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Managing Quality in Construction: Exploring Challenges through Project Quality Plan (PQP) Implementation of the Klang Valley Mass Rapid Transit (KVMRT) Project

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Abstract: The implementation of a Project Quality Plan (PQP) is often deemed a prerequisite in ensuring effective quality management in construction projects. However, issues related to quality persist despite its implementation. Hence, this study aims to investigate quality management challenges in constructions by emphasising obstacles in PQP implementation. Through a thorough exploration drawn from real-world experiences, the factors that hinder effective PQP applications were identified and analysed. Qualitative research methods were first employed, beginning with an extensive literature review to define the key conceptual elements of the project implementation process. Subsequently, face-to-face and phone/online interviews were conducted with quality managers that were subject matter experts to validate the identified elements. The data analysis utilised the ATLAS.ti software and followed by a multi-level thematic analysis process. Four key inhibiting factors of PQP implementation and quality management in a construction project were identified: (1) Inadequate exposure to PQP, (2) Vague process for operationalising PQP, (3) Lack of management commitment, and (4) Communication issues. These elements can offer actionable insights to practitioners to enhance project quality and contribute in the academic field by both increasing theoretical understanding and advancing practical project management activities. While the findings are limited to building construction and infrastructure works within the developing construction industry, such as Malaysia, this research provides valuable recommendations to guide practitioners in enhancing project quality and contributing to improvements in both theoretical understanding and practical project management activities.

Keywords: Managing quality, Project Quality Plan (PQP) implementation, challenges

Introduction

Infrastructure projects are essentially important as they serve the interests of communities and nations. Quality management plays a crucial role in ensuring that construction projects adhere to the highest standards (Abubakar et al., 2023; Ribah & Singh, 2023; Salvi & Kerkar, 2020). The implementation of project quality plans (PQPs) has emerged as a fundamental requirement for effective quality management in current construction practices. However, notwithstanding the steps made in this direction, quality issues persist, as indicated by Azmi et al. (2022), Bhonde & Shaikh, (2015), Othman et al. (2018) and Razak et al. (2017). Therefore, an in-depth exploration of the field of quality management in the construction industry is needed that focuses especially on the ongoing challenges despite the existence of PQPs.

The Malaysian construction industry has engaged in intensive efforts to address quality issues, as evidenced by initiatives such as the Construction Industry Master Programme (CIMP) 2006-2015 and the Construction Industry Transformation Programme (CITP) 2016-2020 (CIDB Malaysia, 2018, 2019). However, the challenge to ensure consistent and high-quality outcomes in construction projects has persisted. Malaysia's ongoing commitment to transformation through programs such as the Dasar Pembinaan Negara (2021-2030) and the Construction 4.0 Strategic Plan emphasises the industry's dedication to continual improvement (Revolution, 2021).

Realising the importance of PQP within Quality Management Systems (QMS) to maintain quality on-site, significant efforts have been exerted within the industry to integrate the use of international standards. For instance, Shengeza (2017) highlighted initiatives aimed at bridging gaps in project quality management, which urged contractors to obtain certification from the International Standards Organization (ISO) and gain experience in QMS implementation to secure project awards. The Klang Valley Mass Rapid Transit (KVMRT) project, where PQP was mandated as a project prerequisite, stands as a relevant case study for this investigation. The emphasis on compliance in the KVMRT project, which led to the establishment of ISO and QMS compliance, was implemented through PQP as a prerequisite for contractors competing for project awards (SPAD, 2011).

The KVMRT project, recognised as a benchmark in the construction industry, strategically positioned itself through a thorough pre-qualification process aligned with ISO certification, demonstrating a strong commitment to high-quality standards. Despite the comprehensive implementation of the PQP, carefully designed to ensure compliance with strict quality standards, the project faced unexpected challenges during the construction phase. The emergence of non-compliance cases during this phase revealed a significant reality: an ongoing and challenging task in maintaining the desired construction quality (Azmi et al., 2022).

Despite the proactive actions taken and the initial positive feedback received upon their implementation, persistent issues concerning project quality had re-emerged in project execution (Azmi et al., 2022; Razak et al., 2017). This study thus aims to discover the factors hindering effective quality management, even in the presence of PQPs using feedback from experienced professionals through semi-structured interviews. This is followed by a section discussing the critical challenges hindering the effective implementation of the PQP within the construction industry and finally, the conclusion section summarises the significant findings of this exploratory study.

Literature Review

Quality Issues in Malaysian Construction Projects

The construction industry in Malaysia, which has experienced a significant spike in projects during the 1980s, has struggled to maintain quality standards. The current phase of economic growth-driven construction expansion has frequently overtaken technological developments and workforce development (Hamid et al., 2021; Othman et al., 2020). Remarkable events, such as water leaks and structural failures, serve as harsh reminders of the complicated challenges the industry faces (Azmi et al., 2023; CIDB Malaysia, 2020; Hannah, 2020; Isa et al., 2012; Janipha & Ismail, 2013; Sohimi, Affandi, Hassan, et al., 2018; Sujata, 2007; Then, 2018).

The seriousness of quality difficulties in this scenario is further complicated by an extensive list of factors including the reliance on inexpensive imported labor, industry resistance to embracing technology, insufficient training, a decline in local labor availability, and the migration of skilled workers abroad. Addressing these multifaceted challenges requires a systematic approach that recognises the involved connections between labor, technology, training, and workforce mobility (Hamid et al., 2019; Sohimi, Affandi, Hassan, et al., 2018; Vidosav et al., 2015). Hence, it is clear that quality management is essential to overcome these obstacles. Initiatives to raise the quality of construction include the 1994 founding of the Construction Industry Development Board (CIDB), which demonstrated the industry's commitment to change. Nevertheless, difficulties still exist despite advancements in industry-wide reforms, staff training, and technology use (CIDB Malaysia, 2015).

One notable outcome of CIDB's proactive approach was the establishment of Akademi Binaan Malaysia (ABM), a pivotal institution that focuses on the training and upskilling of young local

construction workers. The introduction of the Continuing Professional Development (CPD) training further emphasised ongoing professional development to ensure that contractors remain abreast of evolving industry standards and best (Yaman et al., 2015).

In addition to workforce development, CIDB formulated the National Occupancy Skills Standards (NOSS) and Construction Industry Competency Standards (CICS) to set standardised benchmarks for individual proficiency within the construction sector. These initiatives aimed to enhance the skills and competencies of workers and contribute to a more skilled and proficient workforce in the industry (CIDB Malaysia, 2019).

CIDB's commitment to innovation was evident in its introduction of advanced construction techniques. Examples include the integration of the Industrialised Building Systems (IBS) and Building Information Modelling (BIM) that showcases a forward-thinking approach to modernise construction practices and promote higher quality standards (Jusoh & Mohd Yatim, 2012; Mohd Fateh & Mohammad, 2017; Musa, 2019). The implementation of the Quality Assessment System in Construction (QLASSIC) further underscored the commitment to quality in providing a third-party quality audit system for large government projects (Che Ali, 2014; CIDB Malaysia, 2020; Zahrizan et al., 2023).

Significance of ISO, QMS and PQP in Construction

The PQP is an integral document that is deeply embedded in the principles of ISO's QMS that holds paramount significance in ensuring project-level quality assurance within the construction industry (Bhonde & Shaikh, 2015; Razak et al., 2017). Originating from the strict standards of ISO 9000, the ISO 9000, PQP is precisely aligned with the stringent requirements outlined in ISO 9001's latest edition, which exemplifies a commitment to the highest standards of quality management.

The comprehensive scope of PQP encompasses a range of key responsibilities critical to the success of a quality program at the project level. This includes the vigilant monitoring of quality control activities in ensuring the highest standards in design quality assurance and quality control, thorough adherence to project specifications and ISO standards, execution of independent material sampling, and the continuous review of project documents (Hamid et al., 2021; Mustapha et al., 2019; Sweis et al., 2019). These responsibilities collectively contribute to the establishment of a robust quality management framework that guides and governs construction projects towards successful quality outcomes.

Even though PQPs are crucial to QMS, there have been ongoing issues with their efficient use that have resulted in non-compliance, leading to a significant number of accidents in the projects (Mohd Kamar et al., 2023). This is evident in projects such as the KVMRT, where non-compliance cases have raised concerns about the efficacy of PQP procedures. The identification of these challenges emphasises the critical need for a thorough and detailed investigation into the factors that hinder the seamless implementation of PQP that ultimately affects the effective management of the construction quality.

In light of these challenges, it becomes imperative to explore avenues to refine and enhance PQP procedures. This study aimed to explore the details surrounding PQP implementation, with the goal of identifying common factors and challenges that hinder their effectiveness. By understanding the root causes of non-compliance and challenges, the research attempted to propose recommendations and solutions that can contribute to the evolution and improvement of PQP protocols. This comprehensive exploration is not only vital for the success of individual construction projects but also has the potential to inform broader industry practices to stand-in a culture of continual improvement and ensure that PQP plays a truly transformative role in elevating construction quality standards.

Methodology

This research employed a systematic methodology including several stages. As represented in the flowchart (Figure 1), the methodology progressed through data collection, data analysis, code

management and categorisation and theme establishment. Each stage was precisely designed to ensure the validity, reliability, and comprehensiveness of the research process.

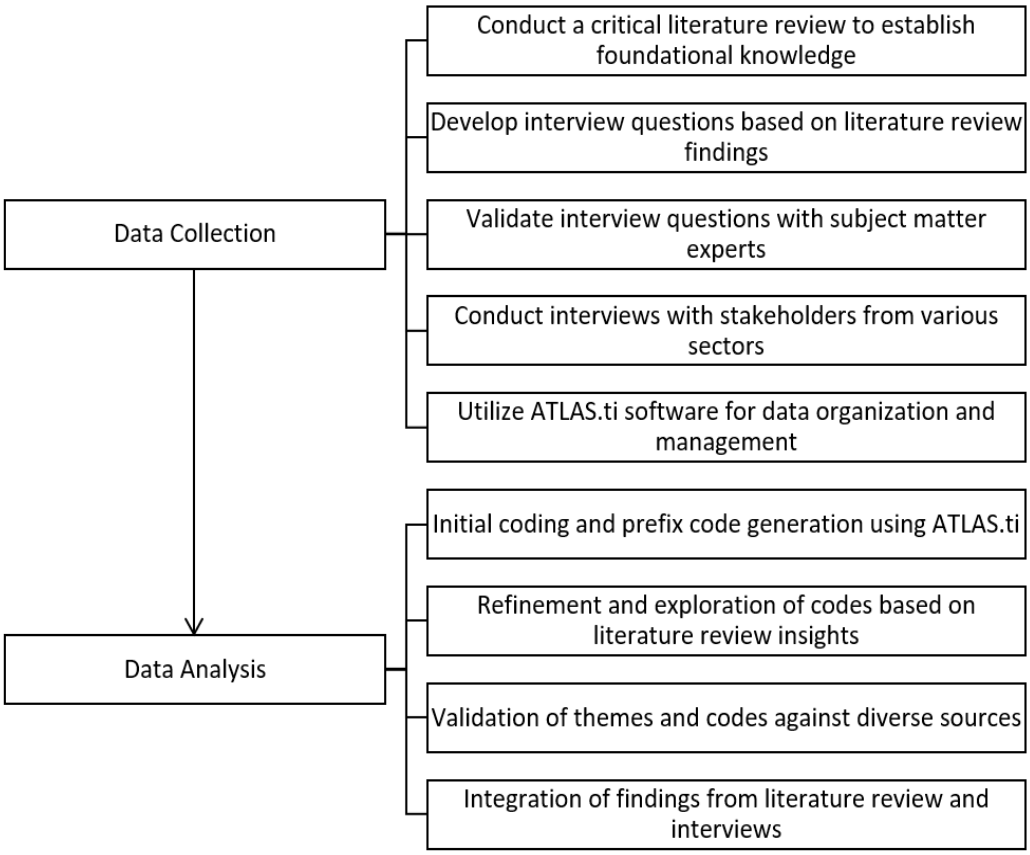

Fig. 1. Research Methodology stages

Data Collection

The qualitative research methods were employed to gain a comprehensive understanding of the factors impacting effective quality management within the project implementation process. A critical literature review was conducted to define and establish the fundamental conceptual elements of quality management in construction, focusing on the Project Quality Plan (PQP) Implementation of The Klang Valley Mass Rapid Transit (KVMRT) project. Following the review, a set of interview questions was formulated using insights from literature reviews. These questions were then subjected to validation by academic experts and practitioners with expertise in quality management. This validation process ensured that the questions were both valid and reliable for assessing the intended aspects of the project.

Data collection involved conducting interviews with stakeholders actively engaged in the KVMRT project, including individuals from the Government, Semi-Government, and Private sectors, particularly Quality Managers with over 5 years of experience in construction projects implementing ISO standards and involved in the establishment of PQP (refer to Tables 1 to 3).

Table 1. Respondents Based on Sectors

Sector	No. of Respondents	Percent
Government	2	6
Semi-Government	6	18
Private	25	76

Table 2. Respondents' Years of Experience in Construction Projects Implementing ISO Standards

No.	Years of experience	No. of Respondents	Percent
1.	Below than 5 years	0	0
2.	5 to 10 years	4	12
3.	11 to 15 years	23	70
4.	More than 15 years	6	18

Between January and February 2022, a total of 33 interviews were conducted, encompassing face-to-face, phone, and online interactions, all recorded with participants' consent. The saturation point was reached during this phase, signifying the stage where recurring themes and information no longer offered novel insights to the analysis (Creswell, 2023; O'Reilly, 2012). For further research, researchers use techniques such as triangulation or data matching to address data inconsistencies. These methods involve validating information gathered from various sources, including interviews, document reviews, and observations, ensuring the reliability and coherence of the findings.

Table 3. Respondent Based on Years of Experience in The Establishment of PQP

No.	Years of experience	No. of Respondents	Percent
1.	Below than 5 years	0	0
2.	5 to 10 years	9	27
3.	11 to 15 years	18	55
4.	More than 15 years	6	18

The collected data were organised and managed using the ATLAS.ti software, leveraged its capabilities in handling diverse data types. This software for the identification of patterns, themes, and categories within the data, contributing to a rich and well-organised dataset for further analysis.

Data Analysis

During the data analysis phase, the collected data through a series of steps using ATLAS.ti software (Mohd Noor, 2021). This phase is important for extracting meaningful insights and understanding the factors influencing quality management within construction projects. In this context, the process starting with the initial coding and code generation, the core of the research is clearly summarised, referring to an extensive literature review. This code served as the foundation for subsequent analysis, ensuring alignment with existing theoretical frameworks and empirical evidence. Through repeated refinement and exploration of codes, ATLAS.ti facilitated a systematic exploration of various factors contributing to PQP misalignment, such as organisational priorities and project requirements. Further validation of themes and codes enhances the credibility of the analysis findings, with ATLAS.ti facilitating rigorous verification of various sources, including literature reviews and interview transcriptions. Finally, the integration of insights from both literature and interviews leads to clear conclusions and action recommendations aimed at improving the effectiveness of PQP, thanks to ATLAS.ti's support in synthesising findings from various sources.

In essence, the data analysis phase, driven by ATLAS.ti, converts raw data into effective insights, driving informed decision-making in quality management within construction projects. This systematic approach, from initial coding to integration and conclusion, ensures compatibility with the existing theoretical framework while enabling the discovery of new insights. By leveraging the capabilities of ATLAS.ti, researchers can steer the various of data analysis with confidence, and eventually contributing to the advancement of knowledge in the field of construction project quality management.

Findings and Discussion

This study identified key factors that inhibited effective quality management in construction project implementation, even with the implementation of PQPs. Based on the interviews, these research findings consistently revealed persistent quality issues despite the mandatory use of a PQP in a project. Figure 2, derived from ATLAS.ti and reflecting findings from collected data, illustrates a 'Network View' that highlights the underpinning factors that have hindered effective quality management in the KVMRT project.

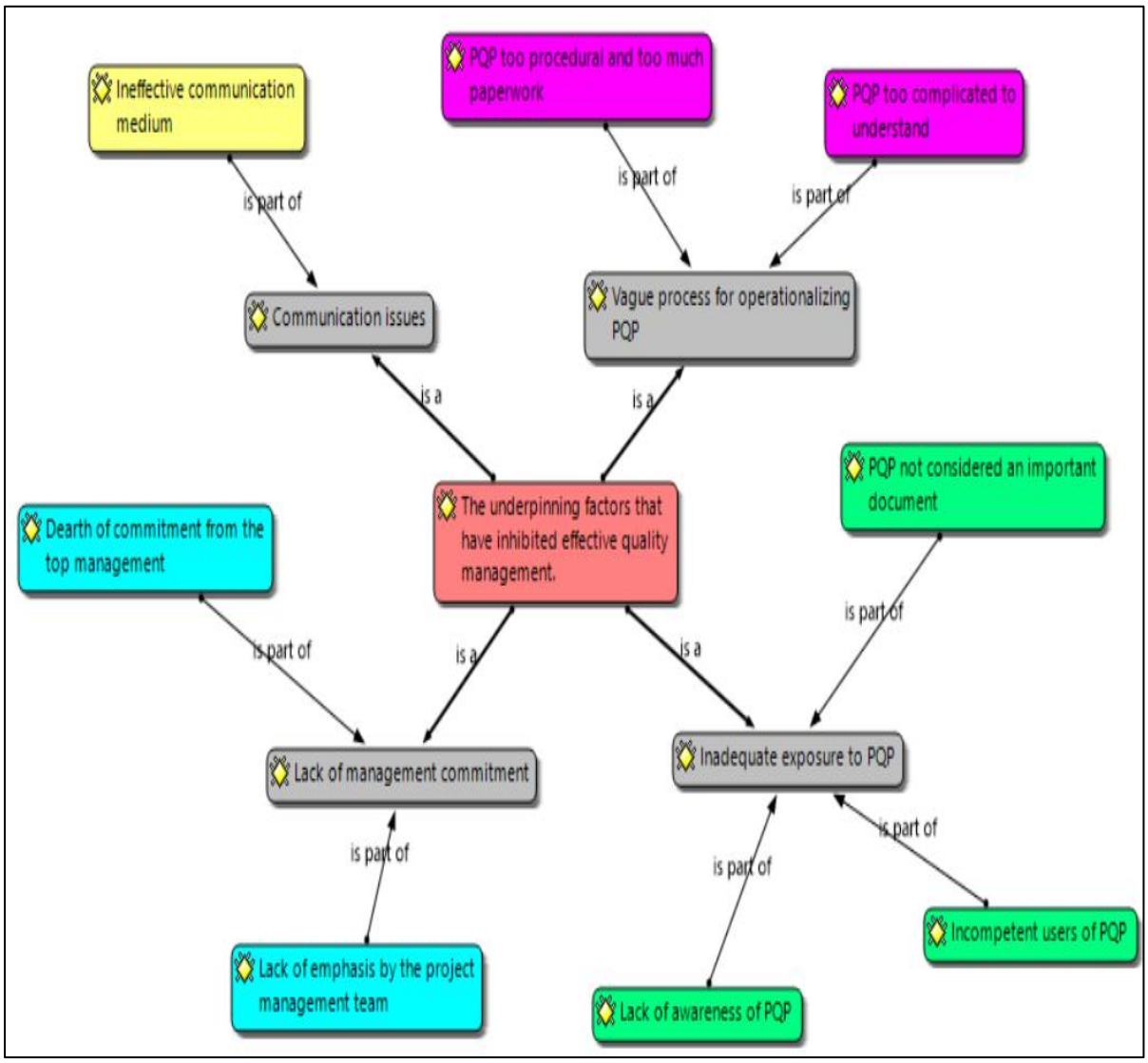

Fig. 2. 'Network view' of the underpinning factors that have inhibited effective quality management

Table 4 shows the respondents' statements that represent responses obtained through the interviews, which provide a detailed understanding of the interrelated elements influencing the dynamics of quality management within the project, as clarified in this study.

Table 4. Summary of Respondents' Statements Regarding Critical Inhibiting Factors

Factors	Coding	Respondent's Statement
Inadequate exposure to PQP	PQP not considered an important document	PQP prepared not based on project needs but more on company needs.
		A few construction teams assumed that the implementation program was not important.
		They only focused on project completion rather than the quality of the finished product.
		Insufficient emphasis from project owner.
	Lack of awareness of PQP	Lack of awareness about the importance of the quality projects and consequences of not following PQP.
		Weaknesses in how they implemented the plans.
		Lack of awareness of the content of PQP for other departments such as construction, testing, and commissioning.
		Awareness to site people.
		The lacking/no awareness of the objective of PQP.
		Lack of training.
	Incompetent users of PQP	Lack of knowledge and experience.
		Some companies do not hire competent people to lead/handle/supervise/control based on PQP.
		The executor or implementor does not understand quality planning.
Vague process for operationalising PQP	PQP too complicated to understand	People think implementing PQP is too complicated. Standards too high.
		Difficult to update or revise the whole PQP when only certain items are revised. Standard practice is for the doer to prepare & checker to check the PQP before submission.
		Project Head/Manager finally approves it. This requires a lot of time & usually works are done without the approved revised PQP.
	PQP too procedural and too much paperwork	PQP was made only as a document reference and is not utilised in actual construction on-site.
		Does not follow the procedure and not enough time to fill the form.
		No review and update on the PQP. Project people treat PQP as a paper needed to comply for project start requirement. Not to treat it as a live documentation.
Lack of management commitment	Lack of emphasis by the project management team	QMS or PQP implementation is not supported by the project team.
		It may be due to a lack of compliance with ISO 9001 among employees.
		The enforcement from the management and attitude of the personnel itself.
	Dearth of commitment from the top management	Lack of knowledge of top management.
		This shall be initiated by the top management.
		Top management.
		Top management
Communication issues	Ineffective communication medium	No enforcement by higher authority.
		Instructing workers to focus on getting quality end-product, need longer time to do work as more staff is needed.
		Ineffective communication line between team has caused the failure to educate the project teams to enforce the quality management as described in the PQP.
		The PQP implementation was not as tight as it could have been, and top management support for control is lacking.

	There may be lack of communication of PQP.
	Not following and maintaining PQP created.
	No monitoring and not taking it seriously.

This comprehensive analysis explores into the key challenges that hinder effective quality management in construction project implementation, reveals as findings from this study. Based on the tabulated information, the identified challenges were categorised into four different dimensions, each providing insights into critical inhibiting factors: inadequate exposure to PQP, vague processes for operationalising PQP, lack of management commitment, and communication issues.

Table 5 below provides a summary of percentages based on all respondents' statements gathered from the interviews.

Table 5. Percentage based on Respondent Statement

No.	Statement	No. of Respondents	Percent
1.	Inadequate exposure to PQP	13	39.4
2.	Vague process for operationalising PQP	6	18.2
3.	Lack of management commitment	7	21.2
4.	Communication issues	7	21.2

The finding highlights a significant challenge related to the inadequate exposure to the PQP, as reported by 39.4% of respondents. This issue was evident from the beginning, with some respondents failing to recognize the PQP as an essential document, as supported by Bhonde & Shaikh (2015), indicating a fundamental misconception of its significance. Additionally, there was a common lack of awareness regarding the importance of PQP implementation, compounded by the identification of incompetent users (Razak et al., 2017). Similar to the findings, Mohammed et al. (2008) mentioned that certain construction teams tended to develop PQPs based on the company's needs rather than the specific requirements of the project. Furthermore, some respondents viewed the implementation program as insignificant, as highlighted by Thorpe & Sumner (2004), where project completion was prioritised over the quality of the finished product. The challenge was further complicated by insufficient emphasis from project owners, contributing to the complexity of addressing this issue.

Next, the study indicates that 18.2% of respondents faced challenges in implementing the PQP, revealing practical difficulties in applying this quality management tool. The respondents believed that the PQP was unduly complex, with Azmi et al. (2023) pointing out certain shortcomings in terms of user-friendliness. Implementation was hindered by strict technical requirements outlined in various documents (CIDB Malaysia, 2020). Mustapha et al. (2019) suggested that the perception of excessively high expectations associated with the PQP further complicated the implementation process. Additionally, as pointed out by Azmi et al. (2023), difficulties in updating or amending the PQP, especially when making minor changes, raised concerns about its flexibility. Importance approval procedures involving the Project Head/Manager were found to be problematic, leading to work proceeding without authorised amendments to the PQP, as mentioned by (Sohimi et al., 2018). Furthermore, some respondents noted that the PQP was primarily used as a document reference and was not actively utilised on-site during construction (Mohamad Zin et al., 2009).

A substantial 21.8% of respondents identified a lack of commitment from the management as a significant hindrance to effective quality management. This issue was observed in several dimensions. Firstly, the project management team neglected to prioritise the implementation of the PQP and QMS, despite the fact that CIDB Malaysia (2020) and Othman et al. (2018) had endorsed this position. Then, as Sohimi et al. (2018) noted, a conspicuous lack of dedication from the upper management revealed an essential gap in leadership support for quality programs. According to Thorpe & Sumner (2004) and Odubiyi et al. (2019), there was also a lack of project team support for the application of QMS or PQP, which further reduced the effectiveness of these quality control methods. The participants also indicated that there may be a relationship between staff members' noncompliance with ISO 9001 and the management's level of commitment (Razak et al., 2017). The necessity for thorough commitment to quality principles throughout the organizational hierarchy was also

highlighted by (Department of Standards Malaysia, 2015), who identified enforcement from management and the general attitude of staff as key contributors to this overarching difficulty.

A total of 21.2% of respondents cited communication as a major barrier, highlighting the critical role that efficient information flow has in quality management. The obstacles in this field were complicated by the fact that enforcement by higher authorities and communication channels were viewed as ineffective, indicating systemic problems with sharing important information across the company as supported by (Meyers et al., 2012). Similar to Hassan et al. (2021), the respondents in this study stated that it can be challenging to inform employees to put quality first, which might lead to longer workdays and possible quality compromises. CIDB Malaysia (2020) emphasised that inadequate communication channels among teams can lead to an inability to adequately train project teams on the PQP, indicating a breakdown in the process of knowledge transfer. Odubiyi et al. (2019) and Zahrizan et al. (2023) pointed out that poor PQP implementation and a lack of top-level management support for control exacerbate communication issues even further. In addition to problems with non-compliance and upkeep, respondents mentioned lack of communication regarding the PQP (Azmi et al., 2023; Ne'Matullah et al., 2021). This broad issue was made more complex by the lack of monitoring and the casual attitude toward the PQP (Sahil et al., 2020), which underscored the vital necessity of effective communication techniques to guarantee the success of quality management initiatives.

The study reveals several critical challenges hindering the effective implementation of the Project Quality Plan (PQP) within the construction industry. Firstly, a notable percentage of respondents lacked adequate exposure to the PQP, indicating a fundamental misconception of its significance and a common lack of awareness regarding its importance and implementation. Practical difficulties in applying the PQP were also highlighted, attributed to its perceived complexity and rigid technical requirements, compounded by challenges in updating and amending the plan. Moreover, a significant barrier emerged from the lack of commitment from management, evident in the neglect to prioritise PQP implementation and a general gap in leadership support for quality programs. Communication issues further complicated matters, with ineffective channels hindering information flow and exacerbating problems with PQP implementation and compliance. These findings underscore the urgent need for concerted efforts to address misconceptions, streamline processes, enhance leadership commitment, and improve communication channels to ensure the successful integration of quality management practices within construction projects.

Conclusion

The results clarify four key elements that not only offer practical insights for enhancing project quality within the construction industry but also lay a groundwork for academic contributions in both theoretical understanding and practical advancements in project management. The implications of this research are significant for both construction industry and the academic community. They provide valuable insights into the fundamental factors that can hinder effective quality management during construction project execution, even when a PQP is in place. The practical significance inferred from this study is multifaceted. For instance, it reveals inadequate exposure to PQP, emphasizing the critical need for enhanced education and training programs. Addressing the issue of insufficiently informed users becomes essential in ensuring compliance and successful PQP implementation.

The identification of a vague process for operationalising PQP highlights the necessity to simplify documentation and provide clearer guidelines within project teams. Some individuals perceive PQPs as complex, highlighting the importance of adopting a more user-friendly approach. Furthermore, the research emphasises the need for firm commitment from project management teams and senior management. Prioritising QMS and PQP implementation can foster a culture of quality throughout organisations. Additionally, recognising communication issues and their impact on instructions to workers and team collaboration emphasises the need for refined communication strategies and strong enforcement mechanisms.

Moreover, these findings have significant academic implications for advancing the theoretical understanding of quality management in project implementation. Enhance understanding by identifying concrete obstacles encountered in construction projects, providing a basis for future

research and theoretical refinement. The practical challenges identified serve as a driving force for academic endeavors aimed at enhancing project management practices.

While these insights offer valuable contributions to quality management challenges in construction projects, particularly in Malaysia's developing construction industry, caution should be exercised when applying them to other industries or regions due to potential differences in conditions and dynamics. Future research efforts should aim to address these limitations and broaden the understanding of quality management in construction and related fields.

Co-Author Contribution

The authors confirmed that there is no conflict of interest in this article. Author 1 carried out the fieldwork and prepared the literature review, while Author 2 wrote the research methodology and conducted the statistical analysis and interpretation of the results. Additionally, Author 3 thoroughly reviewed the entire manuscript for accuracy and coherence.

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