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The International Surveying Research Journal (ISrJ) is a peer-reviewed academic journal dedicated to advancing knowledge and professional practice within the surveying disciplines. It serves as a platform for the dissemination of research that enhances the understanding, innovation, and application of surveying principles across diverse contexts. The journal fosters collaboration among academics, industry professionals, and policymakers through the exchange of ideas, empirical findings, and critical discussions that contribute to shaping sustainable and resilient built environments.

JOURNAL OBJECTIVES

ISrJ publishes a broad range of scholarly works, including original research articles, review papers, technical and practical studies, and case studies in Quantity Surveying, Building Surveying, Property Surveying, and Geomatics and Land Surveying. The journal emphasizes contemporary developments and innovations across multiple spatial scales, from buildings and systems to communities and cities, and promotes research that integrates sound methodologies with reflective insights on policy, practice, and sustainability.

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EDITOR'S MESSAGE

Welcome to the International Surveying Research Journal (ISrJ), Vol. 14, Issue No. 1 for 2025, published by the Royal Institution of Surveyors Malaysia (RISM). This journal continues to serve as a platform that brings together the diverse practices within the surveying profession; Quantity Surveying, Property Surveying, Geomatics and Land Surveying, and Building Surveying.

At its heart, ISrJ aims to connect researchers, academicians, practitioners, and students, offering them a shared space to communicate their ideas, exchange insights, and contribute meaningfully to the advancement of the surveying field. Each publication is a collective effort that reflects our community's commitment to continuous learning, innovation, and professional excellence.

In this issue, we feature papers that highlight pressing and emerging themes in the surveying discipline, reviewed by both local and international experts. The selected works provide fresh perspectives on the evolving challenges and opportunities across the built environment, including:

- Users' Satisfaction Towards the Implementation of Helpdesk System and Maintenance in Higher Educational Institutions
- A Review on Competency Requirements Nexus of Facilities Managers for Green Building
- Exploring Loss and Expenses in Construction: Issues and Challenges Faced by Contractors in Malaysia
- Factors Affecting Cost Performance across G5 Construction Firms
- The Urban Scars: Exploring the Perceived Impacts of Abandoned Construction Projects on the Community

While these topics offer valuable insights, they also remind us that the landscape of surveying research remains vast and full of possibilities. Each article is a small yet significant step in uncovering new knowledge that can inspire better practices, policies, and innovations for the industry and the communities we serve.

As we move forward, we warmly invite more professionals, researchers, and students alike, to share their discoveries and experiences with us. Your voices are essential in shaping the dialogue and direction of our profession.

On behalf of the editorial team, I extend our heartfelt appreciation to all authors, reviewers, and readers for your continued support and trust in ISrJ. May this issue inspire you to explore new ideas, challenge conventions, and continue pushing the boundaries of excellence within the surveying fraternity.

Thank you for being part of this growing community of knowledge.

With warm regards,

Dainna Baharuddin

PP Sr Dainna Baharuddin, CQS, FRISM, FRICS
Advisory Editor
November 2025

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USERS' SATISFACTION TOWARDS THE IMPLEMENTATION OF HELPDESK SYSTEM AND MAINTENANCE IN HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

This study investigates users' satisfaction with helpdesk systems in higher educational institutions (HEIs), focusing on their role in improving maintenance efficiency. Facilities maintenance supports an institution's core business, and the helpdesk system serves as a vital communication tool between building users and management. Despite its widespread use, little is known about how satisfied users are with these systems, prompting this research. A mixed-method approach was applied across two public universities, involving 200 valid survey responses and four semi-structured interviews. Findings show that helpdesk systems enhance maintenance management and act as mechanisms to reduce performance gaps by capturing user feedback. Users' satisfaction levels were found to be above average, and statistical analysis confirmed significant correlations between the efficiency of helpdesk functions and overall satisfaction. Key areas for improvement include faster response times, improved staff efficiency, accurate issue tracking, and continuous system updates. This research highlights the strategic role of helpdesk systems as preventive maintenance tools and underscores their importance in strengthening maintenance performance in HEIs.

KEYWORDS: Helpdesk, higher educational institutes, building maintenance, maintenance performance.

INTRODUCTION

Facilities Management (FM) plays a role in facility operation and maintenance and in managing the facility and building. A professional management discipline is deep-seated in the efficient and sustainable delivery of services and facility improvements within the buildings being managed (Bell, 2020). Facility maintenance involves the people and processes that help organisations get maximum utility (Davis, 2021). May (2010) mentioned that a comprehensive helpdesk is essential in fulfilling customer communication requirements. It functions as the hub of facilities management operation. Hence, the helpdesk is fast becoming a key instrument in enhancing FM productivity. It served as a platform to enhance communication between building users and management teams. It is an appropriate system for monitoring maintenance work quality and routines based on feedback from building users. Educational institutes also have a high demand for maintenance to maintain an effective learning environment. Apart from the performance measurement indicators developed by the strategic management, helpdesk can be a representative tool to indicate the users' satisfaction as first-hand feedback or opinions.

Omoola, Bakare, and Salame (2024) opined that an effective feedback-handling mechanism is vital for stakeholder engagement and satisfaction. A sound helpdesk system is essential for maintaining the quality of a facility's performance and services. In evaluating FM services, the viewpoint of facility users is critical, as the quality of facility maintenance is linked to the amount of user pleasure. According to Li (2008), there is a fundamental gap between users' enjoyment of the physical environment and their experience of the physical environment. Lützkendorf and Lorenz (2006) mentioned that occupant satisfaction feedback is a critical performance measure that can replace several other partial indicators in buildings. Supported by Khalil, Kamaruzzaman, Baharum, Husin, and Nawawi (2014), users can make decisions or take action when they realise that their value system is not being met adequately. This statement is aligned with Seshadhri and Paul (2018), who state that building performance can be best evaluated and understood by receiving feedback from occupants. Among users' satisfaction, the ideal gauge is the end user satisfaction (Seshadhri & Paul, 2018). Users are the ones who experience the building's performance and predict its long-term performance; thus, users can be the respondents in a holistic survey to assess a building's total long-term performance. Therefore, the management must utilise the helpdesk to understand the reality of building maintenance performance.

However, Hauashdh, Jailani, Rahman, and Al-fadhali (2022) highlighted the communication gap between building users and maintenance organisations. The performance gap is the difference between anticipated and actual performance. The factors causing performance gaps are a lack of monitoring and feedback; consequently, the problems rarely need to be identified. Therefore, action should be undertaken promptly when issues arise to close the performance gap in building maintenance. There is an urgent need for the systematic management of the feedbacks and complaints through the use of an effective helpdesk system (Omoola et al., 2024). However, the level of users' satisfaction with the implemented helpdesk system and the maintenance services' efficiency in Higher Educational Institutions (HEIs) remains unknown, which leads to this study being conducted.

USERS' SATISFACTION AS A MEASUREMENT TOWARDS BUILDING PERFORMANCE

The helpdesk system undoubtedly is a gauge for measuring the users' satisfaction. User satisfaction can be a benchmark to determine the building's performance. The total building performance evaluation should cover six in-depth aspects: spatial, thermal, air, acoustic, visual, and building integrity (Loftness, Hartkopf, Aziz, Choi, & Park, 2018). The evaluation shall be measured against physiological, psychological, sociological, and economic limits. However, it contains several uncertainties from the individuals' perceptions, and hence, there is no standard calculation to evaluate the building performance by evaluating the users' minds instead of the users' satisfaction. Satisfaction is defined as an individual's delight or disappointment from comparing the product's performance to the expectations (Kotler, 1997). Satisfaction is subjective and rarely used in performance measurement (Rashvand & Zaimi Abd Majid, 2014).

Nevertheless, many researchers have suggested that individuals' satisfaction should be considered in performance measurement criteria for measuring time, cost, and quality. According to Loftness et al. (2018), user satisfaction studies show significant gaps between the design intent and the actual building performance and systems over time and occupancy changes. Therefore, overall satisfaction can be the overall evaluation response that represents the building users' needs and expectations.

IMPACTS OF EFFECTIVE HELPDESK SYSTEM ON BUILDING PERFORMANCE

BS5240 describes building performance as the "behaviour of a product in use" (Douglas, 1996); it is also defined as the building's ability to contribute to the fulfilment of the functions of its

intended use (William, 1993). Building performance is linked to satisfaction, efficiency, function, and fitness (Khalil et al., 2014). Meanwhile, building performance can be summarised as a building's ability to operate at peak efficiency and accomplish its function throughout its life cycle (Khalil et al., 2014). The helpdesk is an enquiry platform for people to contact management when facing severe maintenance failure. An effective helpdesk should respond to users' enquiries and resolve the issues satisfactorily and promptly. ICT applications can prevent mistakes and improve the consistency of maintenance work in buildings (Hauashdh et al., 2022). A helpdesk system can be used as an online complaints platform to receive the building users' defect reports and improve maintenance performance after the complaints. As mentioned by Mahmoud, Hassanain, and Alshibani (2024), the appropriate provision, maintenance and management of modern facilities like the helpdesk system can enhance the creativity, productivity, comfort, and satisfaction of the stakeholders.

Furthermore, McDougall, Kelly, Hinks, and Bititci (2002) stated that the necessity of a feedback loop in creating performance assessment systems has long been established. Without feedback, the building and systems will have the potential to produce unpredictable outcomes. Hence, users' feedback is vital to ensure that improvement can be established in building performance. Khalil et al. (2014) state that many studies have shown an increasing awareness of the consequences of the responses gathered from the feedback of building users, yet learning from feedback is not yet embedded in the processes which affect the use of the building. An effective helpdesk will significantly impact the building's performance if the data or feedback in the helpdesk system is collected as a performance measurement to improve the building's performance via lessons learned from the building users' feedback or responses.

FUNCTIONS OF HELPDESK USED IN HEIS

Generally, the helpdesk system typically encompasses communication and administration for internal and external use. For instance, the inquiries, feedback, and complaint system, including facilities management, is for external use, whereas the helpdesk IT services are for internal use. An effective helpdesk system helps to ensure a comfortable atmosphere to the university stakeholders, motivates learners, and enhances the reputation of the institution (Mohamed et al., 2025).

Inquiries, Feedback, and Comments System

First and foremost, a helpdesk system should be complete with inquiries, feedback, and comments as it acts as a communication platform. In HEIs, these functions are essential in problem-solving (Shafie, Wan Yusoff, Martin, & Sultan Sidi, 2011). The helpdesk's function is to drive the users' satisfaction by receiving quick and easy resolutions when the users encounter any problems (Wren, 2020). As a helpdesk is mainly used for fixing issues, inquiry and feedback platforms are significant in informing administrative or helpdesk management. Consequently, the problem can be solved promptly. After resolving the problem, the helpdesk management may comment on the corresponding issues. Hence, the inquiry and feedback function of the helpdesk is used to answer questions from the users and fulfil their needs to enhance their satisfaction.

Complaint System

The following function provided by helpdesk services is the complaint system. It receives complaints regarding staff behaviours, safety, maintenance, building defects diagnosis, processes, or systems in the organisation, where the solutions require an extended time frame (Shafie et al., 2011). According to Ismail (2017), online customer complaints (OCC) are a data collection and automation system that solves defects. A complaint system is a way for users to convey their perceptions. In contrast, a complaint system also can be the approach to determine the productivity, efficiency, and effectiveness of the organisation (Haji Azahari, Ason, Rossiman,

Wong, & Idris, 2022). More complaints received result in higher unmet user expectations, as shown via the complaint system. Hence, feedback and complaints are essential for management to identify the issues and eliminate service failure incidents (Msosa, 2021).

Information Technology Services

Furthermore, the function provided via the helpdesk system includes information technology services (IT services). IT services focus on IT maintenance and remote control of the facilities (Shafie et al., 2011). For instance, some universities provide an ICT Services helpdesk for students and staff reporting all the issues regarding IT services, and the System aims to minimise disruption. The IT services are also open to public complaints regarding technical issues and maintenance. Overall, IT services in the helpdesk system are essential in dealing with technical issues and IT asset maintenance since various IT facilities on campus provide a convenient teaching and learning environment to the students and the staff.

Facilities Management

Apart from the general functions of the helpdesk system, there is a helpdesk which only functions for facilities management purposes. In some cases, there is a facility management (FM) helpdesk, an online system that specifically concerns facility maintenance services and service delivery to enhance management performance by receiving users' complaints (Shafie, Wan Yusoff, Ahmad, & Al-Hakim Ramlly, 2013). The FM helpdesk also includes functions such as a complaint system, inquiry and feedback services, and requests for additional services. Overview, organisations typically have one central helpdesk for each department, and the helpdesk will subsequently categorise the aspects the users seek. In short, the FM helpdesk is used to manage and report all maintenance activities, and it is beneficial for managing the facilities through the online user complaint system (Shafie et al., 2013).

This research focuses on the helpdesk system application in higher educational institutes (HEIs) to improve the maintenance work efficiency. Facility maintenance entails the people and processes supporting the organisation's core business, where implementing the helpdesk system helps engage the building users and management. However, the level of users' satisfaction with the implemented helpdesk system and the maintenance services' efficiency remains unknown, which leads to this study being conducted.

METHODOLOGY

A mixed-method approach was employed for this study. Two (2) public universities were selected as case studies, with 200 valid questionnaires analysed and two (2) interviews conducted from each case study. It helps to increase the validity and reliability of the research as the data obtained is from various resources. In addition, the mixed method has integrated the benefits of both methods to gain more complete data statistics (George, 2021). The questionnaire was developed based on prior literature on facility management and user satisfaction, and structured into sections covering demographic data, perceptions of helpdesk functions, and overall satisfaction. Content validity was ensured through expert review by academics and practitioners in facilities management before distribution. Then, the online questionnaire survey was conducted to collect data on the helpdesk system implementation and the users' satisfaction level with the helpdesk system in HEIs. HEIs involved were disclosed anonymously as University A and University B. They shared similar characteristics, such as providing helpdesk functions online, obtaining complaints regarding maintenance issues through the helpdesk system, and opening the helpdesk systems to website users and visitors. The Google questionnaire forms were distributed to the students, staff, lecturers, and visitors of HEIs via email and online platforms. The detailed questionnaire survey respondents' profiles are tabulated in Table 1.

Table 1: Profile of the respondents from the questionnaire survey (n = 200)

Profile	Frequency	Percentage (%)
Student	135	67.5
Management staff	37	18.5
Lecturer	27	13.5
Public/Visitor	1	0.5
Total	200	100

Interviews were conducted sequentially after the survey analysis to clarify and expand upon the survey findings, allowing triangulation of results and deeper insights into the challenges of helpdesk implementation. They were conducted with the staff who oversee the helpdesk system and the maintenance personnel who supervise the maintenance performance of the building in HEIs. The interviewee's selection criteria include the current working position as follows:

a) Interviewee A
   Interviewee A is the Head of the Division of Physical Maintenance under the Department of Development and Estate Maintenance (JPPHB), University A. He is responsible for handling all physical maintenance of the university assets. He has mastered the knowledge and understanding of maintenance issues and the helpdesk roles at the University A.
b) Interviewee B
   Interviewee B is the Director of the Facility Management Office under the Office of the Assistant Vice Chancellor (Development & Facility Management), University B. Interviewee B is responsible for managing the university's facility management. Meanwhile, he is also responsible for regularly monitoring the university's helpdesk system to keep updating the functionalities of the university facilities.

RESULTS AND DISCUSSION

Figure 1 and Figure 2 show the helpdesk as a tool to close performance gap results for University A and University B, respectively. For University A, the data shows that forty-five (45) respondents agreed, and thirty-one (31) strongly agree. Twenty-two (22) respondents stand neutral on this statement, whereas two (2) disagree. Concurrently, fifty-five (55) respondents from University B strongly agree, and thirty-five (35) respondents agree. One (1) respondent disagrees and strongly disagrees with the helpdesk as a tool to close the performance gap. The remaining eight (8) respondents are neutral.

Meanwhile, Table 2 shows the data analysed through the descriptive analysis. From the perspective of University A respondents, the mean value is 4.42 out of 5, which falls within the range of agree and strongly agree. From the perspective of University B respondents, the average mean is 4.05 out of 5, which is approximately 4, indicating "agree" with the statement. Thus, by the analysis, as helpdesk users, most respondents from University A and University B agree that the helpdesk is a tool to close the performance gap.

Table 3 shows the ranking for the satisfaction level for each function of the University A helpdesk. The highest rank is the FM helpdesk function, which scored 3.73 out of 5. The minimum and maximum ratings for users' satisfaction with the FM helpdesk ranking among the 100 respondents are 2 and 5, respectively. The FM helpdesk is rated as the most efficient University A helpdesk function. Next, the inquiries and feedback function is ranked second with a mean of 3.72. The third satisfaction ranking falls under the IT services with a mean of 3.68, followed by the complaint system with a mean of 3.68, yet the minimum satisfaction rate obtained by the complaint system is 1. The lowest ranking of the complaint system might be due to the lack of a specific complaint platform provided by University A, as the complaint system is combined with the inquiry, suggestion, and compliment platform.

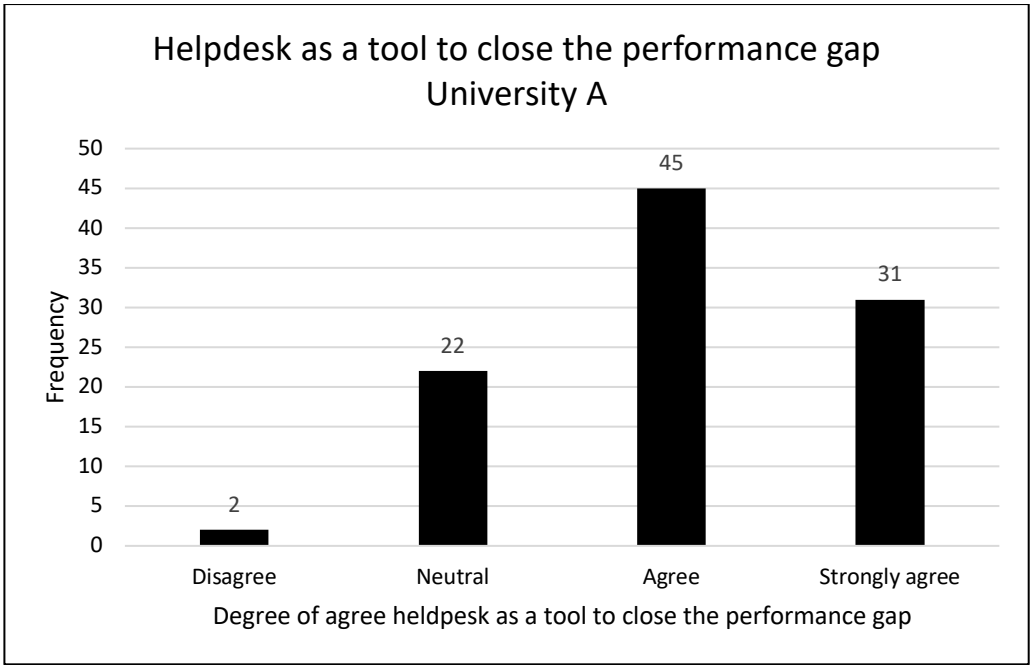

Figure 1: Helpdesk used as a tool to close the performance gap in University A

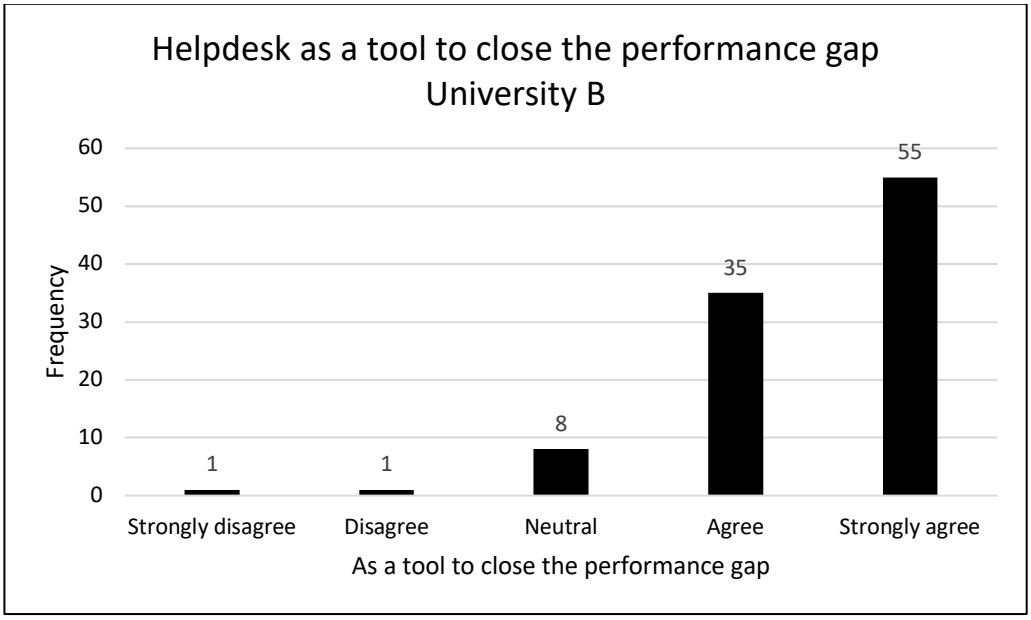

Figure 2: Helpdesk used as a tool to close the performance gap in University B

Table 2: Respondents' perception towards the helpdesk system as a tool to close the performance gap

	Mean	Std. Deviation
As a tool to close the performance gap (University A)	4.42	0.768
As a tool to close the performance gap (University B)	4.05	0.783

Table 3: Ranking of satisfaction level towards University A helpdesk functions

Descriptive Statistics for Satisfaction Level of University A Helpdesk	Mean	Std. Deviation
Satisfaction level towards FM of helpdesk system	3.73	0.750
Satisfaction level towards Inquiries and Feedback of helpdesk system	3.72	0.805
Satisfaction level towards IT services of helpdesk system	3.68	0.777
Satisfaction level towards Complaint System of the helpdesk system	3.68	0.803

Table 4 shows the ranking analysis of the satisfaction level towards the University B helpdesk function. The highest ranking is the inquiry and feedback function, which scored 4.12 mean and the minimum rating scale of 3. The respondents' high satisfaction implied the high comprehensiveness of the University B helpdesk in inquiry and feedback function. Next, the facilities management via the helpdesk is ranked second with a 4.04 mean, followed by the compliant System of the helpdesk with a 3.99 mean. Although the University B helpdesk provides the inquiry, feedback and complaint platform under the same System, the complaint system has a lower ranking than the inquiry and feedback function. It might be caused by the unsatisfied response speed based on the priority of the complaint and the case progress update by the management, as one of the suggestions from University B respondents is to give prompt action for problem-solving. The lowest rank is the helpdesk system's IT services, which is 3.82 mean. The reasons that may cause the lowest rank are the existing technical function issues and lack of system maintenance.

Table 4: Ranking of satisfaction level towards University B helpdesk functions

Descriptive Statistics for Satisfaction Level of University B Helpdesk	Mean	Std. Deviation
Satisfaction level towards Inquiries and Feedback of helpdesk system	4.12	0.742
Satisfaction level towards FM of helpdesk system	4.04	0.650
Satisfaction level towards Complaint System of the helpdesk system	3.99	0.870
Satisfaction level towards IT services of helpdesk system	3.82	0.642

Table 5 revealed that the overall efficiency of the facilities management (FM) helpdesk in University A is significantly associated with the overall satisfaction of users, with a correlation coefficient of 0.401 ($p<0.05$). Also, the correlation coefficient between the FM helpdesk's overall efficiency and user satisfaction is 0.311 ($p<0.05$), as shown in Table 6. It supported what Shafie et al. (2013) mentioned the FM helpdesk acts as a mechanism that enables the efficient and systematic management of facilities via an online users' complaint system. Besides, Spearman's correlation analysis also highlighted a significant correlation between the overall efficiency of IT services and the overall satisfaction of University A helpdesk users, where $r = 0.371$ ($p<0.05$). On the other hand, based on the correlation analysis in Table 6, the findings demonstrated that the efficiency of IT services in the University B helpdesk significantly correlated to the users' overall satisfaction, where $r = 0.434$ ($p<0.05$). The result also aligned with Masongsong and Damian (2016), where the helpdesk provides various online tools that can be used to overcome IT-related problems. Due to the high efficiency of IT services, the helpdesk services provided will be more satisfying to users.

Next, the significant correlation between the inquiry, feedback and complaint system and the satisfaction of University A helpdesk users was also detected through Spearman's correlation shown in Table 5 with the coefficient of 0.362 ($p<0.05$) and 0.337 ($p<0.05$), respectively. Meanwhile, inquiry and feedback efficiency also correlate with users' satisfaction with University B; the data in Table 6 shows a 0.333 coefficient ($p<0.05$). Also, the correlation coefficient between the University B complaint system's overall efficiency and the satisfaction of University B users is 0.310 ($p<0.05$). Indeed, the essential function of the helpdesk system is for inquiry and complaint; consequently, the efficiency and effectiveness of enquiry, feedback, and complaint functions will influence the satisfaction level of the users. Overall, the four functions' efficiencies

significantly correlate with users' satisfaction in University A and University B, as all the data results show a p-value of less than 0.05.

Table 5: Correlation between overall efficiency of University A helpdesk functions and overall satisfaction level rating for University A helpdesk functions

Spearman's rho		Overall satisfaction level rating
Overall efficiency of Inquiries Feedback towards maintenance and management	Correlation Coefficient	0.362**
	Sig. (2-tailed)	0.000
Overall efficiency of IT Services towards maintenance and management	Correlation Coefficient	0.371**
	Sig. (2-tailed)	0.000
Overall efficiency of Complaint System towards maintenance and management	Correlation Coefficient	0.337**
	Sig. (2-tailed)	0.001
Overall efficiency of FM towards maintenance and management	Correlation Coefficient	0.401**
	Sig. (2-tailed)	0.000

Notes:
n=100.
** Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlation between overall efficiency of University B helpdesk functions and overall satisfaction level rating for University B helpdesk functions

Spearman's rho		Overall satisfaction level rating
Overall efficiency of Inquiries Feedback towards maintenance and management	Correlation Coefficient	.333**
	Sig. (2-tailed)	0.001
Overall efficiency of IT Services towards maintenance and management	Correlation Coefficient	.434**
	Sig. (2-tailed)	0.000
Overall efficiency of Complaint System towards maintenance and management	Correlation Coefficient	.310**
	Sig. (2-tailed)	0.002
Overall efficiency of FM towards maintenance and management	Correlation Coefficient	.311**
	Sig. (2-tailed)	0.002

Notes:
n = 100.
** Correlation is significant at the 0.01 level (2-tailed).

Current practice on helpdesk systems in HEIs was found based on the semi-structured interview conducted. The helpdesk system is universalising in HEIs to manage the assets and facilities. The current practice of the helpdesk system is the key to fulfilling the performance of management desired by the public. The mechanism of a helpdesk system in both HEIs is similar, yet the controlling department and practice of the helpdesk are slightly different. Both helpdesk systems in these two HEIs are only open to staff and students. The information technology department developed the University A helpdesk system. JPPHB consists of several division units responsible for maintaining the building, assets, and infrastructure. Under each unit, an engineer acting as the administrator will receive the complaints and subsequently distribute the complaints to the assistant engineer. The assistant engineer will decide whether the issue can be solved in-house or requires an outsource maintenance. The feedback and the progress of dealing with the issues will be updated and followed up with the users until the cases are closed.

On the other hand, the complaint system of University B is managed by the facilities management office and computer centre. There is no physical helpdesk for University B, which means the virtual helpdesk platform is the only path for users to express their views on points. Notably, the helpdesk system in University B will auto-distribute the complaints or issues to the relevant departments according to the category of the issues.

Roles of Helpdesk in Improving Building Performance and Building Maintenance

Yearly complaints from the University A helpdesk are approximately 4000 to 4500 cases; 80% to 85% are related to maintenance issues. At the same time, the current complaints received by the University B helpdesk are approximately 3000 cases per year. The correlation between helpdesk and building performance and maintenance was discussed in the interview. Both interviewees said that the helpdesk is necessary for HEIs and agreed that the helpdesk plays a role in improving the buildings' performance and maintenance. The helpdesk is vital in managing the building maintenance work as it is a way for occupants to inform the management of the occurrence or existence of the problems. Data gained from the system helps deal with planned preventive maintenance. The maintenance department could analyse data and arrange an appropriate preventive maintenance plan. Concurrently, the question of whether the users' feedback is important in improving the building performance or maintenance was discussed via interview. The result found that the communication between the users or occupants and the management is essential and required as he preferred two-way communication for problem-solving. Thus, it is highly encouraged for the building users to directly communicate with staff through helpdesk for the case record, whereas the staff may directly update the status or information of the case using the helpdesk system. In the past, some building performance cases had been reported via the helpdesk, such as heating, ventilating, and air conditioning system (HVAC) damage, roof leaking, and lift malfunction. The cases and complaints will be recorded in the system for analysis purposes.

Data mentioned that the feedback from users is vital for further improvement in the maintenance of assets. Thus, it validates the stand of Khalil et al. (2014) that lessened knowledge is feasible to establish from the feedback or responses of building users. However, unfortunately, due to Malaysia's culture, most users usually do not make a report or give feedback when they encounter maintenance issues, yet the users prefer to spread their minds through social media instead of the helpdesk platform. Consequently, spreading the users' perspectives via the wrong channel takes lots of time to overcome the problems. Meanwhile, the survey distribution for collecting user feedback is always neglected, which causes management to face difficulty investigating the perceptions of helpdesk users.

Nevertheless, user feedback must be collected to form a two-way communication between the management and building users. Therefore, to sum up, user feedback is significant and needed to improve building performance and maintenance. Apart from the feedback system, some factors must be considered to ensure building maintenance quality. The interviewee mentioned that extra consideration is essential to ensure the building's maintenance quality, including preventive schedule maintenance. Maintenance plans are necessary for the regular maintenance of the building and its assets, especially for mechanical and electrical systems, which play an essential role in HEI's regular operation.

On the other hand, the competency and attitude of the staff and experts are essential for ensuring maintenance quality. He believed that the excellent responsibility and attitude of the maintenance management team will always provide a high standard of maintenance services to regulate the asset, building and facilities operation. On the other hand, each staff member is required to train and adapt to advanced technology. Regular training and human development from the technology aspect will help provide more professional services through the systematic maintenance management system. Therefore, staff are highly encouraged to update their understanding of the maintenance system and use the new technology knowledge.

Issues, Challenges, and Recommendations

One of the challenges for University A is promptly responding to the users within the shortest time. However, most of the issues require extended time to proceed with the procurement process; sometimes, the users could understand their situation and feel unsatisfied with their services. Another challenge is that users cannot understand the function and the helpdesk service guide, causing users to inquire about how to use it. The final issue mentioned is network safety.

Regarding dealing with the helpdesk issue, an Interviewee from University B pointed out that they are facing an issue regarding the location of the assets. The location of assets, such as the asset name and number, cannot be detected, and the university does not support having a global information system to detect the coordinate. Therefore, they face difficulties receiving complaints regarding the assets as they need time to look for the exact location. The situation worsens as University B has two campuses, yet the two campuses share the same helpdesk system. Meanwhile, it is also stated that although there is a high awareness of people's use of helpdesks, people would use other ways, such as social media, to express their opinions instead of using helpdesks, causing unsuccessful communication between management and users. As a result, the management cannot receive their opinions successfully through the helpdesk system.

Across both universities, the findings reveal similarities in the overall effectiveness of helpdesk systems, yet notable differences emerged. University A’s users rated the FM helpdesk function highest, while University B’s users expressed greater satisfaction with the inquiry and feedback function. These differences suggest institutional variations in prioritising service delivery. Synthesising the results highlights that while both HEIs recognise the helpdesk as a tool to reduce performance gaps, gaps in complaint handling speed, IT service reliability, and response communication remain. Addressing these gaps may require targeted system improvements and policy adjustments to ensure consistency across institutions.

Some improvements should be considered when developing a helpdesk system. It includes enhancing network security and safety to avoid similar cyber-attack incidents. Meanwhile, the services provided should always be of quality and aid in increasing users' satisfaction with the helpdesk system and its services. In addition, it is also stated that there is a need to improve their own campus's static and stable system. Labelling the category of issues and coordinating the assets and rooms must be appropriately conducted when developing a helpdesk system so that the users may report the issue with the exact issue topic and accurate location. Finally, the integration of Artificial Intelligence (AI) can be helpful to improve the effectiveness of helpdesk system. The functions include complaint categorisation and routing (Setiawan & Adnyana, 2023), instant responses to simple queries (Anozie et al., 2024), performance analysis, etc. Mahmoud et al. (2024) supported that emerging technologies such as like AI help to improve the operational efficiency and FM outcomes. Therefore, further research is recommended to study on the integration of AI in helpdesk system.

CONCLUSION

In a nutshell, the helpdesk effectively improves the maintenance work in HEIs and positively impacts maintenance management in HEIs. The typical functions of the helpdesk system have been identified through a literature review: enquiry and feedback of helpdesk, complaint system, IT services, and FM helpdesk. However, the unawareness of the helpdesk's role in improving maintenance work becomes one of the obstacles to fulfilling the users' satisfaction and expectations. The helpdesk can also be recognised as a tool to close the building performance gap whereby users' satisfaction levels can be identified through the helpdesk system. Hence, the helpdesk system indirectly becomes one preventive maintenance tool to monitor maintenance quality via users' feedback and complaints.

On the other hand, the users' satisfaction level towards the helpdesk is influenced by the performance of the helpdesk functions, and it is currently above the average level of satisfaction. Concurrently, technical functions need to be updated for system maintenance. Network security and safety should be enhanced, and quality improvement and prompt user responses are required. Labelling issue categories and coordinating the assets and rooms using pin location shall be done and improved to make the reporting work easier. In short, the helpdesk system in HEIs is vital and acts as a communication link between management and users. It should always be maintained to ensure it is functioning well.

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A REVIEW ON COMPETENCY REQUIREMENTS NEXUS OF FACILITIES MANAGERS FOR GREEN BUILDING

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ABSTRACT

Buildings have been identified as a major driver of climate change, accounting for 40% of worldwide carbon dioxide emissions and consuming huge quantities of energy and water. Thus, it is imperative to promote sustainability and green building techniques. Even though sustainable practices are acknowledged to be important, facilities managers exhibit a noticeable lack of skill when it comes to maintaining green-certified buildings. This disparity is especially noticeable in Malaysia, where the government's commitment to sustainable development and the world's trend towards sustainability demand that facilities managers have specific knowledge and abilities. The paper aims to identify the competencies required for facilities managers in the context of sustainable buildings. The objectives include comparing current core and additional competencies for facilities managers, deriving key attributes for green buildings from Sustainable Development Goals (SDGs) documents, and assessing sustainable building practices. The investigation of the competences required of facilities managers in green buildings uses a literature review methodology. A comprehensive examination of academic and professional literature, including industry reports, peer-reviewed journal papers, and standards from respectable associations including the International Facility Management Association (IFMA) and the British Institute of Facilities Management (BIFM), is part of this study. The vital role of facilities managers in establishing and upholding sustainable practices in green buildings is covered in this study. It draws attention to the fundamental skills, including waste minimization, water conservation, energy management, and the use of sustainable materials. The results indicate that facilities managers may make a substantial contribution to the sustainability and effectiveness of green buildings in Malaysia by strengthening their competencies in these areas. The study emphasizes how crucial it is to give facilities managers the abilities and information they need to help Malaysia achieve its sustainable development objectives. Facilities managers may be key players in driving the built environment sector's sustainability agenda by filling up competency shortages and ensuring that training programs adhere to international standards.

KEYWORDS: Competency, facilities management, green building, maintenance, operations, sustainability.

INTRODUCTION

Building has been identified as among the major contributors to climatic change in which it also identified as a major consumer for energy and water resources. In the same vein, building also contributes 40% or equivalent to 9 billion tons of carbon dioxide annually. The figures are expected to be doubled by the year 2025. (Hossain, 2019).

The implementation of sustainable practices in buildings and facilities is crucially dependent on facilities managers. Facilities managers require a particular skill set in order to handle sustainability efforts efficiently. Key abilities for facilities managers in respect to sustainability and green technology have been established by the British Institute of Facilities Management (BIFM) and the International Facility Management Association (IFMA) (Kamaruzaman et. al., 2018, Priyangika et. al., 2020, Wisittigars & Siengthai, 2019, Low et. al., 2021)

Facilities managers, according to IFMA, should be proficient in areas including sustainable materials management, energy management, water conservation, waste reduction and recycling, and sustainable building design and construction (IFMA, 2018). The need of facilities managers having a comprehension and thorough understanding of sustainability or specifically green technology and how they can be applied in facilities management is also emphasized by IFMA. Similar to this, BIFM defines skills in sustainability and green technology, such as the capacity to create and implement sustainable facilities management plans, understanding of environmental laws and regulations, and mastery of green technology management (BIFM, 2015).

The significance of sustainability in facilities management and the part that facilities managers play in putting sustainable principles into effect are both acknowledged by IFMA and BIFM. Facilities managers may manage sustainability projects and lessen the environmental impact of buildings and facilities by having expertise in areas like energy management, waste reduction, and sustainable building design.

PROBLEM STATEMENT

The building and facilities management industries have been significantly impacted by the global shift towards sustainability, with green building methods becoming more and more important. The shift to sustainable building operations, however, comes with a lot of difficulties, especially for the facilities managers in charge of upkeep of these green-certified structures. The efficient adoption and upkeep of green building standards is hampered by a noticeable competency gap among facilities managers, despite the acknowledged necessity of sustainable practices. This disparity highlights the need for a thorough comprehension of the necessary competencies and the creation of focused training initiatives to close this gap.

The global push for environmental responsibility and the government's commitment to sustainable development are the driving forces behind Malaysia's adoption of green construction projects. Although they are essential to this shift, many facilities managers lack the specific training and expertise needed to effectively oversee green buildings. The intricacy of eco-friendly technologies, in conjunction with the requirement for continuous learning and adjustment to novel sustainability benchmarks, poses noteworthy obstacles. The effectiveness and sustainability of green buildings are impacted by this lack of competency, which also puts the long-term viability of sustainability programs in the built environment sector at danger.

Moreover, the present frameworks for competency development for facilities managers frequently fail to meet the unique requirements of maintaining and operating green buildings. Although global organizations like the British Institute of Facilities Management (BIFM) and the International Facility Management Association (IFMA) have delineated fundamental competences, these frameworks must be adjusted to the opportunities and problems faced by Malaysia. Therefore, it is imperative that the competency standards be urgently reevaluated and realigned to guarantee that facilities managers have the know-how to support Malaysia's sustainable development goals and make a meaningful contribution to the global sustainability agenda.

AIM AND OBJECTIVES

The main aim for the present paper is to identify the competencies sets for the facilities manager in relation to sustainable buildings. To achieve this, the present core and additional competencies for facilities managers need to be identified and compared. At the same time, the key attributes for green building are derived from the respective SDG's documents and sustainable building's assessment.

METHODOLOGY

The literature review was conducted to examine the key competencies required of facilities managers in managing green buildings effectively. This study specifically seeks to identify existing competency frameworks and the core components essential for ensuring sustainable building operations. To achieve this, an extensive review of both academic research and industry-based publications was undertaken. The reviewed sources include peer-reviewed journal articles, industry reports, and recognized standards and guidelines issued by reputable organizations such as the British Institute of Facilities Management (BIFM) and the International Facility Management Association (IFMA). The purpose of this systematic review is to highlight gaps within current competency frameworks, synthesize existing knowledge, and propose practical recommendations to strengthen the skills and capabilities of facilities managers in supporting and maintaining green-certified buildings in Malaysia. The findings from this review will serve as a foundation for developing a contextualized competency framework that addresses the unique challenges and opportunities of the Malaysian facilities management landscape.

FACILITIES MANAGERS COMPETENCIES

By integrating people, place, process, and technology, facilities management (FM) entails a broad range of integrated processes designed to guarantee the physical environment's operation, comfort, safety, and efficiency. Over the past ten years, there has been a substantial global evolution in FM methods, primarily due to the rising complexity of building systems and technology improvements. Space management, energy management, sustainability practices, and maintenance and repair are all included in FM's core competencies (Alexander, 2019). FM specialists are also in charge of maximizing asset performance and lifecycle management, as well as making sure that health, safety, and environmental requirements are followed (Cotts et al., 2020). Predictive maintenance and real-time data analytics have become more important in the FM sector with the introduction of smart buildings and the Internet of Things (IoT).

The FM sector has expanded significantly in Malaysia, mirroring worldwide patterns while adjusting to specific regional circumstances. The Malaysian government has put in place a number of frameworks and laws to encourage best practices in the field of FM since it understands how crucial it is to the country's infrastructure development (Ismail et al., 2016). In Malaysia, facilities management (FM) encompasses both standard services like cleaning and building maintenance as well as more specialized ones like landscaping and security management (Zawawi et al., 2018). Furthermore, the Malaysian Green Technology Corporation's activities to lower carbon emissions and increase energy efficiency are driving an increasing focus on sustainability and green building (Musa et al., 2019). As a result, sustainable FM techniques are now receiving more attention, including the

Similar to trends around the world, technology integration in FM has also been a major trend in Malaysia. FM personnel may now manage facilities more effectively and efficiently because to the growing usage of Building Information Modeling (BIM) and Computerized Maintenance Management Systems (CMMS) (Salleh et al., 2018). These technologies facilitate better decision-making, improve asset management, and enhance service delivery by providing accurate and up-to-date information on building conditions and performance (Yusof & Mohammad, 2020).

Additionally, the implementation of IoT devices and sensors has enabled real-time monitoring and predictive maintenance, further enhancing the efficiency and effectiveness of FM operations (Abdullah et al., 2017).

Malaysia's FM business is expected to continue expanding and developing in the future. Innovation and technology adoption in the field will be propelled by the growing demand for sustainable practices and smart buildings (Rahman et al., 2020). Furthermore, Malaysian FM practitioners would be compelled to embrace best practices and consistently enhance their abilities and knowledge due to the globalization of FM practices and the requirement for adherence to international standards (Hamid et al., 2021). In order to improve the standard and effectiveness of facilities management in Malaysia, there will be more opportunities for cooperation between the public and commercial sectors as well as between local and foreign FM professionals as the industry develops.

The facilities managers are obliged to be concerned and understand the parameters and directions of sustainability blueprint within built environment industry locally and internationally with knowledge and experience within the area. With reference to United Nations Sustainable Development Goals (SDGs) documents in which ratified by 193 countries including Malaysia at the Paris Accord (COP21) encompass the pressing issues of sustainability, to be addressed holistically on the social, environmental and economical fronts (IFMA, SDG and COP21). At least six (6) areas are very relevant with construction and built environment industry as follows:

- SDG 6: clean water and sanitation
- SDG 7: affordable and clean energy
- SDG 9 : industry, innovation and infrastructure
- SDG 11: sustainable cities and communities
- SDG 12: responsible consumption and production
- SDG 13: climate action

Knowledge and competencies in the above areas have been highlighted and included in major facilities management bodies namely Institution of Workplace and Facilities Management (formerly known as British Institute of Facilities Management (BIFM)), International Facilities Management Association (IFMA) and Royal Institute of Chartered Surveyor in their respective knowledge and competency framework. The concept and application of green and sustainable approaches in the SDG's not only limited to FM's Sustainability and Green Technology competency area but could also be embedded in other competency areas with the knowledge and awareness of individual facilities manager.

Table 1: Comparison of competency set for facilities managers based on the main competency domain (Source: IWFM, IFMA and RICS)

Competency Area	BIFM / IWFM	IFMA	RICS
Sustainability and Green Technology	• Develop and implement sustainable facilities management strategies • Knowledge of environmental legislation and regulations • Implement and manage green technologies	• Energy management • Water conservation • Waste reduction and recycling • Sustainable materials management • Sustainable building design and construction • Knowledge of green technologies	• Sustainable development • Sustainable building design and construction • Environmental management • Energy management • Waste management • Sustainable procurement • Knowledge of green technologies

Financial Management	• Budgeting and forecasting • Cost management and control • Financial analysis and reporting • Procurement and contract management	• Financial management and budgeting • Life-cycle cost analysis • Procurement and contract management	• Financial management and budgeting • Life-cycle cost analysis • Procurement and contract management
Operations and Maintenance	• Preventive and corrective maintenance • Asset management • Health and safety management • Emergency planning and response • Space management	• Preventive and corrective maintenance • Asset management • Health and safety management • Emergency planning and response • Space management	• Asset management and maintenance • Health and safety management • Space management
Leadership and Strategy	• Strategic planning and implementation • Change management - Leadership and team management • Communication and stakeholder engagement	• Strategic planning and implementation • Change management • Leadership and team management • Communication and stakeholder engagement	• Strategic planning and implementation • Change management • Leadership and team management • Communication and stakeholder engagement

The table indicates that BIFM, IFMA, and RICS have competency sets for facilities managers that are similar to and different from one other. For facility managers, all three organisations place a strong emphasis on effective financial management, operations and maintenance, and leadership and strategy. However, there are differences in the specific competencies highlighted within these areas.

With a focus on creating and putting into practice sustainable facilities management strategies, knowledge of environmental legislation and regulations, and the capacity to handle green technologies, BIFM highlights the significance of sustainability and green technology in facilities management. Along with putting an emphasis on certain areas like energy management, water conservation, waste reduction, and recycling, IFMA also supports sustainability and green technologies.

RICS encompasses skills in asset management, maintenance, and management of health and safety, as well as sustainable development and sustainable building design and construction. The competency sets of BIFM and IFMA do not explicitly address sustainable procurement, although RICS notably contain this competency. Overall, while there are differences in the specific competencies emphasized by each organization, there is significant overlap in the overall competency sets for facilities managers.

FACILITIES MANAGER'S ROLE IN BUILDING SUSTAINABILITY

Sustainable facilities management of the existing infrastructure and buildings is very vital in aiding societies to become more sustainable because of many existing building stock and infrastructure relative to new buildings (Nielsen et al., 2016). Jaunzens et. al. (2001), Lee & Kang (2013) and Hodges (2005) contend the practice of sustainable facilities management can provide a wide range of benefits such as efficient resource consumption in buildings including energy and

water, minimisation of operating and maintenance costs, value for money, reduction of greenhouse gas emissions, improving health and safety in the built environment, improving human comfort in buildings, and minimising sick building syndrome.

Therefore, facilities managers and maintenance managers play a crucial role in implementing sustainable practices and maintaining green buildings. In the present context, green building refers to the practice of designing, constructing, operating, and maintaining buildings in an environmentally responsible and resource-efficient manner. This includes minimizing energy consumption, reducing water usage, improving indoor air quality, and using sustainable materials. Based on the competency set for facilities managers by BIFM, IFMA and RICS as shown in Table 1 could be mapped with potential benefits of green building to exploit its possible benefits.

Facilities managers and maintenance managers are responsible for ensuring that green buildings continue to operate efficiently and sustainably throughout their lifecycle. This involves regular maintenance and monitoring of the building's systems and equipment, such as HVAC systems, lighting, and water fixtures. By conducting regular inspections and implementing preventive maintenance measures, facilities managers and maintenance managers can identify and address issues that could negatively impact the building's energy efficiency and sustainability (USGBC, 2009; IFMA, 2022; and BOMA, 2018).

In addition to maintaining green buildings, facilities managers and maintenance managers can also contribute to the design and construction of sustainable buildings. By working closely with architects, engineers, and contractors, facilities managers and maintenance managers can ensure that the building is designed and constructed in a way that maximizes energy efficiency, reduces water consumption, and minimizes waste (WBDG, 2017). This can include selecting sustainable materials, installing energy-efficient systems and equipment, and optimizing the building's orientation and layout to maximize natural light and ventilation (IFMA, 2020).

The promotion of sustainability among building tenants can also be done by facilities managers and maintenance managers. This may entail educating building residents about environmentally friendly behaviours including conserving water, shutting off lights and other appliances when not in use, and disposing of waste correctly. To promote and support sustainable practices among residents, facilities managers and maintenance managers can also create sustainability programs, such as recycling programs.

Ultimately, the sustainability and effectiveness of green buildings depend heavily on the work of facilities managers and maintenance managers. Facilities managers and maintenance managers can contribute to reducing the environmental effect of buildings and producing healthier, more sustainable spaces for occupants to live and work in by implementing sustainable practices and maintaining the building's systems and equipment.

Table 2: Facilities manager's role within green building attributes

Green Building Attribute	Role of Facilities Manager
Energy Efficiency	Facilities managers can play a crucial role in optimizing energy usage within a green building. This may involve implementing energy-efficient lighting systems, HVAC systems, and other building technologies, as well as implementing policies and procedures to reduce energy waste. Facilities managers may also work with energy auditors to identify areas for improvement and implement energy-saving measures. (BOMA,2018; Cotts et. al, 2020; Elmualim et.al, 2010; Hodgesl, 2005; IFMA, 2020; and Tymkow et. al, 2021)
Water Efficiency	Facilities managers can help ensure that green buildings use water efficiently by implementing low flow plumbing fixtures, reducing irrigation, and implementing water recycling and reuse systems. Facilities managers may also monitor water usage and implement policies and procedures to reduce waste. (BOMA,2018; Elmualim et.al, 2010; Hodgesl, 2005; IFMA, 2022; Jaunzen et al, 2001 and Lee et al, 2013)
Sustainable Materials	Facilities managers may be responsible for selecting sustainable materials and products for use in building maintenance and operations. This may involve choosing products that are made from recycled materials, or that have a low environmental impact. Facilities managers may also be responsible for implementing recycling programs and ensuring that waste is properly disposed. (IFMA, 2022; Hamid et al, 2021; Low et. al 2021, Tymkow et. al, 2021; and Radebe et al, 2021)
Indoor Air Quality	Facilities managers can play an important role in ensuring good indoor air quality within green buildings. This may involve implementing air filtration systems, monitoring indoor air quality, and implementing policies and procedures to reduce exposure to indoor pollutants. Facilities managers may also work with building occupants to promote healthy behaviors, such as reducing the use of harsh cleaning chemicals. (Store-valen and Buser, 2019; Priyangika et. al, 2021; Rahman et. al, 2021; Wisittigars and Siengthai, 2019; Tymkow et. al, 2021; and Low et. al, 2021)
Sustainable Site Design	Facilities managers may be responsible for implementing sustainable site design features, such as green roofs, rain gardens, and permeable paving. These features can help reduce the building's environmental impact and improve the health and well-being of building occupants. Facilities managers may also work with landscape architects and other design professionals to ensure that the site is designed to be as sustainable as possible. (Hossain, 2019; Elmualim et. al, 2010; Alexander, 2019; Hamid et. al, 2019; and Nielsen et. al, 2016)

Table 2 above mapped the green building attributes as underlines by major international green building rating bodies and local Green Building Index (GBI) to the major role of facilities managers key functions in attaining green building objectives. Overall, facilities managers are the profession that are directly involve in making sure that green buildings run effectively and sustainably over time. Facilities managers can contribute to reducing the building's environmental impact, enhancing the health and wellbeing of building occupants, and fostering long-term cost savings by implementing sustainable practices and procedures, choosing sustainable materials and products, and monitoring and measuring performance.

The pursuit of sustainability requires a holistic view of the relationship between the Sustainable Development Goals (SDGs), facilities management (FM) competencies, and green building rating tools. While the SDGs provide the overarching vision (United Nations, 2015), FM competencies translate this vision into daily operational practice (IFMA, 2018; IWFM, 2015; RICS, 2024), and rating systems such as LEED (USGBC, 2020), BREEAM (BRE, 2019), and Malaysia's Green Building Index – GBI (GBI, 2021) offer the critical benchmarks for measurement. This nexus reveals an essential truth: competent facilities managers are the crucial link that transforms SDG

principles into tangible building performance. Conversely, these FM competencies must be explicitly aligned with the sustainability imperatives of the SDGs and validated through established rating tools. This study advances the conversation by mapping the intersection of these three dimensions, ensuring competencies are developed not in isolation, but in active synergy with global agendas and local systems.

Table 3: Nexus relationship among SDGs, FM competencies, and green building rating tools (Sources: United Nations (2015), USGBC (2020), BRE (2019), GBI (2021)).

Relevant SDGs	FM Competencies Required (IFMA, IWFM, RICS)	Green Building Rating Tools (LEED, BREEAM, GBI)	Nexus Interpretation
SDG 6: Clean Water & Sanitation	Water conservation, sustainable materials management, operations & maintenance	LEED Water Efficiency, BREEAM Wat 01–04, GBI Water Efficiency	FM ensures optimal use of water-saving technologies, maintenance of greywater/reuse systems, aligning with SDG6 targets and rating credits.
SDG 7: Affordable & Clean Energy	Energy management, predictive maintenance, integration of smart technologies	LEED Energy & Atmosphere, BREEAM Ene 01–05, GBI Energy Efficiency	FM applies energy auditing, demand-side management, and renewable integration to meet both SDG7 and green certification benchmarks.
SDG 9: Industry, Innovation & Infrastructure	Innovation adoption (BIM, IoT, CMMS), lifecycle costing, asset management	LEED Innovation in Design, BREEAM Innovation, GBI Sustainable Site Planning	FM leads digital transformation for efficient operations, ensuring resilience and innovation that contribute to infrastructure sustainability.
SDG 11: Sustainable Cities & Communities	Stakeholder engagement, strategic planning, user awareness programs	LEED Location & Transportation, BREEAM Management, GBI Indoor Environmental Quality	FM promotes community well-being, accessibility, and health through engagement and green operations in line with urban sustainability goals.
SDG 12: Responsible Consumption & Production	Sustainable procurement, waste reduction & recycling, material lifecycle analysis	LEED Materials & Resources, BREEAM Mat 01–07, GBI Sustainable Materials & Resources	FM manages procurement and O&M processes that reduce waste and ensure sustainable product use consistent with SDG12 and rating requirements.
SDG 13: Climate Action	Climate risk management, emergency response, resilience planning	LEED Regional Priority, BREEAM Resilience, GBI Innovation in Climate Response	FM implements climate adaptation measures, energy resilience, and carbon reduction strategies linking operational practices to SDG13.

The matrix analysis in Table 3 above clearly illustrates this interdependence: the SDGs establish the strategic vision for sustainability, FM competencies constitute the operational capacity to execute it, and green building rating tools provide the essential mechanism for measurement and validation. Consequently, this nexus analysis underscores that the successful achievement of sustainable building outcomes in Malaysia is fundamentally dependent on integrating these three domains. It is therefore imperative that facilities managers are equipped with competencies that are not only aligned with global SDG priorities but are also directly applicable to the specific performance criteria evaluated by local rating systems such as the GBI.

CHALLENGES FOR FACILITIES MANAGERS IN MAINTENANCE OF GREEN CERTIFIED BUILDINGS

Facilities managers and maintenance personnel may face challenges in their routine duty of maintaining a green-certified building and along the way of facilities management processes. Moreover, green buildings are intended to be more sustainable and energy-efficient, they can also need specialized maintenance techniques and knowledge to make sure that they keep performing effectively over time. Key challenges in managing facilities and buildings with green features includes:

1. Skill & Knowledge: Due to technical complexity, elements such as mechanical, electrical, plumbing systems, information technology system and electronic devices that require specialized knowledge to maintain and repair. For example, geothermal heating and cooling systems or solar panels require specialized training and expertise to operate and maintain (Radebe & Ozumba 2021, Hasim, 2014; Hodges 2005; Lai and Yik, 2021; Elmualim et al., 2010; Nielsen et al., 2016; Adewumni et al., 2012; Sarpin, 2015; Avila et al., 2017; Store-Valen and Buser, 2019)

2. Cost: While green buildings can be more cost-effective over their lifecycle, they can also require higher upfront costs for construction and ongoing maintenance. This can be a challenge for facilities managers and maintenance staff who must work within limited budgets. (Hodges, 2005; Shah Ali, 2009; Elmualim et al., 2009 Store-Valen and Buser 2019)

3. Limited availability of components: Some green building technologies and systems may be relatively new, meaning that replacement parts may not be readily available. This can increase maintenance costs and lead to longer downtime if parts need to be specially ordered or manufactured. (Hasim, 2014; Hodges, 2005; Shah Ali, 2009; Sarpin, 2015; Avila et al., 2017; Store-Valen and Buser 2019)

4. Dynamic green attributes: Maintaining green building certification often requires ongoing monitoring and reporting of energy usage, water consumption, and other metrics. This can be time-consuming and require specialized tools and software to track and analyze data. Hasim 2014; Hodges 2005; Nielsen et al., 2016; Elmualim et al., 2010; Adewumni et al. 2012; Avila et al.,2017 Store-Valen and Buser, 2019)

5. User awareness: The sustainability of a green building depends in part on the behavior of its occupants. Facilities managers and maintenance staff may need to implement education and outreach programs to promote sustainable culture, such as reducing energy/water usage, recycling and reuse (3R).

Overall, maintaining a green certified building can present unique challenges for facilities managers and maintenance staff. However, by staying up to date on the latest technologies and best practices, and by working closely with building occupants and stakeholders, facilities managers and maintenance staff can help ensure that green buildings continue to operate

efficiently and sustainably over time. As a result, the initiatives could be the catalyst for a and overall built environment industry progresses towards sustainable development goal (SDG).

CONCLUSION

It is evident from a variety of viewpoints regarding FM practice in Malaysia that the built environment sector's continued expansion and development depend on the incorporation of sustainable practices within facilities management. In Malaysia, there is a growing expectation placed on facilities managers to have a thorough awareness of green technologies, sustainability principles, and the legal frameworks governing environmental stewardship. This requirement demonstrates Malaysia's commitment to solving environmental concerns on a global scale and is in line with the country's adherence to international agreements such as the Paris Agreement and the Sustainable Development Goals (SDGs) of the United Nations.

Facilities managers must possess competencies that go beyond typical job descriptions. These include financial management, strategic planning, and the use of cutting-edge technical solutions. This change is in line with the industry's broader trend towards sustainable growth and calls for a proactive approach to building operations and maintenance that places an emphasis on waste reduction, energy efficiency, and resource conservation.

Buildings in Malaysia must be designed, built, and operated in a way that maximizes sustainability outcomes. To this end, synergy between contractors, architects, engineers, and facilities managers is essential. Through the implementation of sustainable materials, energy-efficient technologies, and optimized building designs, these experts may effectively mitigate the built environment's environmental impact. Furthermore, the significance of upholding high-performance In the end, Malaysian facilities managers' roles are changing to satisfy the needs of a sustainable future. Their capacity to impact design and construction processes, along with their proficiency in managing green buildings, places them at the forefront of the country's endeavours to meet its sustainability objectives. Through the promotion of innovation and a culture of continuous development in the FM industry, Malaysia may become more globally competitive and make a significant contribution to the preservation of the environment for future generations. Standards throughout the building lifecycle is highlighted by the emphasis on preventative maintenance and routine inspections.

The nexus analysis further demonstrates that SDGs, FM competencies, and rating tools must be viewed as a unified framework, ensuring Malaysia’s green building agenda is both globally aligned and locally measurable. In the same vein, it might also be suggested that establishing a sustainable facilities management and building maintenance process entails the following crucial steps:

1. Conduct a sustainability assessment: Begin by conducting a sustainability assessment of the building and its systems. This should include an analysis of energy usage, water consumption, waste generation, and other key sustainability metrics. This assessment can help identify areas where improvements can be made to increase efficiency and reduce environmental impact.
2. Develop a sustainability plan: Based on the results of the sustainability assessment, develop a sustainability plan that outlines specific goals, targets, and strategies for improving the building's sustainability. This plan should be aligned with relevant green building certifications and standards, such as LEED or BREEAM, and should include both short-term and long-term goals.
3. Implement sustainable practices: Once the sustainability plan is in place, implement sustainable practices and procedures throughout the building maintenance and facilities management process. This may include measures such as using energy-efficient lighting and HVAC systems, implementing water-saving measures, reducing waste generation, and using sustainable materials and products.

4. Monitor and measure performance: To ensure that sustainability goals are being met, it is important to monitor and measure performance regularly. This may involve collecting data on energy usage, water consumption, waste generation, and other metrics, and using this data to track progress and identify areas for improvement.
5. Continuously improve: Sustainable facilities management is an ongoing process, and it is important to continuously improve and refine sustainability practices over time. This may involve investing in new technologies or systems, implementing employee training programs, and engaging with building occupants to promote sustainable behaviours.

By referring to the processes above, facilities managers and building maintenance staff can adopt a sustainable approach to facilities management and maintenance, reducing environmental impact and promoting efficiency and cost savings over the long term.

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EXPLORING LOSS AND EXPENSES IN CONSTRUCTION: ISSUES AND CHALLENGES FACED BY CONTRACTORS IN MALAYSIA

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ABSTRACT

This systematic literature review explores the issues and challenges related to loss and expenses faced by contractors in the construction industry. The construction sector is increasingly burdened by financial uncertainties and claims, which hinder project success and sustainability. In light of Malaysia's National Physical Plan 4 and Twelfth Malaysia Plan, this study identifies key factors contributing to loss and expenses, including contract clarity, delay management, communication efficiency, economic volatility, risk assessment, training and development, and technological integration. A qualitative approach using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method was employed to systematically review relevant literature. Through document analysis, thematic analysis, and descriptive synthesis, the findings highlight significant implications of these challenges, demonstrating that unclear contracts and inefficient communication can lead to costly disputes and financial losses. Furthermore, the review identifies strategies to mitigate these issues, such as improving contract management practices, enhancing communication among stakeholders, investing in staff training, and leveraging technology for real-time monitoring and decision-making. The results underscore the need for a collaborative culture within the construction industry to enhance transparency and accountability. This study contributes to the existing literature by pinpointing specific themes and actionable strategies, ultimately aiming to strengthen the resilience of contractors in managing loss and expenses effectively. Recommendations for future research include the development of frameworks that can assist contractors in navigating the complexities of financial management in construction projects.

KEYWORDS: Loss and Expenses, Contractors, Construction Industry, Systematic Literature Review, PRISMA, Mitigation Strategies

INTRODUCTION

The construction industry in Malaysia plays a pivotal role in supporting national development goals, as outlined in strategic documents such as the National Physical Plan 4 (NPP 4), National Urbanization Policy 2 (NUP 2), and the Twelfth Malaysia Plan (12MP). These policies emphasize sustainable urban development, improved infrastructure, and economic growth, which require efficient and well-managed construction projects (Economic Planning Unit, 2021). However, achieving these ambitious goals is often hampered by the issues of loss and expenses that contractors face. Addressing these financial challenges is essential to ensure the sustainability and efficiency of construction projects that align with Malaysia's national development strategies (Ministry of Housing and Local Government, 2020). The focus on optimizing resources and minimizing wastage within the construction industry has become more crucial than ever in the context of the rising costs of materials and labour shortages (CIDB, 2022).

In general, issues related to loss and expenses in the construction sector are a significant challenge affecting project profitability and overall industry growth. These issues often stem from delays, changes in project scope, economic fluctuations, and unanticipated site conditions (Chong & Low, 2022). The construction process involves multiple stakeholders, including clients, contractors, suppliers, and regulators, which adds to the complexity of managing loss and expense claims (Rahman & Smith, 2021). Miscommunication and disputes regarding contractual obligations are common problems, leading to cost overruns and project delays (Zhang et al., 2019). Additionally, external factors such as market volatility, material price inflation, and labour shortages further exacerbate the financial stress on contractors, making it increasingly difficult for them to deliver projects within budget (Al-Harbi & Al-Sudairi, 2018).

Despite the growing body of literature on construction disputes, a research gap exists regarding the systematic analysis of issues and challenges that lead to loss and expense claims, especially from the contractor's perspective. While several studies have examined contractual disputes and cost management in construction (Olawale & Sun, 2020; Williams, 2022), there is a need for a comprehensive review that synthesizes existing findings and identifies effective strategies for mitigating these challenges. This paper aims to fill this research gap by providing a systematic literature review of the issues and challenges related to loss and expenses faced by contractors, in line with the objective of enhancing financial sustainability and operational efficiency in the construction sector. Therefore, the aim of this study is to explore the current issues and challenges related to loss and expenses faced by contractors in the construction industry through a systematic literature review. There are two (2) objectives of this study i.e.:

1. To identify the key factors contributing to loss and expense claims in the construction sector, particularly from the contractor's perspective.
2. To provide insights into strategies and best practices that can be implemented to mitigate the issues and challenges of loss and expenses faced by contractors.

While numerous studies have explored contractual disputes, project delays, and financial risks, many of these works examined such issues in isolation or from the client's perspective. This study contributes new knowledge by providing a systematic synthesis specifically from the contractor's perspective in Malaysia, highlighting underexplored factors such as variation/change orders and defective works. By consolidating fragmented findings, this review develops a clearer framework for understanding loss and expense claims in the local construction context, thereby offering fresh insights that extend beyond prior research.

LITERATURE REVIEW

The concept of "loss and expenses" in the construction industry generally refers to the financial claims contractors make to recover costs incurred due to delays or disruptions beyond their control. These claims can arise from a variety of factors, including unforeseen site conditions, variations in design, project scope changes, and contractual breaches by clients (Fawzy & El-Refaie, 2019). Loss and expenses encompass both direct costs, such as additional labour and material costs, and indirect costs, like increased overheads due to prolonged project timelines (Ashworth & Perera, 2018). The ability of contractors to recover such costs depends heavily on the clarity of contract provisions and the effectiveness of their documentation practices, making this an area of significant interest in construction management (Rahman & Smith, 2021).

Globally, the issue of loss and expenses has been a persistent challenge for contractors, often leading to disputes, project delays, and financial instability. For instance, in the United Kingdom, the construction industry has faced increasing loss, and expense claims due to factors such as regulatory changes, Brexit-related uncertainties, and supply chain disruptions (RICS, 2021). In developing countries, contractors often deal with additional issues, such as limited access to capital, fluctuating material prices, and a lack of effective risk management systems (Oyewobi et al., 2020). These factors not only contribute to financial losses but also increase the likelihood of

disputes between contractors and clients, leading to arbitration or litigation, which can be both costly and time-consuming (Gould & Joyce, 2019). The impact of loss and expenses is more pronounced in large-scale infrastructure projects where even small delays or disruptions can lead to substantial financial burdens (Goh & Abdul-Rahman, 2020).

In Malaysia, the construction industry is no stranger to issues of loss and expenses, with contractors frequently encountering challenges such as project delays, material price volatility, and inadequate site information (Chong & Low, 2022). The country's rapid urbanization and infrastructure development, as outlined in the National Physical Plan 4 and the Twelfth Malaysia Plan, have led to increased pressure on contractors to deliver projects within tight timelines and budgets (Economic Planning Unit, 2021). However, factors such as poor contract administration, communication breakdowns among stakeholders, and unforeseen regulatory changes have exacerbated the incidence of loss and expense claims (Ibrahim et al., 2020). Additionally, the COVID-19 pandemic has further highlighted the vulnerability of contractors to financial losses due to unexpected disruptions and supply chain challenges (Lim & Zainun, 2021).

Thus, the literature highlights that while the issues of loss and expenses are not unique to Malaysia, they are influenced by both global and local factors, such as economic conditions, regulatory frameworks, and industry practices. The existing research underscores the need for improved contract clarity, risk management, and effective communication among project stakeholders to mitigate the challenges of loss and expenses faced by contractors. However, a comprehensive synthesis of these issues, specifically from the perspective of Malaysian contractors, is still lacking, presenting an opportunity for this study to fill the research gap.

METHODOLOGY

The literature review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Azhar et al., 2025). Although PRISMA was originally designed for medical research, it has increasingly been applied in other fields, including the social sciences and sustainable development studies (Mensah, 2019). Previous review papers often lack transparency in reporting the procedures used during the article selection process, which is a crucial component of data collection. By contrast, the PRISMA framework provides a standardized methodology for systematic literature reviews, thereby improving both the reliability and quality of the review process (Razak et al., 2022). For this study, PRISMA was adopted as an approach to comprehensively analyse the issues and challenges related to loss and expenses faced by contractors in the construction industry in Malaysia. The review method outlined the search strategy, specified inclusion and exclusion criteria, and detailed the data analysis procedures. This process consisted of four main stages: identification, screening, eligibility, and inclusion (data abstraction and analysis).

Main data resources and search strategies

This review used secondary data that was sourced from electronic database, specifically SCOPUS, accessed through institutional subscriptions to collect relevant literature. This database is among the most comprehensive sources for academic research. As of 2025, SCOPUS indexes approximately 46,700 active journals and conference proceedings. The relevant literature was identified through an advanced search using a combination of the Boolean or Phrase operators i.e., nesting and truncation techniques, for keywords that are associated with:

- "loss and expense" OR "loss and damage" OR "additional cost"
- "construction claim" OR "contractual claim" OR "financial claim"
- "contractor" AND "construction industry"
- "delay claim" OR "variation claim" OR "disruption claim"
- "Malaysia" OR "Malaysian"
- "year 2020 to 2025"

The initial step was not to search these terms in all fields in the literature, and the date was not specified in order to obtain the preliminary number of occurrences of these terms being used in the literature. Consequently, the initial search identified a total of two literature and published between 2020 to 2024.

Identification

Based on the identification of synonyms or similar terms', similar terms were selected based on the suitability of the aim of the study to the search string data on Scopus database. Accordingly, this search string was developed in April 2024 after all relevant keywords have been determined that has resulted in 38 articles. Therefore, a total of 38 articles has been retrieved in the first stage of the systematic review process. Table 1 shows the search string used in this study.

Table. 1. The Search String

The Search String	
SCOPUS	TITLE-ABS-KEY ("loss and expense" OR "losses and expenses" OR "contractor claims" OR "cost overruns") AND TITLE-ABS-KEY (construction OR building OR "construction project*") AND TITLE-ABS-KEY (malaysia OR "malaysian contractor*") AND PUBYEAR > 2019 AND PUBYEAR < 2026

Screening

The purpose of the first screening was to remove duplicate articles. In this case, no article was extracted during the search in SCOPUS, thus, there was no exclusion during the first stage. Then, the 38 articles were screened based on several inclusion and exclusion criteria, as determined by the researcher in the second stage. The two criteria used in this study were the Case Study and Subject Area. These two criteria were specifically chosen for Malaysian perspective, while the subject area was under for construction building technology, building and construction and environmental science. Consequently, 17 articles were excluded based on these criteria. Table 2 shows the lists of inclusion and exclusion criteria used in this study.

Table. 2. The Inclusion and Exclusion Criteria

Criterion	Eligibility	Exclusion
Case Study	Malaysia	Other than Malaysia
Subject Area	Construction building technology, building and construction and environmental science	Other than construction building technology, building and construction and environmental science

Eligibility and Inclusion

The remaining 17 extracted articles were further analysed in the third and fourth stages known as eligibility and inclusion, respectively. In the third stage, the title, abstract and the main content of these articles were thoroughly examined to ensure that they fulfil the inclusion criteria and fit to be employed in the present study in order to achieve its aim. Consequently, all 17 articles remained in this stage because they were based on empirical data and have focused on the issues and challenges related to loss and expenses faced by contractors in the construction industry in Malaysian perspective. Figure 1 shows the flow diagram of the stages in this study.

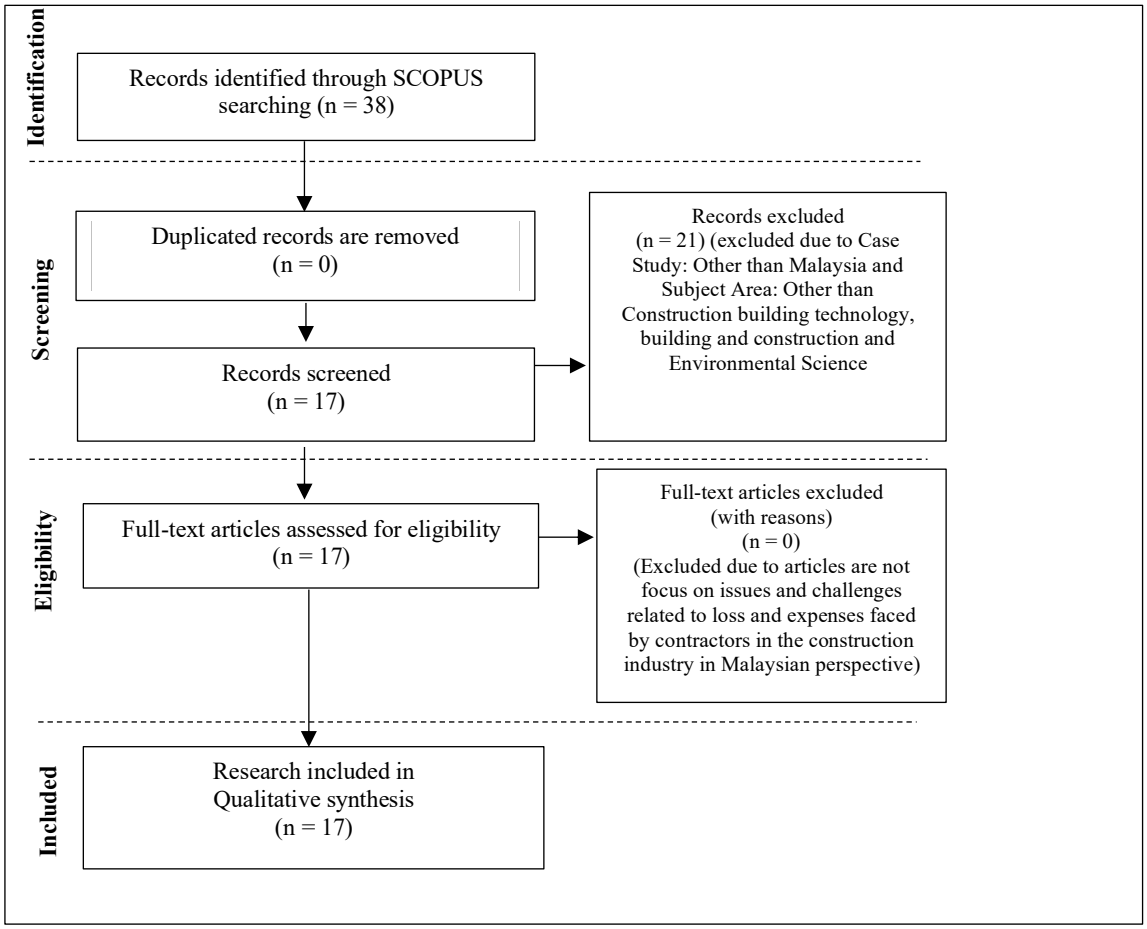

Fig. 1. Flow diagram of the stages in this study

In this study, qualitative method is employed to analyse the selected literature. Document analysis is used as a qualitative method to review and extract relevant information from the identified articles. This process involves carefully examining the content of each selected study to identify recurring themes and critical insights related to loss and expenses. On the other hand, analysis is performed through thematic analysis and descriptive analysis to synthesize the data. Thematic analysis allows for the identification of common themes and patterns across the literature, which helps in understanding the broader context of loss and expenses faced by contractors. Descriptive analysis is then employed to summarize the findings quantitatively, providing a comprehensive overview of the various issues and challenges identified in the literature.

Thus, the methodology employed in this study not only adheres to rigorous academic standards but also facilitates a comprehensive understanding of the complex issues surrounding loss and expenses in the construction industry in Malaysia. By integrating qualitative approach, the study aims to provide nuanced insights that contribute to the existing body of knowledge while identifying gaps for future research. The systematic review methodology enables a holistic examination of the literature, ultimately leading to actionable recommendations for industry stakeholders to mitigate the challenges related to loss and expenses.

RESEARCH FINDINGS AND DISCUSSIONS

In this section, there are three (3) sub-section would be discussed and synthesised i.e. key factors contributing to loss and expense claims, strategies and best practices and synthesis of key themes, implications, and mitigation strategies to achieve the two (2) objectives of this study that has been stated in introduction section.

Key factors contributing to loss and expense claims

The systematic literature review identified several key factors contributing to loss and expense claims in the construction sector, particularly from the contractor's perspective. Table 1 summarizes these factors and their implications.

Table 1. Summarization on key factors contributing to loss and expense claims

No.	Key factor	Description	Source
1.	Contractual ambiguities	Ambiguities in contract terms and behaviours among parties create misinterpretation and disputes, leading to potential loss and expense claims.	Ismail et al. (2021); alwee et al. (2021)
2.	Project delays	Delays caused by administrative issues, critical site factors, or unforeseen events (e.g., covid-19) increase costs for contractors and trigger loss and expense claims.	Aminorlah et al. (2023); ramli et al. (2021); gara et al. (2022); syed zakaria & singh (2021)
3.	Inefficient communication	Ineffective communication between stakeholders reduces coordination, causes misunderstandings, and results in financial claims.	Quan et al. (2022)
4.	Economic volatility	Inflation, fluctuations in labour wages, and rising machinery hire rates lead to cost overruns and subsequent claims.	Alaloul et al. (2021); musarat et al. (2021)
5.	Poor risk management	Ineffective risk assessment and financial management increase vulnerability to cost overruns, wastage, and unsuccessful ppp project delivery.	Abdulrahman et al. (2022); ramli et al. (2021); kamaruddin et al. (2025)
6.	Defective works	Rework and construction defects result in unplanned expenses and time extensions, creating grounds for claims.	Yap & tan (2021); olanrewaju (2022)
7.	Variation or change orders the client expected the contractor to have known	Variations that are reasonably foreseeable by contractors but not considered may be rejected by clients, leading to disputes over entitlement.	Razak et al. (2023)
8.	Variation or change orders taken into consideration while submitting the bids	Pre-construction and procurement-related cost considerations that are overlooked during tendering may later emerge as loss and expense claims.	Che nen et al. (2024); mohd roshdi et al. (2021)

Source: authors (2024)

a. Contractual Ambiguities

Contracts with unclear clauses often lead to misinterpretations between stakeholders. Such ambiguities may result in disputes over scope of work, responsibilities, and payments, which ultimately contribute to loss and expense claims. Research indicates that differing contractual behaviours among participants in civil engineering projects in Malaysia create significant risks of disputes and financial implications (Ismail et al., 2021). Similarly, a strategic protocol for contract administration through Building Information Modelling (BIM) is required to minimise ambiguities during project implementation (Alwee et al., 2021).

b. Project Delays

Project delays are among the most common contributors to additional cost claims. Critical delay factors include administrative issues, site possession, and unforeseen events such as the COVID-19 pandemic. Aminorlah et al. (2023) highlighted that delays in government physical projects have significant consequences on delivery performance. Ramli et al. (2021) ranked

the causes of railway project delays using the Relative Importance Index. Furthermore, the pandemic severely disrupted construction progress, leading to additional financial burdens (Gara et al., 2022; Syed Zakaria & Singh, 2021).

c. Inefficient Communication

Poor communication between contractors, consultants, and clients leads to misalignment, misunderstandings, and inefficiencies, ultimately resulting in financial claims. Quan et al. (2022) demonstrated that weak communication practices in the Klang Valley construction industry were a major cause of disputes and additional costs.

d. Economic Volatility

Economic instability, including inflation, rising labour wages, and increased machinery hire rates, significantly affects project costs. Alaloul et al. (2021) investigated the effects of inflation on labour wages in the Malaysian construction sector, while Musarat et al. (2021) found that fluctuations in machinery rental rates driven by inflation contributed to cost overruns and claims.

e. Poor Risk Management

Weak risk management exposes projects to cost overruns, wastage, and financial disputes. Abdulrahman et al. (2022) stressed the need to integrate risk management with Quality Function Deployment (QFD). Similarly, Ramli et al. (2021) assessed financial risks in public-private partnership (PPP) projects. In modular construction, ineffective risk management results in material wastage and additional costs (Kamaruddin et al., 2025).

f. Defective works

Defective works and rework are major causes of unplanned costs, project delays, and claims. Yap and Tan (2021) examined rework in Malaysian construction projects, while Olanrewaju (2022) used artificial neural network analysis to study rework in sustainable buildings.

g. Variation or change orders the client expected the contractor to have known

Variations that are reasonably foreseeable but not accounted for by contractors are often rejected by clients as legitimate claims. Razak et al. (2023) highlighted dominant issues in loss and expense claim applications, including disputes related to foreseeable variations.

h. Variation or change orders taken into consideration while submitting the bids

When contractors fail to account for possible variations at the bidding stage, they may not be entitled to claim additional costs later. Pre-construction complexity factors strongly influence cost performance (Che Nen et al., 2024), while cost allocation frameworks at the procurement stage also shape future claims (Mohd Roshdi et al., 2021).

Strategies and Best Practices

To mitigate the issues and challenges of loss and expenses faced by contractors, several strategies and best practices were identified in the literature. These strategies are summarized in Table 2.

Table 2. Summarization on strategies and best practices (*Source: authors (2024)*

No.	Strategies and best practices	Description	Source
1.	Improved contract management	Developing clear, detailed contracts with explicit terms and conditions to minimize ambiguities.	Rahman & smith (2021)
2.	Proactive communication	Establishing regular communication channels and updates among all stakeholders to enhance collaboration.	Zhang et al. (2019)
3.	Effective risk management	Implementing comprehensive risk assessment processes to identify potential challenges early on.	Williams (2022)
4.	Training and development	Providing training for staff on best practices in contract management and claims processes.	Lim & zainun (2021)
5.	Use of technology	Utilizing project management software and data analytics to track project progress and expenditures.	Goh & abdul-rahman (2020)

a. Improved Contract Management

One of the most effective ways to mitigate loss and expenses is to develop clear and detailed contracts. By ensuring that all terms and conditions are explicitly outlined, contractors can reduce the likelihood of disputes arising from misunderstandings (Rahman & Smith, 2021). Regularly reviewing and updating contract templates to reflect best practices can also enhance clarity.

b. Proactive Communication

Establishing robust communication channels among project stakeholders is crucial for mitigating loss claims. Regular updates, meetings, and collaboration between contractors, clients, and suppliers can foster a culture of transparency and accountability (Zhang et al., 2019). This proactive approach helps in addressing potential issues before they escalate into significant financial claims.

c. Effective Risk Management

Implementing a comprehensive risk management framework allows contractors to identify and assess potential risks early in the project lifecycle. This proactive approach enables contractors to develop mitigation strategies and contingency plans, reducing their exposure to unexpected costs (Williams, 2022). Regular risk assessments should be integrated into project management practices to ensure ongoing monitoring of potential challenges.

d. Training and Development

Investing in training programs for staff on best practices related to contract management, claims processes, and risk assessment is essential for enhancing operational efficiency (Lim & Zainun, 2021). Equipping employees with the knowledge and skills to navigate complex contractual environments can significantly reduce the incidence of loss and expenses.

e. Use of Technology

Leveraging technology, such as project management software and data analytics, can provide valuable insights into project performance. By tracking project progress and expenditures in real-time, contractors can identify deviations from the budget and timeline early, allowing for prompt corrective actions (Goh & Abdul-Rahman, 2020). This technological integration supports informed decision-making and enhances overall project management.

Thus, by understanding the key factors contributing to loss and expense claims and implementing effective strategies and best practices, contractors can significantly mitigate financial challenges in the construction industry. These findings contribute to the existing body of knowledge and

offer actionable recommendations for practitioners seeking to improve their operational efficiency and project outcomes.

Synthesis of Key Themes, Implications, and Mitigation Strategies

To synthesize the findings from the systematic literature review on loss and expenses in construction, Table 3 is highlighting the key themes, their implications, and how they relate to both the key factors contributing to loss and expenses and the strategies for mitigation would be synthesized. This synthesis table can provide a comprehensive overview, facilitating a clearer understanding of how various elements interconnect.

Table 3. Synthesis of key themes, implications and mitigation strategies (*Source: authors (2024)*

No.	Themes	Key factors contributing to loss and expenses	Implications	Mitigation strategies	Source
1.	Contract clarity	Contractual ambiguities	Misunderstandings lead to disputes and financial claims	Improve contract management practices.	Rahman & smith (2021)
2.	Delay management	Project delays	Increased costs due to extended timelines	Implement proactive communication and monitoring.	Olawale & sun (2020)
3.	Communication efficiency	Inefficient communication	Mismanagement of resources and delays in decision-making	Foster a culture of open communication among stakeholders.	Zhang et al. (2019)
4.	Economic awareness	Economic volatility	Fluctuating costs lead to budget overruns	Develop contingency plans for economic fluctuations.	Al-harbi & Al-Sudairi (2018)
5.	Risk assessment	Poor risk management	Increased vulnerability to unforeseen circumstances and claims	Implement comprehensive risk management frameworks.	Williams (2022)
6.	Training and development	Lack of knowledge in claims and contract management practices	Inefficient handling of claims results in financial losses	Provide training for staff on best practices.	Lim & Zainun(2021)
7.	Technological integration	Limited use of project management tools and data analytics	Difficulty in tracking project performance and expenditures	Leverage technology for real-time monitoring and decision-making.	Goh & Abdulrahman (2020)

a. Contract Clarity

Contractual ambiguities are a primary factor leading to loss and expenses in construction. Vague or poorly defined terms in contracts can result in misunderstandings among parties regarding their roles, responsibilities, and entitlements. Inadequate documentation of project requirements and changes can lead to disputes when claims arise, making it difficult for contractors to substantiate their claims for additional costs (Rahman & Smith, 2021). The implications of unclear contracts are significant. Misinterpretations can lead to costly disputes,

project delays, and strained relationships between contractors and clients. When disputes arise, contractors may face difficulties recovering lost revenues, which can adversely impact their financial stability and overall project viability. Additionally, time spent on dispute resolution detracts from project progress, further exacerbating costs and extending timelines. To mitigate the risks associated with contractual ambiguities, construction firms should prioritize improving contract management practices. This includes developing clear, detailed contracts that explicitly outline all terms, conditions, and expectations. Incorporating standardized language and definitions can help ensure that all parties have a common understanding of the contract's provisions. Regular reviews and updates of contract templates can further enhance clarity and reduce the potential for disputes over loss and expenses (Rahman & Smith, 2021). Training staff in contract management practices is also vital, ensuring that they understand how to navigate complex contractual environments effectively.

b. Delay Management

Project delays are a critical factor contributing to loss and expense claims in construction projects. Delays can stem from various sources, including adverse weather conditions, delays in material delivery, labour shortages, and unforeseen site conditions (Olawale & Sun, 2020). These delays not only lead to direct costs associated with extended labour hours and equipment rentals but also increase indirect costs due to lost opportunities and potential penalties for failing to meet contractual deadlines. The implications of project delays are profound, often leading to financial strain on contractors. Delays can trigger loss of client confidence, resulting in reputational damage and potential loss of future business. Additionally, the cascading effects of delays can disrupt project schedules, impact the overall construction timeline and lead to a domino effect on other dependent activities. This can further escalate costs, as contractors may have to expedite processes or incur additional expenses to meet project deadlines. To manage delays effectively, contractors should implement proactive communication and monitoring strategies. Establishing regular progress meetings with all stakeholders allows for timely identification of potential delays and facilitates collaborative problem-solving (Zhang et al., 2019). Additionally, utilizing project management software can help track project milestones and deadlines, allowing contractors to anticipate potential issues before they escalate into significant delays. Developing contingency plans for common delay scenarios, such as weather-related disruptions or supply chain issues, can also help mitigate their impact.

c. Communication Efficiency

Inefficient communication among project stakeholders can lead to a range of challenges, including misunderstandings, mismanagement of resources, and delays in decision-making (Zhang et al., 2019). When communication is fragmented or unclear, it becomes difficult for contractors to coordinate activities, manage project timelines, and address issues as they arise. This inefficiency can contribute to increased claims for loss and expenses when issues are not resolved promptly. The implications of poor communication can be detrimental to project outcomes. Miscommunication can lead to incorrect execution of tasks, resulting in rework and additional costs. Moreover, the lack of clear communication channels can hinder collaboration among stakeholders, fostering an environment of mistrust and frustration. As a result, financial losses may mount, and the project may ultimately suffer from delays, increasing the likelihood of disputes over claims. To enhance communication efficiency, contractors should foster a culture of open communication among all project stakeholders. This can be achieved by establishing regular communication protocols, such as scheduled meetings and progress reports, to ensure that everyone is informed of project developments (Zhang et al., 2019). Implementing collaborative tools and platforms for real-time communication can also facilitate transparency and quick decision-making. Providing training on effective communication strategies can further empower team members to engage in constructive dialogue and address issues collaboratively.

d. Economic Awareness

Economic volatility is a critical factor affecting the construction industry, with fluctuations in material prices and labour shortages significantly impacting contractors' financial management (Al-Harbi & Al-Sudairi, 2018). Economic changes, such as inflation or changes in government policies, can result in unpredictable costs that contractors may not have adequately planned for, leading to increased financial burdens. The implications of economic volatility are far-reaching. Fluctuating costs can lead to budget overruns, causing contractors to incur additional expenses that may not be recoverable through claims. Moreover, the inability to manage these economic factors can result in cash flow problems, jeopardizing contractors' operational capabilities and sustainability. In a competitive market, the inability to effectively manage costs can lead to loss of contracts and diminished market share. To navigate economic volatility, contractors should develop contingency plans that account for potential fluctuations in material prices and labour availability (Al-Harbi & Al-Sudairi, 2018). Building strong relationships with suppliers can provide contractors with better insights into pricing trends and potential shortages, allowing for more accurate forecasting. Additionally, incorporating flexible budgeting strategies that allow for adjustments based on economic conditions can enhance financial resilience and preparedness.

e. Risk Assessment

Poor risk management is a significant contributor to loss and expenses, as inadequate assessment of potential risks leaves contractors vulnerable to unforeseen challenges (Williams, 2022). Without a structured approach to identifying and managing risks, contractors may find themselves unprepared to address issues such as accidents, regulatory changes, or natural disasters, leading to increased claims. The implications of inadequate risk management are profound, resulting in heightened exposure to unexpected financial losses. Contractors may face significant challenges in navigating claims processes when issues arise, leading to lengthy disputes and potential damage to relationships with clients and stakeholders. Additionally, the failure to address risks proactively can undermine a contractor's reputation and competitiveness in the market. Implementing a comprehensive risk management framework is crucial for mitigating the challenges associated with loss and expenses (Williams, 2022). This involves conducting regular risk assessments to identify potential challenges and developing mitigation strategies tailored to each identified risk. Training staff in risk management practices can also empower them to recognize and address risks promptly, reducing the likelihood of claims arising from unforeseen issues.

f. Training and Development

A lack of knowledge and training in claims management and contract administration can contribute significantly to financial losses in construction projects. Contractors may not fully understand their rights or the necessary documentation required to substantiate claims, leading to missed opportunities for recovery (Lim & Zainun, 2021). The implications of inadequate training are considerable, as unprepared staff may struggle to navigate complex claims processes, resulting in financial losses that could have been avoided. Furthermore, insufficient knowledge can lead to poorly executed contracts and increased disputes, damaging contractor-client relationships and affecting future business prospects. Providing comprehensive training for staff on best practices in contract management, claims processes, and project management is essential (Lim & Zainun, 2021). Training programs should be designed to enhance staff understanding of their roles in preventing and managing claims, equipping them with the necessary skills to address potential issues effectively. Ongoing professional development opportunities can also keep staff informed of industry changes and emerging best practices.

g. Technological Integration

Limited use of technology in project management can hinder a contractor's ability to monitor progress, track expenses, and manage risks effectively. The lack of real-time data can lead to delays in decision-making and an inability to respond promptly to emerging issues (Goh &

Abdul-Rahman, 2020). The implications of inadequate technological integration are significant, as contractors may struggle to maintain project timelines and budgets. The inability to access real-time information can result in mismanagement of resources and increased claims for loss and expenses. Additionally, without leveraging technology, contractors may miss opportunities for efficiency improvements and cost savings. Leveraging technology, such as project management software and data analytics tools, can provide contractors with valuable insights into project performance (Goh & Abdul-Rahman, 2020). Implementing these tools can enable real-time monitoring of progress and expenditures, allowing for informed decision-making and proactive issue resolution. Providing training on the effective use of technology can further enhance its adoption and utilization within the organization.

Thus, the findings from this systematic literature review reveal that multiple key factors contribute to loss and expense claims in the construction sector, particularly from the contractor's perspective. These factors include contract ambiguities, project delays, poor communication, economic instability, and a lack of training and development. Contractual issues and delays were found to be significant contributors to financial claims, often resulting in disputes and increased costs (Rahman & Smith, 2021; Olawale & Sun, 2020). Inefficient communication among stakeholders further complicates project management, leading to mismanagement of resources and decision-making delays (Zhang et al., 2019). Furthermore, economic volatility remains a major challenge, highlighting the need for flexible budgeting and effective risk management (Al-Harbi & Al-Sudairi, 2018; Williams, 2022).

To address these issues, several mitigation strategies and best practices have been identified. Enhancing contract management practices, fostering open communication, and investing in technological integration are crucial steps in reducing loss and expenses faced by contractors (Lim & Zainun, 2021; Goh & Abdul-Rahman, 2020). Additionally, promoting continuous training and professional development in claims and contract management is vital to improve staff competency and preparedness in handling financial challenges. Encouraging a collaborative culture across all project stakeholders can significantly improve transparency, reduce conflicts, and foster more efficient project execution. Overall, the key to mitigating loss and expense claims lies in adopting a proactive approach involving technology, training, and enhanced communication. These strategies collectively contribute to better financial performance, effective risk management, and increased project success for contractors.

CONCLUSION AND RECOMMENDATION

In conclusion, the challenges related to loss and expenses faced by contractors in the construction industry are multifaceted and rooted in various themes such as contract clarity, delay management, communication efficiency, economic awareness, risk assessment, training and development, and technological integration. The synthesis of findings from this systematic literature review indicates that these factors significantly impact contractors' financial performance and project success. Notably, issues stemming from unclear contracts and ineffective communication can lead to costly disputes, while economic volatility poses a constant threat to budgeting and resource allocation. Therefore, it is imperative for stakeholders within the construction industry to adopt a holistic approach to managing these challenges. By implementing best practices such as enhancing contract management, fostering open communication, and investing in training and technological solutions, contractors can mitigate the risks associated with loss and expenses and promote better project outcomes (Olawale & Sun, 2020; Goh & Abdul-Rahman, 2020).

Moreover, to strengthen the resilience of contractors against potential financial setbacks, it is recommended that industry stakeholders prioritize continuous professional development and training in key areas such as claims management and risk assessment. Investing in technology to improve project monitoring and communication can facilitate real-time decision-making and proactive risk management (Al-Harbi & Al-Sudairi, 2018). Additionally, embracing a culture of

collaboration among all project stakeholders will enhance transparency and accountability, ultimately leading to improved project execution and reduced financial claims (Williams, 2022). Future research should focus on the development of specific frameworks and tools that can be utilized by contractors to effectively navigate the complexities of loss and expenses within the construction sector in Malaysia.

The findings of this review carry important implications for both industry practitioners and policymakers. For contractors, the results highlight the need to adopt proactive contract management, communication strategies, and risk assessment practices to reduce the incidence of loss and expense claims. For policymakers and regulators, the study underscores the importance of strengthening guidelines on contract clarity, dispute resolution mechanisms, and industry-wide training programs. Embedding these insights into regulatory frameworks such as CIDB guidelines and public procurement policies can foster greater transparency, accountability, and financial sustainability in the construction sector.

Study Limitation

This study has several limitations that should be acknowledged. First, the review relied exclusively on secondary data extracted from SCOPUS. Although SCOPUS is a comprehensive database, the exclusion of other indexing platforms such as Web of Science, Google Scholar, and ProQuest may have limited the breadth of relevant literature considered. Second, the scope of this study was confined to the Malaysian construction industry and to articles published between 2020 and 2025. While this focus provides valuable localized insights, it also restricts the generalizability of the findings to wider regional or international contexts. Third, the study primarily adopted a qualitative synthesis approach, which, although effective in identifying recurring themes and strategies, does not provide empirical validation of causal relationships or measurable effect sizes among the identified factors.

These limitations highlight the need for cautious interpretation of the findings. Future studies could expand the database coverage, extend the geographical scope through cross-country comparisons, and employ methodological triangulation such as empirical surveys, case studies, or mixed-method designs. Such efforts would strengthen the external validity of the findings and provide more robust and generalizable frameworks for addressing the issues of loss and expenses in the construction industry.

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FACTORS AFFECTING COST PERFORMANCE ACROSS G5 CONSTRUCTION FIRMS

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ABSTRACT

Sarawak is currently undergoing a rapid developmental phase. Many construction companies are struggling with cost performance. Out of many factors that affect cost performance, cost overrun is one of the major problems in the construction industry. Hence, the aim of the present study is to study the factors affecting cost performance across G5 construction firms in Sarawak and to identify factors that contribute to the success or failure in relation to cost performance. The findings of the present study consist of 12 main factors affecting cost performance. 3 out of 12 factors were identified as significant factors affecting cost performance and the remaining 9 factors were identified as moderate significant factors. The top 3 significant factors are "improper planning", "high cost of machinery" and "poor project management". Based on the opinions expressed by the respondents, they opined that 'Experience' is the most influential factor when it comes to the success or failure in relation to cost performance in the industry. The findings demonstrate that the top three variables influencing cost performance offer valuable information about the variables that should be continuously monitored or improved in order to increase the profitability and overall performance of construction companies as well as the successful and failure related to cost performance in construction industry. The findings could serve as a reference or guideline to the construction companies in Sarawak so that future generations of construction firms may mitigate this recurring issue in the industry and respond to them accordingly.

KEYWORDS: Cost, Construction, Factors, G5, Overrun, Performance

INTRODUCTION

One of the important pillars of the Malaysian economy is the building sector. This industry, which ranks among the top three contributors to Malaysia's GDP, is crucial to the nation's growth (Ibrahim, 2010). When the manufacturing, agricultural, and construction sectors are compared, their respective GDP contributions are 57.1, 8.3, and 2.9 percent (Construction Industry Master Plan (CIMP), 2004; Ibrahim, 2010). Numerous studies have identified various internal and external factors contributing to cost performance issues in Malaysia's construction sector (Kamaruddin & Ismail, 2021). Ali & Kamaruzzaman (2010) claim that cost overrun problems are a typical occurrence in the nation's construction industry nowadays. This is a serious issue that frequently arises in the sector. "A construction project will incur cost overruns if it is unable to achieve effective cost performance" (Rahman et al., 2013). According to Ali & Kamaruzzaman (2010), quantity surveyors' underestimation of construction costs and inadequate calculation of the initial project cost are the two primary causes of cost overruns in projects. "The MCI has completed numerous projects but is not cost, quality and time effective" (Ibrahim, 2010). Recent years have seen a significant decrease in the Malaysian government's investment in construction projects. As such, owners of construction firms must adopt cost-cutting strategies that meet client needs and potentially attract foreign investment into the nation (Ibrahim, 2010). Cost overrun remains a critical challenge in Malaysian construction projects due to poor planning, material cost

inflation, and contractor inexperience (Mohamad & Alias, 2022). Therefore, Lee and Lim (2023) stressed that early-stage cost planning and risk allocation are essential strategies for reducing cost overruns in Southeast Asian infrastructure projects.

Procurement problems are another problem the Malaysian building industry faces. Yap et al. (2019) state that the traditional method, which "adopts the separation of design and construction work using a lump-sum contract," is frequently utilized in Malaysia for the procurement of construction projects. The fundamental problem with this strategy is how slowly its procedures move, which raises project costs. Aside from that, the sequential nature of the typical procurement strategy hinders efficient communication within the project team. Yap et al. (2019) also stated that customers in the sector expressed dissatisfaction with the old approach's performance for large, complex projects requiring a greater degree of financial planning.

Throughout Malaysia's history, companies operating in the construction sector have frequently encountered cost overruns when carrying out their projects. Cost overruns are one of the main reasons influencing cost performance concerns in the construction business, according to Ali & Kamaruzzaman (2010). Although the area factor is not unique to Malaysia, many developed and developing nations also face this problem. Majority of Malaysian projects, according to Ibrahim (2010), were similarly not cost-effective. They also noted that "in certain cases the projected costs were exceeded, completion dates were not achieved, and quality was not up to standards." Thus, the Malaysian construction industry is experiencing serious performance problems (cost, schedule, quality) based on historical to contemporary tendencies. The present research aims to study the factors affecting cost performance across G5 construction firms in Sarawak and to identify factors that contribute to the success or failure in relation to cost performance. Therefore, the government of Malaysia and construction companies may use this study as a reference to address any underlying cost performance difficulties that may arise in the country's industry. Zawawi et al. (2021) studied specific cost performance factors within the Malaysian context, reinforcing this study’s findings.

LITERATURE REVIEW

Management of Construction Firm Performance Using Benchmarking

In the construction sector, where time and money are the most important factors in building projects, construction companies must practice good accountability and management to be competitive. Construction companies have realized how important it is to more systematically discover, implement, and maintain improvements because of the industry's competitive character (El-Mashaleh et al., 2007). According to Bogetoft (2013), benchmarking is "a managerial tool that improves performance by identifying and applying best document practices" in the corporate environment. By comparing a company's strengths and shortcomings to those of the industry, benchmarking enables decision-makers to focus on areas within the business that need development.

Based on Ramrez et al. (2004), benchmarking can be employed as a means of motivating staff members by establishing attainable targets that have been demonstrated to be feasible in other organizations. El-Mashaleh et al. (2007) stated that benchmarking is a methodical process that evaluates an individual's performance in relation to the results attained by recognized leaders in the industry in order to find and implement methods that lead to higher performance.

Benchmarking Cost Performance

Asrofah et al. (2010) assert that benchmarking is a useful tool that supports management in their pursuit of improvements concerning their cost performance. By comparing an organization's current state to best practices, benchmarking aims to identify areas that require improvement. It entails a continuous, methodical evaluation of the products, services, and day-to-day operations

of companies acknowledged as premier models of best practices. The ultimate objective is to encourage organizational improvement using these comparisons and evaluations, emphasizing a methodical and ongoing approach. Benchmarking models in construction processes are unfamiliar to the Malaysian construction sector. A weakened cost performance could eventually result from several circumstances. Therefore, by using the components involved in benchmarking processes, benchmarking can be an effective way to ensure that construction firms are able to overcome this repeating issue.

In the construction sector, numerous cost characteristics are together referred to as "cost performance." Yeung et al. (2013) state that "project cost growth (owner)," "project budget factor (contractor)," "change cost factor," and "predictability cost" are some examples of the key components of cost indicators in construction that are combined into one that necessitates proper planning and preparation on the part of construction firms or management. Because benchmarking can help construction businesses with project planning prior to the construction period, it serves a purpose in relation to cost performance. According to Hamilton and Gibson (1996), "risk is reduced, cost performance can increase by as much as 20%, and schedule performance can increase by as much as 40% through formal project-planning effort." This means that every facet of the construction process will be considered, which will ultimately have an impact on the cost performance of a firm. According to Ali and Kamaruzzaman (2010), the elements could include cash flow, skilled staff, effective management, risk management, etc. To put it briefly, the overall cost performance of a construction project is determined by the firm's top-down management.

Cost Overrun Issues in the Construction Industry

Cost overruns, also known as cost escalation, occur when unexpected expenses surpass the initial planned amount due to mistakes made in ascertaining the actual cost throughout the budgeting process (Vaardini et al., 2016). Majority of projects in Malaysia were not cost-effective, according to Razak et al. (2010), who also noted that "in certain cases the projected costs were exceeded, completion dates were not achieved, and quality was not up to standards." Memon et al. (2012) found that 89% of construction projects in Malaysia had cost overrun problems, with an average cost that was between 5% and 10% of the initial projected contract price. Only 11% of projects were judged to have been finished under budget. In the building business, cost overruns are a major worry that can occur in both developed and developing nations. However, cost overrun problems would be significantly decreased with the application of effective cost performance benchmarking models. Alaloul et al. (2021) highlighted recent cost overrun patterns specific to Malaysia, emphasizing recurring issues despite improved technologies. Factors that contribute to cost overruns in the construction industry are listed in the following Table 1.

Table 1 Factors Contributing to Cost Overrun

No.	Factors Contributing to Cost Overrun	Author(s)
1.	Inaccurate or Poor Estimation of Original Cost	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Durdyev et al. (2012); Hatamleh et al. (2018); Olaniran (2022)
2.	Inflation of Project Costs	Ali & Kamaruzzaman (2010); Durdyev et al. (2012; Musarat et al. (2020)
3.	Improper Planning	Ali & Kamaruzzaman (2010); Durdyev et al. (2012); Vaardini et al. (2016)
4.	Fluctuation in Price of Raw Materials	Le-Hoai et al. (2008); Durdyev et al. (2012); Rahman et al. (2013)
5.	Poor Project Management	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Rahman et al. (2013)

6.	Lack of Experience	Ali & Kamaruzzaman (2010); Rahman et al. (2013); Johnson & Babu (2018)
7.	Obsolete or Unsuitable Construction Equipment and Methods	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Johnson & Babu (2018)
8.	Unforeseen Site Conditions	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Johnson & Babu (2018)
9.	Mistake in Design	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Johnson & Babu (2018)
10.	Insufficient Fund	Le-Hoai et al. (2008); Ali & Kamaruzzaman (2010); Rahman et al. (2013); Johnson & Babu (2018)
11.	Poor Contract Management	Frimpong et al. (2003); Ali & Kamaruzzaman (2010);
12.	High Cost of Machineries	Ali & Kamaruzzaman (2010); Durdyev et al. (2012)

Inaccurate or Poor Estimation of Original Cost

One of the main causes of cost overruns, according to Ali & Kamaruzzaman (2010), is inaccurate calculation of a project's starting cost. The inaccuracy of the estimate is partially caused by technical problems with project cost estimating and information scarcity in the early phases of the project. According to a study conducted by the authors, Durdyev et al. (2012) and Le-Hoai et al. (2008) provide additional support for the claim that one of the major project financing category elements that most significantly contributed to cost overruns in residential projects was faulty project cost estimation. Precise project cost assessment is essential to project success and ought to be considered from the outset of the project. Inadequate estimating can lead to project failure, which can cause problems with costs and schedule (Hatamleh et al., 2018). Olaniran (2022) emphasized the importance of accurate cost estimation, recommending a cost significant model to improve budgeting accuracy.

Inflation of Project Costs

Musarat et al. (2020) claim that most construction projects fail to account for inflation in their economic analyses and budgets, which leads to yearly variations in labor costs, building material prices, and machinery hire rates that cause project cost overruns. Cost increases arise from the inflation of project expenses, as substantiated by Ali & Kamaruzzaman (2010). The cost of labor, materials, and equipment can increase or decrease geographically within a nation, and contracts between suppliers and subcontractors may have varied clauses pertaining to inflation protection that are agreed upon with a client. Interest rates will rise in tandem with inflation, driving up overall expenses.

Improper Planning

According to Ali & Kamaruzzaman (2010), insufficient planning and management expertise constraints led to inefficient use of technical resources. As a result, the procedures involved in product development slowed down, which increased the amount of time needed to finish the project. Durdyev et al. (2012) conducted several data studies to support the aforementioned claims. They found that one of the most important variables impacting cost overruns—which ultimately result in a negative cost performance—was faulty planning in correlation. However, Vaardini et al. (2016) state that novice contractors' careless scheduling and poor planning are significant causes of construction cost problems. This lends credence to the idea that inefficient use of technical resources stems from a lack of managerial experience.

Fluctuation In Price of Raw Materials

Price variations can lead to cost overruns, making precise cost estimation difficult. This challenge results from supplier speculation or significant price inflation in emerging nations (Ali & Kamaruzzaman, 2010). Le-Hoai (2008) goes into more detail on this topic, pointing out that the quick growth of the building industry and the resulting high demand for resources like steel, cement, and bricks among others have made these commodities scarce and driven up the cost of raw materials. Rahman et al. (2013) provided additional support for this issue with their findings, which placed the fluctuation of material prices first. This problem can be caused by several things, such as supplier monopolies or a lack of locally accessible building supplies. Price fluctuations may be caused by the deliberate creation of artificial scarcity or by an imbalance between supply and demand. Country instability and inflation rates may also play a role in these price changes. Higher prices for labor, machinery, raw materials, and other associated goods and services are the result of these changes.

Poor Project Management

Cost overruns in construction projects are attributed by Ali & Kamaruzzaman (2010) to inadequate project management support together with inadequate site supervision and management. Le-Hoai et al. (2008)'s findings are corroborated by the analyses conducted in Vietnam, which show that inadequate site management and supervision is the primary cause of cost overruns and project delays in that nation. Construction companies experience unfavourable cost performance as a result of inefficient site management and oversight. The primary reasons for this include significant problems, poor communication with subcontractors, and delayed adherence to legal obligations (Rahman et al., 2013).

Lack of Experience

Project cost distribution plans are poorly implemented, which causes actual project costs to exceed budget (Ali & Kamaruzzaman, 2010). This is because most contractors don't have much experience, especially when it comes to money management. According to Johnson & Babu (2018), limited managerial experience and imprecise projections are frequently linked to the contractor's subpar technical performance. This raises the cost of the project in the long run by resulting in mistakes and reworks throughout the building phase. (Rahman et al., 2013).

Obsolete or Unsuitable Construction Equipment and Methods

Inadequate and outdated tools and techniques hinder the acceleration of building projects. Having access to contemporary technology is essential to the success and advancement of major building projects (Ali & Kamaruzzaman, 2010; Le-Hoai et al., 2008). Many nations make an effort to bring contemporary technologies within their boundaries. But this strategy doesn't work since there aren't enough qualified people to handle the technology. This is corroborated by research conducted by Johnson & Babu (2018), which found that a major contributing cause to cost overruns in construction industry was a shortage of resources (labour, material, and equipment).

Unforeseen Site Conditions

According to Ali & Kamaruzzaman (2010), it is usually not possible to ascertain the exact conditions of a project site until the excavation phase is complete. It's likely that site characteristics were not taken into consideration in the original assessment, or that changes have happened as a result of weather patterns or subsurface circumstances. The movement of goods and machinery into and out of the site may become more difficult logistically due to site conditions changes, which could result in higher expenses. Unexpected site circumstances are one of the most common and significant negative factors in large-scale projects that result in delays

and cost overruns, according to Le-Hoai et al. (2008). Similarly, Johnson & Babu (2018) stated that one of the main causes of cost overruns is adverse weather and site circumstances.

Mistake In Design

Inadequate skills of the designer lead to mistakes or subpar designs. Designs or drawings that are approved through an inefficient process become of poor quality, especially for projects that get government funding. After building projects begin, unrealistic plans must be modified, which could lead to cost overruns (Ali & Kamaruzzaman, 2010; Le-Hoai et al., 2008). Since time and money are correlated, any changes that are necessary for ongoing projects will affect both factors. Johnson & Babu (2018) state that designing without taking into account government needs beforehand and not knowing the proper form and kind of contract are the main causes of modifications, incompleteness, and errors in design.

Insufficient Fund

Inadequate funding is the primary reason of many significant construction project delays (not just during the construction stage), according to Le-Hoai et al. (2008). It should be underlined that in order to pay for all building charges, project delays lead to higher costs. According to the terms of the contract, owners frequently neglect to provide sufficient funding for the project and fail to pay the contractor on time (Ali & Kamaruzzaman, 2010; Le-Hoai et al., 2008). According to Johnson & Babu (2018), client payment delays to contractors are among the most frequent and persistent problems in the construction industry. These delays can impede project development by delaying the delivery of materials and equipment to the site and by delaying the payment of worker salaries. Concurring with earlier remarks, Rahman et al. (2013) adds more detail and mentions the critical role contractors play in any construction project's successful completion, particularly when it comes to the actual performance of work. Thus, to guarantee that work progresses without interruption and to prevent additional cost increases, sufficient cash flow and the financial stability of contractors are essential.

Poor Contract Management

Poor contract management is one of the reasons behind construction project cost overruns (Frimpong et al., 2003). The lowest bidder secures projects as a result of subpar contract management. A subset of the lowest-bidders might not have the necessary management experience, which would mean that the contractor's plan, cost control, thorough site management, and resource allocation—including human, financial, and material—would not be given as much attention. As stated by Ali & Kamaruzzaman (2010), many contractors in underdeveloped countries are fundamentally business owners who prioritize profit over sound management. These contractors frequently give poor pay, make competitive but lower-than-expected bids, and show little aptitude for contract planning and coordination. They might also disregard the terms mentioned in the contract.

High Cost of Machineries

One issue pertaining to the market is the exorbitant cost of machinery. Current market developments have a major impact on the construction business (Ali & Kamaruzzaman, 2010). For example, a rise in the amount of oil required to run machinery results in an increase in the cost of renting such machinery (Durdyev et al., 2012). Durdyev et al. (2012) also point out that the costs of the machinery used in the building process are a major factor in cost overruns in construction projects because the majority of these machines are expensively produced and exported from other nations, which has a substantial impact on project costs.

METHODOLOGY

The present study employs the quantitative research method for data collection, as it facilitates easy comparisons and descriptive analysis (Flick, 2015). As per Nishishiba et al. (2014), the questionnaire survey methodology is the most used method of gathering data since it allows for the timely acquisition of feedback. Furthermore, Mathers et al. (2009) deduced that the initial batch of questionnaires should be permitted to be returned within a minimum of six weeks of the questionnaire survey procedure. Additionally, several activities, including a cover letter, the respondent's background, and multiple-choice questions, were completed using a standardized questionnaire and delivered, depending on the circumstance, online via email or in person.

The primary sampling method in this study is simple random sampling, which is being used to determine the causes of cost overruns among G5 construction companies in Sarawak that are registered with the Construction Industry Development Board (CIDB). Nasir & Price (2023) investigated stakeholder roles in cost control, underlining the importance of collaboration in managing construction costs. The population representativeness of simple random sampling and its inherent characteristics had a major role in the adoption of this sampling technique. A numbered registry with the names of all the G5 construction businesses operating in Sarawak was created to guarantee readability and convenience of navigation. Using their demonstrated expertise in overseeing complicated projects and effectively navigating the complexities of extended project durations is the rationale behind the selection of CIDB grades. The study focuses on 9 key regions in Sarawak because these areas represent the main centres of activity for G5 construction firms, ensuring relevant and concentrated data collection. Including all regions would introduce areas with limited construction activity, which may reduce data quality and increase logistical challenges. Similar approaches in construction research have been adopted by previous studies (e.g., Chan & Kumar, 2019; Lee et al., 2021), which emphasize targeting active regions to enhance data relevance and study feasibility. Therefore, selecting these 9 regions allows for efficient use of resources while capturing representative insights on cost performance factors among G5 firms. Descriptive analysis and mean are used for analysing the data collected. Descriptive analysis helps to analyse the collected quantitative data and generate a simple summary Kemp et al. (2018). It is used to calculate mean values and standard deviation.

According to CIDB (2024), there are approximately 400 registered G5 construction companies in Sarawak. To determine an appropriate research sample size, Slovin’s formula was applied with a 95% confidence level and a 5% margin of error, resulting in a recommended sample size of approximately 196 respondents. However, this study successfully collected a total of 40 responses, yielding a response rate of about 20%. Although this response rate is lower than the conventional threshold, it is still considered acceptable given the sufficient sampling frame. Fosnacht et al. (2017) emphasized that studies with large sampling frames can produce reliable population estimates even with relatively low response rates. More recently, Smith and Jones (2022) also noted that in specialized fields or industries, lower response rates do not necessarily compromise the validity of survey findings, especially when the sample characteristics are representative. Therefore, the findings of this study remain valid and valuable despite the limited response rate.

FINDINGS AND DISCUSSION

Respondents Demographic Profile

The summary of the overall information and background of the respondents are shown in Table 2 below.

Table 2 Respondents Background

Personal Details and Origin of Respondents		Frequency	Percentage (%)
Job Position	Managing Director	2	5
	General Manager	5	12.5
	Project/Site Engineer	6	15
	Contract Manager	5	12.5
	Quantity Surveyor/Cost Engineer	15	37.5
	Site Supervisor/Superintendent	6	15
	Civil Engineer	1	2.5
Working Experience	Less than 5 years	10	25
	6 – 10 years	15	37.5
	11 – 15 years	5	12.5
	16 – 20 years	9	22.5
	More than 20 years	1	2.5
Company's main field of business	Building	13	32.5
	Civil Engineering	12	30
	Mechanical & Electrical Engineering	3	7.5
	Facility Management / Maintenance	11	27.5
	Energy Development Company	1	2.5
Types of projects commonly involved	Private Project	18	45
	Public Project	16	40
	Foreign Project	9	22.5
	Oil & Gas Industry	2	5
Company's region	Kuching	9	22.5
	Samarahan	3	7.5
	Serian	2	5
	Betong	1	2.5
	Sibu	5	12.5
	Bintulu	9	22.5
	Miri	5	12.5
	Limbang	5	12.5
	Lawas	1	2.5

According to Table 2, quantity surveyors or cost engineers make up most of the respondents, standing at 37.5% of total respondents. In terms of work experience, most respondents fall in the '6-10 years' category (37.5%), and the second-largest group is in the 'less than 5 years' category. Only a single respondent had more than 20 years of working experience. Out of 40 respondents, 13 of them work in the building construction field, 12 in the civil engineering scope, and 11 in facility management or maintenance, as they stand as majority of the demographic of the study

(32.5%, 30%, and 27.5%, respectively). The respondents are mostly dealing with private and public projects, being 45% and 40%, respectively, with oil and gas project involvement being the least (5%). The respondents' company involvement in projects is not limited to only one, with some companies branching out to different regions or districts. Most of the respondent's companies are reportedly involved in projects in Kuching, Bintulu and Miri, ranked as the top three of the study (22.5%, 22.5%, and 12.5%, respectively). A total of 40 respondents from G5 construction firms in Sarawak participated in the study. The study focused on 9 major regions in Sarawak where G5 firms are actively operating. These locations were selected based on project activity levels and the presence of registered CIDB contractors. Due to constraints in time and accessibility, remote regions were not included in the study.

OVERVIEW OF FACTORS AFFECTING COST PERFORMANCE

The barriers that impede the for factors affecting cost performance across G5 construction firms and the mean rating, standard deviation, rank as well as significant level for each of the variable are shown in Table 3 below.

Table 3: Scale for factors Affecting Cost Overruns

Variables	Mean	S. D	RII Value	Ranking
Improper Planning	4.13	0.686	0.825	1
High Cost of Machineries	4.05	0.749	0.810	2
Poor Project Management	4.03	0.733	0.805	3
Mistake in Design	4.00	1.086	0.800	4
Poor Contract Management	.983	0.947	0.795	5
Insufficient Fund	3.98	0.698	0.795	6
Unforeseen Site Conditions	3.93	0.971	0.785	7
Fluctuation in Price of Raw Materials	3.93	0.829	0.785	8
Lack of Experience	3.90	0.841	0.780	9
Inflation of Project Costs	3.75	1.032	0.750	10
Inaccurate or Poor Estimation of Original Cost	3.72	0.784	0.745	11
Obsolete or Unsuitable Construction Equipment and Methods	3.58	0.813	0.715	12

DISCUSSION

The RII values and rankings clearly indicate the significant findings. According to the findings, the major factors affecting cost performance across G5 construction firms is agreed upon by the current study respondents. The principal results included "improper planning", "high cost of machinery" and "poor project management". The three (3) described key variables have also received good marks in prior studies.

The first research objective of the current study is to study the factors affecting cost performance across G5 construction firms in Sarawak and to identify factors that contribute to the success or failure in relation to cost performance. The study objectives were achieved in this study. There

are twelve (12) factors affecting cost performance across G5 construction firms highlighted in this research. In the Sarawak construction industry, the current study revealed three (3) barriers of factors affecting cost performance across G5 construction firms in Sarawak which are “improper planning”, “high cost of machinery” and “poor project management”. The mean rating technique is used to classify the statistical significance of the obstacles, which ranges from 2.5 to 3.49 and 3.5 to 4.49. In this study, there are no critical substantial competencies, as no variables have an overall mean of 4.5 to 5. As a result, the current study's goal has been met.

The second objective is also achieved by gathering the experiences of the respondents of G5 Sarawak construction companies in cost performance which contribute to the success or failure in their measure of the financial effectiveness and efficiency of a project. According to the response by the respondents, they opined that the most notable factor that contribute to the success or failure in relation to cost performance was “experience”. This is due to the possibility of difficulties in project implementation for inexperienced contractors, which could lead to increased expenses and delays.

CONCLUSION

In the Sarawak construction business, Grade Five (G5) contractors are particularly affected by certain characteristics, which the current study aimed to identify. Construction firms, particularly G5 companies, which tend to lack experience in resource and fund utilization when compared to their higher-ranking counterparts, the Grade Seven (G7), must comprehend these factors as Sarawak goes through a developmental phase and make informed decisions to anticipate external factors that may directly impact the cost performance. Sarawak's construction industry has had significant growth and development since the study's commencement. This can be attributed to greater awareness of the factors that directly or indirectly effect cost performance.

The success or failure of a corporation in attaining a favorable cost performance is highlighted by this research, along with the factors that may contribute to that outcome. Project execution efficiency and profitability are directly correlated with positive cost performance. The study's conclusions and suggestions, which address the practical realities of the Sarawak construction industry, are therefore well-suited to achieve its goals. The research has delineated the feasible and realistic strategies for augmenting efficacy and output in order to achieve optimal cost outcomes.

The study has several shortcomings even if its goals were met. First off, the study's focus is restricted to Grade Five (G5) organizations, which means the results are exclusive to that group. The variations in the categories or grades of the companies result in variations in the causes that could have affected these companies. Other than that, the current study only looked at the Sarawak region; as a result, the industry's characteristics may differ from those of other states in the nation. In addition, the researcher's capacity to perform a critical examination of the data is hampered by the inherent constraints of the quantitative research approach. It was not possible to include open-ended questions to further elucidate respondents' reasons for rating particular characteristics as "very important" or "very unimportant" because this study used an online self-administered questionnaire. As a result, this limitation could make it difficult for the researcher to support and expand on the interpretation of the results.

Future research on cost performance should concentrate on delving deeper into the topic and extending its reach to include construction enterprises in the G1 to G7 categories. To properly investigate the topic of cost performance, which is quite broad and complex, in-depth research and analysis are needed. In addition, the research should be expanded to other regions of Malaysia to work with other studies and provide a thorough understanding of the country's building sector. Up until now, only some areas of the nation have been examined and monitored; as a result, it is critical to address unexplored places to match the data on cost performance on a larger scale.

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THE URBAN SCARS: EXPLORING THE PERCEIVED IMPACTS OF ABANDONED CONSTRUCTION PROJECTS TO THE COMMUNITY

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ABSTRACT

Despites efforts to ensure timely completion, construction projects in Malaysia are still experiencing delayed or abandoned, negatively impacting surrounding communities. This study investigates the consequences of abandoned construction projects, focusing on their effect on local community. A quantitative survey was conducted among residents to assess the perceived impacts. Results indicate that abandoned sites contribute to illegal garbage dump, become focal points for criminal activity, lead to land wastage, pose injury to trespassers, and have economic repercussions. The study recommends several mitigation strategies, including proactive action by local authorities, adaptive reuse of abandoned sites, increased police patrolling, demolition of abandoned structure, through cleaning of dilapidated areas, and land redevelopment. The findings of this research are expected to be a reference for the local authorities and policymakers in developing effective strategies to address challenges posed by abandoned construction projects.

KEYWORDS: Abandoned, construction projects, community, mitigation strategies, survey

INTRODUCTION

Abandoned construction project are a global and complex issue with significant social, economic, environmental consequences and country development. These construction projects are often left incomplete due to several reasons like financial, mismanagement, unforeseen circumstances and others. According to Mac-Barango (2017) and Ariffin et al. (2018), projects are considered abandoned when it has been completely discontinued and exceeding the original timeline to an unacceptable degree. Furthermore, project is considered abandoned when it is incomplete, inhabitable, unusable or non-functional (Atamean, 2020). Malaysia's Ministry of Housing and Local Government (MHLG) considered a project is abandoned under four circumstances:

- When construction activities stopped for 6 months or more on the site
- If the developer or contractor wounds up before completion
- If the contractor or developer declared inability to complete the work
- If the project is deemed abandoned under the provision of the Housing Development Act (118) by MHG

In Peninsular Malaysia, construction project abandonment is a significant issue that affects our construction industry and buyers (Farhayu et al., 2018). The abandonment of construction projects is the main challenge in the construction industry. At the same time, this issue has arisen in many parts of the world, and it has a detrimental effect on both nations and countries. As reported by the National Housing Department (JPN) 534 construction projects were recorded as problematic; with 117 projects were classified as abandoned (Bunyan, 2022). According MHLG (2023), as of January 2023, there are up to 117 projects involving a Gross Development Value (GDV) of 7.67 billion with the status of abandoned projects. According to Noor-Izhan (2018) and Basharuddin et al (2024), Selangor is the worst state in Malaysia, having a high number of abandoned projects. Table 1 presents the distribution of abandoned projects in Malaysian states.

Due to their detrimental effects on the building sector and economic expansion, several projects were shelved. Further, the enormous sums of money and resources wasted on labour and capital goods lead to negative consequences for the project's clients. To avoid further financial burdens and better serve the public, it's crucial to prevent the abandonment of government projects (Bunyan, 2022).

Table 1: Abandoned Projects in Malaysian States (Source: MHLG (2023)

State	Number of Abandoned Projects	State	Number of Abandoned Projects
Johor	9	Pulau Pinang	3
Kedah	3	Sabah	-
Kelantan	20	Sarawak	-
Melaka	1	Selangor	43
Negeri Sembilan	4	Terengganu	14
Pahang	8	Wilayah Persekutuan Kuala Lumpur	6
Perak	6	Wilayah Persekutuan Labuan	-
Perlis	-	Wilayah Persekutuan Putrajaya	-

FACTORS CONTRIBUTING TO PROJECT ABANDONMENT

Abandoned project is a harsh reality in today's construction business landscape. It signifies a significant investment of money, resources and time that has yielded no tangible results. There are many reasons behind these failures, are often complex and interconnected. A study by Daomah et al. (2019) revealed that projects were abandoned due to several factors like political leadership, poor administration, poor funding, unsafe work environment, cultural factors and external factors. Furthermore, a study by Adil et al. (2019) identified a range of issues contributing to the abandoned projects, including economic crisis, mismanagement, ineffective design, financial corruption, inadequate contractors experience, ineffective scheduling, limited used of technologies, inadequate planning and safety measures and poor working conditions. On top of that, improper management of the market signal and unattractive strategies contribute to project abandonment, along with financial, project stakeholders, project management, market signal, procurement and external factors (Salam et al., 2020)

THE EFFECT OF ABANDONED PROJECTS

The ripple effect of an abandoned project extends far beyond the project site itself, impacting individuals, businesses, communities and country's economy in various ways. According to

Azumah (2019), an abandoned construction project will harm the safety and comfort of the surrounding community. Abandoned buildings can pose a biological threat and become breeding grounds and nests for various animals that contribute to negative impacts and even threaten the community. Pests such as rats, cockroaches, bats, and mosquitoes will seriously impact health, such as dengue fever, malaria, chikungunya disease, and leptospirosis (Zulfakar, 2022). There have been several reports of rodent infestation at the People's Housing Project (PPR) when the pest became increasingly aggressive and multiplied in the housing area. This situation will harm the community, these pests can cause dangerous diseases and damage plants and furniture (Bernama, 2023).

On top of that, abandoned project often turn into hotspot for illegal activity (Alaezi, et al., 2021; Nsiah-Asamoah, 2019). Taiming (2022) reported there was a case where the abandoned building in Tawau, Sabah, became a concern for the villagers when the abandoned building was the location of the killing. In addition, the abandoned building was also found to be a nest of drug addicts for them to live in and to carry out such immoral activities (Shaherah, 2022).

Studies have shown that abandoned projects results in the wastage of land use (Addy et al., 2023; Junaidi, 2022). For example, there are 389 vacant and abandoned buildings in Brunei remain underdeveloped despite being gazetted long time ago Junaidi (2022). This is an unfavourable situation since this building should be able to benefit the public and the government through the assets and revenue obtained if this building works well. Facilities and funds had already been provided, but plans to complete it had failed, and the land was wasted. Other costs were required to be redeveloped to make it work properly.

Moreover, abandoned projects pose a significant risk of injury to trespassers as evidenced by abandoned school building vacated in 2005 due to unsafe building structure (Bernama, 2023). The abandoned sites often become spot that attract wildlife that can pose threats to human life, contain unstable structure that are prone to collapse, all which can lead to serious injuries or even fatalities to trespassers.

The presence of abandoned projects can have bad disfiguration of neighbourhood landscape. According to Nsiah-Asamoah (2019), The existence of abandoned project within a city reflects a lack of proper planning and management and can perceived as an indicator for underdevelopment. According to Bernama (2023), despite the rapid development around Jalan Cheras and Jalan Lombong in Kuala Lumpur, there are still slums and abandoned halls that have not been disposed of, thus spoiling the city's scenery. To make matters worse, there are also piles of rubbish there, not only causing a bad smell but also becoming a breeding ground for mosquitoes, which can affect the health of residents. Meanwhile in Malacca, as reported by Zakinan (2017), the building located at Jalan Parameswara, which is the focus of tourists, is affected by the image of an old building that is abandoned and not operating where the walls of the building are full of moss which causes confusion and gives a bad perspective to tourists towards the management or the related authority.

Illegal dumping occurred at some of abandoned project’s sites. According to (Hasbi, 2017), there was a case where a shop building in Seremban became a garbage dump, which caused a bad smell around the area. Irresponsible parties threw garbage in the area because they knew the building had been abandoned and unoccupied for a long time. The area filled with garbage can also bring rats and stray dogs that can threaten the health and safety of the surrounding residents. Moreover, in another case by Zakarya (2022), an abandoned pool area has been turned into an illegal garbage dump by irresponsible individuals regardless of the impact in the future. The stench arising from the garbage pile gives an unpleasant feeling to the surrounding residents and gives a bad image of the residential area.

According to the Selangor State Council, rural development initiatives are designed and organized to improve the standard of living in rural areas (Aidil et al., 2019). Rapid development projects

in an area can contribute to the standard of living for the comfort of the local community, and this goal will not be achieved if there are many abandoned areas or buildings that fill the area. On the other hand, Ogoh (2016) found that project abandonment has many effects on the standard of living of the people of the Niger Delta and that abandoned roads increase the cost of transportation. This is due to the road conditions, which prevent all vehicles from passing through the road. In this case, the roads connecting their areas and other cities or areas are unpassable, thus interrupting economic activities. Roads are essential for communication purposes that can catalyse economic growth.

Most of the construction industry has contributed to the creation of job opportunities contributing to the local economy. If the constructed building becomes abandoned, it will indirectly result in unemployment since the business plan associated with the building cannot be materialized. It further causes the economy that depends on this business to experience a fall and recession (Ariffin et al., 2019). The fall in this business will affect other businesses related to and dependent on (Salam et al., 2020). On the other hand, according to Mokhtar (2023), local authorities such as state governments and municipalities cannot collect certain taxes in the case of abandoned housing projects. Thus, it reduces the income for the local government to develop the surrounding area, such as building streetlights, repairing roads, and other related developments for community comfort and well-being.

There is a case in Malaysia where an abandoned building is used as a residence by a group of foreigners (Yaakob, 2023). The foreign settlement happens because there are weaknesses in monitoring and security controls to prevent trespassers from entering prohibited areas. In addition, the employer's failure to provide appropriate accommodation facilities is believed to be the cause for foreign and local workers to live in dilapidated abandoned buildings. Other than that, in Spain, there is a case reported by Agensi (2020) where there are two dead bodies found in an abandoned building due to the structure of the building collapse. The abandoned building is a place where migrant people live.

CONTROLLING THE RISKS OF PROJECT ABANDONMENT

Abandoned project requires strategic and controlled response to minimise it adverse impact. This section will investigate the critical control measures that should be considered to effectively manage the consequences of abandoned project. Among the control measures that should be employed are patrolling, governing authority roles, cleaning of dilapidated areas, demolition, adaptive reuse of abandoned building and re-development of land. Governing authorities such as The Ministry of Local Government Development in Malaysia played an essential role in extricating abandoned projects to provide economic opportunities to local communities. As reported by Ahmadi (2023), more than 40 of the 112 abandoned housing projects across the country are currently being rescued by the Ministry of Local Government Development through various programs. Active projects demand jobs and services from the local community, helping to boost the area's economy.

Furthermore, frequent patrols of abandoned project sites serve as a proactive measure to mitigate risks such as vandalism, trespassing and illegal activities. Frequent patrolling allows police to interact directly with the local community. Patrolling builds a better relationship between the police and the community, fosters trust, and positively impacts the community's perception of the police (Ahmad, 2017). A more frequent police presence in community areas serves as a deterrent to criminal activity. Potential criminal activities tend to be avoided when criminals are aware of surveillance and immediate action from the police.

In addition, the effective management of abandoned projects requires a comprehensive approach that includes cleaning of dilapidated areas. The process involves removing litter, debris, and overgrown vegetation, leading to a cleaner and more attractive landscape. This beautification can positively impact the community's overall appearance, making it more inviting and appealing to

residents and visitors. Neglected areas often become breeding grounds for pests, such as rodents and insects, which can carry diseases (Zulfakar, 2022). Cleaning up the area reduces the presence of these pests and lowers the risk of disease transmission, improving public health and safety.

In some cases, cleaning may not be sufficient to address the safety and environmental hazards posed by abandoned projects, necessitating the demolition of dilapidation structures. According to Andrew (2018), demolishing abandoned buildings can decrease the crime rate in the city. Abandoned or derelict buildings often serve as hiding places for criminals, sometimes occupied illegally by squatters or individuals engaged in illegal activities, making it easier for them to carry out illegal activities without being easily detected.

On top of that, a more sustainable approach would be adaptive reuse of abandoned buildings. This approach not only minimises the impact of demolition to the environment but also repurpose the abandoned building into functional spaces that enhance community life. According to Yaakob, (2023), the local authorities, such as Selangor State Development Corporation, take an approach to reuse abandoned buildings in Klang as a temporary quarter for foreign workers. The process of rehabilitation and reuse of abandoned buildings often requires collaboration between owners, local authorities, and other stakeholders (Cherchi, 2015). This collaboration can provide support and incentives to restore buildings and prevent them from being abandoned. On the other hand, reusing abandoned buildings can generate income through rentals or businesses operating in them. Earned income can be used for building maintenance and upkeep actions to maintain the building.

Redevelopment of the land offers another viable approach to addressing abandoned projects. Redeveloping land areas offers numerous benefits to the community and the environment. Studies by Umbugala et al. (2022) suggest that unused land can be transformed into much-needed housing developments such as recreational areas and other facilities that benefit the surrounding community. The redevelopment also offers opportunities to address housing shortages and provides affordable housing options for the community. This development can provide many benefits while reducing the number of abandoned buildings (Tun Tuah, 2018).

RESEARCH METHODOLOGY

This research utilized a quantitative method to explore the impacts of abandoned construction projects located in section 30, Shah Alam, Selangor. Two (2) identified abandoned construction projects have been selected, named as abandoned project A and B. Given their proximity to residential areas, shops, mosque and community hall, abandoned project A and B present ideal case for examining the impact of such project on surrounding communities.

Project A, an 8-10 years old abandoned project, aims to developed 44 single storey terrace houses. Construction is estimated to have reached 80% completion. Project B, a 48 units double-storey terrace houses, is believed to have been abandoned 5 years ago, it is estimated that 70% of the construction work was complete before abandonment.

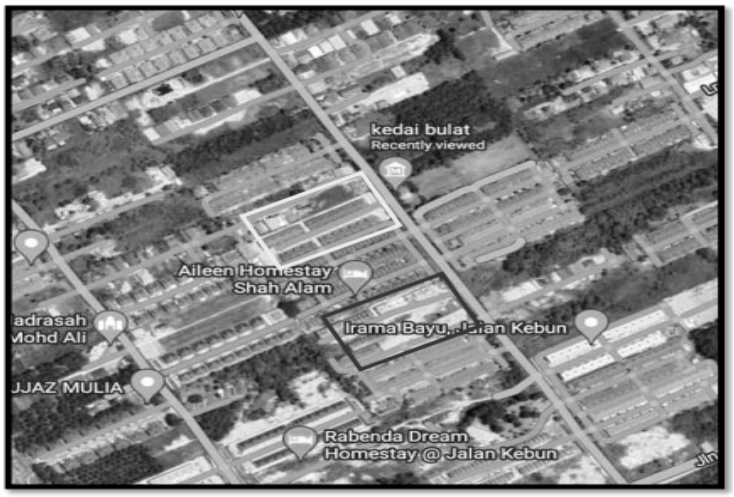

Fig 1: Location plan of the abandoned project A and B in Shah Alam

For this research, the questionnaire was developed based on extensive literature review, focusing on the key effects of abandoned projects. A total of 10 effects and 6 recommended mitigation strategies were identified and incorporated into the questionnaire. To capture respondents' perceptions, a 4-point Likert scale was used, ranging from 1 (strongly disagree) to 4 (strongly agree). Respondents were asked to indicate their level of agreement with each statement as assess the impact of each attribute on project delays.

The study employed purposive sampling, targeting residents in the communities surrounding the abandoned projects (Project A and Project B). To facilitate the data collection, a QR code that linked to the questionnaire was sent to the WhatsApp group of the residents association at nearby residential housing and community centres. One hundred and five responses were received. Severity index formula is used to rank the effect of abandoned project to the community based on severity as indicated by the participants.

Following research by Susmitha et. al., (2018), the formula used are as follows:

$$SI = \frac{\sum_{i=0}^{4} b_i d_i}{4D}$$

Where,
SI = severity index
b_i= the wight assigned to each responses ranges from 0 to 4
d_i = frequency of each response given to each factor
D = total number of responses

The severity index was adopted to rank the effect of the abandoned construction projects systematically. This method is widely used in construction management to prioritise issues based on their seriousness (Sambasivan & Soon, 2007). The using of severity index provide quantifiable approach that enables transparent prioritisation and ensures that the most critical effects are highlighted for attention by policymakers and stakeholders.

FINDINGS

Respondent Demographic

Table 2: Respondents'' Demographic

Respondents Age	
18-20 years old	*10.48%*
21-30 years old	*15.24%*
31-40 years old	*17.4%*
41-50 years old	*38.10%*
50 years and above	*19.05%*
Respondents Placement	
Residential Area	*80%*
Workplace	*20%*

Based on Table 2, the highest proportion of respondents, comprising 38.10 percent (%) of the total respondents, were within the age range of 41 years old up to 50 years old. This matured age group represents the largest segment of participants in the study, indicating a significant representation of this demographic. Following that, respondents who are 50 years old and above account for 19.05 percent (%) of the total respondents. Meanwhile, Figure 5 indicates that 80 percent (%) of the respondents are residents of section 30, Shah Alam. Meanwhile, 20% of the respondents are working in that area

Table 3: Effect of abandoned construction project

Effects	**Severity Index**	**Rank**	**Grouping**
Poor quality of life	0.1881	10	Low
Injury for trespasser	0.2024	4	High
Illegal garbage dump	0.2137	1	High
Fewer improvements in nearby services and amenities	0.1917	9	Low
Economic effects	0.2012	5	Moderate
Illegal Squatting	0.1929	8	Low
Biological threats e.g. a breeding ground for mosquitoes	0.1946	6	Moderate
Illegal activities e.g., taking drugs	0.2125	2	High
Bad disfiguration of neighbourhood landscape	0.1944	7	Moderate
Wastage of land	0.2119	3	High

Findings from the analysis were tabulated in Table 3. The severity index scores were further grouped into high, moderate and low categories. These thresholds were determined by examining the spread of severity index values of high severity ≥ 0.20, moderate severity $0.194 \leq SI < 0.20$ and low severity of < 0.194. Similar methods have been used in construction management research, where indices such as severity index or relative importance index are ranked and

grouped into categories for prioritisation (Doloi et al, 2012). Abdelgawad and Fayek (2010) also emphasised the importance of translating the numerical score into qualitative levels (e.g., high, medium, low) to support decision making. Although the exact value may vary across studies, the grouping adopted here reflects both the distribution of the data and established practices in risk and impact assessment.

Ranked at no 1 with severity index value of 0.2137 is transforming into illegal garbage dump site. This effect emerged as the most critical effect likely because it leads to health issues, pollution and long-term environmental degradation. The accessibility of these sites encourages the illegal disposal of waste, posing environmental and health risks. The problem intensifies when hoarding is only partial, leaving areas uncovered an accessible to everyone. This makes it easier for residents to discard garbage into this area. A prime example is the case of Seri Kembangan, where people have been observed dumping waste at abandoned construction project (Hasbi, 2017).

Ranked second, with a severity index value of 0.2125, the abandoned construction site is becoming a hotspot for illegal activities. This effect was also highly ranked reflecting the stakeholders' concerns about safety, social wellbeing and inefficient land utilisation. An informal interview with the community revealed that the local youth utilised the abandoned site for activities such as smoking, motorcycle riding, and creating disturbance. This is consistent with Hamdan et. al., (2024) findings, where abandoned property was ranked second as an attracting crimes and illegal activities. Abandoned buildings often serve as ideal venues for drug activities, due to lack of supervision and limited visibility from public view. This aligns with Nsiah-Asamoah (2019), who found that abandoned buildings also serve as breeding grounds for illegal activities. Additionally, abandoned buildings pose a significant threat not only as venues for criminal activity but also serve as hideouts for criminals, which can lead to further abandonment to nearby properties (Addy et al., 2023).

On the other hand, wastage of land is in ranked 3rd with severity index value of 0.2119. Respondents emphasized that abandoned projects represents a major underutilised of valuable land resources. Especially in urban areas, this is seen as highly severe as land scarce contribute to economic and social development. The land occupied by abandoned projects remains unproductive and cannot be used for other purposes, such as housing, businesses, parks, or recreational facilities. This limits the potential for economic development and community. Research by Alaezi, et al., (2021), further identified the wastage of resources, with land being a significant example, as a consequence of abandoned buildings. This impact was also ranked third in their study. This is supported by Addy et al., (2023), who also highlighted that the abandonment of project results in wastage of land and resources.

The growth risk of injury for trespassers due to lack of secure fencing was ranked 4th with the severity index value of 0.2024. Safety concern was also rated highly as it increases the risks of accidents and injury. According to Zi Yi Tan et al., (2023), hoardings act as a physical barrier between the construction site and the public, preventing unauthorized access and protecting pedestrians from accidents. Based on the observation, there is no hoarding at the sides of the abandoned construction project makes it easier for trespassers to enter the abandoned area.

At the 5th place with the severity index value of 0.2012, abandoned projects can have significant negative economic impact on local communities. These projects often result in job losses for construction workers and project stakeholders, leading to decreased consumer spending and a ripple effect on local businesses. The abandonment of these projects can also indirectly impact the local economy by preventing new residents and businesses from moving to the area. This is supported with finding by Hamdan et al., (2024), who found that abandoned projects have negative effects to the government.

Ranked 6th is the biological threat, with the severity index value of 0.1946. This threat arises due to the poor drainage system, and materials that are left unused such as bucket containers and

barrels that will create stagnant water indirectly becoming mosquitoes' breeding ground. Addy et al. (2023) and Nsiah-Asamoah (2019) also highlighted this issue. Interestingly, Hamdan et al. (2024) rank this issue 15th in their study. The difference in ranking may be attributed to the distinct perspective of the study. Hamdan et al. (2024), examined the issue from the perspective of contractors while this study focused on the concerns and experiences of the surrounding community.

The effect of the bad disfiguration of the neighbourhood landscape ranked in 7th, with the severity index value of 0.1946. Overgrown plant forms the abandoned project sites blocking the roads in the neighbourhood, making it look messy and unsafe. This makes surrounding community insecure and projects negative image to the outsiders. Studies by Addy et al. (2023), Hamdan et al. (2024) and Ariffin et al. (2018) also highlighted the effect of visual pollution due to abandoned projects.

In the 8th ranking, with the severity index value of 0.1929 is illegal squatting. Despite the project being halted for an extended period, residents report frequent sightings of individuals residing within the abandoned site. This poses a concern for the community due to uncertainty regarding the identities and activities of these occupants. Squatting in abandoned structures is not only violation of property rights but also poses significant risks to public safety and security.

Abandoned projects negatively affect the living standards, with limited improvement to nearby services (ranked 9th with severity index value of 0.1917) and poor quality of life (ranked 10th with severity index value of 0.1881). The low living standards was characterised by factors such as increased noise pollution, environmental degradation, and disrupted access to essential amenities like school, recreational facilities, healthcare, social spaces and transportation. These findings align with the observation of Addy et al. (2023) and Alaezi, et al., (2021), who also emphasize the negative impact of abandoned projects on the overall well-being and living standards of affected communities. Based on the discussion, it is obvious that respondents mainly view abandoned projects through the lens of environmental degradation, safety concerns, and economic impact while the quality of life appears to be a secondary concern.

MITIGATING THE EFFECT OF ABANDONED PROJECTS TO THE COMMUNITY

Abandoned projects can have a significant negative impact on the communities, leaving behind not just unfinished structure but also leading to blighted landscape, economic losses and decline in communities' quality of life. The ideal solution to mitigating the effect of abandoned project is to prevent abandoned project altogether, however, this is not always achievable in practice. Many studies have been conducted on mitigating the issue of abandoned project (Ariffin et al., 2018; Salam, et al., 2023; Hamdan et al., 2024; Addy et al., 2023). In contrast, limited research has focused specifically on proposing solutions to mitigate the effect of these projects on community. Therefore, six recommendations were extracted from the literature to minimise the negative impact of abandoned projects in the community. Addressing the issue of abandoned projects requires proactive and collaborative approach between government agencies, developers and local communities. Table 4 shows the findings of the recommendation to mitigate the effects of abandoned projects.

Six recommendations, identified through literature review were included in the questionnaire. Analysis of the results indicated that respondents prioritize the active roles of local authorities in addressing the issue of abandoned construction projects. For interpretive clarity, the same categorization approach was applied to both the effects and the corresponding recommendations, classified as High ($SI \geq 0.20$), Moderate ($0.194 \leq SI < 0.20$), and Low ($SI < 0.194$). This preference emphasizes the need for direct action and proactive communication strategies to raise public awareness, which was ranked as the highest priority with the severity index value of 0.2231.

According to Bernama (2023), the Malaysian government's efforts in rehabilitating 351 abandoned housing projects highlight the importance of such initiatives.

Table 4: Recommendation to mitigate the effects of abandoned projects to the community

Recommendations	Severity Index	Rank	Grouping
Demolition of the Abandoned Buildings	0.2000	4	High
Local Authorities Roles	0.2231	1	High
Redevelopment of Land	0.1905	6	Moderate
Patrolling	0.2065	3	High
Adaptive Reuse of Abandoned Buildings	0.2083	2	High
Proper Cleaning by Communities/ Local Authorities	0.1917	5	Moderate

Adaptive reuse of abandoned buildings, such as transforming them into community-beneficial projects, is ranked 2nd with a severity index value of 0.2083. Bassal et al (2022) stated that the repurposing of abandoned buildings represents a huge potential for developing more liveable cities. This aligns with his study where most respondents acknowledged that adaptive reuse of abandoned buildings present numerous benefits and contribute significantly to economic, social, environmental and cultural sustainability (Bassal et al., 2022). One notable example is the High Line Park in New York City, showcasing the potential for revitalization and sustainability through adaptive reuse (NYC Parks, 2023). In making this approach applicable in practice, Ghosn (2022) developed a s et of design approach that can be effectively applied in the revival of abandoned buildings.

Ranked in the 3rd place withs severity index value of 0.2065 is patrolling by police, with an aim to create safer environment for the community. This is supported by research from Braga et al (2019) and Halford (2023), which found that increase police patrols in hotspot areas resulted in a decrease in crime incidents. Conversely, Barnes et al (2022) found an increase in crime rates in areas where routine patrols were discontinued for four days, highlighting the importance of consistent police presence.

To mitigate the effect on abandoned projects to the community, demolition of the abandoned buildings ranked 4th, with a severity index value of 0.2000. Demolition is one of the way to eliminate safety hazards such as structural instability, fire risks, and exposure to hazardous materials. Furthermore, it can also remove breeding grounds for pests and potential shelters for criminal activity indirectly improving public safety and health. According to Md Dahlan (2024), demolishing abandoned buildings will revitalising urban landscape and maximising the land use.

Community and authority-led cleaning efforts rank 5th, with a severity index value of 0.1917. This indicates the underlining importance of environmental care and aesthetic improvements. This can significantly reduce the negative impacts of abandoned construction projects by clearing debris, overgrown vegetation, and graffiti transforming the eyesore into a more manageable space, enhancing the neighbourhood's overall appearance, and promoting a nice landscape view. Proper cleaning also can help reduce the breeding grounds for mosquitoes that lead to dengue fever.

The least favourable action to mitigate the abandoned projects is redevelopment of land (ranked 6th) with a severity index value of 0.1905. This shows that surrounding communities fear of the new project being abandoned again, which will repeat the cycle of financial loss and community disruption. Furthermore, communities would prefer alternative land use like public park, community centre, that will give benefits to the community over the perceived risks of private development.

CONCLUSION

This research clearly shows that people in the community strongly agree about the negative effect of abandoned projects to their neighbourhood. One major concern is that these sites turn into illegal dumping ground, which will affect the environment and people's health. Additional concern includes the potential for these sites to become hubs for illegal activities, land wastage, injuries to trespassers and various economic consequences, such as job losses and decreased consumer spending.

The community view these abandoned projects as more than mere eyesores; they represent miss opportunities for enhancing community services and amenities. This neglect can contribute sedentary lifestyles, mental health issues, and reduced quality of life. While economic repercussions are acknowledged, the primary focus of community concern lies in the environmental degradation and safety hazards associated with these abandoned projects.

The research findings indicate a strong desire for local authorities to take proactive measure in addressing the issue of abandoned construction projects. Community members expressed a preference for government-led initiatives aimed at managing and repurposing these sites. This emphasis on adaptive reuse suggests a desire for sustainable solutions that benefit both the community and the environment.

While community policing and demolition were acknowledged as necessary measures, they were less favoured, indicating a nuanced understanding of the issue beyond immediate safety concerns. The least popular option, large-scale land redevelopment, reflects apprehensions about the potential negative impacts such projects could have to community.

This research underscores the urgent need for local authorities to take proactive action and implement strategies to address the challenges posed by abandoned construction projects. A collaborative approach that prioritises community needs and sustainable solutions is crucial for mitigating the negative impacts of these projects and creating a more resilient and vibrant community.

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