P-ISSN: .....

RISK MANAGEMENT OF HERITAGE MUSEUM BUILDINGS IN PERAK

Nurul Ain Farisha Nor Azmi[1)],Hasnizan Aksah[2)] ,Izatul Laili Jabar[2)]&Wan Zuriea Wan Ismail [2)]

[1)]Bachelor of Building Surveying Program,
Universiti Teknologi MARA, Shah Alam.
[2)]Faculty of Built Environment, Universiti Teknologi MARA, Shah Alam.

Email correspondence: hasnizan@uitm.edu.my

ABSTRACT

Heritage museum buildings require careful management because they are prone to several risks that could damage their authenticity, material integrity, and structural integrity. However, a few hazards threaten the longevity and integrity of these valuable structures. This study examines the risk management processes applied in heritage museum buildings in Perak, including Perak Museum, Matang Museum and Kompleks Sejarah Pasir Salak. Key risks are identified in the study using a qualitative research methodology that involves building management teams through interviews. These risks include environmental, fire hazard, climate change risks and architectural risks. The findings shown gaps that require proactive and methodical approaches to address, as well as common issues and limitations in the risk management processes currently in use. This study highlights how crucial it is to combine contemporary risk management processes with historical authenticity, in addition to enhancing policy frameworks and stakeholders' collaboration. Heritage museums in Perak can preserve their cultural significance, guarantee the security of their visitors and collections, and support sustainable conservation for the benefit of future generations by putting in place comprehensive protection plans and educating the public about effective risk management.

Keywords: heritage museum buildings, risk management, historic building management

1. INTRODUCTION

Risk is the probability of losing life, property, money, and environmental values that an event may cause in a given situation and environment. Management means the coordination and administration of tasks to accomplish an objective. Risk management is known as the process of detecting, evaluating, and analyzing potential harm or developing a plan to lessen the harm to buildings (Lee et al,2019). Risk management is crucial as it informs us about the potential threats to the operating environment and enables them to proactively reduce risk. In order to reduce risk, an organization must allocate resources to maximize positive events and minimize, monitor, and control the impact of negative events. The process includes context setting, risk assessment (identification, analysis, evaluation), risk treatment, monitoring, communication, and recording.

Heritage is defined by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as "our legacy from the past, what we live with today, and what we pass on to future generations" (Nadkarni & Puthuvayi, 2020). The three criteria that must be met for a property to be considered as heritage are historic significance, integrity, and context. Museums can be defined as specialized buildings that are designed and built to store collections of stuff, artifacts, and display with historical, cultural, artistic, or scientific value. These buildings usually have unique architectural features and frequently use modern technologies to present the

P-ISSN: .....

collections in an interesting and interactive way.

Preserving and enhancing a country's heritage and artistic legacy helps encourage social development and preserves a community's memory (Lucchi, 2020). For cultural assets to be preserved and visitor safety to be guaranteed, risk management in heritage museum buildings is essential. Interdisciplinary collaboration, logical planning, and in-depth understanding of building and collection characteristics are all necessary for effective risk management (Lucchi, 2020). In the end, risk management in heritage buildings seeks to minimize potential risks, ensure sustainability, and preserve cultural, architectural, historical, and documentary values (Dişli & Kilit, 2024).

2. LITERATURE REVIEW

2.1 Heritage Museum Building

A museum building is a structure created or modified to house and exhibit collections of historical, artistic, cultural, or scientific value. While a heritage museum building is an architecturally significant historical or cultural building that frequently serves as an artifact and a museum (Nursandi & Ashadi, 2022). In short, a heritage museum building incorporates the building's significance into the museum experience, whereas a museum building concentrates on its contents. Cultural tourism and democratizing access to history are greatly aided by museums located in historic structures (Corsane, 2004).

When it comes to conserving and presenting cultural history, heritage museums are essential. These organizations frequently renovate heritage buildings, preserving their architectural value while updating them to contemporary museum standards (Kaymakçi, 2022). Guidelines like those followed by the Pahang State Museum, which preserve its original shape while integrating contemporary ideas, should be followed in conservation efforts (Zulkifli & Bakar, 2020). However, there are special difficulties in converting historic structures into museums, especially regarding fire safety. These buildings are at risk of fire hazards due to their large scale, interconnected voids, and flammable contents. Innovative conservation techniques that strike a balance between preservation and contemporary safety standards are required to address this (Devi & Sharma, 2019). Regular evaluations of the building conditions are crucial to ensuring the longevity of these cultural institutions. Museum buildings' structural integrity can be assessed and preserved using the Building Defect Assessment (BDA) tool (Zuraidi et al., 2019).

As in Perak, a state rich in history and culture, has several heritage museums that provide information about its varied past. Some of the notable heritage museums in Perak include Perak Museum, the oldest museum in Malaysia, located in Taiping. Besides, Royal Museum, located in Kuala Kangsar was once the residence of the Sultan of Perak. It provides an overview into the state's royal past by exhibiting the history and artifacts of the royal family. These museums provide insightful information about the rich historical and cultural fabric of Perak.

P-ISSN: .....

No.	Museum Name	Location	Year Established
1.	Perak Museum	Taiping	1883
2.	Matang Museum	Matang	1850
3.	Kompleks Sejarah Pasir Salak	Pasir Salak	1990
4.	Royal Museum	Kuala Kangsar	1926
5.	Lenggong Archeological Museum	Lenggong	1996
6.	Gopeng Museum	Gopeng	2009
7.	Darul Ridzuan Museum	Ipoh	1926
8.	Sultan Azlan Shah Gallery	Kuala Kangsar	1903

Table 1: List of Heritage Museum in Perak

2.2 Risk Management Process in Heritage Museum Building

The process of detecting, evaluating, and analyzing potential harm or developing a plan to lessen the harm to cultural heritage is known as risk management (Lee, Kim & Ahn, 2019). The goal is to minimize resource investment while removing or lessening the risk effects (Hamir & Sum, 2021). These risks can arise from a few different matters, such as unforeseen financial circumstances, legal obligations, technological problems, poor strategic management, mishaps, and natural disasters. Time, neglect, excessive maintenance costs, and a lack of thorough policies and knowledge about management techniques are all contributing factors to the degradation of historic buildings (Umi Kalsum, Norhanim, Siti & Ismail, 2017).

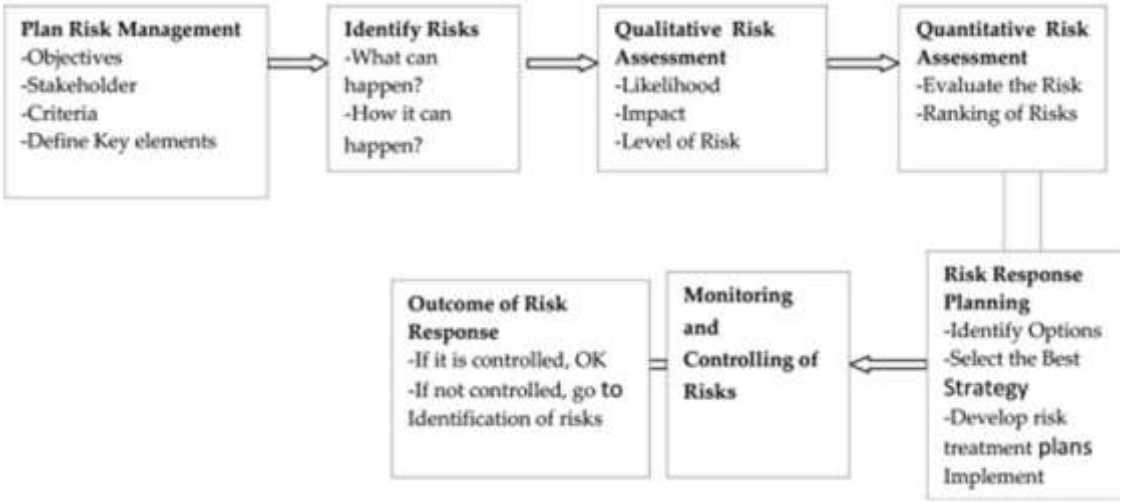

Figure 1: Risk Management Process

The process of risk management begins with the planning phase. In this stage, it is crucial to clearly define the objectives of risk management, ensuring that all involved parties understand the desired outcomes. Stakeholders must be identified to recognize who may be affected by risks or who plays a role in managing them (Kriele & Wolf, 2014). The goal of the risk plan is to figure out whether the company's vision is being carried out in accordance with its Guidelines so that it can achieve its goals and run as efficiently as possible (Siagian et al., 2024).

P-ISSN: .....

The next step is risk identification. Identification and understanding of potential risk sources are the goal of this step (Hamir & Sum, 2021). A thorough understanding of potential threats is made possible by knowing the circumstances and causes that could lead to each risk, which leads the way for efficient assessment and management (Kriele & Wolf, 2014).

Following identification, a qualitative risk assessment is conducted, which involves evaluating the likelihood of each risk occurring and the potential impact it could have. By combining these two factors, the overall level of risk can be determined (Kriele & Wolf, 2014). After qualitative risk assessment is done, a quantitative risk assessment may be performed. Quantitative assessments provide a deeper understanding of the financial, operational, or safety implications associated with each risk (Kriele & Wolf, 2014).

After the assessment, the following process is risk response planning. One of the most important and crucial phases of risk management is risk response, which involves developing suitable solutions to lessen or eliminate threats and increase opportunities from the risks that have been identified and assessed early in the risk management process (Ghaeb & Mahjoob, 2023). Organizations must then select the most effective strategy for managing the risks (Kriele & Wolf, 2014).

Next, the process continues with monitoring and controlling risks. By putting this step into practice, an organization can respond to changes and create new risk-reduction strategies (Hamir & sum, 2021). Learning from accidents, proactive risk analysis, accurate risk ranking, and the creation of early-warning systems are all components of an integrated conceptual framework for risk monitoring and control. As a result, risks need to be regularly tracked and managed using tools that complement each other (Mutlu & Altuntas, 2021).

Finally, the outcome of the risk response is evaluated. If the risk has been successfully controlled, no further action is necessary, and the process can move forward smoothly. However, if the risk remains uncontrolled or new risks arise, it is necessary to return to the risk identification phase and repeat the cycle (Kriele & Wolf, 2014).

2.3 Importance of Risk Management

Around the end of the 1980s, museums began implementing the idea of risk management, and it has been proposed that risks in preventive conservation work could be approached analytically (Erturk, 2021). The importance of risk management in maintaining cultural heritage in museums and historic structures is becoming more widely acknowledged. It encompasses locating, assessing, and reducing possible risks to collections and structures (Dişli & kilit, 2024; Konsta & Della Torre, 2021). Environmental risks, especially in historic structures turned into museums, must be carefully managed to strike a balance between preservation requirements and visitor comfort (Lucchi, 2020). Through logical planning, interdisciplinary collaboration, and thorough understanding of building and collection characteristics, the Pinacoteca di Brera case study demonstrates an inventive approach to environmental risk management in museums that emphasizes the compatibility of conservation and human comfort (Lucchi, 2020).

Priceless artifacts and buildings that symbolize cultural, historical, and artistic significance are housed in heritage museum buildings. Risk management assists in defending these resources against possible dangers like deterioration, vandalism, and natural disasters (Ashley-Smith et al., 2011). Risk management makes sure that safety rules—such as those related to crowd control, structural stability, and fire safety—are followed. This lessens the chance of injuries and accidents in heritage buildings (ICOM, 2004). Damage to heritage buildings and their artifacts can result in large financial losses. Reducing economic impacts requires risk mitigation techniques, emergency savings, and insurance (Whalen, 2003).

P-ISSN: .....

2.4 Types of Risk Management

2.4.1 Environmental Risk Management

According to Lucchi, (2020), environmental risks include both heritage decay and human discomfort. High levels of humidity and seepage encourage the growth of microorganisms and the formation of biofilms, which in turn cause surface contamination of cultural heritage and decaying wood. Besides, the temperature and humidity variations' thermal and wet stresses hasten the cracking of paint layers and wood panels. Furthermore, the location of salt weathering is determined by the height and duration of rising damp, while the degree of temperature and humidity influence the severity of salt crystallization (Ma et al., 2024).

The Forbidden City in Beijing, also known as the imperial palace of the Ming and Qing dynasties, stands as a world cultural heritage site (Ma et al., 2024). Six centuries into its history, the Forbidden City has seen a few water-related deteriorations (Ma et al., 2024). Common occurrences include runoff and shallow groundwater causing capillary water to rise and dampness to affect the masonry walls and floors of heritage buildings (Ma et al., 2024). Furthermore, there is an increased risk of microbial growth, freeze- thaw damage, and salt weathering on interior floors and lower wall sections (Ma et al., 2024).

2.4.2 Fire Hazard Risk Management

Garcia-Castillo et al., (2023) said that fire is a significant threat to the preservation of cultural assets and a key driver of urban change because they were built when modern fire engineering standards did not exist, and the buildings usually do not adhere to the rules as they stand now. Historic buildings are particularly vulnerable to fire because of this as well as additional fire hazards that are commonly encountered in them, such as high fire loads, their proximity to nearby buildings that facilitate the spread of fires, and the difficulty for fire emergency services to access the historic city centers where theyare frequently located (Garcia-Castillo et al., 2023).

According to Li et al., (2024), historic districts have, nevertheless, continued to experience varying degrees of disaster damage in recent years, with fire risks being especially significant. For instance, the 2019 fires at Cathédrale Notre Dame and Shuri Castle resulted in significant financial losses as well as long-term harm to the extraordinarily valuable historic built environment (Li et al., 2024).

2.4.3 Climate Change Risk Management

Cultural heritage sites are already feeling the effects of climate change, which can be seen in the slow changes in temperature, precipitation, atmospheric moisture, and wind intensity, as well as in the rise in sea level and the frequency of extreme events (Sesana, Gagnon, Ciantelli, Cassar & Hughes, 2021).

The effects of climate change on cultural heritage differ depending on the geographic, meteorological, and socioeconomic factors that differ. The presence of geographical features like mountains and bodies of water influences the weather and climate conditions at heritage sites located in different geographical zones (Adetunji and Daly, 2024).

Over the past 20 years, there has been a growing awareness of the risks that climate change poses to cultural heritage. Several attempts have been made to evaluate the expected effects on various building materials and heritage categories, both indoor and outdoor (Bonazza and Sardella, 2023). According to the recent report "Strengthening Cultural Heritage Resilience for Climate Change" (2022) of the EU Open Method of Coordination (OMC) expert group of Member States, just 12 of the 28 participating countries mentioned the presence of cultural heritage in their policies related to climate

P-ISSN: .....

change, and only seven of them have plans in place to coordinate climate change and cultural heritage (Bonazza and Sardella, 2023).

2.4.4 Architectural Risk Management

The field of risk management for architectural heritage has seen several issues. Firstly, enriched data could not be used by Historic Building Information Modeling (HBIM), a tool for managing information on architectural heritage. Non-geometric data has recently enhanced the information that HBIM can store and manage, but its application is constrained by proprietary problems with external systems (Lee et al., 2019). Secondly, information that is relevant to the user's context is not provided by metadata for cultural heritage information management. Because the current metadata is designed for information management and archiving, it does not accurately reflect the context of risk management (Lee et al., 2019). Third, there was ineffective communication between the conservator who assesses the risks and the on-site heritage manager (Lee et al., 2019).

The combination of structural instability and component degradation makes risk management of architectural heritage more difficult (Lee et al., 2019). The degradation ofmaterials that make up cultural heritage is a complicated phenomenon that is typically brought on by a number of environmental factors, including climate change and air pollution (Gaddi, Cacace & Di Menno, 2022). Because each material interacts with its territorial context in a way that is specific to its chemical and physical characteristics, it issubject to a variety of chemical, physical, and biological processes of decay (Gaddi etal., 2022).

2.5 Risk Management Protection Plan

2.5.1 Environmental Risk Management Protection Plan

Environmental monitoring, both indoors and outdoors, has been the mainstay of previous risk assessments. For example, Merello et al. analyzed an interior archaeological site in Spain, examining the impact of relative humidity and ambient temperature through monitoring (Ma et al., 2024). By putting in place temporary measures like a canvas and removing the water layer from the roof, the risk of extremely high temperatures close to the site was effectively reduced.

Similar to this, the addition of a newly installed underfloor heating system in a church dating back to the 16th century may cause contraction and expansion of the paint, wood, and rendering due to changes in indoor humidity and temperature (Ma et al., 2024). Furthermore, Prieto et al. used microwave measurement to map the subsurface moisture between 3 and 11 cm in the stone walls of Stirling Castle in order to study the relationship between moisture distribution and bio colonization (Ma et al., 2024).

2.5.2 Fire Hazard Risk Management Protection Plan

Buildings are increasingly using fire risk analysis as a tool to control the likelihood of a fire and the severity of its effects (Ferreira, Calmeiro, Von & Paulo, 2024). When determining the degree of fire risk associated with existing structures, indicator-based methods can offer a straightforward and trustworthy solution (Salazar, Romão & Paupério, 2021). Creating specific fire safety laws and fire prevention plans that address cultural heritage, improving emergency planning in historic buildings by enlisting the help of fire rescue services and creating emergency evacuation plans for valuable movable assets, or combining passive and active fire protection measures in historic buildings are some of these measures (Salazar et al., 2021).

P-ISSN: .....

2.5.3 Climate Change Risk Management Protection Plan

The preservation of cultural heritage necessitates a comprehensive and interdisciplinary approach to identify all the critical parameters and factors that can put it in danger in a changing environment (Bonazza and Sardella, 2023). According to this framework, passive solutions are frequently used in historic buildings because they can maintain thebuilding's original condition (Lamberti, Contrada & Kindinis, 2024).

Energy retrofitting envelope materials have also been shown by Pigliautile et al. to enhance indoor microclimate for comfort and art conservation. Passive measures can help historic buildings experience less heating and cooling, as demonstrated by Yao et al. However, in certain situations, these measures must be combined with heating, ventilation, and air conditioning (HVAC) systems. Using the EnergyPlus tool, Qu et al. implemented a number of passive retrofitting solutions to a historic building, taking into account their impact on energy consumption and thermal comfort. Their findings demonstrated that summer overheating increased by up to 2.6 °C (Lamberti et al., 2024).

2.5.4 Architectural Risk Management Protection Plan

In the field of architectural risk management, many cultural heritage organizations have carried out research on methods and tools to help conservation and management planning decisions (Lee et al., 2019). This study suggests a new type of metadata and a risk management framework for managing architectural heritage risks using data from Historic Building Information Modeling (HBIM) in a virtual environment (Lee et al., 2019). The HBIM system is a management tool that creates a database connected to the 3D model by integrating historical data about the architectural heritage and risk assessment (Lee et al., 2019).

The degree of surface recession damage risks associated with architectural buildings using a GIS (Geographical Information System) application in conjunction with vulnerability and hazard data. The methodology outlined in the Risk Map of Cultural Heritage, a project created by the Italian Institute for Conservation and Restoration (ICR) in 1996 and founded on the idea of preventive conservation, was the approach used for the risk assessment (Gaddi et al., 2022).

3. METHODOLOGY

As for this study, a qualitative method was used to complete this study. By using a qualitative methodology, sets of interview questions were prepared according to the aim and objectives of this study. The respondents were from the people in building management teams, including manager and staff from the heritage museum buildings namely Perak Museum, Matang Museum and Kompleks Sejarah Pasir Salak . The total number of respondents were six people, two respondents from each heritage museum buildings. All these three museums are listed as heritage museum buildings under Jabatan Warisan Negara (JWN) as they were proven to have significant historical, cultural or architectural value. The interview questions were related to the process of risk management, the issues occurred at the heritage museum buildings and the protection plan for risk management.

P-ISSN: .....

4. ANALYSIS AND FINDING

The process of data analysis is essential for obtaining insightful conclusions from raw information to assist in decision-making. To find relevant information, it entails examining, purifying, converting, and modelling data (Varghese et al., 2023). As part of the analysis process, data is categorized and grouped according to the objectives of the study (Sutriani et al., 2021).

For this study, the data analysis was made based on the interview session with the building management team from the selected heritage museum buildings in Perak. Several respondents are selected from each of these heritage museum buildings to obtain information on risk management. Data was analyzed using thematic content analysis, with interview responses converted into transcripts. The process of the data analysis was carried out according to the problem statement, aim and objectives stated in chapter one. There are four sections of the interview question which are:

- Part A: Respondent Background
- Part B: Risk Management Process
- Part C: Risk Management Issues
- Part D: Approaches to Improve Risk Management

4.1 Respondent Background

Table below shows the list of respondent backgrounds of selected heritage museums including Perak Museum, Matang Museum and Kompleks Sejarah Pasir Salak. The table involves the name, position and years of experience of the respondents.

No.	Building	Respondent	Position	Years of Experience
1.	Matang Museum	R1- Nor Aini	Curator	5 years
		R2- Nordiana	Museum Assistant	24 years
2.	Kompleks Sejarah Pasir Salak	R3- Mohd Fauzi	Assistant Curator	22 years
		R4- Nurul Huda	Museum Assistant	7 years
3.	Perak Museum	R5- Selvaraju	Senior Museum Assistant	10 years
		R6- Zaitun	Museum Assistant	11 years

Table 2: Respondent Background

P-ISSN: .....

4.2 Risk Management Process

Table below shows the process of risk management in heritage museum buildings. The process involved is plan risk management, identifying risk, qualitative and quantitative risk assessment, risk response planning, monitoring and controlling risk and outcome of risk response.

From the table, according to the respondents from R1 and R2, they are not conducting qualitative risk assessment processes. While R3 and R4 stated that Kompleks Sejarah Pasir Salak are not conducting identifying risk process. As for the process of quantitative risk assessment, all three heritage museum buildings do not perform it.

Process / Respondent	Plan Risk Management	Identify Risk	Qualitative Risk Assessment	Quantitative Risk Assessment	Risk Response Planning	Monitoring & Controlling Risk	Outcome of Risk Response
R1	✓	✓	--	--	✓	✓	✓
R2	✓	✓	--	--	✓	✓	✓
R3	✓	--	✓	--	✓	✓	✓
R4	✓	--	✓	--	✓	✓	✓
R5	✓	✓	✓	--	✓	✓	✓
R6	✓	✓	✓	--	✓	✓	✓

Table 3: Risk Management Process

4.3 Risk Management Issues

From the table below, there are multiple issues faced by the heritage museum buildings except Matang Museum. Matang Museum does not face any of the issues including environmental, fire hazard, climate change and architectural risks.

While Kompleks Sejarah Pasir Salak faces multiple issues regarding environmental, fire hazard and climate change risks. As for Perak Museum, this heritage museum building faced issues regarding environmental, fire hazard, climate change and architectural risks. All these issues were collected through the interview session.

Issues / Respondents	Environmental Risks	Fire Hazards Risks	Climate Change Risks	Architectural Risks
R1	--	--	--	--
R2	--	--	--	--
R3	✓	✓	✓	--
R4	✓	✓	✓	--
R5	✓	✓	✓	✓
R6	✓	✓	✓	✓

Table 4: Risk Management Issues

From the interview session, the most environmental risk that occurred is crack and peel of paint and dampness. In Kompleks Sejarah Pasir Salak, they had issue with the crack and peel

P-ISSN: .....

of paint. This is due to the heating process and the unpredictable weather. Ma et al. (2024) said that temperature and humidity variations' thermal and wet stresses hasten the cracking of paint layers and wood panels. While in Perak Museum, they experienced dampness due to the leakage from the gutter. Common occurrences include runoff and shallow groundwater causing capillary water to rise and dampness to affect the masonry walls and floors of heritage buildings (Ma et al., 2024).

Meanwhile, fire is a significant threat to the preservation of cultural assets and a key driver of urban change because they were built when modern fire engineering standards did not exist (Garcia-Castillo et al., 2023). The type of fire hazard that occurred in Kompleks Sejarah Pasir Salak is the building that is caught in fire. While in Perak Museum, the type of fire hazard occurred is short circuit. Research conducted in Pakistan and Malaysia has 93 identified fire safety flaws in heritage buildings, with certain building being considered high-risk (Salleh, 2020). This problem is made worse by Malaysia's inadequate fire safety legislation for heritage buildings (Salleh, 2020).

Other than that, the effects of climate change on cultural heritage differ depending on the geographic, meteorological, and socioeconomic factors that differ. Except Matang Museum, both Kompleks Sejarah Pasir Salak and Perak Museum had experienced flooding. Building damage from floods can occur via 95 several processes such as material saturation, hydrostatic pressure and dynamic impacts (Drdácký, 2010).

Lastly, architectural heritage museum buildings face various risks including environmental factors, abandonment and inappropriate interventions. As in Perak Museum, the common architectural risk that occurred is peeling of paint especially at the building facade. This damage occurred because of dampness due to leakage from the gutter. According to Alauddin et al. (2018), heritage buildings including museums and mosques face various maintenance issue like peeling of paint as a common defect.

4.4 Approaches to Improve Risk Management

Table below shows the approaches suggested by the respondents through the interview session:

Issues / Respondents	Environmental Risks	Fire Hazards Risks	Climate Change Risks	Architectural Risks
R1	Install sensors	Require cooperation from all parties involved	Use advanced climate control systems	Use high quality materials
R2	Improve insulation	Ensuring fire safety systems in good condition	Use advanced climate control systems	Install safety doors
R3	Facilitate the movement	Provide mobile fire extinguisher	Improve the quality of materials	Install an additional concrete wall
R4	Master key	Ensuring fire safety systems in good condition	Install humidifier	Install an additional concrete wall
R5	Elevate floor	Constantly monitored electrical systems	Ensuring temperature and humidity at proper level	Repaint the building façade every 5 years
R6	Place higher shelf	Constantly monitored electrical systems	Ensuring temperature and humidity at proper level	Conducting periodic structural inspections

P-ISSN: .....

Table 5: Approaches to Improve Risk management

From the table above, there are some approaches suggested by the respondents to improve risk management in heritage museum buildings. For instance, according to environmental risk cases, they suggested installing heat sensors, improving insulation, facilitating movement, such as making a ramp to ease the movement, creating a master key, elevating the floor and placing a higher shelf for exhibits. While the approaches to improve fire hazard risk, the respondents suggested seeking cooperation from all parties involved, ensuring fire safety systems are always in good condition, providing a mobile fire extinguisher,

As for the climate change risk, the respondents suggested using advanced climate control systems, improving the quality of materials, installing a humidifier and ensuring the temperature and humidity are at a proper level to secure the quality of exhibitions inside the heritage museum. Lastly, the approaches suggested by the respondents to improve architectural risk are using high-quality materials, installing safety doors, installing additional concrete walls to prevent any theft, repainting the building façade every 5 years and conducting periodic structural inspections.

5. CONCLUSION

The study has been conducted to identify the process of managing risk in heritage museum buildings in Perak, involving Perak Museum, Matang Museum and Kompleks Sejarah Pasir Salak. From the interview session, the data collected shows that all three heritage museum buildings mostly follow the processes.

Based on analysis and findings, there are some issues faced by the heritage museum buildings and several approaches have been suggested by the respondents to improve the issues faced by them. While this study effectively identified the process and issues of risk management and approaches to improve risk management, additional research could provide additional insight into the recommendations to improve risk management in heritage museum buildings.

REFERENCES

Ashley-Smith, J., The Board and Trustees of the Victoria and Albert Museum, British Library, Library of Congress, & Genesis Typesetting. (2011). *Risk assessment for object conservation*. Routledge.

Devi, K. S., & Sharma, T. D. (2019). Innovations in conservation of heritage museums and libraries from fire hazards. *AIP Conference Proceedings*. https://doi.org/10.1063/1.5127129

Dişli, G., & Kilit, R. M. (2024). Risk management and Preventive conservation of cultural heritage: the case of Karaman Hatuniye Madrasa and Karaman City Museum. *IDRiM Journal*,

14(1). https://doi.org/10.5595/001c.94366

Erturk, N. (2021). Kültürel mirasın korunması: Türkiye'deki müzelerde risk yönetimi. *Kültür Araştırmaları Dergisi*, *10*, 82–96. https://doi.org/10.46250/kulturder.934225

Garcia-Castillo, E., Paya-Zaforteza, I., & Hospitaler, A. (2023). Fire in heritage and historic buildings, a major challenge for the 21st century. *Developments in the Built Environment*, *13*, 100102. https://doi.org/10.1016/j.dibe.2022.100102

Ghaeb, H. O., & Mahjoob, A. M. R. (2023). Risk response in construction Project: A review study. *Journal of Engineering*, *29*(08), 121–137. https://doi.org/10.31026/j.eng.2023.08.09

Hamir, H., & Sum, R. (2021). An Analysis of Risk Management Processes and Comparison with ISO31000:2018. *Asian Journal of Research in Business and Management*. https://doi.org/10.55057/ajrbm.2021.3.4.3

ICOM. (2004). ICOM Code of Ethics for Museums. In *ICOM Code of Ethics for Museums* [Book]. https://icom.museum/wp-content/uploads/2018/07/ICOM-code-En-web.pdf

Kaymakçi, S. (2022). Functioning of Heritage Building as Museums and Examining with Examples from Istanbul. *Kocaeli Üniversitesi Mimarlık Ve Yaşam Dergisi*. https://doi.org/10.26835/my.1130594

Kriele, M., & Wolf, J. (2014). The process of risk management. In *EAA series* (pp. 1–16). https://doi.org/10.1007/978-1-4471-6305-3_1

Lee, J., Kim, J., Ahn, J., & Woo, W. (2019). Context-aware risk management for architectural heritage using historic building information modeling and virtual reality. *Journal of Cultural Heritage*. https://doi.org/10.1016/j.culher.2018.12.010

Lucchi, E. (2020). Environmental Risk Management for Museums in Historic Buildings through an Innovative Approach: A Case Study of the Pinacoteca di Brera in Milan (Italy). *Sustainability*, *12*(12), 5155. https://doi.org/10.3390/su12125155

Mutlu, N. G., & Altuntas, S. (2021). Developing an integrated conceptual framework for monitoring and controlling risks related to occupational health and safety. *Journal of Engineering Research*, *9*(4A). https://doi.org/10.36909/jer.9959

Nadkarni, R. R., & Puthuvayi, B. (2020). A comprehensive literature review of Multi-Criteria Decision Making methods in heritage buildings. *Journal of Building Engineering*, *32*, 101814. https://doi.org/10.1016/j.jobe.2020.101814

Nursandi, I. A., & Ashadi. (2022). Kajian Konsep Arsitektur Kontemporer Pada Bangunan Bundeswehr Military History Museum Di Dresden Jerman. *Purwarupa Jurnal Arsitektur*, *6*(2), 33. https://doi.org/10.24853/purwarupa.6.2.33-38

Sesana, E., Gagnon, A. S., Ciantelli, C., Cassar, J., & Hughes, J. J. (2021). Climate change impacts on cultural heritage: A literature review. *WIREs Climate Change*, *12*(4), 1–29. https://doi.org/10.1002/wcc.710

Siagian, T. V., Indradewa, R., Nugroho, S. H., & Iskandar, M. D. (2024). Risk Plan Linen Rental Laundry with RFID Technology PT Think Clean Laundry. *Jurnal Indonesia Sosial Teknologi*, *5*(10), 4102–4111. https://doi.org/10.59141/jist.v5i10.5338

Sutriani, E., Octaviani, R., & Sekolah Tinggi Agama Islam Negeri (Stain) Sorong. (2021). Tugas Resume Ujian Akhir Semester (UAS). In *Ekonomi Syariah* [Thesis].

Varghese, N. A., Joseph, N. C. S., Binoy, N. M., Jacob, N. R., & Joseph, N. A. (2023). Unleashing the Power of Data Analytics: A Pathway to Insightful Decision-Making. *International Journal of Engineering Technology and Management Sciences*, *7*(4), 433–437. https://doi.org/10.46647/ijetms.2023.v07i04.057

Whalen, T. P. (Director). (2003). Managing Change: Sustainable approaches to the conservation of the built environment. In J. M. Teutonico & F. Matero (Eds.), *Getty Conservation Institute Proceedings Series*. Getty Conservation Institute. https://www.getty.edu

Zulkifli, M., & Bakar, M.S. (2020). Heritage Building Conservation : An Overview Of Pahang State Museum.

Zuraidi, S. N., Rahman, M. a. A., & Akasah, Z. A. (2019). Measuring the level of defect condition in the museum building. *International Journal of Engineering & Technology*, *7*(4.14), 396–400. https://doi.org/10.14419/ijet.v7i4.14.27692