Research Article

A Conceptual Model of Perceived Risk-Based Maintenance Management for Public Schools

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Abstract: *The declining condition of public-school facilities is a serious concern, as poor maintenance not only affects safety but also impacts the overall learning experience for students. Many current maintenance practices do not effectively address the challenges of ageing infrastructure, such as performance issues, budget constraints, safety risks, and operational disruptions. These challenges highlight the need for a better approach to maintenance management. This research presents a new model called the perceived risk-based maintenance management (PRBMM) model, which helps prioritize maintenance tasks based on the risks associated with school facilities. The authors identify four key factors—performance, financial, safety, and operational risks—that influence how these risks are perceived. By focusing on these factors, the model offers a clear framework for improving maintenance in public schools. Implementing the PRBMM model is expected to lead to safer school environments, better facility performance, and more sustainable infrastructure. Moreover, this model can be used in various educational institutions and adapted for other sectors facing similar challenges. This study aims to fill a need in current maintenance practices by providing a straightforward framework that improves facility management and safety. The PRBMM model offers a practical solution that can be applied across different sectors needing effective maintenance management.*

Keywords: conceptual model, determinant factor, perceived risk, public school, risk-based maintenance.

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1. INTRODUCTION

Maintaining public school facilities is essential for creating safe, effective learning environments, yet limited funding often forces schools to rely on reactive maintenance rather than a proactive approach (Arif, Bayraktar, & Chowdhury, 2015; Beauregard & Ayer, 2018; Chanter & Swallow, 2017). This approach can lead to minor issues growing into major, costly problems, putting further strain on budgets and affecting the long-term condition of school buildings (Abdullah & Bakri, 2021; Arshad, Ali, Fauzi, & Ihsan, 2023). While preventive maintenance is essential for sustaining school

facilities, inadequate funding often prevents schools from addressing small issues early on, resulting in bigger repairs that compromise both quality and safety (Adejimi, 2015).

A major barrier to effective maintenance is the lack of data and risk assessment methods, which makes it difficult to prioritise repairs. This gap often leads to unplanned, short-term fixes rather than risk-informed maintenance, resulting in limited funds being used inefficiently and infrastructure deteriorating further (Dzulkifli et al., 2021; Ensafi & Thabet, 2021). To address this issue, the study introduces a perceived risk-based maintenance management (PRBMM) model for public schools, which focuses on prioritising tasks based on assessed risks rather than immediate, visible issues. The PRBMM model combines risk assessment with maintenance planning to help allocate resources more effectively and improve safety and functionality.

The PRBMM approach prioritises critical areas, like roof repairs, asbestos removal, accessibility improvements, and fire safety compliance—issues that often get delayed due to limited resources but directly affect health and safety (Bentley, 2012; Chanter & Swallow, 2017; Gerrard & Barron, 2020). In Malaysia, where school buildings are ageing and face similar funding issues, this model offers a practical way for schools to manage maintenance more efficiently. By focusing on perceived risks, the PRBMM model helps schools make the most of their resources, prioritise essential repairs, and create safer, more functional environments for students and staff..

2. METHOD

This study uses a systematic literature review (SLR) to identify the key factors that impact perceived risk in risk-based maintenance management (RBMM). Following PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), we ensured a clear and organised approach to gathering and analysing data. The SLR focuses on literature about perceived risk-based maintenance management (PRBMM) in public schools to better understand which factors affect maintenance practices and how these insights can improve the safety and sustainability of school facilities. The review includes relevant research articles published between 2009 and 2024 from databases such as Scopus, Web of Science (WoS), Elsevier, Google Scholar, and Science Direct.

3. FINDINGS

School facility maintenance is vital for ensuring the safety, efficiency, and long-term sustainability of educational environments. Effectively managing risks related to financial limitations, performance failures, safety hazards, and operational disruptions is essential for maintaining the integrity of school buildings and creating a conducive learning atmosphere. This study critically analyses four primary risks—financial, performance, safety, and operational—as outlined by scholars, offering insights and practical recommendations for addressing these risks in public schools.

The findings highlight the need for a structured and proactive approach to maintenance management in public schools, particularly through the perceived risk-based maintenance management (PRBMM) model. This model focuses on four key factors of perceived risk: financial, safety, operational, and performance. Each factor significantly impacts the sustainability, safety, and functionality of school facilities. The study shows that inadequate funding and limited resources force schools into reactive maintenance practices, which worsen infrastructure degradation over time (Arif, Bayraktar, & Chowdhury, 2015; Beauregard & Ayer, 2018). By prioritising maintenance tasks based on perceived risks, the PRBMM approach marks a shift from reactive methods, providing a more strategic and resource-efficient way to tackle maintenance issues affecting educational environments. These factors are visually represented in the conceptual model shown in Figure 1.

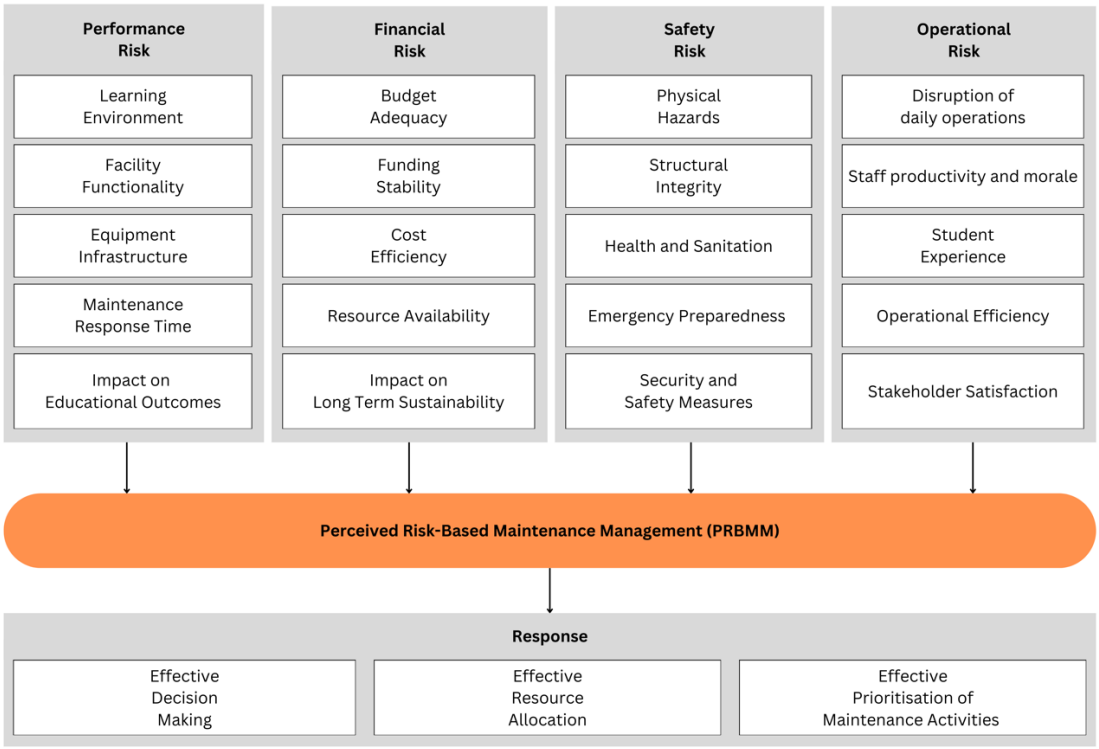

Figure 1. Conceptual model of Perceived Risk-Based Maintenance Management for Public Schools.

The PRBMM model aligns closely with existing literature by integrating perceived risk theory and maintenance prioritisation strategies. It categorises maintenance risks into the four primary types mentioned earlier. Each of these factors directly influences how maintenance decisions are made within school facilities, guiding resource allocation and task prioritization. The PRBMM model promotes a systematic approach that emphasises data-driven, risk-prioritised interventions rather than reactive repairs.

The model also incorporates theories such as the Theory of Planned Behaviour (TPB) and the Decomposed Theory of Planned Behaviour (DTPB), which emphasise the role of perceived behavioural control in decision-making. These theories suggest that attitudes, perceived risks, and external constraints influence how stakeholders, like facility managers and administrators, prioritise maintenance tasks (Ajzen, 2020; Taylor & Todd, 1995). By integrating TPB and DTPB into the PRBMM model, the study creates a framework that not only acknowledges perceived risks but also systematically addresses them. For example, safety risks related to structural integrity and emergency preparedness are prioritised based on the perceived likelihood of negative outcomes and their potential impact on student and staff safety. This prioritisation aligns with the theoretical emphasis on making maintenance decisions according to perceived risks, allowing facility managers to focus on the most pressing needs.

Furthermore, the PRBMM model supports a proactive approach to maintenance, contrasting with traditional practices that often react to problems only after they arise due to funding limitations. The conceptual model advocates for scheduling maintenance based on the likelihood of risks rather than just visible signs of wear. The PRBMM model operationalises this by employing risk-based budgeting and prioritisation, ensuring that significant and probable risks are addressed before they escalate into more severe or costly issues (Lavy & Bilbo, 2009).

Additionally, the model's emphasis on optimising resources is rooted in the conceptual framework. Financial and operational risks are managed through risk-based budgeting and resource

allocation, supporting the view that efficient resource use is crucial for the sustainability of school facilities. By incorporating financial risk analysis, the model ensures that budget constraints are considered, enabling schools to make informed decisions about where to allocate their limited funds for maximum impact (Beauregard & Ayer, 2018; Buban & Janer, 2024).

4. CONCLUSION

The findings of this study show that the PRBMM model could fill important gaps in current school maintenance practices by moving from reactive to proactive management and making better use of limited resources. However, practical challenges remain, especially in obtaining the necessary funding, technical skills, and administrative support to prioritise maintenance based on perceived risks. This study points to the need for government support and policy changes to ensure sustainable school facilities. By addressing financial, safety, operational, and performance risks in an organised way, the PRBMM model offers a well-rounded solution that could improve the safety, functionality, and learning environment of public schools, leading to better educational outcomes and stronger, more resilient school infrastructure. At its core, the PRBMM model connects with the study's framework by drawing on perceived risk theory and decision-making models based on behaviour. It puts these ideas into a structured approach that deals with financial, safety, operational, and performance risks. By focusing on proactive, risk-based maintenance, the model gives schools a more strategic and efficient way to handle maintenance. In bridging theory and practice, the PRBMM model supports the long-term strength of school infrastructure, making educational spaces safer and more functional, and providing a solid approach for managing school facilities over time.

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