, the need to carefully preserve them for the entirety of their lifespans. This, in tandem with, the dynamic nature of the modern world incites the need for museums to adopt adaptability in their design and operation [10]. This adaptability allows museums to respond effectively to changing circumstances, technologies, visitor expectations, and societal needs, as well as to remain relevant, engaging, and sustainable.

In light of the above, adaptability is bound to be a staple requirement for designing museums of the future and a vital criterion for sustainability, hence, the goal of this paper is to highlight the relevance of adaptability in museums as a way to contribute to the collective global efforts towards sustainability. The discussion also highlights the contribution of adaptability to both mitigation and adaptation studies of climate change, particularly in investigating relationships between the circularity of buildings and resilient design. The scope of the paper covers key adaptability research themes, including definitions and various interpretations, associated concepts, features and dimensions, underlying theories and models,

together with application strategies. Furthermore, potential gaps are also identified, providing insights for future research.This study explored the use of adaptability as a design strategy in museum design, focusing on a qualitative research approach through a literature review. Using relevant databases, peer-reviewed papers and articles related to adaptable architecture and adaptability were carefully selected. Information from these literature were organized and discussed in themes as a way to examine the connection between adaptability and museums, particularly its impact on visitors' experience and engagement. The findings offer insights into the evolving role of museums and provide recommendations for future museum design and planning.

2. Materials and Methods

This study looked into the relevance of using adaptability as a design strategy in museum design and operation using a qualitative research methodology, mostly through a thorough literature review. A comprehensive exploration was carried out using multiple databases, such as Google Scholar, Science Direct, and the Covenant University Repository, with an emphasis on peer-reviewed literature. To guarantee a thorough examination of the subject, terms like "Adaptable Architecture," "Adaptability," and "Design for Adaptability" were used as search queries. The papers, journals and articles used were selected using strict criteria; they had to have undergone peer review and specifically address issues of adaptable building design, more so in the context of museums. The process of extracting data from the chosen literature entailed a thorough examination to find relevant information concerning the relationship between adaptability and museum design, and the effect of such relationship on visitors' experience and patronage.

A descriptive approach was used to thematically present and discuss the analysis's findings, providing a thorough summary of the study's findings. This study reinforces the established notion of museums being more than repositories for historical objects and knowledge by synthesizing the body of existing literature. It also makes useful recommendations for designers and museum planners on the future directions in museum research and design.

3. Discussion

Depending on who is asked, the term "adaptability" is often interchanged with "adaptation". However, both terms hold the same meaning and are used to describe the ability of an individual or system to adjust and respond to changes in its environment. This may involve changing the structure, processes and practices based on current and forecasted information to maintain efficiency in the face of changing conditions. The Intergovernmental Panel on Climate Change in 2014 described adaptation as "the adjustment in natural or human systems in response to actual or expected stimuli or their effect, which moderates harm or exploit beneficial opportunities". Adaptability has been widely accepted as crucial in various fields such as economics, climate change, software development, and organization behaviour. In economics, as Vitkovskyi [6] explains, adaptability is a necessary feature that countries should have if they want to cope with external and internal shocks and maintain stability in their economies. According to Orlove [1], adaptability describes the capacity of a system to adapt to changes caused by climate by modifying actions at various levels (individual, community, regional and national) that reduce risks and explore beneficial opportunities in a bid to better cope with future climate conditions. In software development, adaptability is important for model-driven engineering, specifically in transforming models to meet changing requirements [7]. In organizations, adaptability is regarded as a key source of mental resources and determines the ability of employees to thrive in fast-changing environments [11]. However, for the purpose of achieving the goals of this paper, the focus is narrowed to the field of architecture.

The ability of a structure to adjust to the demands and preferences of each individual is referred to as adaptability in architecture [12]. This ability, as Manewa et al [13] opine, combined with flexible systems and control driven by quality user experience, is what makes sustainable building design. Similarly, Ismail & Ibrahim [14] regard adaptability as the capacity of a structure to accommodate the requirements and preferences of specific users while striving for sustainable design through flexible systems and user-driven control. Watt et al [15] make an input by defining an adaptable building as one malleable enough to suit changing requirements, preserving it from premature demolition and reconstruction and the associated carbon emissions. In essence, the discourse on adaptability sums up to finding effective ways to tackle issues threatening the relevance of buildings and infrastructural developments [3].

Across the board, adaptable architecture has been established to have six characteristics, namely convertibility, scalability, refitability, movability, versatility and adjustability. Convertibility refers to the ability of a building to externally and/ or internally switch between multiple uses. Scalability, which may often be referred to as elasticity or expandability, is a measure of how the size of a building or its spaces can change to accommodate the prevailing needs [4]. A building described as refitable can alter its parts either by removal, degradation, mobility or by being collapsible. The movability of an adaptable building refers to how the building and its structure can change locations whilst effectively performing its intended uses [16]. Versatility is defined as a building's ability to alter its interior. This quality is usually predicated on the modularity or unit nature of the building's internal systems such as walls, furniture, services, etc. Finally, adjustability focuses on change in function in relation to people and the building's ability to influence the tasks that people can complete there.

In essence, adaptable buildings are those which allow for easy modifications to suit changing requirements, avoiding premature demolition and reducing carbon emissions in the long term [15].

I. Challenges and Threats Faced by Museums

Museums in their day-to-day operations, attempt to simultaneously satisfy both goals of socio-cultural sustainability as seen in efforts in the conservation and

interpretation of artefacts, and commerce in creating a location for leisure, tourism, and profit [17]. This complex balancing act in museums is further aggravated by various challenges and threats. One of these challenges that museums face is the threat of destruction. Historical objects and information, which are essential components of museums, are often at risk of destruction due to factors such as neglect, lack of maintenance, natural disasters, or rapid urban development [18]. The iconic nature of museum architecture is primarily what invites visitors to experience the education and appreciation of history through the exhibits they provide. Hence, the factors of neglect and poor maintenance erode the aesthetics of museums which is a key feature of this iconic nature, turning a once lively museum into an obsolete piece of architecture. On another level, rapid urban development often leads to displacement in which case historical sites and buildings may be destroyed or unsustainably altered. Urban expansion, which is primarily influenced by economic growth, often prioritizes development over the protection of cultural heritage, leading to tensions in managing urban landscapes with valuable heritage sites [19], [20].

Another challenge is with digital relevance and accessibility. Museums of today and the future require more than the traditional modes of museum operations can accommodate. Today, the removal of barriers to access to users across physical, visual and cognitive backgrounds is a crucial criterion for sustainable building design which, by default, requires the need for harnessing digital technologies. These technologies which generate many benefits such as novel ways to exhibit and store historical data, are muddled with challenges as well. One challenge is the barrier to the adoption of these technologies, particularly for smaller museums, as they would require a considerable level of technical proficiency. Even with the rise of the adoption of digital tools by museums. The low percentage of websites dedicated to cultural heritage compared to other sectors indicates a weak digital heritage presence. As Hookk & Hermon [21] highlight, this lack of digital relevance can hinder museums' ability to engage with audiences and disseminate cultural heritage effectively. As Brischetto et al [22] point out, another issue is that the tilt towards digital collections slowly undermines museums as providers of authoritative content.

Funding is another challenge that museums face. Insufficient or inconsistent funding jeopardizes the financial stability of museums, making it difficult for them to cover operating expenses such as staff salaries, utilities, and maintenance costs. This challenge, as Prokupek, & Ballarini [23] point out can limit their ability to carry out conservation, research, and educational activities, as well as maintaining their collections, facilities, and programs, ultimately putting their long-term viability at risk. In essence, funding issues manifested in the form of limited sources, budget cuts, and economic downturns can impact museums' operations and hinder their capacity to fulfil their missions effectively.

Finally, museums are also confronted with social and political challenges. These challenges which commonly manifest as censorship, political interference, or social unrest can affect their autonomy, freedom of expression, and ability to present diverse perspectives [24]. Conclusively, efforts to help navigate through these challenges must be made to preserve the posterity of our cultural identity and heritage to pass down to subsequent generations.

II. Adaptability in Museums and its Roles in Preserving Museums' Utility

As already established, museums are challenged to move beyond traditional roles as mere archives for artefacts to becoming dynamic enough to foster a deeper connection and understanding of the exhibits through technology [25], [26]. While adaptability yields benefits for a wide variety of building typologies and applications in society, it also greatly contributes to the continued existence of museums. First, adaptability secures the durability of museum infrastructure. Durability entails that a material or product, in this case, a building, remains serviceable without damage in its environment for the entirety of its lifespan considering both maintenance and operational challenges [27]. According to Fauzi et al [18], durable museums have the ability to conserve and preserve heritage buildings, artefacts, and collections in the face of threats and challenges such as natural disasters, vandalism, neglect, and urban development. This may involve the use of innovative technologies, materials, and operational techniques to preserve the museums, as well as the development of sustainable practices and policies that ensure the long-term relevance of museum and their collections [10].

Another way adaptability fosters the continued utility of museums is by providing novel ways to engage and connect with diverse audiences and communities, including those that may be underserved, marginalized, or excluded from traditional museum settings [28]. This may involve the use of mobile maker spaces, digital fabrication technologies, and other innovative tools and platforms for easier penetration of new audiences [28]. Adaptability in museums can also involve the development of flexible and adaptable exhibition and programming models that respond to changing visitor needs, interests, and preferences. This, as Petrelli & Not [29] suggest, may require the use of immersive and interactive technologies, personalized and customized experiences, and other innovative approaches that enable museums to create engaging and meaningful experiences for diverse audiences.

Finally, adaptability in museums can also involve the development of sustainable and resilient business models and funding strategies that enable museums to remain financially viable and sustainable in the face of changing economic, political, and social conditions. This can involve the use of innovative revenue streams, partnerships, and collaborations, as well as the development of strategic plans and initiatives that align museums with the needs and priorities of their communities and stakeholders.

III. The Advantages of Adaptability in Museums

In today's era of rapid technological advancement, changing demographics, and evolving societal needs, museums need to proactively adapt to remain relevant and sustainable. This need for adaptability isn't merely a consequence of the challenges museums face but an opportunity for many benefits. One of such benefits is that adaptability allows for more user-focused and dynamic narratives in the selection and presentation of the

museum's collections. This enhances the experience of visitors, and aids a good understanding of the exhibits and their contexts, whilst catering to their diverse backgrounds, disabilities, and interests, ultimately improving engagement and educational outcomes [30], [31]. As Not & Petrelli [32], put it, such makes museums powerful tools for effective storytelling as visitors leave with a deeper understanding and connection to cultural heritage through the displayed exhibits.

The second benefit is economic in that designing museums with adaptability in mind can save on construction and renovation. By making the most of existing structures and infrastructure or designing new spaces for multiple functions, the need for frequent renovations or expansions is reduced, leading to long-term cost savings [3], [33], [34], [35]. True to what Manewa [33] points out, adaptability increases the economic viability of the museums as the initial investment, by stakeholders at the beginning, continues to yield benefits.

Adaptability also increases the sustainability of the museums. By repurposing already existing spaces and infrastructure, museums reduce the need for new construction and resource consumption. This approach aligns with sustainable best practices by promoting reuse and minimizing waste [36].

From the points as mentioned earlier, the benefits that adaptable museum design provides conveniently sates museums' fundamental goals of longevity and durability whilst remaining relevant.

IV. Challenges and Limitations in Implementing Adaptability as a Design Strategy in Museums

Even with the potential advantages or opportunities for solving the major problems plaguing museums, adaptability, like any strategy for building design and operation, faces several challenges in its adoption. The first of such challenges is user acceptance [37]. The user referred to, here, captures both the operators and staff of the building as well as anticipated visitors. Bakri [38] highlights that, in museum design, the adaptation may result in feeling less in control or alienated from the exhibits. One way this may happen is when one or more user groups find it difficult to adjust to the changing layouts and functionalities of the spaces [37]. This eventually ripples in a growing lack of interest in what the museum has to offer as evidenced by low patronage. On the other hand, operators and staff of museums may question the perceived utility of adaptability as well as how easily it can be adopted with little or no obstruction to their current activities.

This ease of adoption which is strongly linked to simplicity or complexity can be regarded as another limitation to adopting adaptability. True to Rahla et al [39] underpinning, incorporating adaptability in building design and operation, more so in museums, requires an in-depth understanding of the systems that comprise a building. This understanding ensures that is designed in such a way that future expansion and modification are easily achievable. To articulate this complexity in a useful way, museum designers and operators need to be technically sound, which is already a constraint on its own.

Another challenge is building codes or regulatory hurdles. As Rahla et al [39] point out the existing building codes and regulations in an area can restrict the extent to which a building can be adaptable. An example is in contexts with land availability issues, at their peak of infrastructural development or with a considerable amount of heritage or monumental structures [40]. These areas typically have stricter building codes than other areas considering the potential impact of building without consideration for the adjoining communities.

Narahara, [37] highlight initial cost as yet another limitation of adopting adaptability. Given that buildings have been commonly designed as rigid structures, adapting their internal and/or external structures for more flexibility would incur more construction costs. These costs also transcend those incurred during construction, but also for the continued maintenance. Considering that museums struggle a lot with funding, adaptability, because of the financial responsibility it necessitates, is very likely to be considered secondary.

4. Conclusion

As has been established: museums are riddled with numerous recurring challenges and an integration of adaptability in their design and operation provides an opportunity to tackle these challenges while promoting sustainability and resilience. Some of these challenges include threats of redundancy, hence, destruction in favour of commercial or residential infrastructure, digital or technological relevance, funding limitations, and social dilemmas as well as issues related to politics. The desired solution museums seek are within the realms of fostering durability for entire of their lifespan, enhancing and sustaining audience engagement, in addition to promoting financial viability. Incidentally, the advantages of embracing adaptability tally with these expectations. In incorporating adaptable design principles, museums can create dynamic spaces that cater to diverse audiences, foster learning, and facilitate meaningful experiences. However, the implementation of adaptability in museums is not without challenges, including user acceptance, technical complexity, regulatory constraints, and initial cost implications. Overcoming these challenges is possible and would require proper collaboration between designers, operators, policymakers, and stakeholders to prioritize adaptability and invest in sustainable solutions for the preservation and relevance of museums.

In light of the above, the following recommendations are made. First, museum designers must prioritize user needs and preferences when incorporating adaptable design features. This may involve engaging with museum staff and visitors to understand their requirements and channeling the retrieved information to both the building structure of the museum and the organization of exhibits. Another is an advocacy for more lenient and robust building codes for the conservation of heritage architecture. By engaging with policymakers, building industry stakeholders, and heritage conservationists for insight, museum planners and designers can advocate for regulatory reforms that support integrating adaptable design principles in building codes and planning policies. Conclusively, more research in needed to deepen the current knowledge of adaptability in museums. Questions such as "what cost-friendly strategies can museums and their stakeholders adopt in the implementation of adaptability in construction, operation and

maintenance", "what other pain points can adaptability address with museums and other heritage infrastructure", "are there opportunities for increasing the the profitability of museums", etc. In answering and building up on these questions, there is bound to be a widespread adoption of adaptability strategies by both small and established museums both locally and globally, consequently making contributions global cultural sustainability which is the anticipated impact of this paper. In its concise presentation of the discourse of adaptability, this paper arms museum stakeholders and researchers with a good grasp on adaptability as it pertains to museums.

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