UNIVERSITI TEKNOLOGI MARA

PREVENTIVE SOLUTION FRAMEWORK FOR IMPROVING FINAL ACCOUNT CLOSING IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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PREVENTIVE SOLUTION FRAMEWORK FOR IMPROVING FINAL ACCOUNT CLOSING IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

In construction projects, the final account closing process is crucial for determining the final payment owed to either the contractor or the client upon project completion. Despite its significance, the Malaysian construction industry has long struggled with prolonged and disputed final account settlements, particularly in the private sector. While previous studies have explored various problems related to final account disputes, most of this research has focused on government-funded projects and has examined problems only after disputes have already arisen. There is also a lack of comprehensive frameworks to guide industry practitioners in preventing these disputes from occurring in the first place. This research therefore aims to develop a Preventive Solution Framework for improving final account closing in the Malaysian construction industry. To achieve this, an Explanatory Sequential Mixed-Methods (ESMM) approach was adopted, combining quantitative and qualitative data collection. In the first phase, a structured questionnaire survey was distributed to clients (developers), G7 contractors, and quantity surveying firms operating in the private sector. The data were analysed using Exploratory Factor Analysis (EFA) and descriptive statistics to identify and rank the major problems contributing to final account disputes. In the second phase, semi-structured interviews were conducted with twelve experienced industry practitioners, and the findings were analysed through thematic analysis using ATLAS.ti software, to explore the root causes of these problems and identify appropriate preventive solutions. The research identified eight major problems in final account closing, along with their underlying root causes and corresponding preventive solutions. These findings were then integrated to develop the Preventive Solution Framework, which was subsequently validated through a structured questionnaire survey involving forty experienced construction professionals. The validated framework was affirmed as comprehensive, practical, and relevant to the Malaysian construction industry. This research contributes to the body of knowledge by offering the first mixed-methods approach in developing the preventive framework that addresses final account disputes specifically within private-sector construction projects in. It provides construction stakeholders with a practical reference for proactively managing final account risks, helping to improve the efficiency and timeliness of the final account closing process.

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LIST OF ABBREVIATIONS

Abbreviations

AIAC	Asian International Arbitration Centre
ANOVA	Analysis of Variance
BIM	Building Information Modelling
BQ	Bills of Quantities
BQSM	Board of Quantity Surveyors' Malaysia
CA	Contract Administrator
CAQDAS	Computer-Assisted Qualitative Data Analysis Software
CCMGD	Certificate of Completion Making Good Defects
CIDB	Construction Industry Development Board
CPC	Certificate of Practical Completion
CPD	Continuous Professional Development
DLP	Defects Liability Period
DOSM	Department of Statistics Malaysia
EFA	Exploratory Factor Analysis
ESMM	Explanatory Sequential Mixed-Methods
GDP	Gross Domestic Product
IDC	Intelligence-Design-Choice
IT	Information Technology
KMO	Kaiser-Meyer-Olkin

LAD	Liquidated Ascertain Damages
MS	Mean Score
MMR	Mixed Methods Research
NCP	National Construction Policy
PAM	Pertubuhan Arkitek Malaysia
PAF	Principal Axial Factoring
PCA	Principal Component Analysis
PWD	Public Works Department
QA/QC	Quality Assurance / Quality Control
QLASSIC	Quality Assessment System in Construction
QMS	Quality Management System
RCT	Rational Choice Theory
REHDA	Real Estate and Housing Development Association
SO	Superintending Officer
SDG	Sustainable Development Goal
SPSS	Statistical Package for the Social Sciences
TA	Thematic Analysis
VO	Variation Order

CHAPTER 1
INTRODUCTION

1.1 Introduction

This chapter presents the context and overall content of this research. It begins with an overview of the research background, leading to the identification of the research problem. Following this, the chapter outlines the primary aim of the study, articulates the research objectives, and the research questions to be answered. It then summarises the methodology adopted for data collection and analysis. Additionally, this chapter defines the scope of the research and highlights its potential contribution to existing knowledge in the field. Finally, an overview of the thesis's structure is provided to guide the reader through the subsequent chapters.

1.2 Research Background

The construction industry is one of the most significant contributors to Malaysia's economic development (Varghese, 2020), accounting for approximately 4.6% of the national Gross Domestic Product (GDP), with its value recorded at RM18.1 billion in the second quarter of 2025. The sector has shown strong momentum in recent years, recording 17.5% growth in 2024 (DOSM, 2025). Beyond its direct economic contribution, the construction industry plays a broader role in supporting other sectors by providing the physical infrastructure that enables economic activity across manufacturing, services, and other industries (Azman et al., 2013; Ilmi & Yip, 2014; Khan et al., 2014; Qabaja & Tenekeci, 2024).

Despite this growth, the Malaysian construction industry has long been troubled by disputes arising from payment problems, particularly late payments, non-payments, and delays in closing final accounts (CIDB, 2016; Judi & Mustaffa, 2023; Yong, 2018; Zulkhairi et al., 2022). The scale of this problem is well documented. In 2017, the Asian International Arbitration Centre (AIAC) recorded 932 adjudication and arbitration cases, of which 700 cases, 75% involved construction disputes, with total disputed claim values reaching RM1.38 billion. Payment-related issues were identified as the

main driver behind these disputes (AIAC, 2018). These disputes can have several impacts, including time and cost overruns, strained stakeholder relationships, reputational damage, and cash-flow disruptions (Goh et al., 2023).

One of the main issues in these disputes is the final account closing process. In simple terms, final account closing refers to the process of agreeing on and formally concluding all financial matters at the end of a construction project (Nor, 2024; Ramli, 2021). It determines the definitive amount owed to either the contractor or the client, after accounting for all contractual adjustments, variations, and retention sums (Majid, 2017; PAM, 2018). A project is generally not considered truly complete until this process has been resolved to the satisfaction of all parties (Khang & Moe, 2008; Zakaria et al., 2022).

The final account closing process involves complex procedures, including the submission of claims by the contractor, assessment and preparation by the Quantity Surveyor, and issuance of the Final Certificate by the Architect (Hisham & Othman, 2021; Ramli, 2021). Despite the contractual timelines prescribed in the standard form of building contract, the industry frequently fails to adhere to these stipulated periods, resulting in delays, disputes, and financial losses for all parties involved (Ilmi & Yip, 2014; Othman et al., 2023).

The consequences of a delayed or unresolved final account are serious for stakeholders involved. For contractors, the most immediate impact involves delayed final payments, which create significant cash flow challenges. In some instances, this situation can lead to business insolvency, especially among smaller firms (Abidoye et al., 2018; Nor et al., 2023; Romli, 2015). Clients encounter uncertainties of the project's status because an unresolved final account results in undefined total project costs and unfulfilled financial obligations (Ameyaw et al., 2015). For quantity surveying consultants, delays in final accounts can postpone their remaining professional fees (Ramli, 2021). Furthermore, unresolved final accounts indicate inadequate project management and damage the overall credibility of the construction industry (Abidoye et al., 2018; Zakaria, 2015). In the long term, this delayed settlement hampers economic activity within the sector. This ongoing issue necessitates the development of a structured preventive framework to assist industry practitioners in managing the final account closing process more effectively.

1.3 Problem Statement

The backlog in closing final accounts has been a persistent and unsatisfactory phenomenon for decades in the Malaysian construction industry, with settlements frequently dragging on for unreasonable timeframes rather than being completed promptly (Nor et al., 2023; Othman et al., 2023; Ssegawa et al., 2020). According to Ssegawa et al. (2020), 60% of construction projects within local authority governments were overdue in closing final accounts by more than one year, while 7% remained unclosed for more than three years. A recent study by Nor (2024), revealed that final account closing in public-funded projects can take as long as seven years after project completion. While previous research has identified problems with final account closing in the Malaysian construction industry, there is limited research investigating these issues specifically within private-sector projects governed by the PAM Contract 2018.

The problems that hinder the final account closing process stem from multiple sources. These can be categorised into client-related, contractor-related, management-related, contractual-related, human behaviour-related, and environmental-related factors (Ashworth, 2013; Ramli, 2021; Sing et al., 2013; Ssegawa et al., 2020; Zakaria, 2015; Zakaria et al., 2014). Within these categories, specific challenges that frequently trigger problems in final account closing include deficiencies in documentation, poor workmanship, variation orders, communication breakdowns, contractual ambiguities, lack of knowledge and expertise, and unethical practices (Ilmi & Yip, 2014; Kong & Yeow, 2016; Muhammuddin et al., 2023; Naji et al., 2020; Nor, 2024; Ssegawa et al., 2020). Despite growing concern about these issues, there is limited understanding of the major problems contributing to disputes over final account closing and their mitigation strategies in the Malaysian construction industry. Consequently, it is imperative to investigate and identify the major problems that may lead to disputes during final account closing, thereby facilitating the development of strategies to prevent these major problems and improve the final account closing process.

Disputes in final account closing cannot be entirely avoided, especially in construction projects, which are unique and dynamic due to factors such as complex design and technical requirements (Othman et al., 2023; Zakaria et al., 2013a). However, disputes in the final account can be reduced by taking a proactive approach at the early stage of the construction project and addressing problems before they escalate into disputes and affect the successful closure of the final account. Existing

literature primarily focuses on dispute resolution mechanisms rather than proactive measures aimed at preventing disputes (Matarneh, 2024). According to Judi (2020), a preventive approach is important for avoiding and addressing problems before they arise, rather than waiting or reacting after they occur. This can be achieved by understanding the root causes that contribute to the problems that eventually lead to disputes. Therefore, to minimise problems that can lead to disputes in final account closing, a preventive approach should be emphasised, making contracting parties aware of the importance of taking early action to mitigate problems, thus ensuring the successful closing of a final account without dispute and within a reasonable timeframe. This research is therefore motivated by the need to address this gap by developing a preventive framework for improving final account closing in the Malaysian construction industry.

There are also limited frameworks, guidelines and structured procedures developed globally for managing the final account closing process in the construction industry. It is essential to note that the framework, guidelines, and procedures are crucial in preventing disputes and delays in the final account (Khang & Moe, 2008; Yong & Mustaffa, 2017; Zakaria, 2015). Zakaria (2015) has developed a framework that focuses on the variables influencing the success or failure of final account closing in construction projects. Another study by Zakaria et al. (2014) has developed a computer simulation framework for improving the closing of final accounts in construction projects. As previously mentioned, it is important to identify the root causes of the major problems that could lead to disputes and resolve them at an early stage to ensure the successful closing of the final account. Therefore, this research aims to develop an appropriate framework to prevent and mitigate problems that arise during the final account closing process, thereby improving the final account closing in the Malaysian construction industry.

1.4 Research Question

i. What are the current issues related to final account closing in the Malaysian construction industry?
ii. What are the major problems in the final account closing in the Malaysian construction industry?

iii. Why do problems often occur during the final account closing process in the Malaysian construction industry?
iv. How to proactively address the major problems and their root causes in the final account process, thus improving the final account closing in the Malaysian construction industry?
v. What would be the appropriate framework for mitigating and preventing these problems towards improving final account closing in the Malaysian construction industry?

1.5 Research Aim and Objectives

This research aims to develop an appropriate framework to prevent and mitigate problems that arise during the final account closing process, thereby improving the final account closing process in the Malaysian construction industry. The developed framework will serve as a guide for construction practitioners, informing them of possible problems and their root causes during the final account closing process. This will enable them to take proactive and preventive measures, ensuring the timely and successful closing of final accounts. To achieve this aim, the following research objectives have been established:

i. To examine the current issues associated with final account closing within the Malaysian construction industry
ii. To identify and rank the major problems related to final account closing in the Malaysian construction industry
iii. To investigate the root causes contributing to the major problems of final account closing in Malaysia's construction industry
iv. To determine appropriate solutions for preventing the major problems and their root causes towards improving the final account closing in the Malaysian construction industry
v. To propose a preventive solution framework for improving final account closing within the Malaysian construction industry

1.6 Scope of Study

This research primarily focuses on private construction projects due to the significant role of the private construction sector in Malaysia, which has remained dominant for years, based on the value of awarded projects (Yong, 2018). According to statistics reported by the Department of Statistics Malaysia (DOSM), the private sector continued to be the main driver of growth in the construction industry, contributing 64.2 per cent or RM28.2 billion of the total value in the second quarter of 2025, compared to the public sector, which contributed 35.8 per cent or RM15.7 billion of the total value (DOSM, 2025). From these figures, it is further reflected that private construction projects have a significant share in the construction industry and have a higher potential for disputes to occur. Other than that, a recent study by Badroldin et al. (2016) and Judi (2020) revealed that more than fifty per cent (50%) of respondents reported that private-funded projects always cause payment problems compared to government-funded projects.

This research also focuses on a private construction project in Malaysia that uses the PAM Contract 2018 (with quantities), published by Pertubuhan Arkitek Malaysia. This is due to the widespread utilisation of the PAM Contract within the Malaysian construction industry. According to Rajoo (2010), it is estimated that ninety per cent (90%) of building contracts in the private sector are based on the PAM Contract. Yong (2018), further claimed that the PAM Contract remains the most widely used standard form of contract in private construction projects, with the majority of current managers and consultants being familiar with it.

The respondents for this research consist of key personnel from selected G7 Contractors' companies, the Client company, and Consulting Quantity Surveyor firms who have practical experience in the construction industry and are experienced in the final account stage. This is in view of the fact that the Client and Contractor are the key players (main stakeholders) in the business transaction, with a privity of contract between them in the construction industry (Judi, 2020). The Quantity Surveyor plays a crucial role in the final account process, as they are responsible for accurately measuring, valuing, and issuing the final certificate for the completed project (Nayan, 2021). The selection of G7 Contractor companies is justified by the fact that they are usually involved in large projects, employ a large number of workers, subcontractors, and suppliers, and have no limit on tender capacity (Lew et al., 2018). When a contract

is unlimited in amount and involves various types of projects, numerous factors can be explored in detail in payment and final account issues that have arisen in the Malaysian construction industry (Judi, 2020). It should also be noted that the unit of analysis in this research is the individual practitioner, not the organisation or firm. All respondents are individual professionals representing clients, G7 contractors, and Quantity Surveying firms, selected based on their direct personal experience with the final account closing process.

This research excludes Architects among the respondents and informants. Although the Architect functions as the Contract Administrator (CA) under the PAM Contract 2018 and holds exclusive authority to issue the Final Certificate (Clause 30.6, PAM 2018), the Architect's role in the final account process is primarily administrative and certifying in nature. The actual preparation, measurement, and valuation of the final account is the professional responsibility of the Quantity Surveyor, as stipulated under Section 8(1)(a) of the Quantity Surveyors Act 1967 (Nayan, 2021). The Architect's perspective on the final account process is, however, addressed through the views of Quantity Surveyors respondents, who work directly with the Architect during final account closing. This exclusion of the Architect constitutes a delimitation of the research scope, in accordance with the methodology employed in related studies (Judi, 2020; Ramli, 2021).

For data collection purposes, the respondents selected for the questionnaire survey must have at least five (5) years of working experience, as it is sufficient to represent their expertise on final account closing issues (Perera & Dewagoda, 2020; Ramli, 2021). For the semi-structured interview, the selected informants consist of experienced practitioners with more than ten (10) years of professional experience who have been involved in the preparation and valuation of final accounts. This is to ensure that the research can obtain a rich and in-depth investigation on the root causes and appropriate solutions for mitigating the problems, thereby improving the final account closing process. Furthermore, this research seeks validation of the proposed framework from the experienced professionals within the private construction sectors who have more than ten (10) years of experience and are directly involved in handling and managing the final accounts of construction projects. Consequently, suggestions for further improvement can be obtained. These selected respondents and informants were considered to possess in-depth knowledge and understanding of contract administration, particularly in the context of construction projects (Judi, 2020; Zakaria, 2015).

1.7 Significance of the Research

This research is important for gaining an understanding of the current issues pertaining to the final account closing in the Malaysian construction industry. This research is designed to investigate and identify the major problems that lead to disputes related to final account closing. Consequently, it will promote awareness and early action for more efficient and effective management of the final account closing process. This research is expected to contribute to the existing knowledge base, address existing knowledge gaps, and expand the current understanding of final account issues in construction projects in Malaysia. Furthermore, it is hoped that this research will help construction stakeholders gain insight into strategies that can improve and facilitate the successful completion of final account closing in construction projects. From an academic perspective, this study can promote communication and collaboration between academia and the construction industry in solving problems, thereby enabling in-depth discussions on the settlement of final account closing in construction projects. Therefore, clients will benefit from the participation of academia, while the industry will, in return, be able to assist the university in conducting further important research and innovation related to the successful completion of final account closing in construction projects.

This research makes a specific contribution to the body of knowledge in construction contract management by presenting an empirically derived preventive framework for final account closing designed for private-sector construction projects under the PAM Contract 2018 in Malaysia. Previous frameworks, like those created by Zakaria (2015), outlined the scope, variables, constraints, and impacts related to the final account closing process in the public sector. However, there is a dearth of research establishing a structured preventive strategy that integrates quantitative and qualitative data to identify the major problems and root causes of final account issues and to develop practical solutions early, before these problems escalate into disputes. This research applies the Intelligence-Design-Choice (IDC) Model as a theoretical foundation for developing a framework within construction contract management that has not previously been explored. These contributions ensure that the research advances both academic understanding and practical application in ways that are novel and directly relevant to the identified gaps.

This research aligns with Sustainable Development Goal (SDG) 8, which aims to promote sustainable economic growth, productive employment, and decent work for all. The efficient final account settlements create positive ripple effects throughout the construction supply chain, supporting subcontractors, suppliers, and local communities (Fateh et al., 2024). It also supports SDG 17, which focuses on enhancing implementation and revitalising the global partnership for sustainable development. Specifically, the successful closing of final accounts contributes to this goal by fostering effective collaboration and trust among key stakeholders, including clients, contractors, consultants, and regulatory bodies. Furthermore, effective management and successful closing of final accounts in the construction industry can support the National Construction Policy (NCP) 2030, particularly on Thrust 6, which emphasises "Strengthening Good Governance and Adoption of Best Practices" (CIDB, 2022). The successful closing of final accounts without any problems reflects well-structured project management practices. It indicates that a project and its costs have been closely monitored, which is a cornerstone of good governance in the construction industry. Timely closing of the final account is also in line with the “best practices” advocated by the NCP 2030, as they have fulfilled contractual obligations in construction projects. It ensures transparency and accountability in financial dealings within construction projects, thereby supporting good governance practices.

1.8 Research Methodology

An explanatory sequential mixed-methods approach is proposed for this research to gather both quantitative and qualitative data through a questionnaire survey and semi-structured interviews. This research method involves the collection and analysis of quantitative and qualitative data sequentially (Creswell & Creswell, 2018). It was conducted in stages on a specific population and sample, utilising systematic instrumentation and data collection procedures. The mixed-methods approach proposed for this research aims to identify the major problems associated with final account closing that contribute to disputes, the root causes of each major problems in final account closing, and appropriate solutions to prevent these problems and their root causes before they contribute to disputes. As illustrated in Figure 1.1, this research process consisted of four phases: Phase 1, topic and problem identification; Phase 2,

data collection; Phase 3, framework development and validation; and Phase 4, conclusion and recommendations.

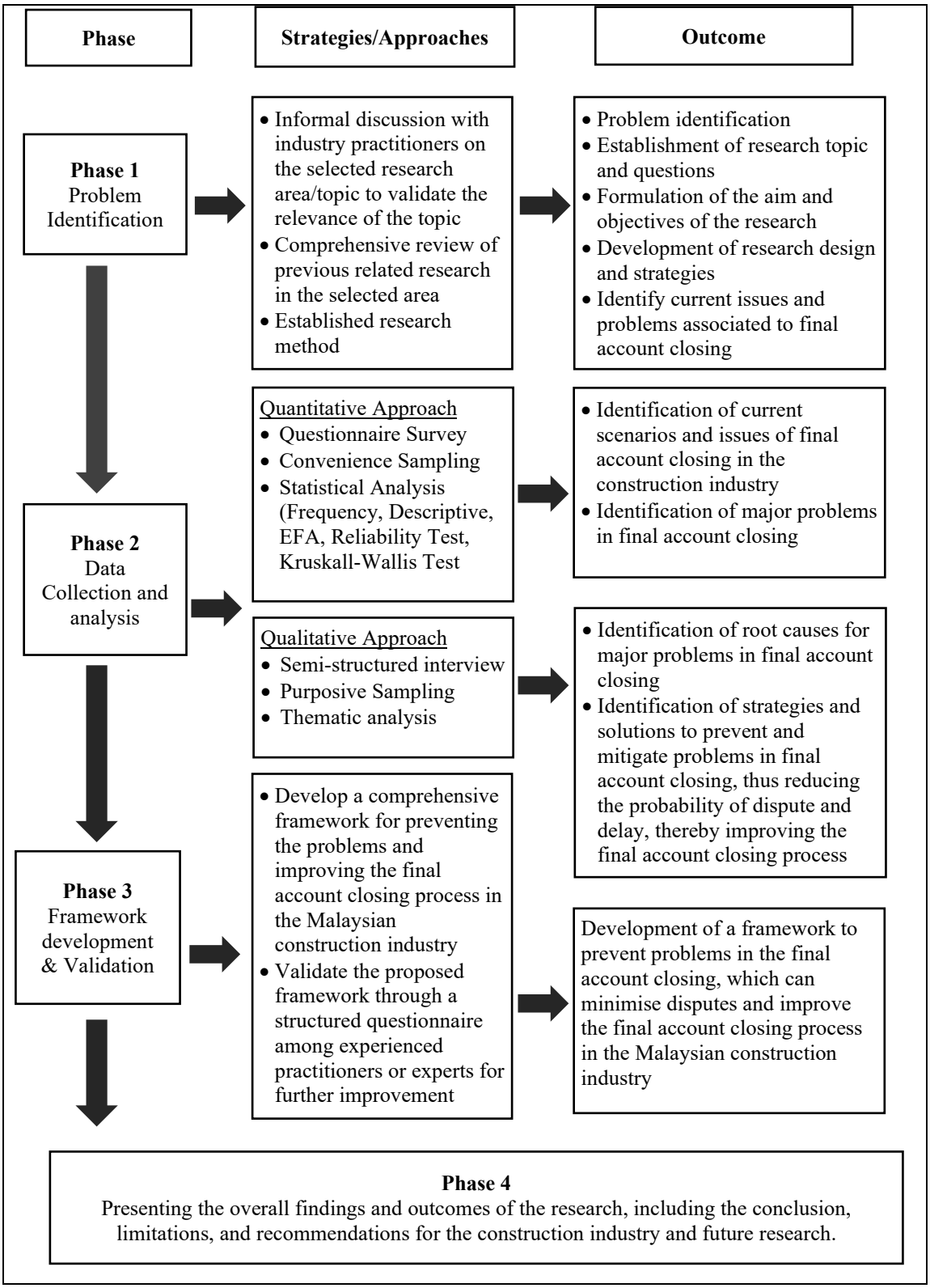


Figure 1.1 Research Process

1.8.1 Phase 1 – Topic/Problem Identification:

The initial discussion was held with industry practitioners to gain insight into the issues prevalent in the industry. Once the research area was determined, an extensive literature review was conducted to identify the gaps and narrow the scope of the study. In addition, the nature of the problem was explored and understood, and the research aim and objectives were established to provide a conceptual framework for the research. In order to thoroughly and comprehensively understand the topic, a literature review on the final account and other related topics was conducted to identify the issues and problems associated with final account. The identified problems are then used as variables in the survey questionnaire to identify major problems in final account closing disputes.

1.8.2 Phase 2 – Data Collection and Analysis:

The first stage of data collection and analysis for this research employed a quantitative method specifically designed to achieve the research objectives one and two, which are to examine the current issues and identify the major problems in the final account closing in construction projects, from the perspective of Clients, G7 Contractors, and Quantity Surveyor Consultants. The quantitative data were collected through a structured questionnaire survey distributed using convenience sampling to elicit a broad range of responses from industry stakeholders. Respondents were asked to rate each problem to indicate its significance based on the Likert scale provided in the questionnaire.

The quantitative data collected from the questionnaire survey were analysed using Statistical Package for the Social Sciences (SPSS) software. The data were tested for validity and reliability using appropriate statistical methods such as Cronbach's alpha. A descriptive analysis was conducted to examine the current scenario of final account closing in the Malaysian construction industry. The Kruskal-Wallis test was also conducted to evaluate differences in perspective among groups of respondents. In addition, an Exploratory Factor Analysis (EFA) was conducted primarily to reduce the large number of identified problems associated with the final accounts closing and to consolidate or regroup them into meaningful components for further discussion.

Furthermore, a descriptive analysis was conducted to identify the major problems in final account closing by selecting the category with the highest mean score for each.

The next phase of data collection involved qualitative research, utilising semi-structured interviews to gather detail information from selected informants about the root causes of each major problem and appropriate solutions to mitigate these problems during the final account closing. Adopting semi-structured interviews as the data collection method to achieve objectives three and four of this research is considered appropriate because they are more suitable for complex and sensitive questions, useful for collecting in-depth information, and allow questions to be explained, thereby reducing the likelihood that informants would misunderstand the questions. A thematic analysis approach was adopted to analyse interview data using Atlas.ti software to identify useful themes for root causes and preventive solutions in developing the framework components.

1.8.3 Phase 3 – Framework Development and Validation:

After interpreting and analysing the data obtained both quantitatively and qualitatively, the findings from both datasets were systematically integrated to develop a framework for preventing final account closing problems and improving the final account closing process in the Malaysian construction industry. The framework incorporates several key components based on the theory or model adopted in this research. The developed framework was then assessed and validated by several industry experts. The validation process is a crucial step that evaluates the framework's content, structure, practicality, and applicability in real-world contexts. The validation techniques used in this research utilised a structured questionnaire survey, administered to selected construction professionals and experts at senior and top management levels within the organisations of Clients, Contractors, and Consultants who are actively involved in the final account closing process of a construction project. Notably, the respondents selected for the validation of the developed framework had not participated in the previous data collection stage in order to prevent bias.

1.8.4 Phase 4 – Conclusion and Recommendation:

In this phase, the research findings are summarised and discussed their implications for the construction industry. It also highlights lessons learned, potential areas for future research, and specific recommendations for implementing the framework to improve the efficiency of final account closing processes in construction projects within the Malaysian construction industry.

1.9 Definition of Key Terms in This Research

In a construction contract, there are three terms pertinent to the final account closing, namely final account, final certificate, and final payment. These three terms are frequently used interchangeably (Zakaria et al., 2022). However, there are distinctions among them, as delineated below.

Final account is a statement of account that details all adjustments made to the original contract price to determine the actual final contract sum, and subsequently reveals the final balance of payment due to either the contractor or the client (Ismail, 2008; Majid, 2017; PAM, 2018).

Final certificate is a document issued by the Contract Administrator or Quantity Surveyor that certifies the Contractor has complied with and executed their responsibility in completing the project and remedying all defects in accordance with the contract requirements. This certificate officially specifies the final payment amount due to either the contractor or the client (Ismail, 2008; Majid, 2017; PAM, 2018).

Final payment is the ultimate payment owed either by the client to the contractor or by the contractor to the client, after all adjustments to the contract price have been calculated. The final payment concludes all financial dealings between the contractor and the client (Ismail, 2008; Majid, 2017; PAM, 2018).

Based on the title of this research, namely, the preventive solution framework for improving the final account closing in the Malaysian construction industry, several key terms are defined as outlined in the Table 1.1 below:

Table 1.1
Definition of Key Terms Used in this Research

Terms	Definition
Preventive	Refers to actions or steps taken early in the project lifecycle to identify, mitigate and address potential problems before they escalate into disputes and delays in closing the final account in the construction projects (Hayati & Latief, 2019; Muhammuddin et al., 2023)
Solution	Refers to the methods or set of actions that effectively resolve a recognised problem or challenge, bridging the gap between the current state and a desired goal state (Rahman, 2019). The solution is not merely any response, but one that is evaluated as appropriate, effective, and feasible within the constraints and criteria defined by the problem context (Heffernan & Teufel, 2018)
Final account closing	Refers to the stage at which the final account achieves its conclusive legal status, often linked directly to the issuance of the final certificate, followed by the settlement of all payments and financial transactions under the contract that satisfy the key parties and stakeholders in the construction project (Ismail, 2008; PAM, 2018; PWD, 2010).

Therefore, the final account closing in this research covers the preparation of the final account through the settlement of the final payment in the construction project.

1.10 Thesis Organisation

This thesis is organised into seven (7) chapters, comprising chapter one on the introduction, which covers the research proposal, chapter two on the literature review, chapter three focuses on the research methodology, chapters four and five reporting on the results from the two methods of data collection approaches, chapter six on the framework development and validation, while the closing chapter (chapter 7) presents the conclusion and recommendations. A summary of each chapter, which addresses specific issues, is as follows:

Chapter 1 outlines the research overview by describing the background of the research and the problem statement. It is followed by the research aim, objectives, scope of the research, and a brief description of the research methodology adopted. It also

explains the significance of the research and provides the definitions of key terms used in this research.

Chapter 2 presents a comprehensive review of the existing literature on previous and current research related to the final account and disputes in the construction industry. This chapter elaborates on the definition and importance of a final account, the parties involved, contract provisions, and the process for closing final accounts in construction projects. It also highlights the issues related to final account disputes, their causes, and their implications for the construction industry. The gist of this chapter will be a review of the issues and problems in final account closing that may lead to disputes. The identified problems will be used as the variables and tested in the quantitative research instrument. Additionally, this chapter presents the research gap, an overview of the theory underpinned in this research, and the research conceptual framework.

Chapter 3 describes the research philosophy, methodology employed in the research, strategies and approaches adopted in the data collection process, and the rationale for selecting such method and approach. This chapter clarifies the relationship between the research question, objectives, data collection method, and data analysis. Additionally, it explains the use of a mixed-method approach and provides a comprehensive overview of the research design, including the development of instruments for both quantitative and qualitative data. Furthermore, it details the framework development process and the method for validating the framework.

Chapter 4 reports on the findings obtained from a questionnaire survey that was distributed to three (3) distinguished groups of respondents, i.e. Client (developers), G7 Contractors and Quantity Surveyor Consultants. This chapter examined the current scenario of final account closing issues in the Malaysian construction industry and identified the major problems contributing to disputes in the closing of final accounts. It concludes with a summary of findings on the attainment of objectives one and two.

Chapter 5 presents the findings from the qualitative data collection approach, utilising semi-structured interviews with experienced construction professionals. The chapter provides a brief overview of the background of the selected informants and the number of interviews conducted. This chapter presents the results of the thematic analysis, which involved coding and generating themes related to the root causes and preventive solutions for major problems contributing to disputes during the final account closing, in order to achieve objectives three and four of the research.

Chapter 6 presents a compilation of findings from Chapters 4 and 5, clarifying the relationship between the findings and the research questions to develop a proposed framework. This chapter also explains the development of the framework and its implications for improving the final account closing process in the construction industry. Additionally, this chapter includes a validation process of the proposed framework, which involves a survey questionnaire conducted among experienced and expert respondents who have dealt with final account closing. Finally, this chapter explains how the framework can assist in preventing problems in the final account, thereby minimising disputes related to final account closing and ultimately improving and ensuring the timely settlement of the final account closing process in the construction industry.

Chapter 7 is the concluding chapter that summarises the findings from each method of analysis. This chapter also discusses this research's contribution to the body of knowledge and to the construction industry. The limitations of this research are acknowledged, followed by recommendations for future research to inspire other researchers.

1.11 Summary

This chapter outlines the research background and presents the problem statement concerning the final account closing in the construction industry globally and within the Malaysian context. It also formulates the specific research questions and objectives to address the identified problems and contribute meaningfully to the field of this research. Furthermore, the chapter elucidates the potential impact and significance of the research findings, highlighting their practical implications towards the Malaysian construction industry and current policies. This chapter also delineates the scopes of the study, provides an overview of the methodological approach employed, and presents a roadmap of the thesis structure to guide readers through the subsequent chapters.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the fundamental elements underpinning this research. It commences with a comprehensive review of the final account closing process in the construction industry, including definitions, the importance of final account closing, guidelines and procedures, and contractual provisions pertaining to final account closing under the PAM Contract 2018. Furthermore, this chapter critically examines the problems associated with the final account closing process that may lead to disputes, their root causes, and strategies to mitigate them. The literature review in this chapter is conducted systematically, drawing on previous empirical studies on final account closing to identify gaps in the existing research. This chapter will also elaborate on the theoretical model underpinning the study and present the conceptual framework developed to guide this study.

2.1.1 Literature Review Methodology

To ensure the literature review is comprehensive, transparent, and reproducible, the search for relevant literature was conducted systematically using a combination of narrative and structured review approaches (Snyder, 2019; Xiao & Watson, 2019). Four primary databases were used, including Scopus, Web of Science, ScienceDirect, and Google Scholar. These databases were selected because of their wide coverage of peer-reviewed work in construction management, contract administration, and the built environment (Falagas et al., 2008; Singh et al., 2021).

The search was guided by combinations of the identified keywords such as “final account in the construction industry,” “final payment,” ‘final certificate,” “disputes in closing final account,” “delay closing final accounts,” “issues and challenges in closing final account,” “construction payment,” and “payment disputes in construction projects.” These efforts resulted in the identification of 125 articles; however, only 73 articles were retained after the second stage of the screening process.

A total of 26 articles relate to issues and disputes in final accounts or final payments in the construction industry, while the remaining articles are linked to issues and disputes in the construction industry in general. Most of the articles focus on issues related to closing final accounts in Malaysia, while a small number of articles touch on issues related to closing final accounts in other countries. The inclusion criteria limited the literature to publications written in English, focused on construction contract management, published between 2010 and 2023, with seminal earlier works retained where they remained foundational to the field. A total of 218 records were initially identified, and after screening for relevance, removing duplicates, and assessing methodological quality, 152 sources were retained for synthesis. To complement these searches, manual searches were carried out on several publications from the Construction Industry Development Board (CIDB), Asian International Arbitration Centre (AIAC), Royal Institution of Surveyors Malaysia (RISM), and the Pertubuhan Akitek Malaysia (PAM).

The findings from this literature review served two related purposes. First, the identified problems became the variables tested in the quantitative questionnaire (Objectives 1 and 2). Second, the same body of literature informed the development of the interview protocol, which investigates the root causes and preventive solutions (Objectives 3 and 4) for the problems identified in the quantitative phase. Grounding the instruments in the literature in this manner ensured that both phases of the research were conceptually anchored and methodologically defensible.

2.2 Overview of Final Account in the Construction Industry

The final account in construction projects is the comprehensive compilation and calculation of all financial aspects of the works under the contract (Majid, 2014). It indicates the value of the works performed by the contractor, including all adjustments made to the original contract price to determine the final contract sum. It also shows the remaining payment to which either the contractor or the employer is entitled (Majid, 2017; Ramli, 2021; Zakaria, 2015). If the final contract sum exceeds the total amount paid to the contractor, the excess shall be paid by the employer to the contractor. Otherwise, if the amount paid to the contractor exceeds the final contract sum, the surplus shall be repaid by the contractor to the employer. Hence, the final account provides an opportunity to the Contract Administrator (CA) to make corrections and

adjustments to payments made through previous interim certificates, if necessary (Majid, 2017).

The final account is prepared upon completion of the work to show the final cost of a project, incorporating a fair valuation of the works carried out by the contractor and is often subject to audit or review (Ahzami, 2017; Garner, 2015; Hassan, 2019). The final account calculation includes various financial adjustments to the original contract sum, such as all additions and omissions resulting from variation and provisional quantities, costs related to loss and expense, provisional sum, price cost sum, liquidated and ascertained damages, client's set-off, contingency cost and any other related payment as stated in the contract (RICS, 2017; Zakaria et al., 2022).

Furthermore, the final account also represents the agreed statement of the total amount of money to be paid at the end of a building contract, normally by the employer (client) to the contractor (Abidoye et al., 2018; Hisham & Othman, 2021; Yahaya et al., 2019). Its primary purpose is to establish the definitive financial position of the project and ensure all parties reach a mutual agreement on the financial outcome (Somji, 2024).

2.2.1 Definition of Final Account Closing in the Construction Industry

Final account closing involved the process of resolving and agreeing on the final balance due under the contract through the issuance of a final certificate (Ahzami, 2017; Hassan, 2019; Ramli, 2021). Several researchers also claimed that the final account closing not only refers to the formal certification of the final account, but it must be followed by the settlement of final payments and all financial transactions in the construction (Kong & Yeow, 2016; Nor et al., 2023; Othman et al., 2023; Zakaria, 2015). In addition, Majid (2017) asserts that the final account closing is conclusive evidence that the work has been properly carried out and completed by the contractor and that the employer has made all necessary payments required by the contract. Therefore, the final payment is an integral part of the final account closing process that concludes the financial aspect of the contract (Majid, 2017; Ramli, 2021; Ssegawa et al., 2020; Zakaria, 2015).

A close reading of the literature reveals that previous researchers tend to emphasise one of two dimensions of the final account closing term. The first group focuses on the procedural act of certifying the final account through the issuance of the final certificate. The second group views final account closing as the broader settlement

of all financial obligations between the parties, which extends beyond the certification stage. Neither perspective is wrong. However, from a holistic project management perspective, and critically for the contractor's cash flow, the final account is typically only regarded as closed once the certified final payment has been made (Hassan, 2019; Kwok, 2009; Othman et al., 2025; Ramli, 2021; Zakaria, 2015). If the final payment remains outstanding, the situation reflects a delay or failure in the final account closing (Nor et al., 2023; Yahaya et al., 2019).

Therefore, in the context of this research, final account closing is defined as the certification of the final account agreed upon by contracting parties, followed by the settlement of all payment and financial transactions, which satisfies the key parties and stakeholders in the construction project.

2.2.2 The Importance of Final Account Closing in the Construction Industry

The final account closing is usually of paramount importance to both the employer and the contractor in a construction project (Ashworth, 2013). It signifies that the contractor's and the employer's obligations under the contract have already been completed, allowing the entire project documentation to be formally closed (Ssegawa et al., 2020; Zakaria et al., 2013a). Nevertheless, it is not evident that the contractor's work is perfect, as the contractor remains responsible and liable for latent defects (Ismail et al., 2008).

The successful closing of a final account is considered a key indicator of project management success (Nor, 2024; Ramli, 2021). According to Khang & Moe (2008) and Zakaria et al. (2022), a project is not considered truly complete until the final account closing is satisfactorily settled. Consequently, a failure to close the final account in a timely and satisfactory manner can signify a fundamental failure in an organisation's ability to manage the project effectively (Othman et al., 2023).

The final account closing also serves as the summary of the project's financial status, providing a detailed breakdown of all expenses incurred and payments made (Othman et al., 2023; Saipallah, 2015). The final account documentation comprises information that ensures all involved parties are informed of their financial obligations, thereby fostering trust and transparency (Othman et al., 2023). It allows the clients and contractors to understand the actual amount spent on a project, the remaining balance due, and to determine the profitability or loss of a project (Ramli, 2021).

The other important aspect of final account closing is that it provides financial stability for the contractor to recover their cash flow for future projects and business viability (Ahzami, 2017; Ramli, 2021). Delays in the settlement of final account closing can severely impact a contractor's financial position, affecting working capital, the ability to secure financing for new projects, and, in worst-case scenarios, leading to bankruptcy (Zakaria, 2015).

Furthermore, a well managed final account closing process is important for dispute avoidance. The conclusiveness of the final account means it is agreed without disputing by the contracting parties (Saipallah, 2015). It is essential for resolving or preventing disputes before they escalate to formal processes, such as mediation, arbitration, or litigation (Kong & Yeow, 2016). It provides a final opportunity for contractors to claim a reasonable and fair sum for the works undertaken, especially if claims were not assessed during the works progressed (Varley, 2021).

In addition, the successful closing of the final account has a direct impact on the reputation and future business opportunities of the involved parties. Delays and disputes in final account closing can damage the reputation of the contracting parties and even tarnish the image of the construction industry at a national level (Nor, 2024; Othman et al., 2023). A smooth and fair closing process builds trust and strengthens contractual relationships, potentially leading to future business opportunities. Conversely, a contentious process can strain relationships and make it difficult to secure future work (Rosli et al., 2022; Saberi et al., 2015).

Moreover, since the final account provides detailed information about the costs incurred during a project, this information can be used as a reference for determining the costs of similar future projects (Ssegawa et al., 2020). By analysing the final accounts, it can help identify areas where costs were higher or lower than expected and make adjustments to estimates for future projects, contributing to cost efficiency and improving construction projects (Offei-Nyako et al., 2016).

2.2.3 Main Parties Involved in Final Account Closing

The process of final account closing is recognised as a crucial, complex, and often time-consuming phase in a construction project, frequently extending beyond the period specified in the contract (Ahzami, 2017; Ilmi & Yip, 2014; Lew et al., 2013; Zakaria et al., 2014). Effective management of the final account requires the

collaborative efforts of several key parties, primarily the client, the contractor, and the consultant quantity surveyor. Each party has specific responsibilities and obligations that contribute to the successful closure of the final account. The following section examines the importance and roles of these parties throughout the project lifecycle to ensure the successful closing of the final account in the construction project.

2.2.3.1 Client

In a construction contract, the client or employer is the entity that initiates the construction process. The project life cycle begins when a client decides to initiate a project and continues through several stages, including planning and design, project implementation, progress monitoring and control, and the final account stage that follows project completion (Ramli, 2021). The client must have adequate funds and clearly define its project goals before any work can begin on the project (Majid, 2017).

In the final account closing process, the client holds responsibility for making final payments to the contractor, which determines the settlements of the final account closure of the construction project (Nor, 2024). Therefore, the final account is prepared to ensure the client is aware of the project's final amount and the balance due to the contractor, enabling the client to understand their financial commitment for the project.

For private construction projects that utilise the PAM Contract 2018, the party who normally acts as the client's representative or Contract Administrator (CA) is the Architect. Whereas, for government projects that utilise the P.W.D. Form 203A (Rev. 1/2010), the client often works through representatives of the superintending officer (S.O.) (PAM, 2018; PWD, 2010). These parties act as the client's agent while simultaneously serving as an independent and impartial certifier or decision maker to both the employer and the contractor in a construction project (Zakaria et al., 2022). Furthermore, the Architect and S.O. are also responsible for the overall supervision and direction of the works (Hassan, 2019).

2.2.3.2 Contractor

The role of the contractor in the construction contract primarily pertains to the execution, completion, and management of the works in accordance with the contract requirements, while upholding specific obligations regarding quality, compliance,

insurance, and indemnity (PAM, 2018). In the final account closing process, the contractor initiates it by preparing and submitting the comprehensive documentation required for the valuation of the final account. This submission must include full particulars of any claims supported by detailed records, such as receipts, vouchers, explanations, and calculations. This must be done within stipulated timelines, for instance, within six (6) months after the issuance of the certificate of practical completion (CPC) under the PAM Contract 2018, or not later than three (3) months after the CPC under the P.W.D. Form 203A (Rev. 1/2010) (PAM, 2018; PWD, 2010).

Furthermore, the submission of final account claim documentation must cover the works relating to nominated sub-contractors (NSC) or nominated suppliers (NS). Critically, before the final payment is released, the contractor must also provide a statutory declaration to the Architects or the S.O. confirming that all wages due to workmen and all statutory contributions, such as those for SOCSO and EPF, have been fully paid (PAM, 2018; PWD, 2010).

2.2.3.3 Consultant Quantity Surveyor

The term consultant generally refers to parties appointed by the client to design, advise, draft contract documents, and act on behalf of the client in matters involving contractors (Nor, 2024). The quantity surveyors are one of the key professionals included in the consultant team to administer the contracts, control costs, and manage financial matters within construction projects (Nayan, 2021). During the construction project, the QS generally will prepare the payment certificate, and the client's obligation to pay the contractor does not arise until the quantity surveyors has issued the payment certificate (Judi, 2020; Ramli, 2021).

In the final account closing process, the quantity surveyors plays an important role in preparing and valuing the final account (Garner, 2015). This involves calculating all adjustments to the original contract sum, which requires evaluation of all variation orders, making adjustments for price fluctuations, remeasuring any provisional quantities, and rationalising all prime cost sums and provisional sums for nominated sub-contractors and suppliers, and all other necessary evaluations for the comprehensive final account The quantity surveyors should advise the contractor to submit claim details with supporting evidence at any time, rather than waiting until project completion, to avoid delays in the final account closing stage (Ramli, 2021;

Romli, 2015). The QS also has a contractual responsibility to meet the specified deadline for the completion of the final account. Under the PAM Contract 2018, the quantity surveyors or Architect must complete and issue the final account within six (6) months after receiving all necessary documents from the contractor.

It is important to clarify the distinct functions of the Architect and the Quantity Surveyor under the PAM Contract 2018, as these are frequently conflated in practice. Clause 30.10 of the PAM Contract 2018 stated the preparation and issuance of the final account as a joint responsibility of the Architect and the Quantity Surveyor. The clause expressly states that "the Architect or Quantity Surveyor" shall complete the final account and forward it to both the Employer and the Contractor. The use of the disjunctive "or" in this clause has been interpreted in practice as a shared mandate, where the Quantity Surveyor undertakes the technical measurement, valuation, and adjustment of the contract sum, while the Architect verifies that the valuation reflects the contractual position and authorises its issuance (Hisham & Othman, 2021; Rajoo & Harbans, 2012). Both professionals are therefore jointly responsible for ensuring the accuracy and prompt issuance of the final account.

For effective final account preparation, quantity surveyors need to display specific competencies, including skills in measurement, valuation, and cost management, a good understanding of contract provisions, especially concerning variations and claims, the ability to advise on strategies to control the budget, and communicate effectively among various team members to expedite the final account closing process (Hisham & Othman, 2021). By fulfilling these responsibilities and demonstrating the required competencies, quantity surveyors contribute significantly to the successful final account closure of construction projects.

2.2.4 Contractual Provisions for Final Account Under the PAM Contract 2018

The procedural requirements for preparing, timing, and the parties' responsibilities for the final account are clearly outlined in standard contract conditions (Singh, 2003). The PAM Contract 2018 contain explicit provisions addressing these aspects. These express provisions cover the relevant conditions precedent and subsequent, the necessary procedural requirements, the obligations of the parties, the schedule in the event of default, the relevant deliverables, the required contents and

details of various documents, prevailing formalities, and collateral issues or matters (Rajoo & Harbans, 2012).

The PAM contract has been widely used in the Malaysian construction industry, and the latest revision is the PAM Contract 2018. According to Rajoo (2010), it was estimated that ninety per cent (90%) of the building contracts in the private sector are based on the PAM contract. The PAM contract is a base form where the risks are known to be local industry and intended to be used for building projects instead of a civil engineering projects (Zakaria et al., 2013c).

The PAM contract provides for the Architect to serve as the Contract Administrator (CA), while also to act as the employer's agent (Hassan, 2019). Zakaria et al. (2013a) state that under the PAM contract, the CA's duty is to issue certifications for all payments due under the contract and to certify acceptance of completed works. The CA must also provide reasonable supervision of the works to ensure that all works comply with the standard workmanship and quality specified in the contract, to enable him to issue certification that the work has been carried out satisfactorily (Rajoo & Harbans, 2012). In exercising his duty, the CA is expected to be impartial and fair to both the employer and the contractor.

The process of final account closing commences after the project completion, where the contractor is required to submit a claim to the architect within six (6) months from the issuance of the CPC. The submission must include all requisite documentation and information necessary for the CA and QS to prepare the final account. Clause 30.10 of the PAM Contract 2018 further stated that the final account must be completed within six (6) months after the CA and QS has received the necessary documents from the Contractor. The clause further provides that if the Contractor delays submitting the necessary documents to the CA and QS, the period for completing the final account will be adjusted accordingly.

The clause also states that if the Contractor fails to provide all necessary documents and information to the Architect, the final account must still be completed and issued by the CA within the period specified in the contract. In this case, the final account is prepared based solely on available information furnished by the Contractor. When the final account is completed, a copy must be sent to both the Employer and the Contractor for their agreement.

Under clause 30.10(a) of the PAM Contract 2018, both parties may contest the final account prepared by the CA and QS. If either party does not dispute the final

account within 3 months of its issuance, it is considered conclusive and agreed upon by the Employer and the Contractor. Clause 30.10 (b) further mentioned that in case of disagreement by either party to the final account, the disputing party can send a notice stating the grounds of dispute to the CA. The CA will decide whether to amend or not the final account within three (3) months after receiving the notice. Within three (3) months after receiving the decision (amended or unamended final account) by the CA, the disagreeing party may refer the dispute to arbitration. The final account is considered conclusive and agreed upon by both parties when no dispute is brought to arbitration within the stipulated three (3) months.

2.2.5 General Content of the Final Account

The final account shows the overall amount due to the contractor for the works carried out under the contract. Rajoo (2010), highlighted that the final account should consist of the following content:

i. All adjustments made to the contract sum
ii. The amounts to which the contractor is entitled under the express provisions of the contract
iii. Adjustment of prime cost sum
iv. Adjustment of provisional sums and the deduction of any provisional sums if they remain unexpended
v. Any approved set-off or contra changes, and
vi. Any adjustment for price fluctuation

Furthermore, Singh (2003) clarifies that all adjustments that the contract administrator considers should be made to the contract sum, including:

i. Value of physical work executed
ii. Item shown and separately priced in contract, e.g., preliminaries
iii. Value of material or good delivered to the site
iv. Value of unfixed material or goods prior to delivery
v. Value of variation work executed, and
vi. Value of direct loss and expense claim

Furthermore, the deduction must be taken on the following to achieve the balance of payment:

i. All previous payments paid to the contractor, nominated sub-contractor, and nominated supplier, by referring to the previous certificates of payment
ii. Amount of advanced payment paid to the contractor
iii. Liquidated ascertain damages (LAD) amount (if applicable)
iv. Defect of works (if applicable)
v. 10% surcharge for quotation (if the contractor fails to repair all defective works)
vi. Any other deductions entitled to be taken by the client under contract terms, such as any client's payment, insurance premiums, and others

Specifically, under the PAM Contract 2018, the following matters shall not be included in the final account and are intended to be resolved separately between the employer and contractor:

i. Any liquidated damages imposed by the employer for the delay in completion
ii. Any amounts related to deductions or set off made by the employer where expressly provided in the contract (e.g., costs incurred by the employer due to contractor default on minor defects)
iii. Any interest payable by either party to the other for late payments

2.2.6 Procedures of Final Account Closing in Construction Projects

In practice, the final account closing process commences after the issuance of the CPC and should be completed upon the expiry of the defect liability period (DLP) or the issuance of a certificate of completion making good defects (CCMGD) (Hassan, 2019; Zakaria, 2015; Zakaria et al., 2013a). Normally, the construction contracts provide a timeframe for a final account to be completed after the DLP. Based on the provision under clause 30.10 of the PAM Contract 2018, the period to complete the final account shall be fifteen (15) months from the date of practical completion (as illustrated in Figure 2.1).

The processes of final account generally involve three main activities, which include submission of the final account claim and documentation by the contractor, preparation and valuation of the final account by the quantity surveyor, and agreement to the final account by the client and contractor, followed by certification of the final account by the contract administrator (Hisham & Othman, 2021; Zakaria, 2015).

However, these three main processes do not determine the closing of the final account. As previously mentioned, the final payment is an integral part of the final account closing process. Therefore, the final account is successfully and appropriately closed after the settlement of all payments and financial transactions that satisfy the key parties and all stakeholders in the construction project (Majid, 2017; Othman et al., 2025; Ramli, 2021; Ssegawa et al., 2020; Zakaria, 2015).

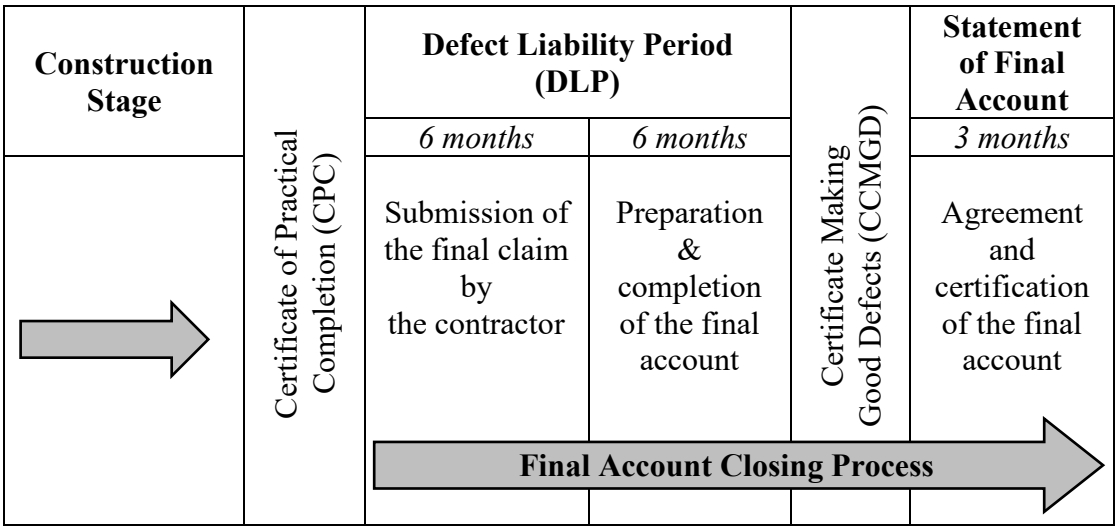
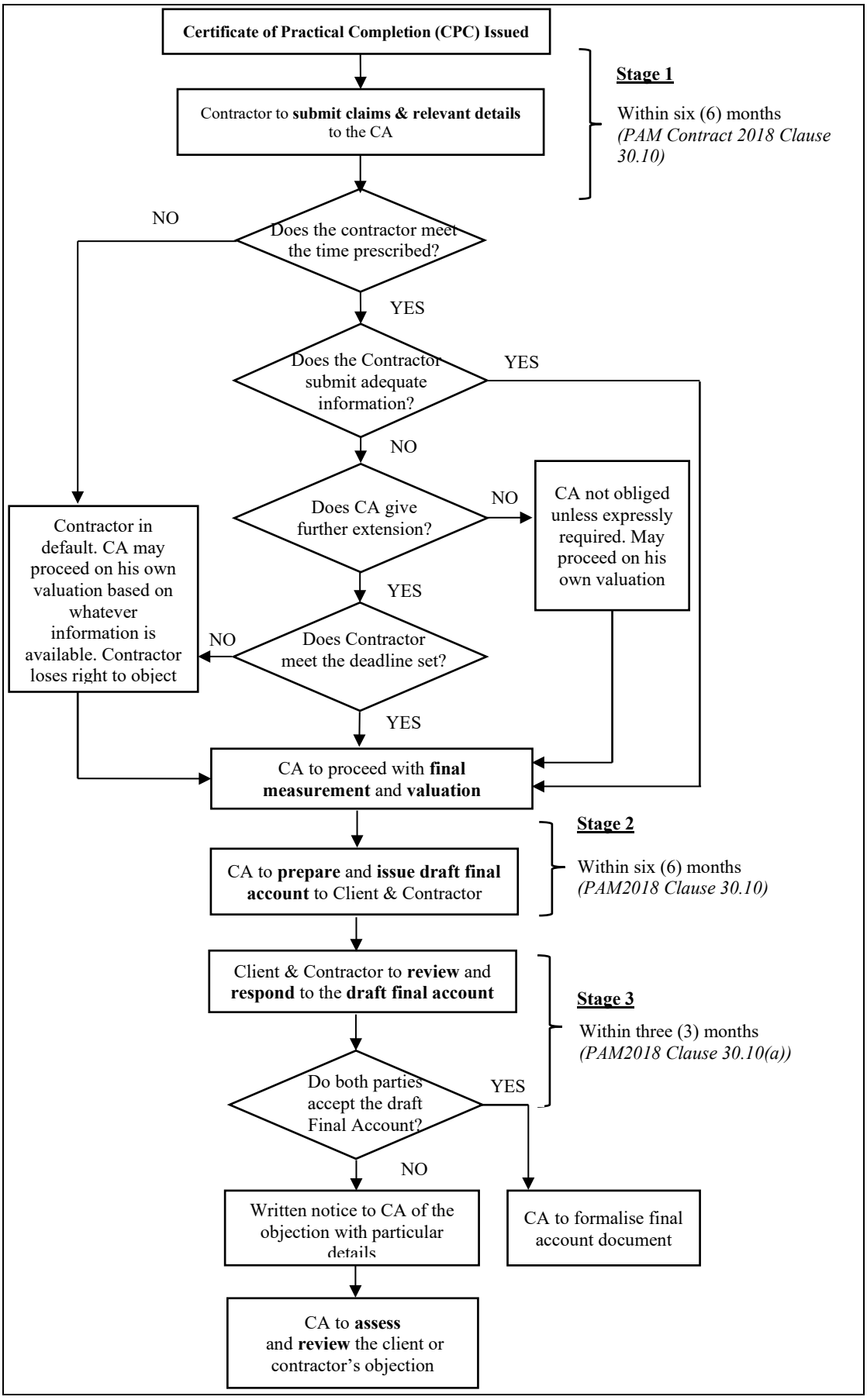


Figure 2.1 Process of the Final Account Based on the PAM Contract 2018 (with Quantities)

2.2.7 Detailed Process of Final Account Closing Based on PAM Contract 2018

The flowchart in Figure 2.2 illustrates the procedures for settling and closing the final account for a construction project under the PAM Contract 2018. It describes a step-by-step process outlining the tasks for the Contractor, Client, Architect (hereinafter referred to as the Contract Administrator), and Quantity Surveyor (QS), along with specific timeframes and actions. This process commences following the issuance of the certificate of practical completion (CPC), marking the formal end of the Contractor's physical works on site. As outlined in Figure 2.2, the final account closing procedure consists of six (6) distinct stages, each governed by specific actions and contractual timeframes as set out in clause 30.10. of the PAM Contract 2018.


Certificate of Practical Completion (CPC) Issued
Contractor to submit claims & relevant details to the CA
Stage 1
Within six (6) months
(PAM Contract 2018 Clause 30.10)
Does the contractor meet the time prescribed?
NO
YES
Does the Contractor submit adequate information?
YES
NO
Does CA give further extension?
NO
CA not obliged unless expressly required. May proceed on his own valuation
YES
Contractor in default. CA may proceed on his own valuation based on whatever information is available. Contractor loses right to object
NO
Does Contractor meet the deadline set?
YES
CA to proceed with final measurement and valuation
Stage 2
CA to prepare and issue draft final account to Client & Contractor
Within six (6) months
(PAM2018 Clause 30.10)
Client & Contractor to review and respond to the draft final account
Stage 3
Within three (3) months
(PAM2018 Clause 30.10(a))
Do both parties accept the draft Final Account?
YES
NO
Written notice to CA of the objection with particular details
CA to formalise final account document
CA to assess and review the client or contractor's objection

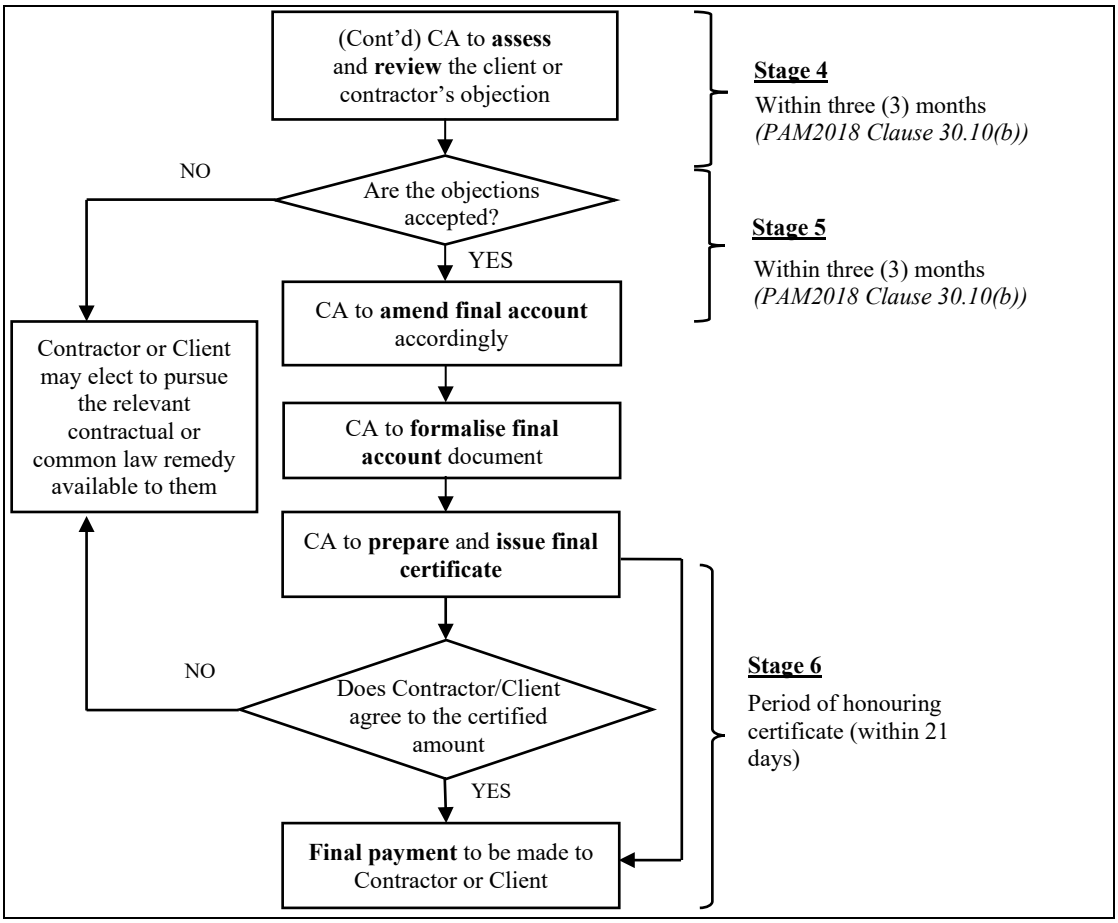


Figure 2.2 Flowchart on Procedure for Final Account Closing Process Based on PAM Contract 2018

2.2.7.1 Stage 1: Initial Submission of Final Account Claim

The process for the final account is initiated upon the issuance of the CPC, which marks that the construction works are sufficiently completed in accordance with the contract. Following this milestone, the Contractor is required to submit all outstanding claims and supporting documentation, including variation claims, loss and expense, and any other particulars, to the CA and QS. This must be done promptly within six (6) months of the CPC date as stipulated by the PAM Contract 2018 (clause 30.10).

Once the necessary information is gathered, the QS proceeds with the final measurement and valuation of the final account. If the contractor fails to meet this requirement within a reasonable timeframe and does not request or receive an extension, the CA may declare the contractor in default. In such cases, the QS are empowered to proceed with the final measurement and valuation based solely on whatever information is available, thereby extinguishing the contractor's right to subsequently dispute the

final account. This stage is foundational, as it establishes the evidentiary basis for all final account determinations.

2.2.7.2 Stage 2: Valuation, Preparation and Issuance of the Draft Final Account

Provided that the contractor's submissions are adequate, the QS undertakes the process of final measurement and valuation. This includes verifying all submitted claims, reconciling all previous payments, valuing the final work done, and calculating all adjustments made to the works to determine the final contract sum. This process must be carried out within six (6) months of the contractor's complete submission, as expressly stated in Clause 30.10 of the PAM Contract 2018:

Upon completion of valuation and preparation, the CA is required to issue a draft final account to both the client and the contractor. This draft functions as an initial final account assessment that reflects the independent evaluations conducted by the Architect and QS regarding the contractor's entitlements under the contract. The issuance of this draft not only fulfils procedural requirements but also commences a formal review process, enabling both parties, which are the client and the contractor, to scrutinise and provide feedback on the proposed final account valuations.

2.2.7.3 Stage 3: Review and Respond to the Draft Final Account

Once the draft final account has been issued, both the client and the contractor are given a period of three (3) months to review its contents and submit any objections, as stipulated by Clause 30.10(a) of PAM Contract 2018. If neither party submits a written objection within this timeframe, the draft final account shall be deemed accepted, and the Architect may proceed to finalise it based on the original valuation. In the event of an objection by either party, such objections must be submitted in writing and must include detailed supporting particulars within the subsequent three (3) months following the review of the draft final account. For those who submit valid objections within the specified period, the Architect is obligated to review the grounds of the objection and evaluate whether the claims are contractually justified. This procedural requirement enhances rigour by mandating timely and well-supported responses, thereby ensuring that all disputes are resolved within a clearly defined timeframe and under controlled circumstances.

2.2.7.4 Stage 4: Amendment and Finalisation of Final Account

If the Architect finds merit in any objections raised by either party, they are obligated to revise and finalise the final account accordingly. This process must be completed within three (3) months from the date the objection was received, in compliance with Clause 30.10(b) of PAM Contract 2018.

During this stage, the Architect revisits the relevant elements of the valuation, adjusts calculations as necessary, and incorporates corrections for errors or omissions previously identified. The resulting final account document, once amended and formalised, becomes the conclusive statement of account under the contract. The strict three (3) months timeline ensures that the resolution process remains efficient and does not unduly prolong the financial closure of the project.

2.2.7.5 Stage 5: Formalise the Final Account and Issuance of the Final Certificate

Following the finalisation of the final account, whether amended or unamended, the Architect is to issue the final certificate without undue delay. While no exact timeframe is prescribed for this issuance of the final certificate, it is expected to follow immediately upon the finalisation of the final account. The final certificate certifies the final sum due under the contract and signifies the contractual determination of all financial obligations between the parties. The final certificate facilitates the final payment to be made based on the agreed-upon final account, whether the certified sum is to be paid to the contractor or returned to the client. This stage represents the penultimate procedural act in achieving financial finality under the PAM Contract 2018.

2.2.7.6 Stage 6: Final Payment

The final stage in the final account closing process requires the certified sum to be paid within 21 days of the issuance of the final certificate. This period, often referred to as the period for honouring the certificate, ensures the enforcement of the certified amount in a timely manner. In cases where disagreement persists despite the Architect's final certification, either party retains the right to pursue available contractual or common law remedies, including adjudication or arbitration, as outlined in the broader dispute resolution framework of the PAM Contract 2018. If both parties agree to the

certified amount, the final payment is made, thereby concluding all financial obligations under the contract. It is noted that the successful closing of the final account is defined as the point at which the final payment has been paid. This final stage underscores the binding nature of the certification process while also preserving legal avenues for unresolved claims.

Overall, the PAM Contract 2018 envisages an overall timeframe of approximately fifteen (15) months from the issuance of the CPC to the formal closure of the final account, exclusive of the Defect Liability Period and any extension granted for delayed submission. This fifteen-month period comprises six (6) months for the Contractor to submit the final claim and supporting documentation, six (6) months for the Architect and QS to complete the valuation and prepare the draft final account, and three (3) months for the parties to review the draft and either accept it or raise objections. A further three (3) months may be required for the Architect to consider any objections and finalise the account, after which the final certificate is issued and the certified sum becomes payable within twenty-one (21) days. Although fifteen months may appear generous, empirical evidence consistently shows that the actual closure period extends well beyond this contractual envelope, with delays of several years frequently reported in the Malaysian construction industry (Hassan, 2019; Nor et al., 2023; Othman et al., 2023; Ramli, 2021). Understanding this gap between contractual expectation and practical reality is central to the present research.

2.3 Problems in Final Account Closing

The problems encountered during the final account closing phase of construction projects frequently escalate into disputes due to complex processes, administrative, financial, and behavioural issues. The Malaysian construction industry is facing numerous disputes related to final account closing in both government and private funded projects (Kong & Yeow, 2016; Othman et al., 2023). Previous research has highlighted a number of payment disputes in the Malaysian construction industry, as reported in relevant law journals and law reports concerning the settlement of final accounts (Hassan, 2019; Ilmi & Yip, 2014; Kong & Yeow, 2016; Ramli, 2021).

A review of cases reported in the Malayan Law Journal (MLJ), available in the LexisNexis Legal Database, reveals several final account disputes that have undergone formal court proceedings. These disputes includes, i) Contractors errors in submitting

documents and fail to provide sufficient information for final claims *(Liang Court Wanisara (Sarawak) Sdn Bhd v Mohamed Shookry Abdul Ghani & Ors [2014])*, ii) Contractor do not agree with final account valuation *(Cobrain Holdings Sdn Bhd v Perwira Bintang Holdings Sdn Bhd [2014])*, iii) Consultants delay in certifying (*Projek Penyelenggaraan Lebuhraya Berhad v Base Specialist Sdn Bhd, [2012])*, iv) Unreasonable late payments and non-payments by employers *(Ng Eng Wan trading as Pembinaan Wan Jaya v Maju Holdings Sdn Bhd [2013])*, and v) Inexperienced contractor lead to poor quality of work *(United Exploration (M) Sdn Bhd v IJM Corp Bhd, [2011]).*

Previous researchers have conducted various studies to evaluate the problems that contribute to the final account dispute. Several researchers have grouped these related problems into three categories, namely: client-related, contractor-related, and contractual-related (Ilmi & Yip, 2014; Ramli, 2021; Romli, 2015; Ssegawa et al., 2020; Yahaya et al., 2019; Zarabizan Zakaria et al., 2013). Furthermore, Ismail et al. (2014) discovered that management-related problems significantly contributed to the disputes in the final account closing. On the other hand, Hisham & Othman (2021), Ramli (2021), Romli (2015) and Ssegawa et al. (2020), have further classified the problems into human behaviour, variation, and external or environmental factors and opined that these also contributed to the final accounts closing disputes. With consideration of previous studies, this research identified seven (7) categories of final accounts closing problems, namely, client related, contractor related, contractual related, management related, variation related, human behaviour related, and external or envirobmental related, as shown in Table 2.1.

Table 2.1
Problems of Final Account Closing in Construction Projects

Categories	**Problems in Final Account Closing**	**Author**
Client related	1. Clients' disagreement on the valuation of work done 2. Clients' poor financial management and sources 3. Clients' wrongfully withholding the final payment 4. Late progress payment to the contractor 5. Clients' refusal to pay the final sum 6. Client issues additional work during DLP	(Abidoye et al., 2018; Ameyaw et al., 2015; Ilmi & Yip, 2014; Kong & Yeow, 2016; Odeyinka et al., 2011; Ramli et al., 2023; Romli, 2015; Ssegawa et

Categories	Problems in Final Account Closing	Author
		al., 2020; Yahaya et al., 2019; Zakaria, 2015)
Contractor related	7. Contractors' improper planning and management 8. Contractors' failure to follow certain procedures or guidelines in final claims 9. Contractors' failure to agree to the valuation of the final work done 10. Contractors' poor record-keeping and loss of information in supporting the final claim 11. Lack of skills and experience by the contractors 12. Contractors' delay in submitting the final claim 13. Contractors' failure to repair defective work 14. Incompetent and insufficient contractors' staff to handle the final accounts process 15. Excessive workload of the contractors' staff	(Ameyaw et al., 2015; Kong & Yeow, 2016; Odeyinka et al., 2011; Offei-Nyako et al., 2016; Romli, 2015; Ssegawa et al., 2020; Yahaya et al., 2019; Zakaria et al., 2012, 2013a, 2013b, 2014)
Contractual related	16. Ambiguity of contract terms regarding final accounts 17. Mistakes and discrepancies in contract documents 18. Non-comprehensive contractual provision pertaining to the final accounts aspect 19. Excessively complicated contract terms that the parties must comprehend	(Abidoye et al., 2018; Ilmi & Yip, 2014; Kong & Yeow, 2016; Odeyinka et al., 2011; R. A. Ramli, 2021; Romli, 2015; Zakaria et al., 2022)
Variation related	20. Cost overrun due to variations and provisional quantities 21. The provision of an insufficient allocation for contractual risks 22. Excessive variation orders that increase the final cost of construction 23. Delay in approving and finalising variation work for adjustment of contract sum 24. No written confirmation of oral instructions for variation work 25. Complexity of the process of variation claim assessment 26. Disagreement on the valuation of variation works	(Hisham & Othman, 2021; Ilmi & Yip, 2014; Kong & Yeow, 2016; Ramli, 2021; Romli, 2015; Ssegawa et al., 2020; Zakaria et al., 2012, 2014)

Categories	Problems in Final Account Closing	Author
	27. Unclear and not properly estimated Provisional Sum and Prime Cost Sum items	
Management related	28. Failure to assess and prepare the final accounts promptly 29. Delay in issuance of the final accounts certificate by the contract administrator 30. Inadequate experience of the Quantity Surveyor to handle the final account process 31. Poor communication and coordination between the consultant and other parties 32. The person in charge is retired or transferred	(Hisham & Othman, 2021; Ilmi & Yip, 2014; Kong & Yeow, 2016; Ramli, 2021; Romli, 2015; Ssegawa et al., 2020; Zakaria et al., 2012, 2022)
Human Behaviour related	33. Corrupt or fraudulent practices 34. Lack of commitment from the parties to settle the final accounts promptly 35. Attitude and culture of perceiving delays in closing final accounts as acceptable 36. Not understand the roles, duties, and responsibilities in the contract	(Odeyinka et al., 2010; Ramli, 2021; Ssegawa et al., 2020; Yahaya et al., 2019; Zakaria, 2015; Zakaria et al., 2012, 2022)
External related	37. Fluctuation of material prices 38. Inclement weather due to heavy rain and flooding 39. Changes in regulations and policies 40. Force majeure	(Ameyaw et al., 2015; Offei-Nyako et al., 2016; Ssegawa et al., 2020)

2.3.1 Client Related Problems

The role of clients in the final account process is crucial, as they are the project owners and hold significant responsibilities regarding financial matters. However, previous research identified that clients may contribute to disputes over final accounts (Kong & Yeow, 2016). A significant problem that emerges during the closing process of final accounts is when clients intentionally delay or wrongfully withhold final payment to the contractor for their own financial advantage (Ye & Rahman, 2010). According to (Poh, 2010), delaying or deferring payment of all or part of the certified payment certificate without reasonable cause is one of the major causes of disputes at various stages of construction, including the final accounts stage. Such actions can

adversely affect the contractor's cash flow and impede the overall progress of the project (Umar, 2020). Furthermore, Kong & Yeow (2016) added that there are certain circumstances in which the employer deliberately withholds payment to the contractor and delays the closing of the final accounts due to unethical practices in order to receive some gift from the contractor before releasing payment. This practice not only creates disputes but also undermines the integrity and raises ethical concerns in the construction industry.

Additionally, client disagreement on the valuation of work done is also a significant factor contributing to disputes in the closing of final accounts (Ameyaw et al., 2015; Ilmi & Yip, 2014; Ssegawa et al., 2020; Zakaria, 2015). When one party disagrees with the valuation of the work done on site, this leads to conflicts and hence disputes (Mohamad et al., 2012). If there is a disagreement about the measurement or valuation of any part of the final accounts by the quantity surveyor, the disputing party can ask the contract administrator to review and decide. If the contracting parties are dissatisfied with a decision of the contract administrator in this regard, either party may refer the matter to a dispute resolution procedure in accordance with the contract, thus prolonging the closing of final accounts (Othman et al., 2023; Zakaria, 2015).

Another significant factor contributing to disputes in the closing process of final accounts by clients is their poor financial management and limited financial resources (Ramli, 2021; Romli, 2015; Zakaria et al., 2013b). Poor financial management practices, such as inadequate budgeting or improper allocation of funds, may result in insufficient resources to complete the project as planned. Clients with limited financial resources may also have difficulties finishing the project on time, which can add to delays and disputes in the closing final accounts (Hasmori et al., 2012). Furthermore, late progress payments or interim payments, as highlighted by Hassan (2019), have a substantial impact on the closure of the final accounts. When these payments are delayed, it disrupts the contractor's cash flow, resulting in financial strain and challenges in fulfilling financial commitments to subcontractors, suppliers, and workers (Lew et al., 2013). This, in turn, would slow down the contractor's work, causing delays in the project timeline and hindering the timely completion of the final accounts (Judi & Rashid, 2010; Peters et al., 2019).

Furthermore, it has been observed that there are instances where the client has instructed the contractor to perform additional work during the Defect Liability Period (DLP) (Nor, 2024; Ssegawa et al., 2020). By right, the contractor is only obliged to

receive and carry out the instructions pertaining to rectifying the defects during the DLP. However, the assignment of additional work during the DLP may influence the final valuation of the final account and extend the completion of the DLP, thereby influencing the final account closing settlement.

2.3.2 Contractor Related Problems

Contractor related problems include their organisational approach and behaviour in managing and dealing with the final accounts in a construction project (Hassan, 2019; Kwok, 2009). Several studies have found that contractors' failure to follow certain procedures or guidelines in final claims or errors in submitting the final claim are significant contributors to disputes and delays in closing the final accounts . These errors include inadequate supporting documents for claims, incorrect calculations, incomplete submissions, and non-compliance with proper procedures (Hisham & Othman, 2021; Ilmi & Yip, 2014; Kong & Yeow, 2016; Ssegawa et al., 2020; Zakaria et al., 2012). Furthermore, studies conducted by Ramli (2021) and Zakaria (2015) discovered that poor record-keeping practices by contractors that result in a loss of information to support claims cause issues with the closing of final accounts. In such cases, contractors are required to rectify these errors and resubmit their claims, leading to further delays in the final accounts process (Zakaria et al., 2014). In addition, Judi (2020) stated that errors in pricing by contractors during the tendering stage due to a lack of experience may result in cost overruns and cause problems with the closing of final accounts.

Other study by Yahaya et al. (2019), have identified that a lack of experience among contractors can lead to delays in construction projects and contribute to disputes during final accounts. Inexperienced contractors may have difficulties estimating costs accurately, properly planning and managing projects, and adhering to the project's schedule, leading to disagreements in the final accounts (Ahzami, 2017; Saberi et al., 2015). Similarly, Kong & Yeow (2016) observed that inadequate experience among contractors may also lead to poor quality of work and failure to meet project deadlines, thus causing disputes in the settlement of final accounts.

Another significant problem contributing to disputes in the final accounts closing process is the contractors' disagreement with the valuation of the works or the certified amount determined by the quantity surveyor in the final accounts (Kong &

Yeow, 2016; Ramli, 2021; Romli, 2015; Zakaria et al., 2014). Cheung & Yiu (2006) mentioned that valuation works are always the major cause of disputes in construction, as they always involve monetary issues. The valuation work calculated by the quantity surveyor for the final accounts may lead to conflicts for the contractor due to incomplete or unavailable documents required for the preparation of the final accounts. Contractors are required to submit claims accompanied by all necessary documentation, including drawings, vouchers, rate and price information, and detailed calculations (Azman et al., 2014). These documents serve as evidence to enable the accurate preparation of the final accounts by the quantity surveyor (Hisham & Othman, 2021). However, the absence of necessary supporting documentation can impede the quantity surveyor's ability to effectively assess and value the executed and completed work by the contractor, as well as the associated expenses. This lack of accurate assessment and valuation creates fertile ground for disputes to arise during the final accounts' closure. Disagreements in the valuation of work not only lead to disputes between the contractor and the client but also to unfortunate delays in certifying the final accounts (Lew et al., 2013).

Moreover, Kwok (2009) and Ramli (2021) highlighted that the contractor's organisational structure and management can significantly affect the final account process. The burden of various tasks, including preparing the final account, falls on the existing contractor staff, indicating poor workload management. This mismanagement ultimately leads to the contractor's inability to complete the final account effectively. Insufficient or incompetent staff within a contractor's team poses a challenge in managing the complex calculations and careful documentation involved in the final account process (Hisham & Othman, 2021; Lew et al., 2013).

Furthermore, the contractor's failure to rectify the defective work during the DLP also contributes to disputes and delays in final account closing (Aryal & Dahal, 2018; Kenyatta, 2016). A defect can be defined as the completed work does not complied to the specification or fails to meet the functionality requirements set out in the contract (Lew et al., 2013). The contractor is obliged to remedy the defects at its own cost during the DLP, which is typically 12 months, unless otherwise specified (PAM, 2018). If the contractor does not fulfil this obligation, the client may refuses to agree to the final account, which delays the completion of the final account (Ramli, 2021; Romli, 2015).

Other studies identified that contractors' delays in submitting claims and necessary documents for the preparation of the final account contribute to delays and

disputes in the completion of the final account (Abdul-Rahman et al., 2014; Ramli, 2021; Samuel, 2011). Judi (2020) added that the delay in submission of claims and necessary documents by the contractor can lead to a delay in valuation and certification by the quantity surveyor, thus prolonging the final account closing process.

2.3.3 Management Related Problems

Management-related problems are generally attributable to the actions, competencies, and efficiency of the Contract Administrator (CA) or Consultant Quantity Surveyor (QS). The CA has a contractual responsibility under the contract to ensure that the date stipulated for completion of the final accounts is achieved. Similarly, the QS is responsible for accurately assessing and certifying the claims submitted by the contractor. Delays in closing the final accounts can occur when the CA and QS take longer than stipulated in the contract to certify the claim and issue the final accounts certificate (Hisham & Othman, 2021; Kong & Yeow, 2016; Romli, 2015; Ssegawa et al., 2020; Zakaria et al., 2022). When the certification process of the final claim is delayed, the contractors' cash flow is disrupted, potentially impacting their ability to meet financial obligations or continue with other projects (Ramachandra & Rotimi, 2011). This increases the likelihood of disputes and disagreements during the closing stage of final accounts.

The reason for parties at the management level not assessing and certifying the final accounts promptly usually occurs when the person in charge of the project is no longer in service with the company, is transferred, or is retired (Ahzami, 2017; Ssegawa et al., 2020; Zakaria et al., 2013a). The new person taking over the responsibilities may require time to familiarise themselves with and have different approaches to the specific requirements of the project, resulting in inconsistencies and delays in assessing and certifying the final accounts (Othman et al., 2023).

Furthermore, inadequate communication between management and other stakeholders can result in significant delays and disputes in the closure of the final account (Abidoye et al., 2018; Romli, 2015; Yahaya et al., 2019; Zakaria, 2015; Zakaria et al., 2022). Ssegawa et al. (2020) further observed that insufficient communication and coordination among stakeholders, including management, constitute a primary factor contributing to delays in final account closure for construction projects managed by local authorities. This problem contributes to the complexity of the final account

closure process, which requires the involvement of multiple parties, such as the contract administrator, consultant team, contractor, and client. Inadequate communication among these parties can impede the coordination of their activities and hinder the dissemination of essential information, potentially resulting in errors, delays, and conflicts. Therefore, it is imperative for management to establish clear communication channels, ensure the provision of timely and accurate information, and actively engage with all relevant stakeholders throughout the process of final account closure.

2.3.4 Contractual Related Problems

Contractual related problems generally refer to the stated terms and conditions and any provisions provided under the contract. Contractual issues can arise if the contractual clauses used are too complicated to be understood by the client and the contractor, especially with regard to the final accounts and payments (Kong & Yeow, 2016; Ramli, 2021; Romli, 2015; Ssegawa et al., 2020; Zakaria et al., 2013c). According to Yong (2018), complicated terms used in the contract may create misunderstandings, which can create confusion and disagreements among the contracting parties. Abidoye et al. (2018) noted that the lack of clarity in contract terms concerning the final accounts procedure plays a significant role in contributing to disputes. Ambiguities in the contract terms can lead to different interpretations and understandings among the involved parties, as they may have varying expectations from the contract agreement, which can further contribute to disputes between parties (Rosli et al., 2022). Furthermore, if one party understands the terms of the contract better than the other, this may lead to an unfair advantage or exploitation, resulting in disagreements and disputes (Othman et al., 2023). It is therefore crucial that contractual clauses are clear, concise, and easily understood by all parties to promote transparency, fairness, and effective communication throughout the project.

Inadequate contractual provisions constitute another significant issue that contributes to disputes during the settlement of final accounts in construction projects and contributes to contractual-related problems (Hisham & Othman, 2021; Ssegawa et al., 2020; Zakaria, 2015). According to Ilmi & Yip, (2014) and Kong & Yeow (2016), disputes and delays in the preparation of final accounts are often due to incomplete contract provisions and terms, particularly in relation to payments and final accounts. Both studies have observed that comprehensive coverage of contract terms is crucial to

avoiding or minimising disputes and delays. Romli (2015), meanwhile, claimed that the limited time for preparing final accounts stipulated in the contracts can create difficulties and obstacles for contractors in compiling and submitting the required documentation. Therefore, the importance of thorough and detailed contract terms in construction projects cannot be overstated, as these can significantly affect the preparation of the final accounts and lead to delays and disputes.

Furthermore, discrepancies in contract documents are a significant source of contractual-related problems in construction projects, as highlighted by Nee et al. (2014) and Zakaria (2015). These discrepancies can manifest in various forms, including incomplete drawings and specifications, missing clauses, and errors in pricing or quantities (Aryal & Dahal, 2018). Such discrepancies can lead to cost overruns that affect the project's final cost, thereby creating a conflict and causing disputes during the final account closing.

The issue of contractual fairness also creates potential for disputes and their impact on the final account. Ssegawa et al. (2020) observed that unfair contract terms, which are biased in favour of one party, can create an imbalance in the contractual relationship. This imbalance not only increases the likelihood of disputes arising during the project's execution but also complicates the process of final account closing. When one party perceives the contract terms as unfair, it can lead to disagreements over interpretations, responsibilities, and financial obligations, further exacerbating the challenges in reaching a mutually acceptable final account settlement.

Zakaria, (2015) found in his study that project cost overruns are a significant factor contributing to disputes in the final account. If the amount of the final cost is substantially higher than the contract price, this can lead to disagreements in the final account and delay the closing. According to Hisham & Othman, (2021) and Ilmi & Yip, (2014), cost overruns due to variation and provisional quantities that need to be remeasured have an impact on the completion of the final account.

2.3.5 Variation Related Problems

Variation refers to alterations or modifications made to the original scope of work, specifications, or design during construction projects. Variations are a common occurrence in construction projects (Curran, 2016). According to Romli (2015) and Zakaria (2015), variations can impact the successful closure of final accounts,

particularly in finalising the contract price upon project completion. Moreover, Ssegawa et al. (2020) noted that excessive variation orders issued for the project may lead to cost overrun in the project's final cost, resulting in disputes in the final accounts. Hisham & Othman (2021) and Ilmi & Yip (2014), also noted that cost overruns due to variations and provisional quantities can impact the completion of the final account. Cunningham (2017) observed that excessive variation can impose a significant financial burden on both the contractor and the client. Contractors may encounter difficulties in managing the additional cost associated with variations, which can lead to financial strain. Conversely, clients may contest the necessity and reasonableness of the additional costs, especially if they perceive an excessively high increase in costs.

Additionally, Zakaria et al. (2014) have identified that variations are the primary cause of disputes in the settlement of final accounts, due to the complex contractual provisions associated with the valuation method for variation claims. Although the construction contracts include specific variation clauses, disputes often occur as a result of disagreements concerning the valuation of variation works. Typically, the rates specified in the bills of quantities (BQ) serve as the basis rate for determining the value of variation works. However, from the contractor's perspective, these BQ rates are sometimes not appropriate to be used to price the variation works, especially when the variation work involves a different method that falls outside the original work scope (Ramli, 2021).

Moreover, there are instances where the approval of variation work is postponed by management or the client, even though the variation work has already been executed on site (Judi, 2020; Romli, 2015). This delay complicates the process of finalising the accounts. This situation may occur when the client is dissatisfied with the quality of the contractors' performance in executing the variation work.

Furthermore, several studies have identified that variations can also lead to disputes when instructions are communicated orally without subsequent written confirmation (Ilmi & Yip, 2014; Kong & Yeow, 2016; Romli, 2015). The contractor may lose the entitlement to claim the variation works due to insufficient evidence to substantiate the claim. Consequently, this results in disputes during the final account closing. Therefore, it is imperative that all variation orders are duly recorded and confirmed in writing when initially communicated orally.

The allocation of a provisional sum in a project may also contribute to disputes when the item is ambiguous, lacks information such as drawings and a bill of quantities,

and is not properly measured at the tender stage (Ramli, 2021). Consequently, the contractor may not properly include such items in their planning, work program, and preliminary pricing. According to Yong (2018), disputes may arise when the amount allocated for the provisional sum in the tender significantly differs from the exact expenses incurred, thereby creating a substantial variation and leading to disputes in finalising the final account.

Furthermore, the inclusion of prime cost sum items within construction contracts presents several specific problems that commonly lead to disputes and delays in the final account closing process (Judi, 2020; Zakaria et al., 2012). The prime cost sum is intended to cover works, services, materials, or goods provided by a nominated sub-contractor (NSC) or nominated supplier (NS). A primary constraint of prime cost sum contributing to final account problems is the undefined nature of the work. This lack of clarity arises because the items are not detailed at the tendering stage, meaning adequate drawings and BQ for these items have not been prepared (Ramli, 2021). The prime cost sum requires adjustment in the final account, and disputes frequently arise during the closing stage because of disagreement on the valuation of works for prime cost sum (Zakaria et al., 2014)

2.3.6 Human Related Problems

Human behaviour is related to the attitudes, motivations, interactions, and ethics of the individuals involved in the final accounts closing process. Several studies found that a lack of understanding among the parties involved in contractual obligations and responsibilities was a significant cause of disputes in the closing process of final accounts (Ramli, 2021; Ssegawa et al., 2020; Yahaya et al., 2019; Zakaria et al., 2022). When parties or individuals do not clearly understand their roles and responsibilities, it becomes difficult to manage the process of final accounts closing. This lack of clarity can lead to confusion and disagreements, as each party interprets their duties and expectations differently, thereby delaying the closing process of the final accounts (Othman et al., 2023; Zakaria, 2015).

Other issues related to human behaviour problems are corruption, which have a significant impact on disputes in the closing of final accounts (Odeyinka et al., 2011; Ssegawa et al., 2020; Zakaria et al., 2012). There are circumstances where the client deliberately withholds payment in order to receive some kind of gift from the contractor

before releasing the final payment (Ramli, 2021). These unethical behaviours often undermine the integrity and transparency required for a successful final account settlement, leading to prolonged conflicts and formal dispute resolution procedures.

Furthermore, the attitudes of parties or individuals who perceive delays in the closure of final accounts as normal and acceptable significantly contribute to disputes in this process (Ramli, 2021; Zakaria, 2015). In construction projects, certain parties or individuals may regard delays in completing and closing the final accounts as acceptable or even anticipated. Consequently, these parties may not feel compelled to proactively address issues or ensure the timely completion of final accounts.

In addition, the lack of commitment by the parties can also contribute to delays and disputes in closing the final accounts (Ilmi & Yip, 2014; Zakaria, 2015). According to Yong & Mustaffa (2017), commitment refers to the dedication and interests of all parties involved in the project, especially the support of top management in settling the final accounts without dispute. A lack of commitment can take many forms, such as the contractor's failure to provide the required documentation or information for final claim assessment, the unwillingness of the parties to negotiate in good faith, and the unwillingness to resolve issues or disagreements in final account statements in a timely manner. Therefore, it is essential for all parties to be committed to the project and collaborate to ensure a seamless process for closing the final accounts.

2.3.7 External Related Problems

External problems refer to factors beyond the control of the contracting parties to the project that can impact the final accounts process. These problems can include fluctuations in material prices in construction projects (Odeyinka et al., 2010). Offei-Nyako et al. (2016) stated that the fluctuation of prices is the main reason for cost overruns, which have a significant impact on the final accounts of a project. On the other hand, Idrees & Shafiq (2021) mentioned that cost overruns or additional costs do occur in the construction industry worldwide, and it is difficult for a project to be completed within the allocated cost budget. When the actual construction cost deviates significantly from the budgeted cost, it can put a strain on project financing and result in financial losses for both the contractor and the client (Ramachandra, 2013). These financial difficulties can also affect the quality of the work, as contractors may cut

corners to save costs, leading to disagreements in the valuation of work done and disputes in the closing of final accounts.

Other factors that can affect the smooth completion of closing final accounts are associated with force majeure and inclement weather that occur during the construction process (Offei-Nyako et al., 2016). Force majeure refers to an unexpected event that is beyond the control of the parties involved in a contract (Alshammari et al., 2017). Inclement weather, such as heavy rain, flooding, and extreme hot temperatures, is also a common cause of delays, legal claims, and economic losses in construction projects (Ballesteros-Pérez et al., 2018). In some cases, inclement weather events are considered force majeure (Chamuwange & Yan, 2022). This situation can disrupt the construction process due to interruptions in work progress, thereby delaying the closure of the final account.

In addition, Ssegawa et al. (2020) found that changes in regulations and policies that introduce new contractual obligations between the parties, such as new safety regulations, new environmental regulations, and imposed taxes, may incur additional costs for the project. As previously discussed, additional costs and cost overruns can significantly impact the project and lead to delays and disputes during the closing process for final accounts.

2.4 Root Causes of Final Account Closing Problems

The term "root causes" refers to the fundamental underlying reasons that lead to a problem or undesirable outcome (Paulsen, 2021). In addition, Rosenfeld (2013) identified root cause analysis as a problem-solving approach that uses a systematic process to identify the fundamental reasons behind problems or undesirable outcomes. This method is widely applied across various fields, including construction management, to prevent recurrence by addressing the underlying issues rather than just the symptoms (Fisher et al., 2020; Paulsen, 2021). It helps in identifying indirect and underlying sources of problems, which are significant for understanding specific incidents and preventing future occurrences (Newman, 2006; Peerally et al., 2017). In this research, understanding root causes is important for developing effective preventive solutions. While the previous section identified several problems associated with final account closing, this section examines the underlying causal factors that give rise to these problems.

2.4.1 Contractual and Procedural Ambiguities

Ambiguity in contract terms, particularly those governing the final account submission process, timelines, and the valuation methodology for variations and provisional quantities, is a significant root cause of payment disputes in construction projects (Liyanawatta et al., 2024). If the contract does not provide sufficiently detailed guidance, parties may interpret their obligations differently, leading to disagreements and bringing them to formal dispute resolution procedures (Kong & Yeow, 2016).

2.4.2 Documentation and Record Management Deficiencies

Poor documentation management is widely recognised as one of the most pervasive root causes of final account closing problems (Hisham & Othman, 2021; Ilmi & Yip, 2014). The absence of comprehensive site records, incomplete variation order documentation, missing correspondence, and the late submission of supporting documents by contractors fundamentally impede the QS's ability to prepare an accurate and timely final account (Nor et al., 2023). Inadequate documentation does not merely delay the process; it creates substantive disputes over the value of works executed, particularly where verbal instructions were issued without formal written confirmation (Abidoye et al., 2018).

2.4.3 Resource Constraints and Stakeholder Competency

Several studies attribute final account delays to a shortage of competent staff in both contractor and consultant organisations to prepare, submit and evaluate the final account within the stipulated contractual time (Hisham & Othman, 2021; Lew et al., 2013; Romli, 2015). Mirzaee & Martek (2024) added that insufficient staff and competency levels, may limit the capacity of organisations to manage the final account process effectively. The complex valuation requirements for variation works and the technical skills in preparing comprehensive final account documentation require experienced professionals, whose availability is often constrained particularly during the final account stage (Ramli, 2021)

2.4.4 Variation Order Management Deficiencies

Variation orders (VO) are among the most common sources of dispute in final accounts closing process (Othman et al., 2023). The root causes of variation-related problems include the late issuance of architect's instructions, inadequate information of variations works at the time of instruction, disputes over the scope and value of varied works, and the absence of a systematic VO tracking system (Koc & Gurgun, 2022). The failure to manage variations proactively during construction results in a substantial backlog of unresolved VO claims that accumulate to the final account stage.

2.4.5 Communication and Coordination Deficiencies

A lack of effective communication between the client, contractor, and consultant teams is a primary driver of misunderstandings and conflicts, which easily escalate into formal disputes (Ahzami, 2017; Hassan, 2019). The final account closing requires a complex process and involves multiple parties. Poor communication makes it difficult to coordinate work and share essential data, leading to errors and delays in final account closing process (Othman et al., 2023). Furthermore, ineffective communication reduces cooperation and trust, fostering an adversarial relationship among project stakeholders. This hostility makes it difficult to resolve claims amicably and increases the likelihood of litigation (Zakaria, 2015).

2.5 Impacts of Final Account Closing Problems in the Construction Industry

The problems associated with the closing of final accounts have significant financial implications, particularly for contractors, as these issues are inherently linked to payment issues, which are primary concerns within the construction industry (Ahzami, 2017; Ramli, 2021). A primary impact is on the contractor's cash flow and their capacity to secure financing, leading to financial strain (Judi, 2020; Nor, 2024). Inadequate cash flow resulting from the non-settlement or delayed settlement of the final account can jeopardise the contractor's business viability, potentially resulting in insolvency, bankruptcy, or liquidation (Nor, 2024; Ramli, 2021; Zakaria et al., 2013a).

The failure to close the final account also results in a loss of profitability for the contractor, as the final payments, which were intended to be used as working capital for

new projects, cannot be obtained, thereby causing an opportunity loss for securing new work (Othman et al., 2023; Zakaria, 2015; Zakaria et al., 2012, 2013a).

Problems in closing the final account often contribute to disputes, leading the parties resorting to formal dispute resolution procedures, such as arbitration, adjudication, or litigation, which involve a lengthy and costly process (Ahzami, 2017; Kong & Yeow, 2016; Ramli, 2021; Zakaria, 2015). These procedures are generally viewed as a last resort, used when parties fail to resolve conflicts amicably through negotiation (Kong & Yeow, 2016). When parties resort to a dispute resolution procedure, such as arbitration or litigation, the final account settlement may have to be protracted until the conclusion of the dispute (Hassan, 2019; Zakaria, 2015). In addition, the dispute resolution process may increase the financial burden for the parties involved due to additional expenses incurred during this process (Kong & Yeow, 2016). Furthermore, escalating disputes to arbitration or litigation procedures severely impacts the relationships between the contracting parties and damages the professional reputation of the organisation (Ramli, 2021; Zakaria et al., 2013a).

The unresolved final account closing in the project is also often considered not entirely successful, even though physical completion has been achieved (Ssegawa et al., 2020; Zakaria, 2015). Project success is not solely limited to physical completion, but must also take into consideration the satisfaction of all stakeholders (Othman et al., 2023). The success of a construction project is normally measured by three main objectives, known as time, cost, and quality (Hassan, 2019). If the final account remains unresolved, the cost objective is not conclusively achieved, meaning the financial aspect of the project is not accomplished (Zakaria, 2015). Moreover, the successful completion of the final account is indicative of overall project management success. If the final account is not completed, the project management process is deemed unsuccessful (Mirzaee & Martek, 2024).

2.6 Strategies for Successful Final Account Closing in Construction Projects

Final account closing is a critical phase in construction project management where all financial obligations are reconciled and settled between contracting parties. The successful closing of the final account is essential for evaluating the overall success of a construction project, encompassing both financial and managerial aspects. Nevertheless, the complexity of this process often leads to disputes and delays that can

significantly impact project success, contractor cash flow, stakeholder relationships, and industry reputation. It is imperative to review several strategies derived from previous research to develop preventive solutions that mitigate problems associated with final account closing, thereby improving the process.

2.6.1 Comprehensive Documentation and Record Keeping

Implementing comprehensive documentation and record-keeping management systems throughout the construction project lifecycle forms the foundation of project management and is essential for achieving successful project goals (Akintoye et al., 2024). The valuation of final accounts depends entirely on the timely submission and adequacy of supporting documentation for variations, claims, and other financial adjustments (Ilmi & Yip, 2014). Several previous studies highlight that inadequate record documentation is a significant barrier to final account settlement, particularly the incomplete submission of documents by the contractor (Abidoye et al., 2018; Hisham & Othman, 2021; Ilmi & Yip, 2014; Nor et al., 2023). When documentation is poor, imprecise, or lacks sufficient evidence, claims may be rejected or disapproved, prolonging the final account evaluation process and delaying closure (Ghosh & Karmakar, 2024).

To mitigate this, construction parties are urged to adopt measures such as maintaining proper documentation and improving record keeping (Nor et al., 2023; Othman et al., 2023). Proper record keeping involves documenting all project-related communications, including emails, letters, meeting minutes, and verbal discussions, and includes documents such as invoices, progress reports, site diaries, photographs, variation work orders, and records of materials used that substantiate any claims or adjustments to the contract sum (Ilmi & Yip, 2014). Furthermore, creating a centralised repository for all project documentation, whether digital or physical, ensures easy retrieval and reference during the final account closing process (Hewitt, 2020). Therefore, a systematic approach to documentation significantly reduces the likelihood of disputes arising from unclear or missing information during the final account settlement process (Hassan, 2019; Zakaria et al., 2012).

2.6.2 Contractual Clarity and Clear Procedures

Clear, comprehensive, and unambiguous contract documents are fundamental for avoiding disputes, particularly related to financial matters (E. E. Chan et al., 2021; Liyanawatta et al., 2024). Construction contracts facilitate payment processes by outlining obligations, permissions, and prohibitions for various project stakeholders and activities, which are essential for smooth financial transactions within the supply chain (Alhilli & Rezoqi, 2021; Lew et al., 2013). Previous studies have identified inadequate contract conditions as a significant factor contributing to disputes when closing final accounts, with incomplete contract terms, particularly those related to payments and final accounts, being a frequent cause of disputes and delays (Abidoye et al., 2018; Othman et al., 2023). Furthermore, ambiguity in contract terms is identified as a significant factor leading to conflicts in construction projects (Koc & Gurgun, 2022). Therefore, it is recommended that construction professionals establish clear contract terms and standardised procedures, explicitly define the final account process, including submission requirements, assessment procedures, and timelines (Rajapaksha et al., 2025; Umar & Ochigbo, 2024). This ensures that all parties understand their contractual obligations and the procedures for evaluating claims.

2.6.3 Effective Communication and Collaboration

Establishing clear communication and regular stakeholder engagement throughout the project lifecycle significantly reduces the likelihood of misunderstandings and disputes during the final account closing process. Several studies found that regular and clear communication helps avoid misunderstandings that might result in disputes (Gamage & Kumar, 2024; Rajapaksha et al., 2025; Umar & Ochigbo, 2024). Since the construction project involves several parties working together in a short timeframe, it is essential to establish clear lines of communication to manage information effectively (Khalfan et al., 2007; Subramaniam et al., 2021). Regular communication also ensures that all parties maintain a current understanding of project progress, variations, and the resolution of contractual issues and their financial implications, reducing the unexpected situations that may lead to conflicts and disputes during the final account closing process (Barnado & Karim, 2024; Umar & Ochigbo, 2024). Regular meetings among project team members are among the most

effective communication channels. Apart from that, another effective means of communication that could significantly assist project team members includes face-to-face interactions and virtual communication channels, such as telephone, email, and online meeting platforms (Yusuwan, 2016).

Moreover, effective stakeholder communication creates an environment of trust and transparency, preventing minor issues from escalating into disputes (Umar & Ochigbo, 2024). When project teams establish regular communication, they can identify potential problems early and work collaboratively to resolve them before they impact the final account. Therefore, fostering clear, good and proactive communication and cooperation among the project team and construction parties is essential to mitigate conflicts, especially related to variations and measurement issues, ensuring that the final account closing process is efficient and successful.

2.6.4 Utilisation of Digital Tools and Technology

The adoption of digital tools, software and technology systems for project management will create efficiency, enhancing transparency and reducing errors, thereby mitigating problems in final account closing (Nanayakkara et al., 2021; Umar & Ochigbo, 2024). Ghosh & Karmakar (2024) highlighted that excessive dependence on traditional or manual document management methods, such as printed paperwork and filing systems, contributes to inefficient record-keeping and inadequate documentation. Technology solutions mitigate numerous manual processes and human errors that have traditionally complicated final account preparation and negotiation. Integrated systems ensure data consistency throughout all project phases, eliminating the need for manual reconciliation of multiple data sources (Olanipekun & Sutrisna, 2021).

Real-time monitoring systems, such as Building Information Modelling (BIM), enable project teams to track costs and variations as they occur, thereby supporting the final account process and facilitating early intervention strategies (Oluwatosin, 2024; Tantawy et al., 2025). According to Khawaja & Mustapha (2021), BIM is recognised as a transformative solution capable of precisely measuring quantities and estimating costs, thereby helping reduce disputes related to payments, variation valuation, and claim assessment. Furthermore, BIM also provide a centralised information repository for records and digital documentation (Wang et al., 2023a).

Technology also facilitates collaboration by providing shared access to project information and creating audit trails that support transparent decision-making (Ghosh & Karmakar, 2024; Umar & Ochigbo, 2024). This digital and technological approach overcomes conventional drawbacks, such as the labour-intensive nature of manual data input and retrieval, which often results in insufficient evidence for claim approval (Ghosh & Karmakar, 2024).

2.6.5 Prioritising Staff Competency and Human Resources Continuity

The competencies and dedication of personnel directly influence the final account process. Therefore, organisations should prioritise improving staff skills and maintaining the continuity of key personnel (Hassan, 2019; Ramli, 2021). Providing targeted training to employees, specifically on final account procedures, contract administration, and the importance of accurate claim submission, is crucial (Nor, 2024). This ensures that project teams have the necessary knowledge to handle complex claims and final account issues, thereby mitigating potential disputes.

Furthermore, a significant cause of difficulty arises when the person in charge of the final account, such as a project manager or quantity surveyor, is transferred, resigns, or retires, leading to the loss or delay in assembling project information (Ssegawa et al., 2020). Ensuring sufficient staff or personnel are involved in the project and the final account closing stage is crucial to prevent knowledge gaps and delays that frequently arise when key individuals leave before the settlement of the final account (Silva et al., 2025)

Therefore, a strategic measure involves maintaining the key personnel responsible for the project and the final account settlement until the closure process is fully completed. Organisations should ensure they employ adequate competent staff to handle the detailed final account process (Romli, 2015).

2.6.6 Proper Management of Variation Works and Defect Rectifications

Considering that variations and delays in finalising variation orders are substantial causes of dispute during final account settlements, it is essential to adopt a strategy for managing variations effectively (Ahzami, 2017; Kong & Yeow, 2016). All variation issues and their valuation should be settled earlier, ideally during the

construction stage, rather than carried forward to the end of the project (Ramli, 2021). Any verbal instructions for variations must be systematically followed up with written instructions to prevent disagreements over entitlement and cost (Hisham & Othman, 2021). Moreover, a comprehensive valuation of variation works, including direct and indirect costs, should be taken into account when pricing variation work (Akomah et al., 2023). This approach ensures that variation works are properly priced, thereby reducing possible disputes and delays in the final account closing (Othman et al., 2023; Zakaria, 2015)

Furthermore, it is essential to address any defects proactively. The contractor must adopt a proactive approach to rectify all snagging issues and defects during the construction and defects liability period (DLP) to facilitate the issuance of the Certificate of Making Good Defect (CMGD) promptly (Nor, 2024). This is because the issuance of CCMGD serves as a prerequisite for issuing the final account (PAM, 2018; PWD, 2010). Therefore, the effective management of variations and defect rectifications throughout the project lifecycle is essential to ensure a smooth final account closing settlement and to prevent unnecessary disputes.

2.7 Existing Payment Framework Related to the Final Account

The final account is the instrument to determine the final payment due in a construction contract. Under the PAM Contract 2018, the Employer is obligated to honour the final payment certificates within twenty-one (21) Days from the date of the certificate, if no specific time frame is stated in the Appendix. In the case of late payment or non-payment by the client, the contractor is contractually entitled to suspend or slow down work, or further determine the contract if the client continues the breach under Clause 26 (PAM, 2018). These provisions are intended to give the contractor a cash-flow remedy.

In addition, the Construction Industry Payment and Adjudication Act 2012 (CIPAA 2012) further reinforces these payment obligations by providing a statutory adjudication mechanism for unpaid parties (Zulkhairi et al., 2022). CIPAA was a direct response to chronic late payment in the construction industry and offers a binding decision within prescribed timeframes that is enforceable as a court judgment (Singh, 2015; Zaini, 2012).

While both existing payment frameworks (PAM Contract 2018 and CIPAA 2012) provide remedies to the contractor in the case of late payment or non-payment, they primarily operate reactively, designed to resolve payment disputes after they arise rather than to prevent them (Dzulkalnine et al., 2017). The limitation of these frameworks is that they do not address the contractual management deficiencies that cause final account disputes in the first instance, such as the failure to manage variations, document site activities, or adhere to submission timelines. This gap between current reactive payment systems and the need for proactive contract management is a main reason for the preventive framework created in this research.

2.8 Research Gap

Several previous studies have investigated certain aspects of final account closing in the construction industry, both locally and internationally. However, some underexplored aspects of final account closing have potential for further research. Previous studies have highlighted that disputes frequently arise during the final account process, often resulting in delays in closing the final account (Kong & Yeow, 2016; Ssegawa et al., 2020; Zakaria, 2015). However, there has been limited research examining the root causes of these disputes and exploring preventative strategies. While the disputes regarding the final account closing were identified as arising from various problems in management and the process of final account (Abidoye et al., 2018; Kong & Yeow, 2016; Nor et al., 2023; Zakaria et al., 2012), the existing research often analyses the problems after disputes have arisen. The problems in the final account closing should be resolved at an early stage of the project, before they escalate into disputes and affects the successful closure of the final account (Zakaria et al., 2014). According to Alrasheed et al., (2023), disputes in construction projects arise due to failure to address their root causes and lack of procedures for dispute avoidance and mitigation. Many previous studies primarily focus on dispute resolution mechanisms to resolve construction-related disputes after a dispute has taken place, rather than proactive measures aimed at preventing disputes (Matarneh, 2024; Silva et al., 2025). This indicates a critical gap in developing strategies to prevent problems associated with the final account closing process. Therefore, the present research aims to develop an appropriate measure, such as a proactive and preventive solution, to address the

problems associated with final account closing at the beginning or during the construction phase, before they escalate into disputes at the final account closing phase.

Additionally, numerous prior studies on final account management have been conducted, such as those by (Nor et al., 2023; Romli, 2015; Ssegawa et al., 2020; Tarmizi, 2018; Yahaya et al., 2019; Zakaria, 2015), which have focused on the management of final accounts within the government sector or public-funded projects with less attention paid to the private sector. These studies explicitly acknowledge their limitations, stating that findings from one sector or a specific geographical context cannot be directly generalised to other sectors or contexts. Furthermore, the contract conditions and timeframes for final account closing differ between the public and private sectors (Zakaria et al., 2022). The roles of clients in the private sector may also vary in their decision-making processes and risk tolerance compared with those of governmental agencies. For example, a private client might prioritise maintaining good relationships with contractors for future ventures, which could influence how final accounts are managed (Ilmi & Yip, 2014). These differences necessitate separate investigations. Therefore, this study focuses on investigating the final account closing process within the private sector that uses the PAM2018 standard form of contract.

In terms of guidelines and procedures, the management of final accounts in construction projects is guided by various standard procedures derived from standard contracts. While these existing procedures provide a foundation, they are often insufficient in practice, necessitating further development and improvement of the framework to address the persistent challenges of the final account closing. This has served as motivation for future research. It is vital to note that the framework, guidelines, and procedures are crucial in avoiding disputes and delays in a final account, which can contribute to the loss of time, cost, and tarnished reputation of a construction project (Khang & Moe, 2008). Previous research by (Zakaria, 2015) has developed a framework that focuses on variables that influence the success and failure of final account closing for construction projects. As previously mentioned, it is essential to identify the root causes of the major problems that could lead to disputes and resolve them in the early stages to ensure a successful closing of the final account. Therefore, this research aims to develop an appropriate framework to prevent and mitigate problems that arise during the final account closing process, thereby improving the final account closing process in the Malaysian construction industry

Several previous studies on the final account closing mainly employed quantitative methods, focusing on measurable aspects to test hypotheses and generalise findings. These studies, including (Abidoye et al., 2018), (Hassan, 2019), (Ramli, 2021), (Ssegawa et al., 2020) and (Yahaya et al., 2019), utilised questionnaire surveys to collect perspectives from respondents and identify and rank the measured variables. For example, a study conducted by (Abidoye et al., 2018) used a questionnaire survey distributed among contractors to examine the effects of non-settled final accounts in construction projects. Similarly, (Yahaya et al., 2019) employed a quantitative survey design to investigate the contributions of contracting parties to the non-settlement of final accounts. While quantitative methods are effective for verifying theories and hypotheses and for rapid data collection, they may have disadvantages, such as a lack of clarity on respondent seriousness or differing interpretations of questions, which can affect validity (Ramli, 2021; Zakaria, 2015). Some quantitative studies, even when extensive, have noted limitations in their ability to explore certain variables in depth (Hisham & Othman, 2021). Conversely, other research has primarily employed qualitative approaches, which utilised semi-structured interviews to gather in-depth insights from industry practitioners to identify factors delaying the final account settlement in the Malaysian construction industry (Ilmi & Yip, 2014), or conducted case studies and document analysis to investigate final account delays due to defective work in public projects (Nor, 2024). The qualitative method excels in in-depth exploration, developing a detailed understanding, and interpreting collected data within natural settings. However, qualitative methods, particularly single case studies, may be limited in their ability to generalise findings to other contexts or stakeholders (Mirzaee & Martek, 2024).

The limitations of relying on single methods, such as the restricted depth of quantitative surveys for exploration or the limited generalisability of qualitative interviews and case studies, underscore the importance and need for mixed-method approaches. These combined methods offer a more comprehensive and reliable understanding of final account issues. Although some research employs mixed-methods approaches that integrate qualitative and quantitative methodologies, such approaches are less frequent, thereby highlighting a methodological gap in the existing literature. In response to these gaps, an explanatory sequential mixed-methods approach is proposed as appropriate for the current research, combining quantitative surveys to identify major problems and qualitative interviews to investigate root causes and

preventive solutions comprehensively. This integrated approach is seen as crucial for developing robust frameworks and strategies to improve final account closing processes

2.9 Theoretical Foundation of the Study

The construction industry faces unique challenges due to its complex and dynamic nature, which frequently results in disagreements and disputes among stakeholders. These circumstances have led to the development of various theories and models aimed at understanding and addressing these issues in order to find effective solutions. Li & Love (1998) highlighted that diverse problem-solving theories have been developed that integrate cognitive processes and decision-making processes to address problems within the construction industry. Building upon an understanding of the importance of resolving the construction industry's challenges, this study explores the theoretical foundations that underpin the concept of problem-solving and decision-making as a guide to developing a framework for preventing problems in final account closing, thereby improving the final account closing process within the Malaysian construction industry.

Problem-solving is a crucial aspect of various disciplines, including the construction management field, and involves the utilisation of specific techniques and strategies. In construction, problem-solving is typically associated with achieving a goal or milestone or perhaps simply answering a question (Schultz, 2012). Effective problem-solving is an essential skill in the construction industry, as it is fundamental for addressing the challenges that arise during construction projects (Chang & Yu, 2016). Therefore, it is important to examine its specific components and processes to fully appreciate its significance in addressing industry challenges.

According to Li & Love (1998) and Charoenngam & Maqsood (2001), problem-solving comprises components that are crucial for effective decision-making, primarily characterised by cognitive processes. These components include problem identification, comprehension of the problem, identification of the underlying reasons or the problem causation, suggesting appropriate and potential solutions, and implementing them to achieve a desired outcome (Charoenngam & Maqsood, 2001; Dostál, 2015; Li et al., 2024; Lunenburg, 2010). After generating solutions, decision-making processes will be utilised to select the most viable option and evaluate the outcomes to ensure the problem is resolved effectively (Lunenburg, 2010). According to Delen (2019) and Jonassen,

(2012), decision-making is often viewed as a part of problem-solving, and the two terms are frequently used interchangeably, particularly in complex situations. This process involves selecting actions from various alternatives, which is a crucial step in resolving problems.

Integrating the problem-solving and decision-making processes creates a synergistic approach to preventive solutions (Dordevic-Emeritus & Miletic, 2010). Problem-solving identifies and defines the issues, while decision-making provides the framework for choosing and implementing the best solutions (Weitzman & Weitzman, 2000). This integrated approach can lead to more proactive and effective prevention of problems and disputes in construction projects (Alaloul et al., 2019). By integrating these problem-solving theories and decision-making models, construction professionals can develop a comprehensive framework for addressing challenges, ultimately contributing to the improvement of final account closing processes in the Malaysian construction industry.

According to Schultz (2012), construction management involves both reactive and proactive problem-solving practices. While reactive problem-solving relies on passive responses to address issues when they arise, proactive problem-solving focuses on preventing problems through careful planning and management (Yu et al., 2007). Both reactive and proactive approaches involve finding solutions to many problems that are essential for the successful completion of construction projects (Schultz, 2012). Nevertheless, proactive problem-solving is designed to address issues promptly and efficiently, using a systematic approach to address construction problems, derived from lessons learned in past projects and expert knowledge to improve overall organisational performance (Yu et al., 2007). Having explored the theoretical foundations of problem-solving and decision-making in construction, it is important to consider their practical application in addressing issues or problems in the final account closing process.

Traditionally, problem-solving and decision-making in construction relied predominantly on human experience and intuition (Gao & Low, 2013). However, as project complexity has increased, the integration of digital technologies and data analytics tools has facilitated more informed and objective decision-making (Hu et al., 2024). For example, Building Information Modelling (BIM) can identify conflicts between building systems before construction commences, thereby avoiding additional costs or cost overruns due to variation works that affect the final account closing process (Tantawy et al., 2025). Effective problem-solving during construction projects can

minimise disputes related to variations, payments, and delays that impact the final account closing process (Othman et al., 2023).

The application of problem-solving theory and decision-making models to address final account closing issues in the construction industry is crucial to enhancing efficiency and effectiveness. By applying a structured process of problem-solving and decision-making, the final account closing issues can be systematically addressed, thus improving the final account closing process (Nor, 2024). When problems occur in the construction industry, the key players, who are also considered decision-makers, will take action by making predictions and decisions aimed at resolving the problem and achieving specific goals (Khahro et al., 2023). Therefore, they need to utilise conceptual tools or frameworks from interdisciplinary fields of problem-solving and decision-making. The following sections explore prominent theories and models of problem-solving and decision-making in the construction industry, and their suitability for developing a preventive solution framework to improve final account closing.

2.9.1 Intelligence-Design-Choice (IDC) Model

This model was developed by Newell & Simon (1972), which emphasises systematic approaches to identifying and addressing challenges based on cognitive reasoning as a rational process. This model outlines three main phases of problem-solving, which include the intelligence phase (identifying the problem), the design phase (developing possible solutions), and the choice phase (selecting the best solution), as shown in Figure 2.3. This systematic approach allows for a comprehensive understanding of the problem-solving process.

The intelligence stage focuses on identifying and understanding the problem, where the decision-maker seeks indications that a problem exists and requires attention. This stage involves identifying and understanding the problem and recognising its reasons and root causes (Simon, 2001). During this phase, the problem solver gathers relevant information and thoroughly analyses the situation to clearly define the problem (Taylor, 2012).

The design phase focuses on developing potential solutions to the problem identified in the intelligence phase. This involves generating and exploring various alternatives or courses of action. This phase often requires creative thinking, as well as leveraging past experiences and existing knowledge to formulate viable options. This

phase is critical for expanding the range of possible solutions and ensuring robust decision-making (Simon, 2001).

The choice stage involves selecting the most appropriate solution from the alternatives generated in the design stage. This requires evaluating the potential solutions against specific criteria or objectives to determine their suitability and effectiveness. The decision-making process concludes with the selection of a solution for implementation (Uzonwanne, 2016).

The IDC model is appropriate for solving problems in the construction industry primarily because construction management is fundamentally a problem-solving activity due to the complexity and uncertainty problems (Li & Love, 1998; Zhu et al., 2021). A previous study by Liberatore & Wagner (2022) emphasised that the IDC model phases reflect the actual cognitive process they use, particularly when working with modern tools like BIM software for solving construction related data visualisation tasks.

Bordetsky & Friman (2007) argued that the IDC model is considered too simplistic and can be applied to any problem-solving exercise without much specificity. This generality means it may not adequately address the complexities of certain decision-making scenarios (Kramarenko, 2022). However, despite being simplistic, the model is robust enough to be applied to a wide range of problem-solving scenarios, making it easier to implement for decision-makers who need a straightforward framework to guide their processes (Bordetsky & Friman, 2007; Simon, 2001).

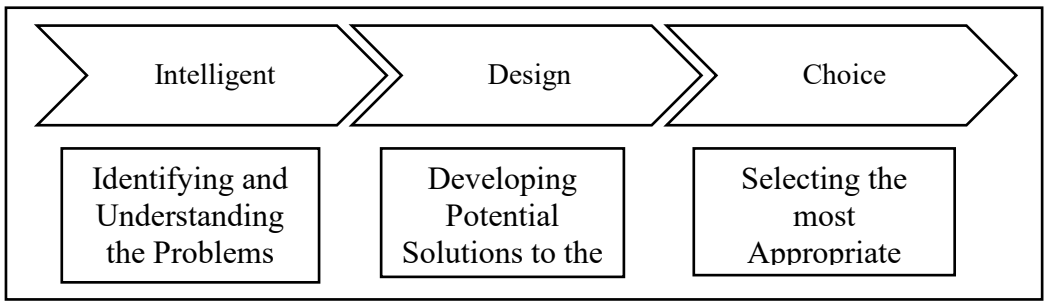


Figure 2.3 Intelligence-Design-Choice Model (IDC) (Newell & Simon, 1972)

2.9.2 The Toyota Way Problem-Solving Model

This model comprises a structured framework that serves as the philosophical core of problem-solving practices at Toyota, emphasising a disciplined, long-term

approach to eliminating the root causes of problems and fostering continuous improvement (Gao & Low, 2013). The model revolves around three fundamental principles, consisting of Genchi Genbutsu (Go and See for Yourself), Consensus Decision Making, and Kaizen (Continuous Improvement) & Hansei (Reflection), which reflect Toyota's approach to effective problem resolution and organisational learning. The model offers a structured procedure for basic problem solving and follows the Plan Do Check Act (PDCA) cycle, providing a clear framework that the construction industry often lacks (Gao & Low, 2013).

Research on large Chinese construction firms shows that this model improves quality, cost, time, and organisational learning (Gao & Low, 2013). The model also encourages construction organisations to see problem-solving as an active, continuous process that leads to strategic advantages and better organisational adaptation, contrasting with reactive models where solutions are often isolated and fail to contribute to overall system improvement (Gao & Low, 2013). Despite its strong relevance for the problem-solving process, the model is more specific to process and operational improvement. In addition, the model is embedded within the broader Toyota production system philosophy, whereas the current research focuses on specific problem solving and decision making related to final account closing.

2.9.3 Rational Choice Theory (RCT)

The Rational Choice Theory (RCT) is a foundational framework in the social sciences for understanding human decision-making, providing an analytical approach to complex problems. The RCT primarily focus on identifying the most effective way for an individual and organisation to achieve their predetermined goals. It highlighted that people are rational decision-makers who choose options that maximise their own benefit or self-interest (Burns & Roszkowska, 2016).

The decision-making process within the RCT typically involves a framework, comprising Identifying Alternatives, Determining Consequences, Ordering Preferences, and Selecting the Optimum Choice (Burns & Roszkowska, 2016; Carson & Carson, 2014). These frameworks are suitable for decision-making within the construction industry, given the technical, complex, and adversarial nature of construction projects (Bakht & El-Diraby, 2015; Li & Love, 1998).

RCTs are increasingly used to support complex decision-making in construction. For instance, construction projects require choosing between various options, such as materials, equipment, or maintenance strategies (Antuchevičienė et al., 2006). RCT frameworks help structure these choices by quantifying preferences, risks, and outcomes (Liljefors & Köhler, 2024; Zavadskas et al., 2017). Despite its strength, RCT is primarily concerned with the outcome or result of the choice (Barros, 2010), without providing a structured framework for problem-solving. In contrast, the IDC model, as previously discussed, is designed to structure problem identification, analysis, and the generation of alternative solutions.

2.10 Justification for Selecting the IDC Model as the Underpinning Theory

Having examined the three theoretical models above, it is necessary to justify the selection of the IDC model as the primary theoretical lens for this research. The choice was not made arbitrarily. Each of the three theories has demonstrated value in construction management research. However, the choice among them depends on the specific purpose of this research. Table 2.2 summarises the comparison across five evaluation criteria, including alignment with the preventive approach of this research, the problem-solving stages, specificity to construction, flexibility for adaptation to a final account context, and prior application in construction-related studies.

Table 2.2
Comparative Evaluation of Theoretical Models Related to Problem Solving

Criterion	**IDC Model**	**Toyota Way**	**Rational Choice Theory**
Preventive orientation	Explicitly identifies and addresses problems before action	Strong on continuous improvement but operational rather than strategic	Focuses on choosing among existing alternatives once a decision point is reached
Coverage of problem-solving stages	Identification, design of solutions, and choice	Operational cycle (Plan-Do-Check-Act); less developed at the design-of-solutions stage	Assumes the alternatives have already been identified

Criterion	IDC Model	Toyota Way	Rational Choice Theory
Specificity to construction	Has been applied directly in construction (Charoenngam & Maqsood, 2001; Liberatore & Wagner, 2022; Li & Love, 1998)	Adapted to construction in some studies but rooted in manufacturing (Gao & Low, 2013)	Applied to individual construction decisions, but not suitable for management processes.
Flexibility for adaptation	Generic enough to be tailored to any complex problem domain	Embedded within Toyota Production System philosophy	Assumes quantifiable preferences
Application in construction-related studies	Well-established in construction problem-solving literature	Strong in operational improvement contexts	Strong in discrete decision modelling

On balance, the IDC model is the most appropriate for this research for three connected reasons. First, the research is explicitly preventive in approach, and the IDC model's components, which include intelligence, design, and choice, are mapped directly to the objectives of this research. The Toyota Way is excellent at improving existing processes, but it is less well-suited to designing a framework to prevent disputes from the outset. Second, the IDC model encompasses the entire problem-solving process, whereas RCT assumes that the alternatives are already identified, but does not provide a structured framework for problem-solving (Barros, 2010). Third, the IDC model has been directly applied in the construction management research (Charoenngam & Maqsood, 2001; Li & Love, 1998), and a recent study has confirmed its continued relevance in modern construction settings, including digital construction environments (Liberatore & Wagner, 2022).

2.11 Development of Conceptual Framework

Both theoretical and conceptual frameworks serve similar purposes in guiding the research process. Theoretical frameworks offer a structured approach based on one or more existing theories. In contrast, conceptual frameworks are designed to clarify concepts, organise ideas, and identify relationships within the study. The conceptual framework serves as a guide and provides a foundation for interpreting research

findings (Hernon, 2007). It provides a basis for understanding a set of interconnected concepts, theories, and assumptions that form the basis for research design and data analysis (Garvey & Jones, 2021). According to Miles & Huberman (1994), a conceptual framework can be presented in written or visual form, such as a schematic diagram, graph or narrative, that complements the researcher's explanation of the relationships between variables.

The aim of this research is to develop a framework that provides guidance on preventing problems related to final account closing, thereby minimising disputes and delays and improving the final account closing process in construction projects. Three main components are considered to develop the framework, which comprise the major problem in final account closing, the root causes of the problem, and appropriate solutions to prevent these problems, thereby improving the final account closing process. The integration of theoretical insights, such as from the IDC model, provides a robust foundation for this framework, ensuring that the solutions are grounded in problem solving methodologies.

Effective problem solving and decision making are crucial processes in which individuals, groups, or organisations analyse available resources and set objectives to generate strategies to mitigate the problems (Turpin & Marias, 2004). Therefore, the framework that will be developed in this study is based on the concept of the problem-solving and decision-making process.

Considering some related theories and models of problem solving and decision making in the construction industry, this current research developed a conceptual framework based on the IDC model adopted from Newell & Simon (1972), as the model provides a set of structured steps known as Intelligence, Design, and Choice phases for addressing the complex issues and problems pertaining to final account closing in the construction industry. Delen (2019) suggests that the IDC components can be viewed as phases in the problem solving process, with the 'choice' component representing the decision making phase. Some others consider phases one to three (1–3) as formal decision making steps that conclude with a recommendation, while viewing problem solving as extending to the actual implementation of that recommendation (phase 4). Decision makers typically follow a series of analytical steps to make rational decisions. These steps include reviewing relevant facts, observations, and potential outcomes to ensure the most accurate course of action is selected (Bakht & El-Diraby, 2015; Uzonwanne, 2016).

In the construction industry, the IDC model can be effectively employed to prevent issues by anticipating potential problems throughout the project lifecycle and formulating proactive solutions (Liberatore & Wagner, 2022). Opting for the IDC model in this research is considered a strategic choice, particularly in solving problems related to final account closing in construction projects. Based on the IDC model, individuals or construction stakeholders make decisions to solve problems by considering the costs and benefits of different options and selecting the option that maximises the value and profitability of their organisation (Simon, 2001). Based on Simon's opinions, there may be multiple actions that best suit the situation, as the person making the decision may always be missing information. In other words, there is always a better way to make decisions based on the available information about the situation (Simon, 2001).

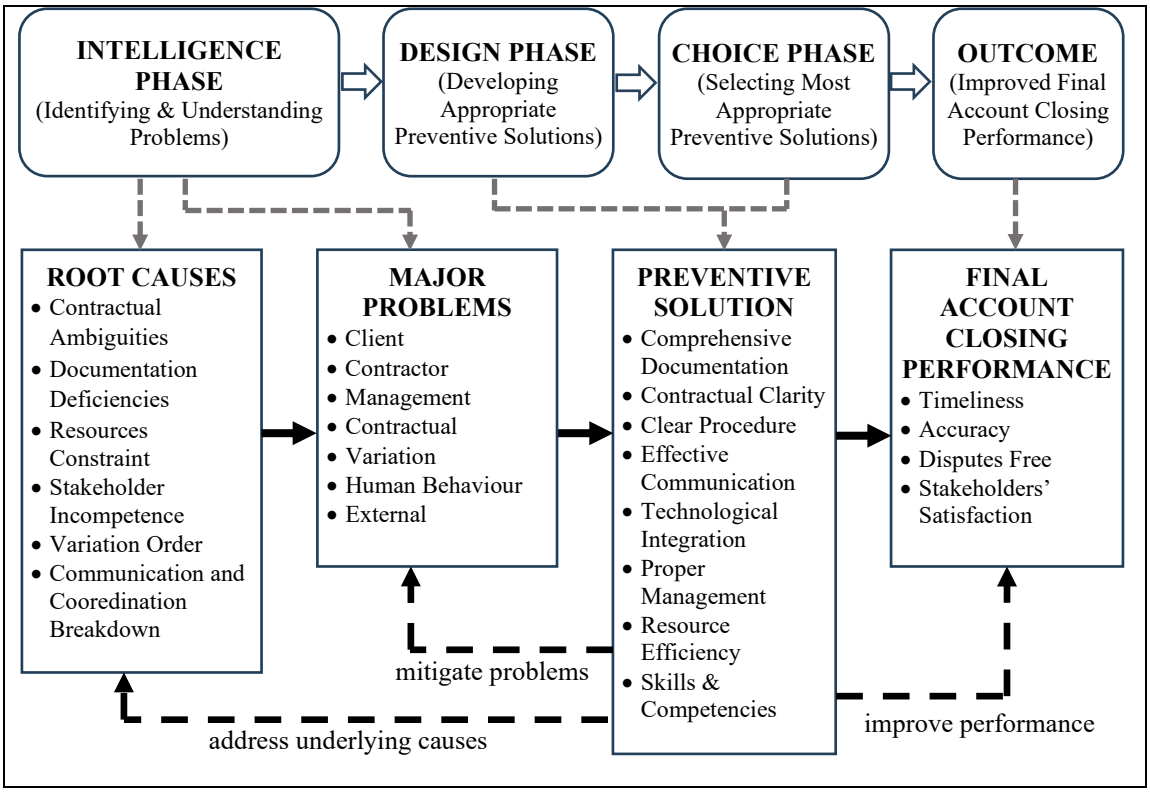


Figure 2.4 Conceptual Framework for a Preventive Solution Framework to Improve Final Account Closing in the Malaysian Construction Industry

Figure 2.4 illustrates the conceptual framework of this research, which integrates the Intelligence Design Choice (IDC) problem solving model with the key constructs influencing final account closing. As mentioned in Figure 2.3 above, the IDC model consists of three main components that consist of Intelligence (identifying the

problem), Design (developing possible solutions), and Choice (selecting the best solution). Within this framework (Figure 2.4), it can be observed that the components of 'Major Problems' serve as independent variables, which are recognised to have an impact on the 'Final Account Closing Performance' (the dependent variable).

2.12 Summary

This chapter provides a comprehensive overview of the final account closing process in the construction industry, including its definition, importance, contractual provisions, parties' obligations, and the procedure and guidelines for final account closing. The review also identifies various problems associated with final account closing, categorised as client related, contractor related, contractual, management, variation, human behaviour, and external factors. These problems can lead to disputes and delays in closing the final account, with significant financial implications for contractors and potentially affecting project success. The identified problems will serve as variables in the survey questionnaire to determine the major problems in final account closing in the Malaysian construction industry. Strategies to mitigate these problems are also discussed to provide a basis for developing preventive solutions to final account closing problems. This chapter further identifies research gaps by highlighting underexplored areas within the subject matter that this research addresses. The theoretical foundations of problem-solving and decision-making in the construction industry are examined, with emphasis on integrating these processes to address challenges effectively. The Intelligence Design Choice (IDC) Model serves as the basis for developing a conceptual framework for this research, which aims to provide guidance on preventing problems in final account closing and improving the process. The next chapter will explain the research methodology employed in this research.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the entire research process undertaken for this research. Key elements of the research process are described in various sections, including research philosophy, research approaches, research techniques, data collection methods, and data analysis. Each section focuses on the selected approach adopted for the current research and the rationale behind its selection. The chapter begins with an overview of the research methodology, followed by an explanation of the philosophical positions adopted in current research. Moreover, the chapter outlines research approaches and techniques employed in this research. Furthermore, the chapter elaborates on the procedures for data collection and the data analysis techniques used in the current research to fulfil the research objectives. Lastly, the chapter will describe the validation technique used to strengthen the validity and reliability of the research outcome, followed by a summary of the key issues discussed.

3.2 Overview of Research Methodology

Research methodology refers to the underlying principles of how research should be carried out (Saunders et al., 2023). It encompasses the systematic procedures and techniques that researchers use to gather, analyse, and interpret data, in order to test hypotheses, answer research questions, and achieve research objectives (Gamage, 2025). It also involves the intersection of philosophical assumptions, research designs, and specific methods (Creswell & Creswell, 2018). Researchers should adopt a research methodology that aligns with their research problem and underlying philosophy for further exploration. Overall, research methodology provides a roadmap for conducting research, guiding data collection, the choice of tools and methods, and the analysis and interpretation of findings.

The research methodology for this study is structured based on the nested research design model, as illustrated in the Figure 3.1 adapted from Kagioglou et al.

(2000). Within research model, research methodology is conceptualised in three layers, including research philosophy (the researcher's fundamental beliefs about reality, knowledge, and values), research approach (the general strategy for data collection and analysis, such as quantitative, qualitative, or mixed methods), and finally, research techniques (the specific tools used for data collection and analysis). This research model is appropriate for this research because it provides a systematic framework for aligning the philosophical stance with the chosen methods, ensuring coherence between the nature of the research problem and the design of the enquiry. Furthermore, this model provides a clear framework for understanding how various elements of research design and strategy interrelate to address the research questions.

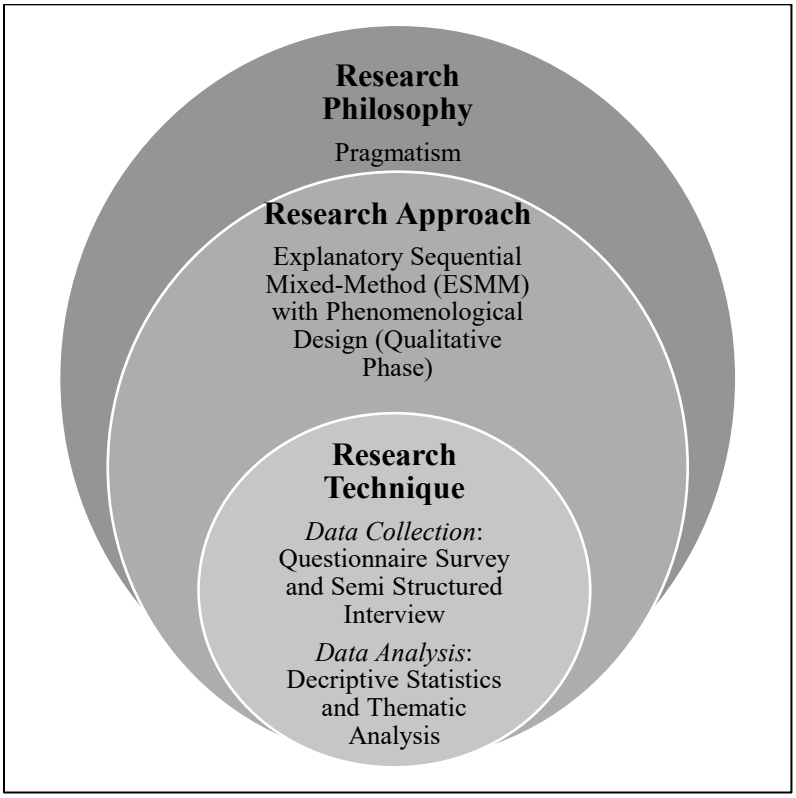


Figure 3.1 A Nested Approach as the Research Methodology (Adapted from Kagioglou et al. (2000))

3.3 Research Philosophy

The outer layer represents the research philosophy. Research philosophy refers to a system of beliefs and assumptions about the development of knowledge and the nature of that knowledge (Saunders et al., 2023). It provides a framework for guiding

the research approach and methodology. Different research philosophies offer distinct perspectives on how knowledge is acquired, the nature of issues to discover, and the appropriate methods for conducting research (Morgan, 2014).

This research adopts pragmatism as its guiding philosophical stance. According to Gamage (2025), pragmatism is a research approach that emphasises practicality, real-world application, and the integration of theory and practice. It is based on the belief that research should focus on addressing real-world problems, making a positive impact on society, and generating actionable insights (Allemang et al., 2022). The pragmatic approach recognises that the value of knowledge is determined by its usefulness in solving practical problems rather than solely by its theoretical concepts (Saunders et al., 2019).

Furthermore, Saunders et al. (2019) emphasised that pragmatists begin their research by identifying a problem and aim to offer practical solutions that can inform future actions. Researchers who embrace the pragmatic paradigm prioritise collaboration among academics, practitioners, and stakeholders. They value interdisciplinary approaches that draw from various fields to deliver comprehensive solutions (Kelly & Cordeiro, 2020). Pragmatism encourages the integration of quantitative and qualitative methods to achieve a holistic understanding of a problem and to develop solutions that are both empirically grounded and practically relevant (Gamage, 2025). These arguments align with the aim and approach of this research, confirming that the philosophical stance and methodological approach confirm that the knowledge claim for this research is consistent with a pragmatist view.

This research aims to develop a preventive strategy for the major problems associated with final account closing in the Malaysian construction industry. While numerous studies have addressed issues related to contract management, none have specifically focused on the final account issue, thoroughly examining the specific problems and identifying a proactive, preventive approach to resolving them. Additionally, this research engages closely with construction practitioners and professionals directly involved in the final account closing process to gather their perspectives and opinions. Consequently, the findings will be beneficial for improving the management of final account closing in construction projects.

3.4 Research Approach

The second layer of the nested research design model outlines the strategies and procedures for conducting research. Understanding research approaches is crucial, as it enables researchers to determine the appropriate research design for their study, including the type of data to be collected, data sources, data collection techniques, and data analysis and interpretation (Creswell & Creswell, 2018). Research approaches can be classified into three main categories, which are quantitative, qualitative, and mixed-methods approaches that combine quantitative and qualitative elements (Creswell & Creswell, 2018; Tashakkori & Teddlie, 2010; Williams, 2007). This classification is based on the types of data required, the data collection and analysis techniques employed, the level of flexibility required within the research design, and the nature of the research questions being addressed.

Considering the advantages and flexibility of a combined approach, the present study utilises a mixed-methods approach to investigate the research questions. As illustrated in , this research employed a mixed-methods approach, specifically using an explanatory sequential mixed-methods (ESMM) design. This research approach aligns with the philosophical assumptions of pragmatists, which allow the integration of quantitative and qualitative methods and enable the researcher to benefit from the strengths of each approach.

The rationale for adopting this research approach is that it offers the breadth (quantitative data) and depth (qualitative data) to address the research problems. The quantitative phase of this research aims to fulfil objectives one and two, which are to identify the current issues and major problems associated with final account closing in the Malaysian construction industry. The quantitative findings directly determined the focus and content of the qualitative phase. Following this, the qualitative phase aimed to achieve objectives three and four of the research, which are to identify the root causes of the major problems and determine a preventive solution to mitigate the major problems and their root causes, thereby improving the closing of the final account in the construction industry. Rather than asking open-ended questions about final account problems in general, interview informants were asked to explain the root causes of, and preventive solutions for, the specific major problems identified in the quantitative findings.

Integration between the two phases occurs at the point of instrument design for the qualitative phase. The transition from phase 1 (quantitative) to phase 2 (qualitative) is explicitly documented. After analysing the questionnaire data, the researcher reviewed the quantitative findings and formulated interview questions targeting the most statistically significant problem. This integration decision is reflected in the research design flowchart (Figure 3.2), which shows the directional arrow from the quantitative analysis output to the qualitative instrument design stage.

The qualitative phase of this research employs a phenomenological research design within the ESMM framework. Phenomenology is a qualitative research design that seeks to understand the essence of a phenomenon as experienced by individuals who have lived through it (Creswell & Poth, 2018; Manen, 2016). In this study, the phenomenon is the experience of managing the final account closing process in Malaysian construction projects. Semi-structured interviews with experienced construction practitioners were conducted to explore how these professionals experience, understand, and respond to the problems of final account closing. A phenomenological design is appropriate in this case because the research seeks not only to list root causes but to understand the meaning that practitioners attach to their experiences, which cannot be accessed through statistical analysis alone (Creswell & Poth, 2018).

In construction related research, ESMM has been employed to investigate various topics and phenomena. For instance, Ismail (2021) has utilised this research approach to examine contractual behaviour among contractors in civil engineering projects. Additionally, Judi (2020) employed this approach to analyse issues of late payment and underpayment within the construction industry among contractors and clients. Furthermore, another study by Yusuwan (2016) adopted ESMM approach to examine the issue of extension of time (EOT) claims in the construction sector among architects and contractors. This sequential approach enabled the researchers to integrate findings from both phases, thereby providing a comprehensive analysis of the specific issues under investigation. The use of an ESMM approach offers several benefits for this study, particularly in understanding the complexity of final account closing problems in the construction industry. Employing both quantitative and qualitative methods enhances the empirical depth of the analysis, thereby contributing to a more robust understanding of the problem.

3.5 Research Techniques

The third layer of this research model, as highlighted in distinguishes the research techniques used in data collection. Research techniques refers to the specific instruments or tools that researchers use to collect and analyse data in order to address research questions and achieve research objectives (Almalki, 2016; Bean et al., 2019). Research techniques involve the practical and hands-on procedures used to gather and analyse data. Different types of data (quantitative and qualitative) require the use of different research techniques for their collection and analysis (Bean et al., 2019).

To fully understand the research techniques in this research, it is helpful to situate them within the broader framework of research design. Research design refers to the overall plans for a study, detailing the methods, procedures, and strategies used to collect, measure, analyse, and interpret data to answer research questions and meet research objectives (Creswell, 2014). It acts as a comprehensive framework that systematically guides the researcher throughout the entire research process (Gamage, 2025).

The research design of this study is depicted in Figure 3.2. The process was methodically structured into three phases, beginning with the define and design phase, which encompassed the selection of the research area and topic, articulating the problem statement, and formulating precise research questions. This initial phase was supported by an extensive review of relevant literature, which helped delineate the scope and context of the research. Subsequently, the research plan and methodology were established, incorporating clearly defined aims and objectives that guided the subsequent stages.

The second phase involves data collection and analysis, utilising both quantitative and qualitative methods. Quantitative data were gathered through a structured questionnaire survey, facilitating the achievement of objectives 1 and 2. These data were subjected to rigorous statistical analysis, yielding key findings pertinent to the identification of current issues and major problems in the final account closing process. The subsequent phase involved qualitative data collection, derived from the same semi-structured interviews, which enabled the fulfilment of objectives 3 and 4.

The final stage of the research design focused on integrating both quantitative and qualitative findings to develop a comprehensive component of a preventive solution

framework for improving final account closing in the Malaysian construction industry. A developed framework will be validated through feedback and assessment among experts to ensure the framework's credibility, relevancy and applicability in real-world scenarios, leading to informed conclusions and recommendations for future research. Finally, the developed framework will serve as the final output of this research.

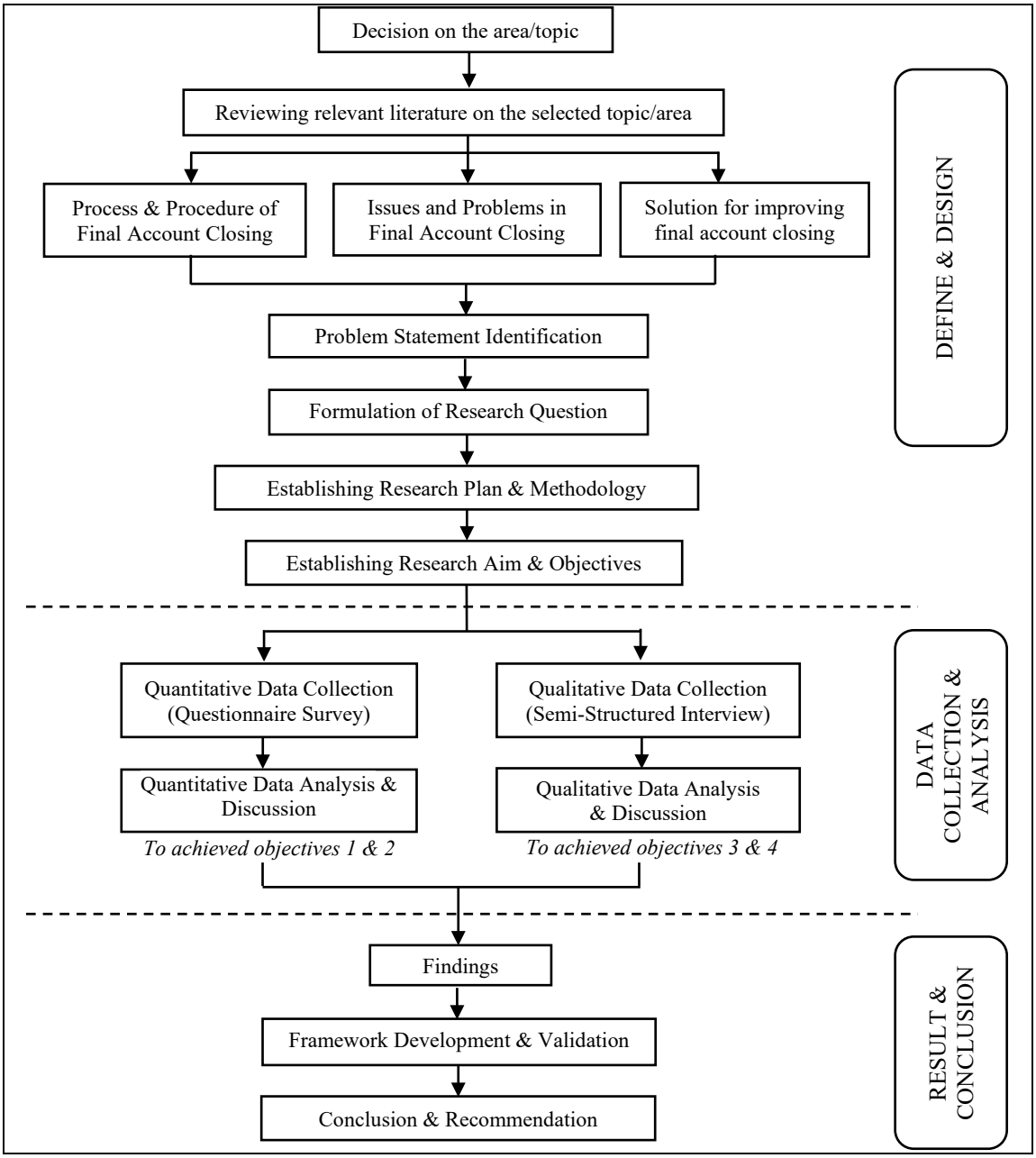


Figure 3.2 Research Design Flowchart for Current Research

3.5.1 Literature Review

A thorough review of the existing literature constitutes a fundamental and essential phase of any research project. This process involves a critical step of systematically identifying, evaluating, and synthesising the published information and work that scholars and practitioners have previously produced within a specific field (Fellows & Liu, 2015). The primary objective of a literature review is to gain a comprehensive understanding of the current state of knowledge on the research topic (Saunders et al., 2019).

The literature review also helps to refine and clarify research questions and objectives (Creswell & Creswell, 2018). It can also help researchers formulate questions that lead to theoretical explanations rather than just descriptive answers, helping to locate existing theory and avoid replicating prior work (Saunders et al., 2019). Furthermore, a comprehensive literature review contributes to the increase in validity and reliability of research findings (Sharma et al., 2023). It allows researchers to theoretically validate outcomes by referencing established theories, ensuring high validity and reliability (Alwee, 2023). It also encourages reflexivity, where researchers critically examine their own beliefs and assumptions in relation to existing philosophies and research designs (Saunders et al., 2023).

In the context of this research on final account closing in construction project management, reviewing the literature offers an essential overview of the contractual provisions governing final accounts, final account procedures and processes, the issues and problems related to final accounts, contributing factors in final account disputes, and the management of final account issues and disputes. Such an appraisal establishes the theoretical foundation for the study and provides a benchmark for comparing current findings. The search for relevant literature for this research was conducted systematically using a range of digital academic resources. The primary search engines and databases utilised included Scopus, Web of Science, Science Direct, and Google Scholar, which are renowned for their extensive collections of peer-reviewed scholarly works (Xiao & Watson, 2017). The search also encompassed a variety of source types, including academic journals, books, conference proceedings, dissertations, and official industry reports. A critical appraisal of each source ensures that only high-quality and pertinent literature informs the research synthesis.

The literature review in this study adopts both narrative and systematic approaches. A narrative review enables an interpretive synthesis of research on topics such as final account closing disputes, management practices, procedural approaches to final accounts, contract provisions related to final accounts, and payment issues in the construction industry. This broad perspective helps to contextualise the research problem and to understand how concepts have evolved. The systematic component, meanwhile, employs explicit search strategies and inclusion criteria to ensure that the review is comprehensive and reproducible. To ensure a focused and relevant search, the inquiry centred on key topics directly related to the research problem, such as the management of final account closing disputes, the process and procedure of the final account, relevant contract provisions, and broader payment issues within the construction industry. This structured approach ensured that a comprehensive and relevant body of literature was gathered to inform the subsequent stages of the research.

The findings from this extensive literature review were important in shaping the methodological approach and design of this research, serving a dual purpose by informing both the quantitative and qualitative phases. For the quantitative phase of the research, the review was critical for identifying the factors, variables, and challenges that contribute to disputes and delays in the final account closing process. These factors, once identified and synthesised from the literature, formed the basis for the development of the items included in the questionnaire survey, which is to achieve objectives 1 and 2 of the current research. For the qualitative phase, the insights gained from the literature review were essential for developing the initial thematic areas and formulating specific guiding questions for the semi-structured interviews, which aimed to achieve objectives 3 and 4 of the current research. By grounding the research instruments in established literature, this process ensured that both the survey and the interviews were targeted, relevant, and well-equipped to achieve the study's distinct objectives. The review of literature does not conclude when data collection begins; rather, it continues to serve as a reference point for interpreting findings and placing them within the broader body of knowledge.

3.5.2 Data Collection and Analysis

The data collection for this research study involved a combination of quantitative and qualitative approaches, including a questionnaire survey and semi-structured interviews.

3.5.2.1 Quantitative Data Collection Method

A questionnaire survey was conducted to achieve objectives one and two of this research, which are to examine current issues in final account closing and to identify the major problems in the Malaysian construction industry. Given the need for a large sample size to meet these objectives, a questionnaire survey is considered the most appropriate method for data collection.

a) Development of Questionnaire Survey

The questionnaire for this research was prepared in accordance with the data needed to answer the research questions and the required analysis techniques. The structure and design of the questionnaire were also adapted from a prior related study by (Ahzami, 2017; Hassan, 2019; Romli, 2015; Zakaria, 2015). In formulating the questions, careful consideration was given to the literature review and previous similar studies outlined in Chapter 2, which focuses on the current issues and problems related to final account closing.

The questionnaire consisted of three sections (refer to Appendix 1). Section 1 collected information regarding the respondents' demographics, including their organisation, designation, years of experience in the construction industry, and the types of projects they were mainly involved in. The respondents were provided with a list of options to choose the appropriate answer. This section establishes a demographic profile of the respondents involved in this research.

Section 2 contains categorical questions to collect data about the current issues and scenarios related to final account closing in the Malaysian construction industry. These include difficulties encountered during the final account closing process, problems or disputes during final account closing, and the time required to settle final accounts in construction projects. The respondents were asked to provide their

responses based on their experience with the final account closing process. Multiple Likert scale types, as outlined by Vagias (2006) were employed in this section to correspond to the questions, which include options such as “Very Difficult = 1 to Very Easy = 5” and “Never = 1 to Very Often = 5”.

Section 3 comprises rating questions designed to assess respondents' level of agreement regarding the various factors identified as common problems in the final account closing process. Respondents were asked to rate the level of agreement regarding the forty (40) problems associated with the final account closing, as identified through the literature review. The five-point Likert scale (Strongly Disagree = 1, Disagree = 2, Moderately Agree = 3, Agree = 4, Strongly Agree = 5) were used in this section. The questionnaire was written in a straightforward bilingual format (English and Malay) to ensure its clarity, eliminate ambiguities, and reduce comprehension time.

b) Pre-Test

Pre-testing is generally conducted to ensure that respondents understand questions and that there is no ambiguity in the wording or measurement (Bougie & Sekaran, 2020). As suggested by Kumar (2011), pre-testing of the instrument has five purposes, which are to ensure (a) the correct choice of wording for the items, (b) the correct sequence of the items, (c) that the respondents unambiguously understood the items (d) if adjustment is needed for the items (addition or elimination of items) and (e) clear and adequate instructions. It avoids poor data quality by rectifying any inadequacies before the actual data collection. Ikart (2019) and Memon et al. (2020) highlighted that pre-testing normally involves an informal process and requires no statistical analysis.

In this research, the draft questionnaire underwent a formal pre-testing exercise with five (5) expert reviewers, which consisted of two (2) academicians specialising in construction management research methodology, one (1) statistician with expertise in survey instrument design, and two (2) senior industry practitioners who have direct experience in final account administration. The reviewers generally agreed that the instrument was suitable, but they highlighted several areas for improvement.

In the general instructions, the initial target respondents were narrowed strictly to Registered Quantity Surveyors under the Board of Quantity Surveyors Malaysia (BQSM). However, in the revised version, this requirement was dropped, reverting to

general Malaysian professionals in client, contractor, and QS firms. The definitions of key terms, such as "Preventive," "Final Account," and "Final Account Closing," were included, as recommended by the reviewers, to clarify the research context for respondents.

Additionally, in Section 1, the years of work experience in the respondent's details included options up to "More than 15 years". However, the reviewers recommended simplifying these options to cap at "More than 10 years" in the revised version. Regarding project involvement, the question about the types of projects respondents are involved in has been reformatted. Early versions used a 1-5 frequency scale (Never to Very Often). The revised version was changed to use multiple-choice checkboxes.

Furthermore, particular attention was given to Section 3, which examined the determinants (problems) contributing to disputes during final account closing. In the preliminary draft of the questionnaire, several determinants were found to overlap conceptually, potentially creating confusion among respondents and affecting the quality of the data collected. Therefore, the items in Section 3 were revised and streamlined before the questionnaire was finalised for the main survey.

For the Contractor Related Factor, two initial determinants, namely "Contractor's non-compliance with submission guidelines" and "Contractor's failure to adhere to final account procedures," were found to carry similar meanings. Both statements essentially referred to the contractor's failure to comply with the required procedure when preparing and submitting the final account claim. Retaining both items would have created unnecessary repetition and may have caused respondents to interpret the two determinants as the same issue. Therefore, both items were consolidated into one clearer determinant: "Contractor's failure to follow procedures in the final account claim". This revised wording was considered more direct and less repetitive in measuring the contractor's non-compliance during the final account closing process.

For the variation-related factor, the earlier draft included three separate determinants, namely "Oral instruction for variation work not confirmed in writing," "Verbal variation orders lacking proper documentation," and "Unwritten directives for additional work". Feedback from the reviewers indicated that these three items were not sufficiently distinct, as they all referred to the same underlying issue. To avoid respondents from rating repetitive statements, the three items were merged into a single

determinant, namely “Verbal instruction for variation work not confirmed in writing.” This revised item captures the core problem more accurately because the absence of written confirmation for variation instructions may contribute to disagreement, uncertainty, and disputes during final account valuation.

For the client-related factor, the initial questionnaire included “Client’s inadequate cash flow tracking” and “Client’s poor financial management”. However, feedback from the reviewers suggested that inadequate cash flow tracking is part of poor financial management rather than an independent factor. Keeping both items would have risked double counting the same issue. Therefore, the cash flow tracking item was removed, while “Client’s poor financial management” was retained as a more representative determinant. At the same time, “Client’s lack of financial resources” was maintained as a separate determinant because it reflects a different issue. Poor financial management concerns how financial resources are planned, monitored, and controlled, whereas a lack of financial resources concerns the client’s actual capacity to make payment.

Overall, the refinement of the instrument through the pre-test has improved the questionnaire mainly by removing overlapping items, simplifying terminology, and ensuring that each determinant represented a distinct factor contributing to final account closing disputes. This process strengthened the instrument's content validity, reduced the risk of respondent confusion, and ensured the questionnaire was more focused and practical for use in the main survey. These refinements were incorporated prior to the pilot survey to ensure the instrument was fit for purpose.

c) Pilot Survey

This research includes a pilot survey as a preliminary step before the main data collection. A pilot survey might serve a similar purpose as a pre-test, which is to refine the questionnaire so that respondents have no difficulties in understanding or answering the questions, and there are no issues with data recording (Bougie & Sekaran, 2020; Saunders et al., 2019). While the term is sometimes used interchangeably with pre-testing, a pilot survey is technically broader in scope, specifically a trial run of a questionnaire. Pre-testing typically assesses the clarity and validity of questions, whereas a pilot survey is a small-scale version of the entire survey project, testing both the instrument and the overall process (Ivankova et al., 2006). Pilot survey also helps

to gauge the validity and reliability of the questions and the data that will be collected, contributing to the overall reliability of the research findings (Saunders et al., 2019). Creswell & Creswell (2018) added that a pilot survey was also conducted to assess how long the survey would take to complete and identify potential concerns regarding respondents' fatigue.

The sample size for the pilot survey was determined based on guidelines from previous studies. Connelly (2008) and Hertzog (2008) recommended that the pilot survey should be ten per cent (10%) of the sample in the main study. Cooper & Schindler (2014), recommended a sample size range between 25 and 100 respondents. Furthermore, Bougie & Sekaran (2020) suggested that a minimum sample size for a pilot survey is 30 samples. Consequently, the pilot survey for this research will involve 30 respondents, comprising construction practitioners from clients, G7 contractors, and quantity surveying consultants. The pilot survey for this research utilised e-questionnaires on Google Forms, distributed via email and WhatsApp. Following the pilot survey, some adjustments were made to the questionnaire based on feedback from the responses.

d) Pilot Survey Analysis

A pilot survey was conducted in July 2023 and distributed to professionals within the client, the G7 contractor, and the quantity surveying organisation, who were selected as respondents. A reliability analysis was conducted using pilot survey data to assess the questionnaire's internal consistency. This research successfully obtained 30 samples for the pilot survey as mentioned above, thereby providing an adequate dataset for conducting reliability analysis. Reliability analysis was conducted after the pilot survey to confirm that the retained problem items consistently measured the intended construct before the main survey was distributed. As outlined by Hair et al. (2019), an alpha value above 0.70 demonstrates adequate reliability and internal consistency. In this research, the analysis of 40 items yielded a Cronbach’s alpha of 0.952 (refer to Table 3.1), indicating strong internal consistency. Therefore, no item was removed after the reliability test. Only minor wording and formatting changes were made before the questionnaire was finalised for the main survey.

Table 3.1
Cronbach's Alpha Value for the Items in the Questionnaire

Cronbach's Alpha	Number of Items
0.952	40

Moreover, the pilot analysis confirmed that the five-point Likert scale was appropriate for measuring both the frequency and severity of final account closing problems, and that no further scale modifications were required. The pilot survey also confirmed that the questionnaire could be completed in approximately 15 to 20 minutes and that respondents experienced no significant difficulties with comprehension or navigation of the Google Forms platform. The finalised questionnaire comprised seven pages, including the front cover (Appendix 1).

e) Population

A population refers to the elements, such as people, events or objects, sharing a common set of characteristics that a researcher aims to investigate (Bougie & Sekaran, 2020; Hair et al., 2019). The target population for this research comprises individual construction practitioners employed in three categories of organisations, including (i) private developer client organisations, (ii) Grade 7 (G7) contractor companies, and (iii) quantity surveying consultant firms. These three groups of organisations were selected because they are directly involved in preparing, submitting, valuing, negotiating, approving or settling final account matters. This research focuses on collecting data from individual practitioners within these organisations, rather than treating the organisations themselves as respondents, because the management of final account closing is fundamentally experienced and driven by individual professional conduct and decision-making.

Initially, the information regarding the population in this research was derived from the number of organisations related to private developers, G7 contractors, and quantity surveying consultants in Malaysia. The list of organisations was obtained from relevant associations and professional bodies, such as the Real Estate and Housing Development Association (REHDA) of Malaysia, the Construction Industry Development Board (CIDB) of Malaysia, and the Quantity Surveyors' Board of Malaysia (BQSM). As of October 2023, a total of 1,327 private developers were

registered with REHDA, 9,545 contractor companies were registered under the G7 category with CIDB Malaysia, and 424 consulting quantity surveying practices/firms were registered with BQSM.

These identified numbers of organisations served as contacts and references rather than representing the actual population of individual practitioners. The population derived from identified organisations within these databases cannot be comprehensively listed for probability sampling. While the population figures presented above are associated with organisations, the unit of analysis in this research is the individual construction practitioner, for whom the total population is unknown, due to the absence of a comprehensive database to identify the current number of individual practitioners in the Malaysian construction industry. This provides justification for adopting a non-probability sampling method in this research.

f) Sampling

Sampling is a technique used to select a subset from a larger group or population for research purposes. Conducting a survey on an entire population can be both time-consuming and expensive, therefore, sampling becomes a more practical and efficient option (Bhardwaj, 2019). Sampling involves finding the right sample or respondents for a study. Two commonly used sampling methods are probability and non-probability (Bougie & Sekaran, 2020). Despite the widespread belief that probability sampling is the optimal method for research, the great majority of social science studies use non-probability samples (Mellenbergh, 2019; Zhao, 2021). Non-probability sampling has always been in academic research due to its cost and convenience benefits (Sarstedt et al., 2018).

Based on the identified unit of analysis, as mentioned in the section above, a non-probability sampling technique was employed. Probability sampling is viable when the sampling frame is available (Memon et al., 2020). The researcher must obtain a complete list of all members in the target population. In this case, the availability of the sampling frame for construction practitioners within developers, G7 contractors, and quantity surveying consultant organisations is nearly impossible to obtain. Without a sampling frame, it is more appropriate to use non-probability sampling, such as convenience sampling. This type of sampling denotes that not all individuals in the population will have an equal opportunity to be chosen (Bougie & Sekaran, 2020).

As part of the non-probability sampling method, a convenience sampling approach was adopted, primarily to obtain a large number of respondents. Any member of the target population who is easily accessible is approached and asked to participate in the research survey. This approach is easy, inexpensive, and consumes less time (Alvi, 2016; Etikan, 2017). According to Thatcher & Drane (2003), convenience sampling can be treated as simple random sampling and sometimes can yield results that are similar to those obtained from more rigorous sampling methods (Mullinix et al., 2015; Peterson & Merunka, 2014). Furthermore, convenience sampling might be appropriate if the research aims to obtain perceptions (Golzar & Noor, 2022). The adoption of convenience sampling in construction management research is well established and has been justified in previous studies (Ahzami, 2017; Gledson, 2022; Ismail, 2021; Judi, 2020; Ramli, 2021).

Although convenience sampling is open to potential bias, due to the fact that the response might not be generalised to a larger population (Zahrizan et al., 2023), this sampling method can be considered appropriate when researchers have a specific target group of respondents that meets specific criteria to fulfil research purposes (Zia et al., 2022). The researcher has taken measures to mitigate response bias when distributing questionnaires. The researcher does not distribute the questionnaires randomly without knowing the recipients. The questionnaires are sent via individual email to identified practitioners within each group organisation rather than through open public distribution. The selection bias was reduced by limiting repeated responses from the same organisation where possible. In this case, responses were limited to a maximum of three (3) respondents selected from the same company. Additionally, physical distribution was conducted at construction-related CPD (continuing professional development) events and seminars. Furthermore, since specific respondent criteria have been established, the researcher ensures that those who respond meet the predetermined criteria. This approach ensures to mitigate sampling bias.

g) Identification of Sample Size

Determining an appropriate sample size is essential to the success of any research (Tabachnick & Fidell, 2019). There are several methods that can be used to determine the sample size in research, as highlighted by (Memon et al., 2020). Therefore, several methods are considered for establishing the sample size for this

research, based on the rationale and justification provided by previous scholars. Initially, the estimated minimum sample size for this research was determined using power analysis with G*Power software (Faul et al., 2009), which is commonly used in social science studies (Cheah et al., 2019; Giebelhausen et al., 2021; Memon et al., 2020). As recommended for social science research, the present research used F-test and A-priori power analysis to compute the required sample. (Hair et al., 2019; Memon et al., 2020). The parameters entered into G*Power software to calculate the sample size for this research are summarised in Table 3.2. This parameter is the most common recommended setting for social science research involving a survey questionnaire (Hair et al., 2019).

Table 3.2
Parameter Used for Power Analysis

Parameter	**Value/Setting**	**Rationale**
Statistical test	ANOVA (F-test, fixed effects, omnibus, one-way)	Compares mean ratings across the three groups
Effect size (f)	0.25 (medium)	Expecting moderate differences among groups
Significance level (α)	0.05	Conventional 5 % error probability
Desired power (1 – β)	0.80	Provides 80 % chance of detecting the specified effect
Number of groups	3 independent groups (Contractor, Client, QS consultant)	Each respondent rates each problem once; no repeated measurement

Consequently, G*Power indicated that a minimum total of 159 valid responses is needed to achieve the desired statistical power. This total sample should be evenly distributed among the three respondent groups, requiring at least 53 complete responses from clients, 53 from G7 contractors, and 53 from QS consultants. However, to ensure at least 159 usable questionnaires are collected, a larger number must be distributed to account for nonresponse and incomplete surveys. Therefore, the estimated sample size was increased.

In addition to utilising statistical power to determine the sample size, this research also considers a recommended sample size for Exploratory Factor Analysis (EFA). The present study aims to conduct EFA to examine the relationships among

observed variables and to identify underlying latent factors or dimensions (Beavers et al., 2013; Leech et al., 2011; Osborne, 2014).There is general agreement that larger sample sizes are preferable when conducting EFA, as they tend to produce more stable, accurate, and generalisable results (Beavers et al., 2013; Costello & Osborne, 2005; MacCallum et al., 1999). Previous studies have classified sample size adequacy based on specific criteria, with 200 samples considered adequate, 300 very good, and 400 excellent (Sürücü et al., 2022; Taherdoost, 2016).

Additionally, some criteria suggest using the sample-to-item ratio as a guide for determining an adequate sample size, based on the number of items in the study. It is generally advised that the ratio should be at least 5 cases for each item (5:1 ratio) (Gorsuch, 2013; Hatcher, 2014; Suhr, 2006). In the present research, given a total of fourty (40) items related to problems in final account closing, a sample size of 200 respondents is recommended. Consequently, a sample size of 200 to 300 respondents is deemed sufficient for conducting EFA in the current research.

In this research, an allocation of 200 questionnaires was distributed to each group. This oversampling approach aligns with prior construction surveys, which frequently gather a greater number of responses than the minimum requirement (Chen et al., 2021; Vaughan, 2017). Distributing an equal number of 200 questionnaires to each stakeholder group in this research provides an adequate buffer to ensure a minimum number of valid responses per group, accounting for expected non-response and incomplete returns. Furthermore, equal distribution among the three stakeholder groups provides efficient, balanced representation, ensuring that the views of smaller but important groups, especially QS firms and clients, are not overwhelmed by the larger contractor population. As a result, the final target for the questionnaire survey distribution was set at 600 samples comprising qualified construction professionals within Client, G7 Contractor, and Consultant Quantity Surveying.

h) Response Rate

Survey questionnaires are a common data collection tool in construction-related research, but the question of what constitutes an "acceptable" response rate is frequently debated. Several studies and reviews indicate that response rates in the construction field are often lower than in some other disciplines. A rate of 20–26% is generally considered the minimum threshold for acceptability, especially for postal and web-

based surveys (Ofori & Gang, 2001; Root & Blismas, 2003). Other researchers also highlighted that the typical response rate for questionnaire surveys in the construction industry is around 20-30%, reflecting practical constraints such as limited resources and sample accessibility (Akintoye, 2000; Dulaimi et al., 2003; Takim et al., 2004). Additionally, Fateh & Nijar (2019) and Fellows & Liu (2015) noted that a response rate of 25% to 35% is acceptable for a self-administered questionnaire in construction research.

In this research, a total of six hundred (600) sets of questionnaire surveys were distributed. By the end of October 2023, two hundred fifty-seven (257) had been completed and returned, within three months of the questionnaire being sent, which accounted for a 43% response rate. This response rate is considered acceptable and exceeds the minimum requirement of survey response in construction-related research.

i) Questionnaire Distribution

According to Saunders et al. (2019), questionnaires can be categorised into several types based on how they are administered, known as self-administered and interviewer-administered questionnaires. A self-administered questionnaire refers to a survey that respondents complete independently without interaction with a researcher or interviewer. Additionally, respondents have the freedom to answer questions at their own pace, which can reduce interviewer bias and increase the sense of privacy during response (Wolf, 2008). In contrast, interviewer-administered questionnaires involve an interviewer who guides the respondents through the survey. This can be done either through face-to-face, telephone surveys, or video conferencing. This method enables more detailed data collection, as the interviewer can guide respondents through complex questionnaires, thereby reducing errors in responses. However, this method may be high-cost and time-consuming (Puhan et al., 2011).

The quantitative data for this research required a large number of respondents, including clients, G7 contractors, and quantity surveying consultants across Malaysia. Consequently, it was impractical to conduct face-to-face interviews with each respondent or to interview them online. Therefore, a self-administered questionnaire was chosen as the appropriate method. The decision to use an online survey was made after considering the practical aspects of distributing the survey. The practicality and reliability of online surveys or e-questionnaires in collecting quantitative data from

large respondents have gained significant attention in recent research, as they enable efficient data collection and reduce transcription errors (Regmi et al., 2017). In addition, online surveys are increasingly recognised for their cost-effectiveness and ability to gather large data quickly (Teo, 2013) , making them a viable alternative to traditional methods, such as printed paper survey forms sent via postal service or delivered by hand. While online surveys offer many benefits, traditional methods may still be preferred in situations where personal interaction is valued or when reaching respondents with limited internet access. Therefore, this research utilised both an online e-questionnaire survey and printed paper survey forms to accommodate the different preferences of respondents. This highlights the need for a balanced approach in choosing data collection methods.

The online survey invitations were mainly distributed through email and personal contacts on WhatsApp. Additionally, an official email was sent to the company's administrative department, which includes the client, G7 contractor, and quantity surveying consultant, requesting their assistance in distributing the online questionnaire to their staff members who are eligible to participate in this research. The survey invitation included comprehensive information and instructions regarding the survey, along with a Google Form link to access the survey. Data collection took place over three months in 2023, with respondents having four weeks to complete and return the questionnaire. This period was considered appropriate because the target respondents were busy construction professionals, and the questionnaire required them to reflect on their actual final account experience rather than provide rushed answers. The four-week period also allowed follow-up reminders to be sent while keeping the data collection process controlled and manageable. A reminder was sent via email and WhatsApp message as a follow-up strategy to maximise respondents' rates.

3.5.2.2 Quantitative Data Analysis Method

The data collected from the questionnaire survey are analysed using the Statistical Package for the Social Sciences (SPSS) version 29, employing descriptive statistics. Frequency analysis is appropriate for examining the data collected on respondents' demographic profiles in Section A of the questionnaire. This is followed by a descriptive analysis of the data in Sections B and C of the questionnaire, which pertain to the current issues and problems in final account closing. Furthermore, the

Kruskal-Wallis Test was utilised to compare differences in the Mean Score (MS) for each variable across groups of respondents (client, G7 contractor, and consultant). Additionally, exploratory factor analysis (EFA) was conducted to reduce the set of variables related to final account closing problems and to establish meaningful components among the observed variables. The subsequent sections delineate the quantitative analyses conducted in this study.

a) Reliability Analysis

Assessing the reliability and validity of quantitative data is fundamental to ensuring the quality and trustworthiness of research findings (Gamage, 2025; Saraswati & Devi, 2023). The purpose is to confirm that the measurements accurately reflect the intended concepts and that the results are consistent and stable, allowing for meaningful inferences and generalisations (Bougie & Sekaran, 2020). Without establishing these qualities, the conclusions drawn from quantitative research may lack credibility, thereby hindering their acceptance and utility (Saunders et al., 2019). To evaluate the reliability of quantitative data, a key method is to assess internal consistency (Creswell & Creswell, 2018). This involves examining the degree to which items within a multi item instrument behave similarly and are positively correlated to one another (Bougie & Sekaran, 2020). A commonly used measure of internal consistency is Cronbach's alpha (α), which typically ranges from 0 to 1 and generally has optimal values between 0.7 and 0.9 (Bougie & Sekaran, 2020; Creswell & Creswell, 2018). Researchers also ensure reliability by using rigorously defined, highly structured methods for data collection (Saunders et al., 2019). This research has conducted a reliability test for the pilot survey using Cronbach's alpha (α), as presented in Chapter 4 (section 4.2).

b) Descriptive Analysis

Descriptive statistics range from central tendency to variability measures. The current study used the most common descriptive statistics of mean and standard deviation, along with frequency distribution, to analyse the responses to categorical as well as rating questions in the questionnaire. The frequency distribution method was performed to analyse the profile of the respondents. The data were presented in tables and graphic forms, providing a complete view of the profiles of the responses.

Meanwhile, due to the data gathered in the form of a 5-point Likert scale, it was considered as ordinal data. Therefore, descriptive analysis by means of calculating the mean score of each variable was found to be the most appropriate method. According to Ismail (2021) and Shehu et al. (2014), using the mean score for indexing and ranking has been common in presenting exploratory and descriptive data analysis. Hence, this study employed the same technique to determine the ranking of each variable. The Mean Score (MS) was computed using the following formula:

$$MSi = \sum (f\ x\ S)/N \tag{3.1}$$

where S was the score given to each variable by the respondents, ranging from 1= strongly disagree to 5 = strongly agree, f was the frequency of the responses to each score for each variable, N was the total number of responses for that particular variable, and i was for the respective variables.

c) Normality Assessment and Kruskal-Wallis Test

The normality of the data distribution was assessed to determine whether to use parametric or non-parametric tests prior to applying inferential statistical tests. In this research, the Shapiro-Wilk test was employed to assess the normality of the data distribution for each variable (Razali & Wah, 2011). The Shapiro-Wilk test evaluates the null hypothesis that the observed data are drawn from a normally distributed population, which produces a p-value. A p-value of less than 0.05 indicates that the null hypothesis of normality is rejected, confirming that the data deviate significantly from a normal distribution (Pallant, 2020). The Shapiro-Wilk test was selected in this research for its effectiveness in detecting deviations from normality across a range of sample sizes, including the moderately large samples used in this study (Field, 2009). In this research, the test results showed that the quantitative variables were not normally distributed, as the p-values were below 0.05 (p-value < 0.05). Therefore, the assumption of normality required for a parametric test was not met.

Based on this result, the Kruskal-Wallis Test was selected in this research as the appropriate non-parametric test to compare responses across the three independent

respondent groups, namely, clients, G7 contractors, and quantity surveying consultants. This test can be used to determine whether there are statistically significant differences among three or more groups of independent variables on a continuous or ordinal dependent variable (Ostertagová et al., 2014; Pallant, 2020; Schmidt, 2022). This involved testing the following hypothesis:

H_0: μ_1=μ_2=μ_3; mean of all groups are equal
H_1: at least one of the group mean is different

The accept or reject decision in hypothesis testing is based on a probability value, usually set at 95% confidence that the decision is correct. In other words, there is only 5% chance that the decision is wrong, that populations are different. Therefore, usually a p-value of less than .05 is considered in rejecting the null hypothesis. It is essential to conduct this test because the findings would be biased if they relied solely on the overall mean score. Furthermore, this can identify mutual perceptions and understanding among groups of respondents regarding the factors contributing to disputes during final account closing. The findings derived from this analysis are reported and discussed in Chapter 4, Section 4.2.4.2

d) Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a statistical method used to identify the underlying structure of a set of variables by examining their interrelationships (Hair et al., 2019; Williams, 2007). Additionally, EFA condenses a large set of observed variables into fewer components, capturing key patterns and reducing redundancy (Watson, 2017). The main advantage of EFA is its ability to reduce the number of variables to a few that can explain the variance in the data (Sürücü et al., 2022). In essence, it serves as a data reduction method that helps researchers understand the relationships among variables within an instrument. In this research, EFA is conducted to analyse the data in Section C of the questionnaire survey, and to validate the relevant problems pertaining to the final account closing process. The EFA method is widely used across fields such as the social sciences, health sciences, and economics. Furthermore, this method has been widely used in numerous construction studies

involving multiple variables, facilitating more effective analysis of these variables (Głuszak & Leśniak, 2015; Rahman et al., 2016).

In the present research, EFA was adopted as part of the analysis primarily to reduce the large number of variables (referred to as problems in final account closing), understand the relationships and patterns among the observed variables, and establish meaningful components for the observed variables. By regrouping the observed variables into a limited set, this research can focus on a smaller set of variables rather than considering all variables that may be unimportant (Muhammuddin et al., 2023; Sürücü et al., 2022).

The data were analysed using SPSS software, utilising EFA for dimension reduction. The analysis includes checking the Bartlett Test of Sphericity, and sampling adequacy using Kaiser-Mayer-Olkin (KMO) to test whether the dataset is suitable for EFA. Bartlett's Test of Sphericity and the KMO are widely used in the literature to determine the strength of relationships and evaluate the factorability of variables. While KMO provides information on sample adequacy, Bartlett's Test of Sphericity also provides information on whether the dataset has pattern relationships. Bartlett's test for sphericity provides evidence that the observed correlation matrix is statistically different from a single matrix and confirms the existence of linear combinations (Hair et al., 2019). If the value of this test statistic is significant ($p < .05$), it indicates that the correlation matrix is sufficiently large, demonstrating that the correlation matrix is not an identity matrix and confirming its suitability for factor analysis (Field, 2009; Hair et al., 2019).

The analysis also includes an examination of sampling adequacy using the Kaiser-Meyer-Olkin (KMO) measure to quantify the degree of correlation among the items. The results regarding sampling adequacy align with the suggested thresholds by Kaiser (1970), which are as follows: a KMO value above 0.90 is deemed marvellous; between 0.80 and 0.90 is considered meritorious; between 0.70 and 0.80 is categorised as middling; between 0.60 and 0.70 is regarded as mediocre; between 0.50 and 0.60 is classified as miserable; and below 0.50 is deemed unacceptable. This KMO assessment was based on the thresholds recommended by (Worthington & Whittaker, 2006).

According to Hair et al. (2019), there are no specific guidelines for selecting the extraction and rotational methods in exploratory factor analysis (EFA), as no compelling analytical reason suggests favouring one over another. Furthermore, Sürücü et al. (2022) assert that statistical methods in EFA are flexible, and it is up to the

personal preference of the researcher which methods to apply. However, the EFA method chosen in this study is based on the standard practice and application observed in previous construction-related research aimed at reducing factors (such as; Dogbegah et al., 2011; Głuszak & Leśniak, 2015; Judi, 2020; Karji et al., 2020; Lew et al., 2013; Muhammuddin et al., 2023; Rahman et al., 2016; Saar et al., 2017; Treacy et al., 2016; Zakaria, 2015). Costello & Osborne (2005) suggest that two methods are commonly used to extract the underlying factors for analysis, namely, principal component analysis (PCA) and principal axial factoring (PAF). Even though there are some mathematical and theoretical differences, the practical steps and processes are similar for both methods. According to (Sürücü et al., 2022), both generate similar results in most cases, with the ability to mathematically reduce variables by breaking them down into fewer components. The primary difference, computationally, between the two is that PCA aims to reproduce all information (variance and covariance) associated with the variables, while PAF is focused on understanding the covariation among variables (Leech et al., 2011). The current research has employed the PCA method to extract the relevant variables, referred to as problems, in the final account closing process.

The orthogonal rotation method using Varimax rotation is used, as this method is the most common choice suitable for data reduction (Costello & Osborne, 2005). In addition, the Varimax rotation method is used because it is believed that the variables are uncorrelated with one another, which can make results easier to interpret and to simplify the expression of a particular item into a few components.

Factor loadings were used to assess the validity of the variables (Hair et al., 2019). Factor loads indicate the contribution of a variable to the formation of a relevant component. Therefore, factor loads need to be controlled. Previous literature reviews recommended setting the lower cut-off value at 0.50 or 0.40, depending on the number of variables in the components. The choice of cut-off point may vary depending on the ease of interpretation, including how complex variables are handled. In this research, the cut-off threshold of factor loading is set at 0.50 to ensure that the extracted variables are highly reliable (Costello & Osborne, 2005; Hair et al., 2014).

Regarding the value of communalities, it is deemed “high” if all are 0.80 or above. More typical communalities range from 0.40 to 0.70, representing low to moderate levels (Costello & Osborne, 2005). In the present research, communalities exceeding 0.50 were employed to ensure a high level of confidence and acceptance of the extracted variables and items as valid (Hair et al., 2019).

Finally, the internal consistency test of the grouped variables in the components resulting from the EFA was examined using a Cronbach's Alpha reliability test. (Nunnally & Bernstein, 1994) recommended that a cut-off value of 0.70 or higher can be employed to determine whether the grouped variables were reliable. However, Hair et al. (2019) claimed that a reliability score above 0.60 may be acceptable to suggest that the grouped variables form a reliable set of components.

In summary, EFA was conducted in this research using SPSS software (version 29) to analyse the data in Section C of the questionnaire survey and validate the relevant problems pertaining to the final account closing process. The EFA procedure in this research was adopted in accordance with the best practices suggested by previous researchers. After the analysis, the relevant problems in the final account closing and their components were identified as presented in Chapter 4 (section 4.4.3.1).

3.5.2.3 Qualitative Data Collection Method

Following the quantitative analysis and results, qualitative data were collected through semi-structured interviews to further clarify the findings. As mentioned earlier in the section 3.4 above, this research employed an explanatory sequential mixed-methods approach. A semi-structured interview was conducted to achieve objectives 3 and 4. Specifically, it investigates the root causes contributing to the major problem in final account closing and determines the strategies and solutions for preventing the major problems and their root causes towards improving the final account closing process in the Malaysian construction industry.

The adoption of semi-structured interviews in the second phase of data collection was appropriate due to their suitability for addressing complex and sensitive inquiries. It enables researchers to explore the reasons behind the quantitative findings and adjust questions based on new insights. Additionally, the questions can be explained during the interview, thereby reducing the likelihood of misunderstandings (Kumar, 2011). Furthermore, semi-structured interviews can facilitate the collection of in-depth information, using a predetermined list of themes and key questions to guide the discussion, but allowing flexibility for the interviewer or interviewee to pursue ideas in more detail, adapting to the flow of conversation and emerging insights (Merriam & Tisdell, 2016; Saunders et al., 2019).

a) Development of Interview Protocol and Interview Questions

An interview protocol, also referred to as an interview guide, is a predesigned form used by a qualitative researcher to record information during an interview (Creswell & Creswell, 2018). It essentially serves as a guide for conducting interviews, outlining the questions the researcher intends to ask and providing a structured framework for the interaction (Merriam, 2009). The primary purpose of an interview protocol is to ensure standard procedures are used from one interview to another, helping to organise the researcher's thoughts and manage the flow of conversation (Creswell & Poth, 2018). The core component of the interview protocol is the questions to be asked. The questions typically begin with an ice-breaker question to ease into the conversation, followed by open-ended and substantive questions related to the research topics. Additionally, the follow-up questions are used to encourage informants to explain their ideas in more detail, elaborate on what they have said, or clarify unclear or incomplete answers (Gill et al., 2008).

The interview questions for this research were formulated to address research questions 3 and 4, which are why major problems often occur during the final account closing, and how to proactively address these problems and their root causes to improve the final account closing process. The questions were also structured based on the findings from the earlier questionnaire survey and guided by the knowledge acquired from past literature. According to Creswell & Poth (2018), it is also important to have a sound theoretical understanding of past works and literature of the study topics before developing the interview questions.

The interview questions in this research are primarily divided into three main sections. Section one includes questions about the informant’s background, such as the name of the organisation, experiences and position within the organisation, which aimed to collect relevant information on the background of each informant. The second section focuses on the informant’s views about the current issues and scenarios of final account closing in construction projects faced by the organisation and the informants themselves. The third section was designed to acquire a comprehensive understanding and perception of the eight major problems in the final account closing process identified from quantitative findings. This section specifically investigates the root causes of these problems and explores proactive strategies to prevent their occurrence before they escalate into disputes. Moreover, this section aims to address research

questions 3 and 4 previously mentioned. The interview concluded with inquiries about various initiatives that could efficiently and effectively improve the final account closing process in Malaysia. The sessions were finalised with expressions of gratitude to acknowledge the interviewees' time and included a request for follow-up information.

According to Merriam (2009), it is essential and advisable to review and refine the interview protocol and questions prior to conducting the actual interviews. Accordingly, the interview protocol was reviewed and validated by a panel comprising two (2) senior academics in the built environment programme, one (1) academic reviewer in the English language programme and two (2) experienced industry practitioners, prior to the commencement of the interview. This multi-party review panel ensured that the protocol was assessed from both academic rigour and industry relevance perspectives. Specifically, the panel reviewed the clarity of question framing, the relevance and appropriateness of questions for addressing the research questions, the logical sequencing of interview questions, and whether the questions were sufficient to elicit relevant information from informants. The feedback from this review also helps identify any unforeseen challenges that may arise during data collection. Furthermore, this contributes to the overall reliability and validity of the collected data (Alwee, 2023; Creswell & Creswell, 2018; Merriam, 2009). All recommendations from the review panel, including questions, content, and structure, were refined and revised multiple times and integrated into the final interview protocol. As a result, the interview protocol was finalised (refer to Appendix 2).

b) Sampling

In the current research, non-probability sampling is employed for qualitative data collection, similar to the initial quantitative phase, to select key stakeholders involved in the final account closing, comprising the Client, G7 Contractor, and QS Consultant. This approach is suitable when detailed information about the population is unavailable, as it enables in-depth exploration of specific issues or relationships within the social context (Kumar, 2011; Neuman, 2014). Unlike quantitative methods aimed at generalisation, qualitative sampling focuses on understanding particular cases thoroughly (Setia, 2017).

The phenomenology research design was chosen as the most suitable for the qualitative phase of the current research because it focuses on understanding

individuals' perceptions, reactions, and behaviours within their social practice (Lindseth & Norberg, 2004; Manen, 2016). Governed by the phenomenological research design, this research uses purposive sampling to select knowledgeable informants with relevant experience, ensuring valid and comprehensive data for the research questions (Bekele & Ago, 2022). This sampling method is also commonly used in qualitative research and is appropriate for conducting phenomenological research, as it allows the researchers to select participants based on specific characteristics or qualities that are relevant to the study, to gain deep insights and an in-depth understanding of issues (Ahmad & Wilkins, 2025; Guest et al., 2020; Staller, 2021).

Consequently, the key personnel from clients, G7 contractors, and quantity surveying consultants with practical experience in the construction industry and expertise in the final account stage are selected as informants for qualitative data collection. As this research focuses on the issues related to final account closing in private projects, the selected informants must also be involved with private projects and specifically utilise the PAM Contract 2018. The potential informants were selected based on the predetermined criteria that include: i) having at least ten (10) years of experience in managing construction projects, ii) having been directly involved in managing the final account closing process, iii) possessing knowledge of construction contracts, and iv) holding a senior-level or top management position at their respective organisation. These criteria were considered to have in-depth knowledge and understanding of contract administration, particularly on the final account and payment process (Judi, 2020; Zakaria, 2015).

The details and information regarding the potential informants for the semi-structured interview were obtained from the questionnaire survey in which they had previously participated. Furthermore, the researcher identified potential informants among professional colleagues in the construction industry and through professional networking platforms such as LinkedIn, which verified their professional backgrounds in the construction sector.

Potential informants who met the inclusion criteria were subsequently contacted by email and telephone for formal purposes. The purpose and objectives of the research, as well as the nature of the information required during the interview sessions, were thoroughly explained. The faculty letter for data collection was obtained after the informants agreed to participate in the interview. This step was essential to get their informed consent to participate in the research. Those who expressed a willingness to

participate were then scheduled for interviews at their preferred times and locations, predominantly conducted through online platforms such as Google Meet, or in a face-to-face setting. Interview questions were shared in advance to help informants better understand the research topic and allow them to reflect more deeply on their experiences, leading to more thoughtful and detailed responses. Haukås & Tishakov (2024) highlighted that sharing questions in advance can enhance participant engagement and foster transparency, as it clarifies what will be discussed and allows participants ample time to recall specific events or information pertaining to the research topic.

c) Sample Size

The primary conceptual guideline for determining qualitative sample size is data saturation, as recommended by numerous scholars (Bougie & Sekaran, 2020; Creswell & Creswell, 2018; Saunders et al., 2019). Saturation occurs when additional interviews fail to yield new information, themes, or pertinent insights related to the research question (Guest et al., 2006; Marshall et al., 2013; Naeem et al., 2024; Rahimi & Khatooni, 2024). Some studies have indicated that saturation should be deemed achieved only after two or three consecutive interviews fail to reveal any new issues or information (Coenen et al., 2012; Francis et al., 2010; Morse, 2015). Overall, saturation was described as the point at which few or no new relevant codes or themes were identified in the data, and information was repeated without further insight.

Although the concept of data saturation is valuable for determining the appropriate sample size, researchers typically need to estimate sample sizes during the preliminary or proposal stages of their study. Subsequently, a review of existing literature provides guidelines for estimating sample sizes specifically in phenomenological research. Based on the systematic review conducted by Hennink & Kaiser (2022), the average number of interviews required to achieve saturation ranges from 12 to 13 cases. This finding is notably consistent with earlier research by Guest et al. (2006), which identified saturation at 12 interviews.

The current research, therefore, established the sample size for semi-structured interviews based on the principle of data saturation, complemented by established recommendations for phenomenological research design and thematic analysis methods as previously discussed. Consequently, in conducting the semi-structured interviews for

this research, a total of twelve (12) informants, comprising four (4) Clients, four (4) G7 Contractors, and four (4) QS Consultants, were selected to serve as the benchmark for achieving saturation. The decision to include an equal number of informants from each stakeholder group (Clients, G7 Contractors, and QS Consultants) ensures that perspectives from all key parties are adequately represented in the research. This strategy not only enhances the reliability of the findings but also enables a comprehensive exploration of the phenomenon under study from multiple perspectives.

d) Conducting the Interview

There are four interview techniques in qualitative research, known as face-to-face, online, telephone, and focus group (Creswell & Poth, 2018). Face-to-face interviews are widely regarded as the gold standard in qualitative research, primarily for their capacity to establish rapport, encouraging deeper engagement and observing nonverbal cues, which can result in more detailed and richer data (DiCicco-Bloom & Crabtree, 2006; Peters & Halcomb, 2015). However, this method can be time-consuming and expensive, particularly when participants are geographically dispersed (Janghorban et al., 2014; Oltmann, 2016). Additionally, logistical issues like coordinating schedules can pose substantial challenges (Panyasai & Ambele, 2025).

The evolution of technology and the impact of the COVID-19 pandemic have accelerated the adoption of online interviewing, making it an increasingly popular alternative to traditional face-to-face interviews. Online video interviews offer similar benefits to face-to-face interviews, with more accessibility to a broader range of participants, offering flexibility in terms of time and location and reduced costs (Aborisade, 2013; Janghorban et al., 2014). However, technological proficiency is required from both the interviewer and the interviewee, which can be a barrier for some informants. Additionally, the lack of physical presence may limit the ability to observe non-verbal cues during the interview (Aborisade, 2013).

After considering various factors, this research employed the interview approach based on the preference of the potential informants. The researcher contacted and inquired about their preferred interview approach, recognising their busy schedules and the demanding nature of their roles in managing various scopes of construction projects. Most informants who were contacted and agreed to participate preferred online

interviews due to their flexibility with timing and location, while some others preferred face-to-face interviews at their offices.

The informants were briefed on the research background at the beginning of the interview. Permission to record video (for online interviews) and audio (for face-to-face interviews) was obtained to ensure data accuracy. Video and audio recording may also assist both the researcher and the informant in maintaining attentiveness during the interview session. Field notes were also utilised to document the additional information provided by the informant.

During the interview session, the researcher often acts as the primary instrument, playing an active role in obtaining in-depth and detailed information about the specific problems and issues related to the research topic. The good rapport between the researcher and informants during the interview session can significantly affect the depth and honesty of the responses, making informants more willing to share sensitive issues or information (Alam, 2024). Cheron et al. (2022) emphasised that the interviewer is not just a passive questioner, but a skilled facilitator who creates a conversational space that encourages informants to share rich and meaningful insights. Hence, several probing questions, derived from the researcher's knowledge, literature reviews and the previous informants' responses, were posed during the interview to enable the researcher to explore the study issue comprehensively and to develop new insights and understanding, thereby enhancing the study's outcomes and discoveries. The questions sometimes need to be adapted based on the participant's responses, which can extend the duration of each session. The interview session lasted approximately 90 to 150 minutes on average, depending on the extent to which the informants expressed their opinions and arguments regarding the discussed issues. Nevertheless, these sessions concluded in a natural manner rather than unexpectedly, as the researcher observed that the informants repeatedly disclosed similar information and narratives pertaining to the specific issues.

The process of gathering data through interviews frequently requires substantial time and effort, as it involves transcribing and analysing data simultaneously during the data collection phase. The transcription and review of data were conducted after each interview to ensure that no information was missed or overlooked, thereby preventing the potential omission of significant findings or facts. Some informants were re-contacted or followed up to clarify information that was missed or not fully understood during the previous interview. This can be considered a good practice to enhance the

validity and reliability of the data (Rowlands, 2021). In addition, challenges related to logistics, scheduling, and the distance of informants for conducting interviews collectively contribute to the prolonged data collection period. Consequently, the data collection process was conducted over a period of four (4) months, from March 2024 to June 2024. Following the completion of each interview, the data were systematically compiled and labelled as either Client (CL), Contractor (CR), or QS Consultant (CS), then subsequently uploaded into the Atlas.ti version 25 software application utilised for data analysis.

Additionally, second-round or follow-up interviews were conducted with four (4) selected informants, during which the data and preliminary findings from the first interview were presented to verify their accuracy and relevance to the informants' experiences. This approach, often called member checking, can enhance both the reliability and validity of research findings, as it allows the researcher to revisit emerging themes and refine understanding, contributing to the overall trustworthiness of the study (Birt et al., 2016; Coleman, 2021). Furthermore, follow-up interviews contribute to prolonged engagement in the field, which is a key strategy for establishing the validity of qualitative findings (Ahmed, 2025; Kamarul Azmi, 2012). This interaction minimises potential researcher bias by engaging informants in validating the results, ensuring their viewpoints are properly represented instead of being limited by the researcher's point of view only. Table 3.3 presents the audit trails that emphasise methodological documentation of data collection activities, involving semi-structured interviews among several identified informants conducted through face-to-face and online sessions:

Table 3.3
Audit Trails on Data Collection Activities

No.	Date	Informant	Position	Mode of interview	Duration of interview
1	10 Mar 2024	CS 1	Managing Director	Face-to-face	2 hours
2	14 Mar 2024	CS 2	Managing Director	Online	1 hour 30 minutes
3	19 Mar 2024	CR 3	Company Director	Online	3 hours
4	25 Mar 2024	CR 4	Company Director	Face-to-face	2 hours 15 minutes
5	5 Apr 2024	CL 5	Senior Manager	Online	2 hours 30 minutes

No.	Date	Informant	Position	Mode of interview	Duration of interview
6	22 Apr 2024	CL 6	Senior Quantity Surveyor	Online	2 hours 45 minutes
7	26 Apr 2024	CR 7	Project Manager	Face-to-face	2 hours
8	2 May 2024	CS 8	Senior Quantity Surveyor	Face-to-face	2 hours
9	8 May 2024	CS 9	Senior Quantity Surveyor	Online	1 hour 45 minutes
10	21 May 2024	CR 10	Contract Manager	Online	2 hours
11	4 Jun 2024	CL 11	Assistant Contract Manager	Face-to-face	2 hours 30 minutes
12	14 Jun 2024	CL 12	Assistant Contract Manager	Online	1 hour 45 minutes
Second-Round / Follow-up Interview					
1	7 Sept 2024	CR 4	Company Director	Face-to-face	30 Minutes
2	9 Sept 2024	CS 8	Senior Quantity Surveyor	Face-to-face	20 Minutes
3	13 Sept 2024	CL 12	Assistant Contract Manager	Face-to-face	30 Minutes
4	21 Sept 2024	CS 1	Managing Director	Face-to-face	30 Minutes

3.5.2.4 Qualitative Data Analysis Method

Various methods exist for qualitative data analysis, including thematic analysis, grounded theory, interpretative phenomenological analysis and content analysis (Ahmed et al., 2025). Among these, thematic analysis is the most widely utilised method for analysing qualitative data, offering a structured yet flexible framework for identifying, analysing, and interpreting patterns of meaning (theme) within datasets (Fuchs, 2023; Sandhiya & Bhuvaneswari, 2024). It allows researchers to uncover and interpret themes embedded within data, contributing to theory development and detailed insights. thematic analysis can be conducted inductively (themes emerge from data) or deductively (pre-existing theoretical knowledge applied to data), or as a hybrid approach (Braun & Clarke, 2012; Naeem et al., 2023). It is also useful for analysing

both large and small qualitative datasets (Saunders et al., 2019). Hence, the thematic analysis method is deemed appropriate for analysing the qualitative data collected through semi-structured interviews in the current study.

a) Thematic Analysis

This research employed thematic analysis to examine and identify patterns of themes related to the research questions, derived from data collected through interviews with research informants. The analysis process was guided by a Braun & Clarke (2006) framework, as illustrated in Figure 3.3. Although the six phases are organised in a logically sequential order, it is essential to recognise that the analysis is not strictly linear. Instead, it is both recursive and iterative, requiring the researcher to navigate back and forth between phases as needed (Braun & Clarke, 2020). Consequently, thematic analysis is a time-consuming process as the researcher navigates the different phases, potentially leading to new interpretations of the data and necessitating further iterations of earlier phases. Therefore, it is important to view the six-phase model as a flexible guideline rather than a rigid set of rules, allowing for adaptation to the specific data and research questions (Braun & Clarke, 2013, 2020). The analysis employed a hybrid approach, combining deductive (theory-driven) and inductive (data-driven) elements. This allowed for the exploration of concepts from existing related literature while also remaining open to new, unexplored insights emerging directly from the experiences of the research informants.

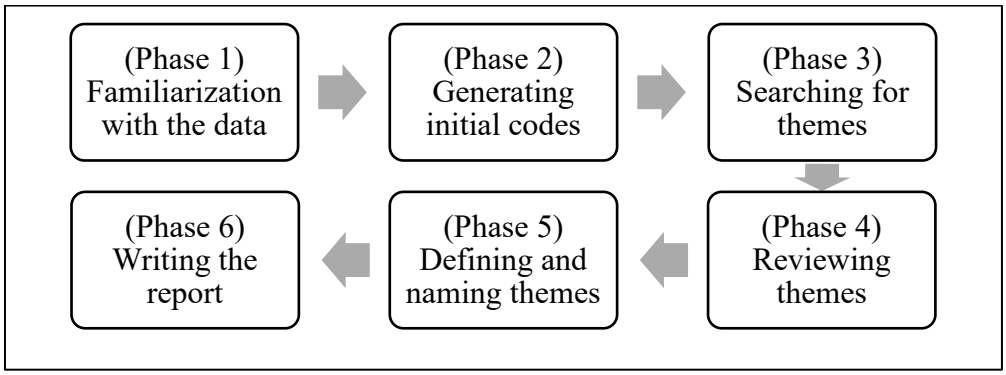


Figure 3.3 Six Phases in Thematic Analysis (Braun & Clarke, 2006)

Phase 1: Data Familiarisation

This stage is fundamental, involving researchers deeply engaging with their dataset to develop a comprehensive understanding of the data's breadth, depth, and patterns, which is essential for identifying information relevant to the research questions (Ahmed et al., 2025). According to Nowell et al. (2017), this process requires an active and iterative process that requires patience and meticulous attention to detail of the text data. The researcher begins this phase by transcribing data collected through semi-structured interviews. Audio recordings from interviews are played multiple times and transcribed manually, with the online software (oTrascribe.com) utilised to perform the transcription. Although several web-based applications (such as TurboScribe, Transkriptor, and Notta) are readily available for automatic transcription, the researcher does not depend entirely on these tools. Instead, they are used to assist the transcription process. Recognising the limitations of these online applications in accurately capturing the data that can lead to misleading results, the researcher prefers manual transcription to ensure the accuracy of the transcripts and reflect the true meaning of the interviews. The time spent transcribing a single audio recording interview was approximately four to six hours. Although time-consuming, manual transcription was an appropriate choice. The transcription process also served as part of the analysis, as it requires careful attention to the details and substance within the data (Campbell et al., 2021; Christou, 2022).

Most interviews are conducted in Malay language (with some English terms incorporated), since it is the native language of both the researcher and informant. The edited transcription is employed in transcribing the audio files, which involves the omission of certain sentences or phrases deemed unnecessary or excessive. According to Brady (2015), the process of selecting certain parts of an interview and leaving out others is important because it makes the transcript more concise and easier to analyse. However, it is done minimally to preserve the text's originality and maintain the essence and overall idea of the date.

Once all interviews were transcribed, the next step was data management and repeated reading, facilitated by ATLAS.ti software version 25. This software was useful in managing the large volume of qualitative data generated from the interviews. Using ATLAS.ti allowed for a more systematic and transparent approach to data interpretation, as it keeps all data sources organised in a single project file, which can

enhance the efficiency and validity of the analysis (Alwee, 2023; Shahruddin et al., 2024; Zairul, 2025). The completed transcripts are coded by informant type, such as CS1 for the first interview with the QS Consultant, CR3 for the third interview with the G7 contractor, CL5 for the fifth interview with the client, and so forth. After all the data had been transferred to ATLAS.ti, the researcher conducted active and repeated reading. Each transcript was read multiple times while listening to the corresponding audio file simultaneously. During this immersive reading stage, the researcher engaged in initial note-taking using the 'memo' function within ATLAS.ti. These were not formal codes but preliminary thoughts, observations of recurring ideas, or potential patterns related to research objectives (Byrne, 2021).

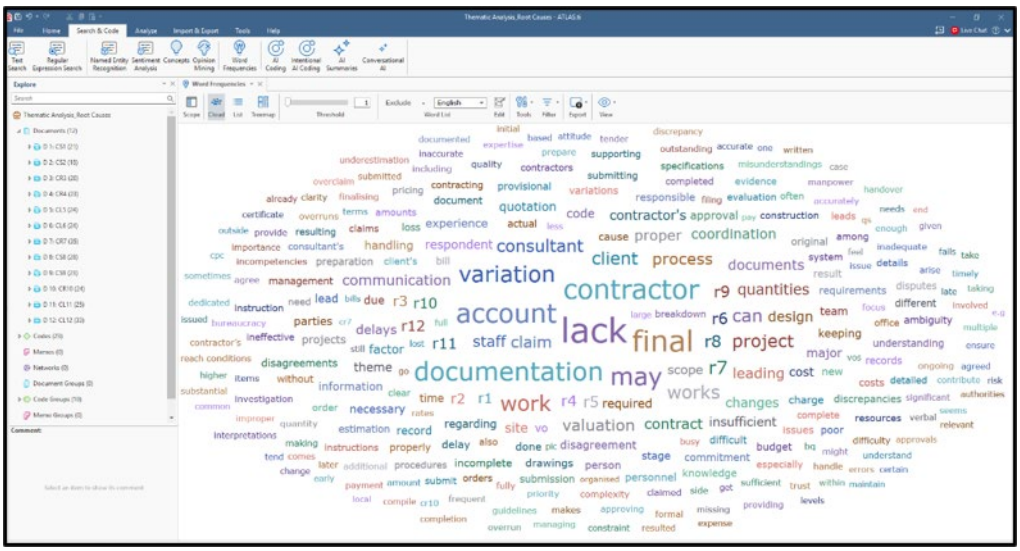


Figure 3.4 Storing and Organising Data Using ATLAS.ti Software

Phase 2: Generating Initial Codes

Following the data familiarisation phase, the researcher moves to the next systematic process of generating initial codes. This phase serves as a critical step of analysis, moving from a general understanding of the data to organising and labelling it into meaningful codes (Ahmed et al., 2025; Nowell et al., 2017). A code is a label assigned to a segment of text data that captures its essence or most salient feature in relation to the research questions (Braun & Clarke, 2006). The primary purpose of coding is to reduce the large volume of complex qualitative data into smaller and manageable units by assigning short phrases or words that capture the core message,

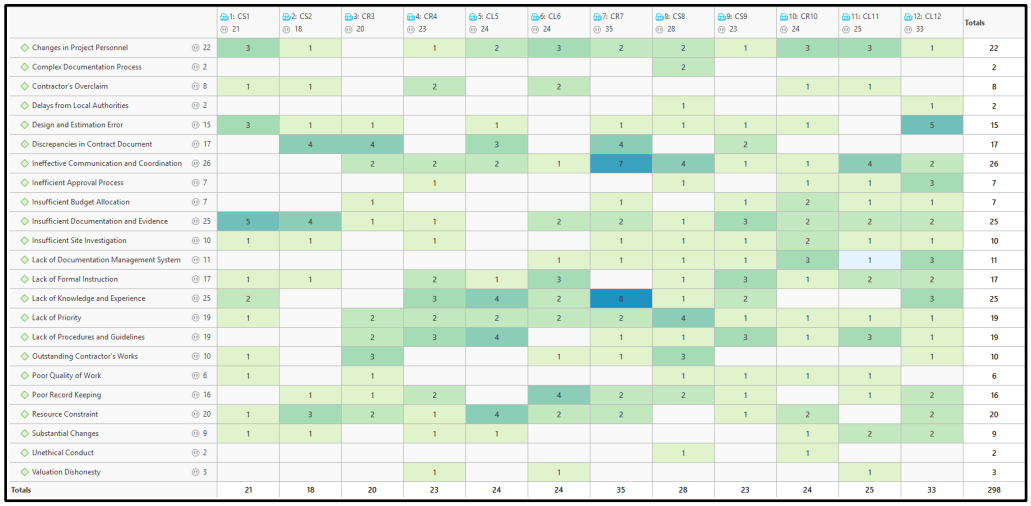
significance, or underlying patterns of data segments (Maguire & Delahunt, 2017; Naeem et al., 2023).

The researcher plays an active and interpretive role in this phase. Codes are not simply found residing in the data but are actively constructed through the researcher's interpretation. During this process, researcher engage in a meticulous and iterative process, systematically working through the entire dataset. Codes can be semantic, reflecting the explicit or surface meanings of the data, or latent, which delve deeper to identify hidden meanings, underlying ideas, assumptions, or ideologies that inform the semantic content (Byrne, 2021; Christou, 2022; Maguire & Delahunt, 2017). The codes are also developed based on the researcher's assumptions, biases, and theoretical positioning, as these naturally influence coding decisions (Byrne, 2021; Maguire & Delahunt, 2017). The coding process is fluid and recursive rather than linear, meaning researcher frequently revisit and refine codes, merging similar ones or creating sub-codes as their understanding evolves (Byrne, 2021). These codes act as the fundamental building blocks for the later development of themes (Braun & Clarke, 2006).

In accordance with the hybrid methodology, the coding process was conducted using both deductive and inductive approaches. For deductive coding, the researcher analysed the data with specific concepts derived from existing literature on final account issues. For example, when multiple informants highlight concerns regarding undocumented verbal instructions for variation works, the code "Improper Variation Order" was assigned, as this terminology was already recognised by the researcher, based on established literature. Whereas inductive coding involved open coding, where codes were developed directly from the informants' narratives. This approach allowed for unexpected insights to emerge. For example, several informants mentioned the challenges of managing and storing project documentation; a new code, "Poor Record Keeping", was created. During this phase, regular discussions and meetings were also conducted with research supervisors and colleagues from both academia and industry who are familiar with the research topic and phenomena to solicit their input for interpreting data and generating the codes. This approach, also known as peer debriefing techniques, helps to clarify the findings and explore alternative interpretations, thereby minimising potential biases of the researcher and improving the trustworthiness of the findings.

In this research, the coding process was conducted using ATLAS.ti software. Figure 3.5 shows an example of several developed codes and their frequencies for this

research, which are organised and generated using the software. The overall success of the thematic analysis relies on the quality of the initial coding. Clear codes help create meaningful themes, making the analysis reliable and easier to progress. The analysis identified twenty-three (23) codes that emerged from the interview data, pertaining to root causes contributing to major problems in the final account closing issues (refer to Chapter 5 section 5.3.1), and twenty-four (24) codes of preventive solutions for improving final account closing issues (refer to Chapter 5 section 5.4.1).



	1: CS1 (21)	2: CS2 (18)	3: CR3 (20)	4: CR4 (23)	5: CL5 (24)	6: CL6 (24)	7: CR7 (35)	8: CS8 (28)	9: CS9 (23)	10: CR10 (24)	11: CL11 (25)	12: CL12 (33)	Totals
Changes in Project Personnel (22)	3	1		1	2	3	2	2	1	3	3	1	22
Complex Documentation Process (2)								2					2
Contractor's Overclaim (8)	1	1		2		2				1	1		8
Delays from Local Authorities (2)								1				1	2
Design and Estimation Error (15)	3	1	1		1		1	1	1	1		5	15
Discrepancies in Contract Document (17)		4	4		3		4		2				17
Ineffective Communication and Coordination (26)			2	2	2	1	7	4	1	1	4	2	26
Inefficient Approval Process (7)				1				1		1	1	3	7
Insufficient Budget Allocation (7)			1				1		1	2	1	1	7
Insufficient Documentation and Evidence (25)	5	4	1	1		2	2	1	3	2	2	2	25
Insufficient Site Investigation (10)	1	1		1			1	1	1	2	1	1	10
Lack of Documentation Management System (11)						1	1	1	1	3	1	3	11
Lack of Formal Instruction (17)	1	1		2	1	3		1	3	1	2	2	17
Lack of Knowledge and Experience (25)	2			3	4	2	8	1	2			3	25
Lack of Priority (19)	1		2	2	2	2	2	4	1	1	1	1	19
Lack of Procedures and Guidelines (19)			2	3	4		1	1	3	1	3	1	19
Outstanding Contractor's Works (10)	1		3			1	1	3				1	10
Poor Quality of Work (6)	1		1					1	1	1	1		6
Poor Record Keeping (16)		1	1	2		4	2	2	1		1	2	16
Resource Constraint (20)	1	3	2	1	4	2	2		1	2		2	20
Substantial Changes (9)	1	1		1	1					1	2	2	9
Unethical Conduct (2)								1		1			2
Valuation Dishonesty (3)				1		1					1		3
Totals	21	18	20	23	24	24	35	28	23	24	25	33	298

Figure 3.5 Code Development Using ATLAS.ti

Phase 3: Searching for Themes

Once the initial list of codes was generated, the analysis moved into the third phase, which is searching for themes. This phase involves a shift from labelling segments of data with individual codes to a more interpretive process of identifying broader patterns (Ahmed et al., 2025). A "theme" in thematic analysis represents a recurring and meaningful pattern of significance within the data that is closely related to the research question (Braun & Clarke, 2006). At this phase, the researcher will analyse different codes and explore how they might interact, overlap, or contrast with each other. The development of themes relies on the researcher's creativity and analytical judgment and a thorough understanding of the data (Naeem et al., 2023). This involved an iterative process of grouping, combining, and organising the codes (Christou, 2022). For instance, codes such as "Inadequate documentation," "Poor record-keeping," and "Complex documentation process" were examined to see if they

could be clustered together under a broader, more abstract theme. This phase is dynamic, involving trial and error, where the researcher might need to revise, collapse, or split themes as they interrogate the initial thematic structure (Sánchez-Castany, 2023). Naeem et al. (2023) propose considering four "Rs" to enhance the process of developing the theme, namely: 1) Reciprocal (themes are built upon a mutual connection between different codes), 2) Recognisable (themes must align closely with and be easily identifiable from the original data), 3) Responsive (themes should align with and address the overall aims and objectives of the research), and 4) Resourceful (themes should provide useful insights that help answer the research question).

To facilitate the analysis process of the current research, the researcher utilised the visualisation tools within ATLAS.ti 25. Creating network views and conceptual diagrams, often referred to as thematic maps, was particularly helpful (Braun & Clarke, 2012). These visual aids help the researcher see how different codes cluster together and how they relate to one another, assisting in evaluating the coherence and distinctiveness of emerging themes. By the end of this phase, the researcher had produced an initial thematic map outlining a set of themes and codes (refer Figure 3.6). This map offered a clear, though provisional, outline of the data, which would be thoroughly refined in the next phase.

Phase 4: Reviewing Themes

The fourth phase involves carefully checking and refining the themes that have been tentatively identified in the previous stage, ensuring they genuinely represent the data and tell a clear, meaningful story about the research question. The goal during this phase is to assess whether the initial themes and the groups of codes formed are well represented when compared to the coded data extracts and the dataset (Ahmed et al., 2025; Byrne, 2021). It involves verifying that the themes accurately and coherently represent the insights conveyed by the data.

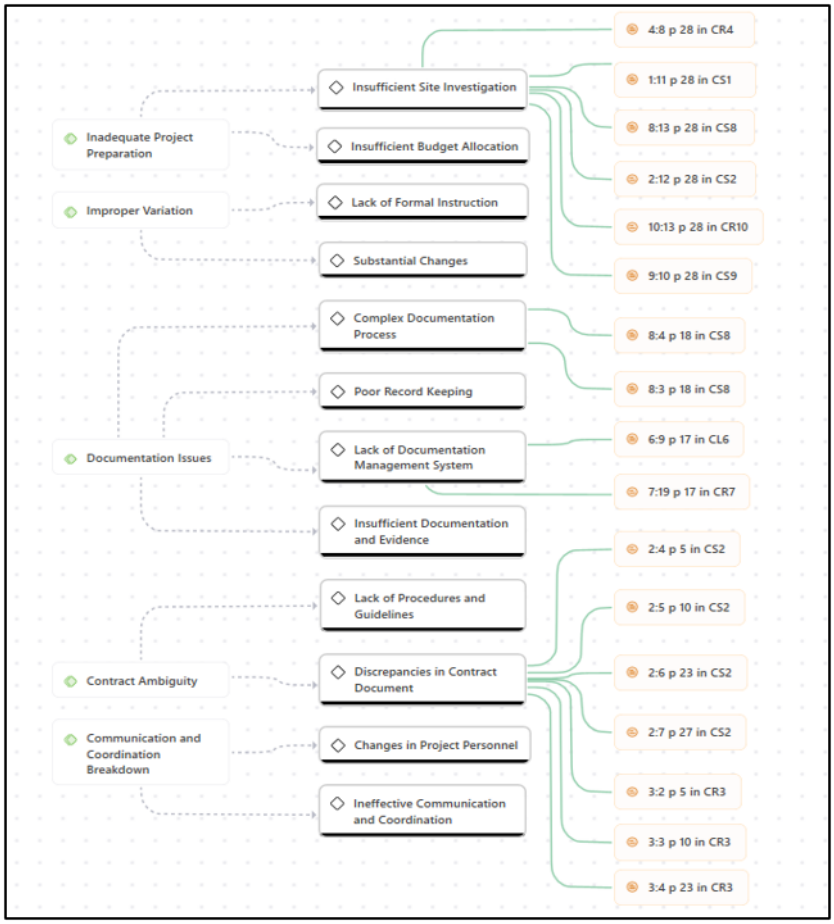


Figure 3.6 Thematic Network for Themes and Codes Using ATLAS.ti

To achieve this, the researcher carefully reviews all the coded data extracts for each theme. The researcher seeks internal homogeneity, meaning that all the coded data within a specific theme should logically align and share a common core idea. At the same time, the researcher should aim for external heterogeneity, meaning each theme should be distinct and different from all other themes (Maguire & Delahunt, 2017). There should not be too much overlap between them.

This process is highly iterative, involving multiple cycles of reading the data. It includes adjusting theme boundaries, merging similar themes, splitting broad themes into more specific sub-themes, or discarding themes that lack sufficient support or relevance to the research objectives (Byrne, 2021). For instance, a researcher might find that an initial theme is too dense and needs to be broken down, or that several smaller themes could be combined into a more comprehensive theme.

In this research, several modifications to themes have been conducted. For example, a theme initially labelled "Collaboration" was found to be too broad (lacking internal homogeneity). After reviewing the coded extracts, it was added to be a more

specific and coherent theme: "Collaborative Work Approach". Conversely, two separate themes on "Early Documentation Process" and "Early Preparation" were found to overlap significantly and were merged into a single, more robust theme called "Timely Processing".

Throughout this phase, the ATLAS.ti 25 software was used to manage the refinement process. It allowed the researcher to easily move coded data between themes, merge or split theme categories, and update the thematic map to reflect the evolving structure of the analysis. The phase concluded when the researcher was satisfied that the thematic map presented a coherent, well-supported, compelling narrative that accurately represented the entire dataset and directly addresses the research aims, making the researcher feel confident in moving forward.

Phase 5: Defining and Naming Themes

The fifth phase involves defining and naming the final themes. After an extensive process of reviewing and refining potential themes, this stage focuses on clearly defining each theme's identity and articulating its unique voice, thereby preparing them to effectively convey the narrative of the research (Ahmed et al., 2025; Braun & Clarke, 2006; Maguire & Delahunt, 2017).

A key part of this phase is selecting names for the themes. Theme names should be concise, informative, memorable, and accurately represent the core idea of the theme (Braun & Clarke, 2013; Byrne, 2021). Researchers are encouraged to be creative and avoid names that are overly vague, overly technical, or merely direct quotes from the data, as the name should capture the interpretive work involved. The name is often the first indication to the reader of what the theme encompasses, so it's a vital task that requires careful consideration (Byrne, 2021).

Reflexivity is essential at this stage, requiring the researcher to constantly reflect on their interpretations and theoretical assumptions, recognising how these might influence the way themes are defined and named (Christou, 2022). It is undeniable that some data interpretations, codes, and themes developed during the analysis were influenced by personal experiences of the researcher. For example, the researcher had gained some experience in managing payments and final account in construction projects while previously working in a construction company. Researchers must also

ensure that the final theme definitions remain consistent with the study's overall research objectives and theoretical framework (Ahmed et al., 2025).

For example, in this analysis, a theme initially named "Issues Related to Contract Terms and Procedures" was refined to the more compelling and analytical name, "Contract Ambiguity," which better captured the difficulties and frustrations expressed by the participants. The "Memos" function in ATLAS.ti 25 software was used to write, store, and refine the definitions for each theme. This ensured that the analytical narrative for each theme was developed and stored alongside the corresponding data, maintaining a clear and transparent audit trail of the interpretive process.

This phase concluded when each theme had a clear, well-defined narrative and a fitting name, ready for the final write-up. Consequently, this research identified ten (10) main themes pertaining to root causes contributing to major problems in the final account closing issues (refer to Chapter 5 section 5.3.1), and nine (9) main themes of preventive solutions for improving final account closing issues (refer to Chapter 5 section 5.3.1 and 5.4.1).

Phase 6: Writing the Report

The sixth and final phase of the analysis is writing and producing the report. The primary aim of this phase is to translate all established themes into a structured document that presents the results of thematic analysis. It is not merely about listing themes, but synthesising them into a meaningful narrative that aligns with the research question and captures the rich complexity of the dataset (Ahmed et al., 2025; Byrne, 2021). It is also important for researchers to provide a logical, coherent, and concise narrative of the story that the information or data reveals across the established themes (Christou, 2022).

An important element of the report is the integration of illustrative quotes or data extracts (Ahmed et al., 2025; Byrne, 2021; Christou, 2022; Maguire & Delahunt, 2017). These quotes provide direct evidence for each theme, based on the original voices of interview participants or informants. It is important to select quotes that are representative, insightful, and help to demonstrate the diversity of expressions within a theme, rather than being overly lengthy or repetitive (Ahmed et al., 2025; Byrne, 2021). Each extract should be supported by analytical commentary that explains its significance and its connection to the specific theme and the overall research objectives.

This commentary should not be a mere simple description, but a detailed interpretation of the data in a meaningful way, ensuring the analysis offers depth and insight (Maguire & Delahunt, 2017).

In the current research, the thematic analysis findings were structured with an introduction for each theme, providing the meaning and context that reflect the research objectives and relate to the research topic. The researcher will additionally contextualise each identified theme within the existing literature pertinent to the study to enhance its significance and relevance toward achieving the research objectives. This approach indicates that the developed themes are not arbitrarily created or merely labelled but are grounded in a scholarly context. For instance, when researchers identify the theme "Documentation Issue" as a fundamental root cause contributing to challenges in final account closing, this assertion is typically corroborated by existing literature emphasising the critical role of documentation in the final account closing process. Following the elaboration of the specific theme, there will then be a subsequent elaboration of each code under the particular theme that supports its development. Within the elaboration for each code, some selected quotes from informants were incorporated.

b) Validity and Reliability

In qualitative research, validity refers to the degree to which a finding is correctly evaluated and interpreted, ensuring that the findings genuinely represent the reality experienced by the participants (Creswell & Poth, 2018). Meanwhile, reliability depends on the researcher's position and role in demonstrating the data collection and analysis processes (Creswell & Poth, 2018). It also pertains to the application and appropriateness of the methods used during data collection and analysis (Coleman, 2021; Noble & Smith, 2015). Notably, other pioneering scholars, such as Lincoln & Guba (1985), have commonly used the concept 'trustworthiness' to reflect the validity and reliability of qualitative research. The criteria of credibility, transferability, dependability, and confirmability are defined as essential components to be evaluated for ensuring trustworthiness in qualitative research (Ahmed, 2024; Lincoln & Guba, 1985). This research addresses the validity and reliability of qualitative findings through the concept of trustworthiness. Table 3.4 delineates several recognised strategies for

trustworthiness in qualitative research as proposed by previous scholars and compares them to the approaches employed in this research.

Table 3.4
Trustworthiness Strategy Implemented in the Current Research

Criteria & Strategy	Definition & Application	Implementation in the current research
1. Credibility	The degree to which the findings accurately reflect the reality experienced by the participants. It ensures that the interpretations are faithful to the data and the participants' perspectives (Ahmed, 2024; Lincoln & Guba, 1985; Noble & Smith, 2015)	
a) Prolonged Engagement (Lincoln & Guba, 1985; Noble & Smith, 2015)	Spend ample time in the field to build rapport, gain a deeper understanding of the data, and check misinformation.	This research was conducted twelve (12) interviews over a period of four months, from March to June 2024. Each interview lasted approximately 90 to 150 minutes. The engagement with informants was extended through four (4) follow-up or second-round interviews conducted in September 2024, involving CR4, CS8, CL12, and CS1. The overall data collection process, including follow-ups, spanned approximately seven months, thereby conforming prolonged engagement. (refer section 3.5.2.3(d)
b) Member Checking / Participant Feedback (Birt et al., 2016; Lincoln & Guba, 1985)	Return preliminary interpretations and findings with participants to confirm their accuracy and alignment with their experiences. This process ensures that their perspectives are accurately captured and reflected.	Presented preliminary findings back to informants during second-round interviews to confirm accuracy and resonance with informants' experience. Sessions were conducted face-to-face (20–30 minutes) and documented in the audit trail (refer to Table 3.3)
c) Data Triangulation (Creswell & Poth, 2018; Eldh et al.,	Involves collecting and comparing data from two or more data sources and verifying evidence from various groups of informants. Triangulation can	A total of twelve (12) construction stakeholders were selected as informants, comprising 4 Clients, 4 G7 Contractors, and 4 QS Consultants, ensuring equal representation across

Criteria & Strategy	Definition & Application	Implementation in the current research
2020; Lincoln & Guba, 1985)	enhance the depth, richness, and details of findings.	groups. Balanced viewpoints were employed to cross-validate themes emerging from the interviews. (refer section 3.5.2.3(b)
d) Expert Review and Vetting of Protocol (Creswell & Creswell, 2018; Merriam, 2009)	Review and refine instruments (interview protocol) before fieldwork to ensure clarity and relevance.	The interview protocol for this research has been reviewed by experts, including research supervisors, senior academics, and industry practitioners. Questions were refined multiple times before finalisation to ensure alignment with RQ3 and RQ4. (refer section 3.5.2.3(d))
2. Transferability	The extent to which the findings can be applied or transferred to other contexts or settings. This is achieved by providing detailed descriptions of the research context, participants, and methods (Ahmed, 2024; Lincoln & Guba, 1985; Noble & Smith, 2015).	
a) Thick Description & Sampling Strategies (Creswell & Poth, 2018; Fusch & Ness, 2015; Patton, 2014; Staller, 2021)	Providing comprehensive and detailed explanations of the research context, participants, and methods	This research delineates specific criteria concerning its scope, namely private projects utilising the PAM contract 2018, and the informants, who are characterised by a minimum of ten years' experience, direct involvement with final accounts, possessing contractual knowledge, and holding senior or top management positions.
3. Dependability	The consistency of the findings ensures that if the research process is repeated using the same methods and in the same context, it would yield similar results. It refers to the "trustworthiness" by which the methods have been undertaken (Ahmed, 2024; Lincoln & Guba, 1985; Noble & Smith, 2015).	
a) Methodological Documentation / Audit Trail (Lincoln & Guba, 1985; Noble & Smith, 2015)	Thoroughly documenting each step of the research process, including procedures, decisions made, and the rationale behind them.	This research compiled an audit-trail table listing details for each interview (refer Table 3.3)

Criteria & Strategy	Definition & Application	Implementation in the current research
b) Use of Qualitative Data Analysis Software (QDAS) (Ahmed, 2025)	Use software to enable systematic coding, organisation, and traceability that can reduce the chance of manual errors, contributing to data handling inconsistencies.	This current research used ATLAS.ti v25 software to manage, store and categorise large volumes of qualitative data (interview transcripts). This software also facilitates the thematic analysis process by generating codes, searching for patterns, developing themes and visualising networks to examine the relationship between themes.
c) Iterative & recursive Approach (Braun & Clarke, 2006; Christou, 2022; Fuchs, 2023; Naeem et al., 2023; Sandhiya & Bhuvaneswari, 2024)	This process involves continuous cycles of reading, coding, and refining data and themes. The process is dynamic, allowing researchers to revisit earlier steps and adjust their understanding.	This research involves a non-linear process of qualitative data collection and analysis. Data collection and analysis were conducted concurrently, moving back and forth between familiarisation, coding, theme development, and writing as new understandings emerged. The themes were reviewed and renamed multiple times accordingly.
d) Data Saturation (Guest et al., 2006; Hennink & Kaiser, 2022; Naeem et al., 2024; Rahimi & Khatooni, 2024)	The point at which further data collection no longer yields new insights, themes, or categories relevant to the research question.	This research has established a targeted sample of twelve (12) informants that is consistent with saturation guidance from previous researchers (refer to section 3.5.2.3(c)). The evidence of data saturation for this research is presented in Chapter 5, Section 5.3.2 and 5.4.2.
4. Confirmability	Pertains to the impartiality and objectivity of the findings, guaranteeing that they remain unaffected by any biases or preferences of the researchers. It is achieved when credibility, transferability, and dependability have been addressed.	
a) Reflexive Journaling (Ahmed, 2024; Creswell & Poth,	Researchers record their thoughts, biases, values, and reflections throughout the research process.	The researcher explicitly acknowledged his previous background in contract administration and final account management, which may have influenced coding and theme naming.

Criteria & Strategy	Definition & Application	Implementation in the current research
2018; Noble & Smith, 2015)		
b) Peer Debriefing (Lincoln & Guba, 1985; Noble & Smith, 2015; Shahruddin et al., 2024)	Soliciting input from colleagues or experts who are familiar with the research or phenomenon explored to authenticate interpretations, challenge assumptions, and mitigate researcher bias.	The peer debriefing approach in this research is an ongoing process, regularly conducted during data analysis with research supervisors and colleagues from both academia and industry familiar with the research topic.

3.5.3 Framework Validation

Validation is a crucial phase in research, ensuring that developed frameworks achieve a level of accuracy and reliability appropriate for practical application in real-world contexts (Patterson et al., 2021; Sargent, 2013). Sadeghi & Goerlandt (2021) describe validation as the process of determining the extent to which a model or framework accurately represents the real world in relation to its intended purposes. Consequently, the validation process is critical for confirming that a research output is not merely a theoretical construct but a realistic and applicable tool for addressing real-world situations, such as those encountered in the construction industry. In this research, validation aims to determine whether the developed framework can enhance the industry by improving final account closing management practices within the Malaysian construction industry. The credibility of a framework developed within the study is greatly enhanced when it goes through a systematic assessment (Elsayah, 2016).

Engaging experts, such as experienced practitioners, during the validation process can increase the framework's relevance and applicability in real-world scenarios (Almomani et al., 2020). Experts should be regarded as external reviewers with relevant experience in the subject area. Their insights are particularly valuable for evaluating model or factors and for ensuring the accuracy and completeness of the framework's components and underlying data (Idros et al., 2020). In this research, the questionnaire survey method has been chosen as the validation technique, adapted from previous related studies, as presented in the Table 3.5 The questionnaires were designed to

evaluate and assess the framework's practicality, relevance, and applicability within the Malaysian context.

Table 3.5
Number of Expert Reviews for Framework Validation Based on Previous Related Research

Previous Related Research / Field of Study	**Researcher / Year**	**Number of Expert Validation**
Construction Contract Management and Administration	Judi (2020)	69
	Nayan (2021)	26
	Zakaria (2015)	7
Construction Project Management	Ahmad (2022)	6
	Marhani (2021)	7
	Elsayah (2016)	24
Construction Law	Yong (2018)	16
Information Technology in the Construction Industry	Fernández (2019)	7

The number of experts engaged in the validation process of this research aligns with established precedents in related academic research. Table 3.5 illustrates that expert validation sample sizes typically range from 6 to 69, with a central tendency around 20 to 30 experts. In this research, forty (40) experts within the Clients, Contractors and Consultants from both public and private organisations participated in the validation survey. Thus, the number of expert validations determined in this research is deemed appropriate compared to past works. The details and results of the validation process are presented in Chapter 6 (section 6.9.1 to 6.9.2)

3.6 Summary

This chapter explains the research methodology employed in this study. The research philosophy adopted is pragmatism, which allows for a mixed-methods approach combining quantitative and qualitative methods. An explanatory sequential mixed-methods design is used, involving two distinct phases: quantitative data collection and analysis, followed by qualitative data collection and analysis to further explain the quantitative findings. Quantitative data is collected through a questionnaire

survey among clients, G7 contractors, and quantity surveying consultants to identify current issues and major problems in final account closing. The sample size for quantitative data collection is primarily determined using G*Power, with consideration of the recommended EFA sample adequacy and sample-to-item ratio guidelines. The quantitative data is analysed using descriptive statistics, the Kruskal-Wallis test, and EFA. Qualitative data are gathered through semi-structured interviews with purposively selected informants from the same stakeholder groups to investigate the root causes of major problems and determine preventive solutions. Thematic analysis following Braun & Clarke's approach is employed to identify patterns and themes in the interview data. The six-phase thematic analysis process involves data familiarisation, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Finally, the developed framework is validated through a questionnaire survey of 40 experts to assess its practicality, relevance, and applicability in the Malaysian construction industry.

CHAPTER 4
QUANTITATIVE DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the analysis and findings of the quantitative data collected through the questionnaire survey. The objectives of this chapter are: (i) to investigate current issues related to final account closing in the Malaysian construction industry and (ii) to identify the major problems associated with final account closing in the Malaysian construction industry. The discussion of the results in this chapter is divided into three main sections. The first section involves analysing the data based on frequency analysis, specifically for examining the demographic backgrounds of respondents. The second section employs descriptive analysis to identify current issues related to final account closing. Meanwhile, in the third section, an exploratory factor analysis (EFA) was conducted on the list of variables or problems related to final account closing, in order to reduce, summarise, and regroup the variables into different components. Furthermore, a descriptive analysis was conducted to rank the variables based on their average mean scores, in order to identify the major problems in final account closing.

4.2 Response Rate

Table 4.1
Total Number and Percentage of Overall Responses

Type of Respondents	Sample	No. of responses	Percentage (%)
Private Client (Developer)	200	69	35
G7 Contractor	200	107	54
Quantity Surveying Consultant	200	81	41
Total	600	257	43

A total of 600 questionnaires were distributed to various target groups of respondents within Malaysian construction organisations, as illustrated in Table 4.1.

Among these, 257 questionnaires were completed and returned within three months of dissemination, representing a response rate of 43%. All responses satisfactorily fulfilled the required criteria. Sixty-nine respondents (35%) were from the private client group, 107 (54%) from the G7 contractor group, and 81 (41%) from the quantity surveying consultant group. A response rate of 43% is considered acceptable and exceeds the minimum requirement for survey response in construction-related research (Refer to Chapter 3, section 3.5.2.1h).

Although the responses are grouped by organisation type, the unit of analysis is the individual practitioner. The findings should therefore be understood as the views of experienced practitioners representing their respective organisational groups, rather than as organisational level data. The survey responses reflect the personal professional experience of these individual practitioners in handling and managing final account processes, rather than constituting an organisational position. Each respondent answered based on their own knowledge and direct involvement in the final account closing of the projects they have handled.

The questionnaire was distributed to identified individual practitioners. To minimise the risk of response bias arising from overrepresentation of any single organisation, a maximum of three (3) respondents from the same organisation were permitted to participate in this study. This sampling control was applied to ensure that no single company's perspective disproportionately influenced the findings, thereby enhancing the breadth and representativeness of the survey data.

4.2.1 Analysis and Discussion of Questionnaire Survey

In order to address research objectives 1 and 2 of this research, the analysis of the questionnaire is presented in three parts. Section A presents the demographic background of the respondents. Section B discusses the results relating to current issues of final account closing in construction projects. Section C presents the results of the factors or problems contributing to disputes in the final account closing process.

4.2.2 Section A: Demographic Profile of Respondents

Table 4.2
The Demographic Profile of Respondents

Demographic Information		**Frequency**	**(%)**
Type of Organisation	Client	69	27%
	G7 Contractor	107	42%
	Quantity Surveyor	81	31%
Respondent's Designation	Company Director	25	10%
	Project Manager	15	6%
	Contract Manager	42	16%
	Engineer	17	7%
	Quantity Surveyor	158	61%
Years of experience	1 – 5 years	24	9%
	6 – 10	50	20%
	More than 10 years	183	71%
Involvement in the Final Account Closing Process	1 – 3 projects	88	34%
	4 – 6 projects	76	30%
	7 – 10 projects	21	8%
	More than 10 projects	72	28%
Type of project undertaken	Residential	111	43%
	Institutional	27	10%
	Commercial	35	14%
	Infrastructure	75	29%
	Others	9	4%

Table 4.2 presents the demographic profile of the 257 respondents as stated in section 4.2 above, including their organisational types, professional designations, years of experience, levels of involvement in the final account closing process, and the types of projects they are most involved in. In terms of organisational background, the largest representation came from G7 Contractors, comprising 42% (n=107), followed by Quantity Surveyors at 31% (n=81), while Clients accounted for 27% (n=69). The diverse group of construction stakeholders involved in the survey assumed that the

research findings were reliable and robust, as clients, contractors, and quantity surveyors are the main parties involved in final account closing and key players in the construction industry.

With respect to professional designation, most respondents were quantity surveyors, constituting 61% (n=158), followed by Contract Managers at 16% (n=42). Respondents who held positions as company directors comprised 10% (n=25), while 7% (n=17) and 6% (n=15) were engineers and project managers, respectively. This analysis highlights a broad spectrum of professional roles involved in the current research. Additionally, the significant number of quantity surveyors involved in this study provides valuable insight into the collected data, as quantity surveyors are usually responsible for handling matters related to contract management and final account closure in construction projects (Nayan et al., 2017).

Regarding professional experience, a significant majority of respondents (71%) had more than 10 years in the construction industry. Meanwhile, 20% of respondents had between 6 and 10 years of experience, whereas 9% had 5 years or less. The substantial years of professional experience among the respondents, with a significant proportion of senior-level employees with over 10 years of expertise in construction projects, suggest that they had sufficient and reliable knowledge of the research subject matter.

Regarding respondents' involvement in the final account closing process, 34% of respondents reported their involvement in between 1 and 3 projects, 30% involved in between 4 and 6 projects, 8% had experience with 7 to 10 projects, and 28% of them had been involved with final account closing in more than 10 projects. The findings demonstrate that the survey captured responses from practitioners with significant involvement in final account processes, strengthening the credibility of findings regarding challenges and final account management.

The types of projects undertaken by respondents were predominantly residential projects (43%). Infrastructure projects accounted for 29%, followed by commercial projects (14%) and institutional projects (10%). A small portion (4%) was involved in other types of projects. The variety of project types involved ensures that the current research findings are not confined to a single project type in the construction industry, as the challenges encountered during final account closing may differ across projects. This diversification facilitates the development of a more comprehensive and generalisable framework. Overall, this demographic distribution underscores the depth

of experience and the diversity of professional roles represented in the survey, thereby enhancing the reliability and robustness of the study's findings.

4.2.3 Section B: The Scenario and Issues of Final Account Closing in the Malaysian Construction Industry

This section analyses the current scenario and issues related to final account closing as reported by three key stakeholder groups, known as Private Clients (n=69), G7 Contractors (n=107), and Quantity Surveyor Consultants (n=81). For each variable in Section B of the questionnaire, a cross-tabulation analysis was conducted to examine how perceptions and experiences differ across these groups. The Kruskal-Wallis tests were applied to compare mean rank scores between groups. A p-value of less than 0.05 ($p < 0.05$) is considered statistically significant.

The Section B of the questionnaire cover four domains related to the scenario and issues in the final account closing, includes (i) the difficulty of the final account closing process (B3), (ii) the extent to which organisations are affected by final account closing disputes (B4), (iii) the average settlement period for final accounts, and (iv) the frequency of problems encountered at each stages of final account closing.

4.2.3.1 Difficulty of the Final Account Closing Process

Table 4.3
Difficulties in the Final Account Closing Process by Respondent Group

Perceptions of the Final Account difficulties	**Client (n=69**	**G7 Contractor (n=107)**	**QS Consultant (n=81)**	**Overall (n=257)**
Very difficult	0 (0%)	9 (8.4%)	2 (2.5%)	11 (4.3%)
Difficult	40 (58%)	59 (55.1%)	26 (32.1%)	125 (48.6%)
Moderate	28 (40.6%)	39 (36.4%)	46 (56.8%)	113 (44%)
Easy	1 (1.4%)	0 (0%)	5 (6.2%)	6 (2.3%)
Very easy	0 (0%)	0 (0%)	2 (2.5%)	2 (0.8%)

Table 4.3 presents respondents' perceptions of the difficulty of the final account closing process. The cross-tabulation results in Table 4.3 reveal statistically significant

differences ($p < 0.001$) between the three respondent groups in their perception of the difficulty of the final account closing process. G7 Contractors perceived the final account closing process as the most difficult, with 63.5% rating it as either 'Difficult' or 'Very Difficult'. Clients similarly perceived the process as challenging, with 58.0% rating it 'Difficult', though no client respondent rated it as 'Very Difficult'. In contrast, the majority QS Consultants (56.8%) rating the process as 'Moderate', suggesting they perceive the final account process as comparatively less difficult than the other two groups. This disparity is consistent with the nature of each group's role, where contractors and clients are directly exposed to the financial consequences and administrative complexity of final account disputes, while consultants manage the process in a more structured, professional capacity.

Only a small percentage (2.3%) of overall respondents found the process easy, and a mere 0.8% described it as "Very Easy." This suggested that a few respondents experienced minimal difficulty with the final account closing process for construction projects. Overall, the findings suggested that the final account process is generally perceived as fraught with challenges and problems. This is consistent with previous research that has discovered that the final account process requires complex procedures that can be time-consuming and challenging for the contracting parties (Hisham & Othman, 2021; Ilmi & Yip, 2014; Othman et al., 2023). It often leads to disputes between parties and delays the final account settlement in a construction project (Hassan, 2019; Kong & Yeow, 2016; Ssegawa et al., 2020).

4.2.3.2 Effect of Final Account Disputes on the Organisation

Table 4.4
Effects of Final Account Problems on the Organisation by Respondent Group

Effect of the final account problem on the organisation	**Client (n=69**	**G7 Contractor (n=107)**	**QS Consultant (n=81)**	**Overall (n=257)**
Very affected	15 (21.7%)	34 (31.8%)	11 (13.6%)	60 (23.3%)
Moderately affected	25 (36.2%)	44 (41.1%)	29 (35.8%)	98 (38.1%)
Unsure	10 (14.5%)	7 (6.5%)	9 (11.1%)	26 (10.1%)
Slightly affected	14 (20.3%)	18 (16.8%)	19 (23.5%)	51 (19.8%)
Not affected	5 (7.2%)	4 (3.7%)	13 (16%)	22 (8.6%)

Table 4.4 presents respondents' perceptions of how final account issues affect their organisations. G7 Contractors reported the highest level of impact, indicating that their organisations are 'Very Affected' (31.8%) and 'Moderately Affected' (41.1%) due to the final account disputes. The financial exposure of contractors who often carry the costs of disputed claims and delayed final payments elucidates this higher organisational impact. Clients similarly reported significant organisational impact, with 21.7% reporting 'Very Affected' and 36.2% 'Moderately Affected'. QS Consultants were comparatively less affected, with only 13.6% reported 'Very Affected' and 16.0% reporting 'Not Affected'. This pattern reflects the financial exposure of contractors and clients to unresolved final accounts due to delayed cash flow, financial losses, and damage to stakeholder relationships (Abidoye et al., 2018; Odeyinka et al., 2011; Yahaya et al., 2019), while QS consultants face relatively lower financial risk from final account closing disputes.

4.2.3.3 Average Period to Settle the Final Account

Table 4.5
Average Period to Settle the Final Account in Construction Projects by Respondent Group

Settlement period of the final account	Client (n=69)	G7 Contractor (n=107)	QS Consultant (n=81)	Overall (n=257)	Kruskal-Wallis Sig. p
Less than one year	2.09	1.86	1.95	1.95	0.227
1 year to 2 years	2.52	2.36	2.64	2.49	0.099
2 years to 3 years	3.17	2.94	2.94	3.00	0.408
3 years to 4 years	2.59	2.83	2.41	2.63	0.064
More than 4 years	2.36	2.04	2.00	2.11	0.027*

Table 4.5 presents the average period to settle the final account in a construction project, as perceived by respondents in this research. For settlement periods of less than 1 year, clients reported a slightly higher mean (M = 2.09) than Contractors (M = 1.86) and Consultants (M = 1.95). The Kruskal-Wallis test indicates no significant difference in mean scores among respondents (p = 0.227). The majority of respondents across all groups reported that settling the final account in less than one year 'Never' or only 'Rarely' occurs, confirming that a short period for final account closing is uncommon in the Malaysian construction industry.

For the settlement period within 1 to 2 years, the Kruskal-Wallis test identified no significant differences ($p = 0.099$). The majority of all three groups indicated that this timeframe applies only 'Sometimes' to 'Rarely', suggesting that while a 1–2 year settlement is more feasible than a settlement in less than 1 year, it remains uncommon.

The analysis further shows that the most common final account settlement duration across all respondent groups is 2 – 3 years, with the highest overall mean score of 3.00. Importantly, the Kruskal-Wallis test indicated no significant differences ($p = 0.408$) for this period category. This means that Clients, G7 Contractors, and Quantity Surveying Consultants show broad consensus that final account closing commonly occurs within the 2 – 3 year range.

For the 3 to 4 year settlement period, the overall mean score is $M = 2.63$, and the Kruskal-Wallis test also revealed no significant difference ($p = 0.064$) among groups. G7 Contractors recorded the highest mean ($M = 2.83$), indicating that they are the group most likely to experience settlement extending to 3 – 4 years. This reinforces the contractor's exposure to prolonged negotiation over claims, variation valuation, documentation, and final payment.

For settlement periods of more than 4 years, the overall mean score is $M = 2.11$, with a statistically significant difference among groups ($p = 0.027$). Interestingly, Clients reported a higher frequency of a settlement period of more than 4 years ($M = 2.36$) compared to Contractors ($M = 2.04$) and Consultants ($M = 2.00$). This may reflect that client-side bureaucratic processes, delayed budget approvals, and slow institutional decision-making contribute to a prolonged settlement period on the client's side of the final account process. From a project management perspective, any final account settlement that extends beyond 4 years represents a serious failure in financial close.

Overall, these findings suggest that the processes required for final account closing in construction projects are often time-consuming and complex, which takes longer than the stipulated period in the construction contract. This aligns with the findings of previous research, indicating that final account closing management is not efficient and is frequently delayed (Hassan, 2019; Ramli, 2021; Ssegawa et al., 2020; Zakaria, 2015).

4.2.3.4 Problems at Each Stage of Final Account Closing

Table 4.6
Problems Encountered in the Stage of Final Account Closing by the Respondent Group

Problems encountered in the stage of final account closing	Client	G7 Contractor	QS Consultant	Overall	Kruskal-Wallis Sig. p
Stage 1 – Gather and submit all relevant documentation (Clause 30.10)	3.54	3.94	3.80	3.76	0.058
Stage 2 – Valuation, Preparation and Issuance of the Draft Final Account (Clause 30.10)	3.22	3.77	3.81	3.61	0.001*
Stage 3 – Responding to the Draft Final Account (Clause 30.10a)	3.57	3.68	3.36	3.55	0.069
Stage 4 – Revise and Amend the Draft Final Account (Clause 30.10b)	3.52	3.46	3.64	3.55	0.241
Stage 5 – Formalise and Certify the Final Account and Issuance of the Final Certificate (Clause 30.10b)	3.46	3.52	3.14	3.38	0.081
Stage 6 – Final Payment by the Client to the Contractor	3.36	3.65	3.25	3.45	0.046

Table 4.6 presents the frequency of problems encountered across the six main stages of final account closing, in accordance with the PAM Contract 2018. Stage 1 recorded the highest overall mean score of 3.76, indicating that gathering and submitting all relevant documentation is perceived as the most problematic stage in the final account closing process. Among the three respondent groups, G7 contractors recorded the highest mean score of 3.94, followed by QS consultants at 3.80, while clients recorded the lowest mean score of 3.54. This suggests that contractors perceive documentation-related problems more seriously than the other groups, which is reasonable because contractors are usually responsible for compiling and submitting the necessary records, such as variation orders, measurement records, claims documents, site instructions, payment records and correspondence. QS consultants also recorded a high mean score, suggesting that they experience difficulties when reviewing and verifying incomplete or poorly organised contractor submissions. The Kruskal-Wallis

test yielded a p-value of 0.058, slightly above the 0.05 significance level. Therefore, although the mean scores show visible differences among the groups, these differences are not statistically significant.

Stage 2 recorded an overall mean score of 3.61, making it the second most problematic stage after documentation submission. Among the respondent groups, QS consultants recorded the highest mean score of 3.81, followed closely by G7 contractors at 3.77, while clients recorded the lowest mean score of 3.22. This pattern indicates that QS consultants and contractors perceive valuation, preparation and issuance of the draft final account as more problematic than clients. This is an important finding because QS consultants are usually directly involved in evaluating variations, provisional sums, loss and expense, and other final account adjustment items. Their higher mean score suggests that they encounter substantial technical and administrative difficulties during valuation. Contractors also recorded a high mean score, which may reflect their concern over how their claims, variations and entitlements are assessed in the draft final account. The Kruskal-Wallis test produced a p-value of 0.001, which is statistically significant at the 0.05 level. This indicates that there is a significant difference among the three respondent groups in their perception of problems at this stage. Based on the mean scores, the main difference appears to be between the client group and the two more technically involved groups, namely QS consultants and G7 contractors.

Stage 3 recorded an overall mean score of 3.55, indicating that responding to the draft final account is also perceived as a moderately serious problem in the final account closing process. Among the three groups, G7 contractors recorded the highest mean score of 3.68, followed by clients at 3.57, while QS consultants recorded the lowest mean score of 3.36. This suggests that contractors experience greater difficulty at this stage, probably because they must respond to the draft final account by justifying disputed items, providing additional evidence, challenging deductions, explaining variations, and negotiating unsettled claims. Clients also recorded a relatively high mean score, suggesting they may have difficulty reviewing contractor responses and reaching agreement on outstanding financial matters. The Kruskal-Wallis test produced a p-value of 0.069, which is above the 0.05 significance level. Therefore, the differences among the three respondent groups are not statistically significant.

Stage 4 recorded an overall mean score of 3.55, the same as Stage 3, showing that the revision and amendment of the draft final account is also a moderate problem area. Among the groups, QS consultants recorded the highest mean score of 3.64,

followed by clients at 3.52, while G7 contractors recorded the lowest mean score of 3.46. This result suggests that QS consultants perceive this stage as more problematic than the other groups, because they are normally responsible for revising the draft final account after receiving comments, clarifications, additional documents and objections from the contractor or client. Clients also recorded a moderately high mean score, indicating that they may experience problems in approving revisions of the final account. The Kruskal-Wallis test yielded a p-value of 0.241, well above the 0.05 significance level. Therefore, there is no statistically significant difference among the three respondent groups.

Stage 5 recorded the lowest overall mean score of 3.38, suggesting that formalising and certifying the final account is the least problematic stage compared with the other stages. Among the respondent groups, G7 contractors recorded the highest mean score of 3.52, followed by clients at 3.46, while QS consultants recorded the lowest mean score of 3.14. Contractors may be concerned with delays in final certification, withheld amounts, or the timing of final payment. Clients may also perceive problems because certification confirms the final contractual and financial obligations of the project. The Kruskal-Wallis test produced a p-value of 0.081, which is above the 0.05 significance level. Therefore, the differences among the three groups are not statistically significant.

Stage 6 recorded an overall mean score of 3.45, indicating that final payment by the client to the contractor remains a moderate problem in the final account closing process. Among the three respondent groups, G7 contractors recorded the highest mean score of 3.65, followed by clients at 3.36, while QS consultants recorded the lowest mean score of 3.25. This pattern is expected because contractors are the party most directly affected by delayed or disputed final payment. Problems at this stage can affect contractors' cash flow and overall project close-out. Clients recorded a lower mean score, suggesting they may not perceive final payment as problematic, as payment is often viewed from the perspectives of compliance, verification, and financial control. The Kruskal-Wallis test, however, produced a p-value of 0.046, which is below the 0.05 significance level. Therefore, there is a statistically significant difference among the respondent groups at this stage. Based on the mean scores, the significant difference is likely driven by the higher concern among G7 contractors compared with clients and QS consultants.

4.2.4 Section C: Identification of Major Problems in Final Account Closing

In this section, respondents were asked to indicate their level of agreement with problems encountered during final account closing. Respondents were asked to rank the problems on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). Exploratory factor analysis (EFA) was adopted in this analysis primarily to reduce the large number of identified problems that contributed to final account closing issues, thus representing them in different components.

Furthermore, to determine the major problems in final account closing for construction projects, this research ranked the problems by their criticality as perceived by respondents (clients, G7 contractors, and quantity surveyor consultants) using mean scores. In this research, mean scores ranging from 4.00 to 5.00 are considered highly significant, whereas those between 3.00 and 3.99 are deemed moderately significant. Conversely, problems with mean scores below 3.00 are regarded as not significant, in accordance with methodologies employed in prior studies such as (Adedokun et al., 2013; Ismail, 2021; Shehu et al., 2014; Takim et al., 2004).

For statistical analysis using SPSS, all variables in Section C of the questionnaire survey were systematically coded from C1 to C40. Table 4.7 shows all the identified determinants for final account closing problems that have been used in the questionnaire survey for this research.

Table 4.7
Determinants of Final Account Closing Problems

Code	Determinants of the final account closing problems
C1	Failure to follow procedures in the final account claim
C2	Delay submission of final account claim
C3	Disagreement with the valuation of the final account
C4	Lack of documents and evidence for submission of final account claim
C5	Lack of experience in estimating the cost of the project
C6	Inefficient planning and management of the project
C7	Contractor's failure to repair defective works during the Defect Liability Period (DLP)
C8	Incompetent and insufficient staff to handle the final account process
C9	Excessive workload of the contractor due to involvement in other projects

Code	Determinants of the final account closing problems
C10	Client disagrees with the quality of executed works by the contractor
C11	Client deliberately withheld or refused to pay the final payment without a reasonable reason
C12	Client imposed extra work on the contractor during the Defect Liability Period (DLP)
C13	Late payment or underpayment by the client to the contractor on the interim payment
C14	Client's poor financial management
C15	Client's lack of financial resources
C16	Delay certification and issuance of the final certificate
C17	Delay issuance of the Certificate of Completion Making Good Defects (CCMGD) by the Consultant
C18	Delay evaluation and preparation of the final account
C19	Inadequate experience of Quantity Surveyor in handling final account process
C20	Lack of communication and cooperation between consultant and other parties in the project
C21	The person responsible for the final account is no longer with the organisation
C22	The ambiguity and lack of clarity in the contract terms regarding the final account procedure
C23	The terms of the contract are too complicated to be understood by the parties in the project
C24	The contractual provision for the final account aspect is not comprehensive
C25	Mistakes and discrepancies in the contract document
C26	The allocation fund provided for risk and contingency events in the project is insufficient
C27	Excessive variation orders that increase the overall cost of construction project
C28	Cost overrun due to variation and provisional quantities
C29	Delay approval and finalisation of variation work
C30	Verbal instruction for variation works are not confirmed in writing
C31	Complexity of claim and valuation process for variation works
C32	Disagreement on the valuation of variation works
C33	Corrupt or fraudulent practices among parties in the construction project
C34	Lack of commitment among contracting parties to settle the final account promptly
C35	Attitude and culture that perceived delay in final account closing were common and acceptable

Code	Determinants of the final account closing problems
C36	Misunderstanding of the contracting parties on the contract condition regarding the final account
C37	Fluctuation of construction material prices cause cost overrun to project
C38	Force majeure events caused a delay in the progress of work
C39	Inclement or extreme weather disrupted the construction process
C40	Changes in regulations and policies that caused additional costs on the project

4.2.4.1 Exploratory Factor Analysis

The current research adopted an appropriate EFA method to reduce the large number of variables (referred to as problems in final account closing), understand the relationships and patterns among the observed variables, and establish meaningful components for the observed variables highlighted in Chapter 3. The analysis confirmed that the data met the necessary conditions for factor analysis. Sampling adequacy was confirmed by a Kaiser-Meyer-Olkin (KMO) value of 0.843, which falls within the 'meritorious' range (Kaiser, 1970), and Bartlett's Test of Sphericity was significant ($\chi^2 = 7081.25$, $df = 780$, $p < .001$), as presented in Table 4.8.

Table 4.8
KMO and Bartlett's Test

Statistical Tests		Result
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.843
Bartlett's Test of Sphericity	Approx. Chi-Square	7081.249
	df	780
	Sig.	.000

Principal Component Analysis (PCA) with Varimax rotation was applied, retaining factors with eigenvalues greater than 1.0 and a cumulative variance threshold of 60% (Hair et al., 2019; Tabachnick & Fidell, 2019). After a series of iterative reruns, ten items that failed to meet the minimum factor loading threshold of 0.50 were excluded: C7, C9, C10, C13, C14, C15, C21, C27, C33, and C35 (see Table 4.7).

It is worth briefly examining why these ten items were excluded, as this provides important context for interpreting the final EFA solution. Items C7 (Contractor's failure to repair defective works during the DLP), C9 (Excessive workload of the contractor), and C21 (The person responsible for the final account is no longer with the organisation) relate to operational and personnel management issues that are not correlated with other final account problems. Items C13 (Late payment or underpayment by the client on interim payments), C14 (Client's poor financial management), and C15 (Client's lack of financial resources), while occurring within the Malaysian construction context, may be perceived differently among respondent groups, leading to weaker and inconsistent factor loadings. Item C27 (Excessive variation orders) was likely captured through other variation-related items already retained in the EFA, making it statistically redundant. Items C33 (Corrupt or fraudulent practices) and C35 (Attitude and culture that perceive delay as acceptable) represent attitudinal and ethical dimensions that are difficult to measure consistently through a Likert-scale instrument and may be subject to social desirability bias, weakening their statistical association with other constructs. Finally, C10 (Client disagrees with the quality of executed works) is more closely associated with the defects liability process than with the core final account process. Their removal does not mean that these issues are unimportant in practice. It means that, statistically, they did not strongly explain the final component structure in this dataset. Collectively, the removal of these ten items strengthened the internal consistency and conceptual coherence of the five retained components.

The result shows that five (5) components were extracted, including thirty (30) items. The extracted components are 67.59%, which exceeds 60% of the cumulative percentage of variance explained (Hair et al., 2019). Hence, this confirms the extraction of five components from the 30 items or variables. The results of the EFA analysis, factor loadings and Cronbach's Alpha coefficients, are presented in Table 4.9.

Table 4.9
EFA Result for Final Account Closing Problems

Final Account Closing Problems	**Factor Loadings**	**Communalities**
Evaluation Process		
(C2) Delay submission of final account claim	**.740**	**.726**
(C3) Disagreement with the valuation of the final account	**.719**	**.766**

Final Account Closing Problems	Factor Loadings	Communalities
(C4) Lack of documents and evidence for submission of final account claim	**.711**	**.700**
(C31) Complexity of claim and valuation process for variation works	**.654**	**.669**
(C18) Delay evaluation and preparation of the final account	**.637**	**.664**
(F32) Disagreement on the valuation of variation works	**.574**	**.534**
(C29) Delay approval and finalisation of variation work	**.535**	**.667**
(C16) Delay certification and issuance of the final certificate	**.509**	**.816**
Eigenvalue = 8.112, % variance explained = 27.97%, Cronbach's alpha = .792		
Contractual Management		
(C24) The contractual provision for the final account aspect is not comprehensive	**.852**	**.781**
(C23) The terms of the contract are too complicated to be understood by the parties in the project	**.840**	**.788**
(C25) Mistakes and discrepancies in the contract document	**.676**	**.716**
(C28) Cost overrun due to variation and provisional quantities	**.674**	**.616**
(C22) The ambiguity and lack of clarity in the contract terms regarding the final account procedure	**.642**	**.651**
(C26) The allocation fund provided for risk and contingency events in the project is insufficient	**.543**	**.652**
(C36) Misunderstanding of the contracting parties on the contract condition regarding the final account	**.521**	**.793**
Eigenvalue = 3.518, % variance explained = 12.13%, Cronbach's alpha = .867		
Incompetencies of the Project Team		
(C5) Lack of experience in estimating the cost of the project	**.780**	**.760**
(C19) Inadequate experience of Quantity Surveyor in handling final account process	**.772**	**.791**
(C1) Failure to follow procedures in the final account claim	**.749**	**.644**
(C8) Incompetent and insufficient staff to handle the final account process	**.707**	**.701**
(C6) Inefficient planning and management of the project	**.692**	**.682**
Eigenvalue = 2.911, % variance explained = 10.04%, Cronbach's alpha = .781		

Final Account Closing Problems	Factor Loadings	Communalities
Professional Practice		
(C30) Verbal instructions for variation works are not confirmed in writing	**.829**	**.747**
(C11) Client deliberately withheld or refused to pay the final payment without a reasonable reason	**.702**	**.704**
(C20) Lack of communication and cooperation between consultant and other parties in the project	**.679**	**.793**
(C12) Client imposed extra work on the contractor during the Defect Liability Period (DLP)	**.669**	**.739**
(C17) Delay in issuance of the Certificate of Completion Making Good Defects (CCMGD) by the Consultant	**.547**	**.651**
(C34) Lack of commitment among contracting parties to settle the final account promptly	**.527**	**.776**
Eigenvalue = 2.034, % variance explained = 7.01%, Cronbach's alpha = .755		
Unforeseen Events		
(C38) Force majeure events caused a delay in the progress of work	**.889**	**.828**
(C39) Inclement or extreme weather disrupted the construction process	**.841**	**.785**
(C40) Changes in regulations and policies that caused additional costs on the project	**.662**	**.670**
(C37) Fluctuation of construction material prices cause cost overrun to project	**.634**	**.606**
Eigenvalue = 1.777, % variance explained = 6.13%, Cronbach's alpha = .838		

As observed in the Table 4.9, each component was labelled based on its interrelated characteristics and the combination of variables. In this stage, the existing theoretical knowledge was referred to establish a basis for interpreting and naming the components. Subsequently, expert validation in related fields was conducted to provide additional insights, which could assist in accurately naming the components, as suggested by (Costello & Osborne, 2005).

Component 1, associated with the final account evaluation process, has the highest variance of 27.97%, which indicates that all problems under this component

were the critical in the final account closing. In particular, problems such as delays in submitting final accounts claims (74%), disagreements over the final accounts valuation (71.9%), poor record-keeping and insufficient documentation (71.1%), and the complexity in variation work and claims process (65.4%) often lead to disputes and delays in final accounts closing. These findings aligned with several studies which emphasised that the claim and evaluation process in construction projects is complex and can lead to disputes if not managed effectively (Matarneh, 2024; Mustaffa et al., 2023; Umar & Ochigbo, 2024). Furthermore, delays and misunderstandings in evaluating the claim process may contribute to disputes related to payment and final accounts in construction projects (Aibinu, 2009). In addition, the complexity of the works and evaluation process due to misinterpretation of contractual clauses and subjectivity in assessment may lead to inconsistencies in evaluating the final works (Wang et al., 2023b). Moreover, contractors may disagree with the valuation of the works or the certified amount determined by the quantity surveyor, leading to conflicts due to incomplete or unavailable documents required to prepare the final accounts (Othman et al., 2023). This component has been named 'Evaluation Process' based on eight (8) problems included.

The variables that make up the second component represent the contractual management issues inherent in construction projects that affected the closing of the final accounts. Based on seven (7) problems included, this component was named 'Contractual Management'. Problems such as non-comprehensive contractual provisions (85.2%), complicated and ambiguity of contract terms (84%), mistakes and discrepancies in contract documents (67.6%), the ambiguity of contract terms pertaining to the final accounts procedure (64.2%), and misunderstanding of final accounts condition in the contract (52.1%) can lead to disputes. This impedes the prompt settlement of the final accounts. Meanwhile, cost overruns due to variations and provisional quantities (67.4%) and insufficient allocation of funds for risk and contingency events (54.3%) further worsen these issues. These findings are also consistent with the results of other studies such as (Amoah & Nkosazana, 2022; Elziny et al., 2016; Hanák & Vítková, 2022), which stated that contract management issues are the most significant source of disputes, with ambiguities in contract terms and a lack of clarity on scope and obligations leading to conflicts. Additionally, inadequate and inaccurate contract documentation, including errors in the bill of quantities and unclear measurement standards, can lead to disputes over final accounts closing settlements

(Kong & Yeow, 2016; Ogbu & Ebiminor, 2020). Furthermore, contractual changes, such as work variations and contract document adjustments, frequently result in disputes due to their impact on project costs and timelines (Cakmak, 2016; Kalyan et al., 2022). Contractual management issues can become contentious, causing financial losses and disputes between parties (Khangale et al., 2022). Therefore, ensuring effective contractual management practices is crucial to avoid potential issues during final account closure.

Furthermore, the five (5) problems extracted in the third component highlight the competencies and capabilities of professionals, such as contractors and consultants, in handling and managing the project and final accounts closing process. This component, labelled "Incompetencies of the project team", accounted for 10.38% of the variance. Problems such as lack of experience in cost estimation (78%), lack of experience in handling the final accounts process (77.2%), non-compliance with final accounts claim procedures (74.9%), inadequate staff to handle final accounts (70.7%), and inefficient planning and management of the project (69.2%) can lead to disputes in final accounts closing settlements. This is also supported by Othman et al. (2023) who claimed that the lack of competencies within the project team, particularly among contractors, can result in poor decision-making, inaccurate cost estimations, inefficient planning and management, errors in claim submissions, and inadequate record keeping. Therefore, competencies, knowledge, and abilities of teams play a crucial role in effective project management (Avença et al., 2024; Gasemagha & Kowang, 2021), directly influencing the success of final account closing in construction projects.

The fourth component represents "Professional Practice", particularly in communication, documentation, and work compliance. The six (6) problems extracted for this component include undocumented verbal instruction for variation orders (82.9%), withholding and refusing final payment (70.2%), poor communication and cooperation (67.9%), additional works imposed during the defect liability period (66.9%), delay in issuance of Certificate of Completion Making Good Defects (CCMGD) (54.7%) and lack of commitment by the parties to settle the final accounts promptly (52.7%) indicate the risks associated with professionalism and ethical issues that affect construction projects and final accounts management. Thus, professional practice in construction projects is crucial to successfully closing the final accounts. These factors contribute to the timely and accurate completion of the final accounts, which is essential for the financial success of the project and the satisfaction of all

parties involved (Kuoribo et al., 2023). Therefore, maintaining professionalism and ethical conduct throughout a construction project is essential for ensuring compliance with contractual obligations, fostering trust among stakeholders, and preventing disputes. These elements facilitate effective communication and coordination, thereby strengthening contractual relationships and potentially leading to future business opportunities. As such, professionalism and ethics serve as foundational elements that contribute to the overall success of construction projects (Al-Nahyan et al., 2019; Ismail et al., 2017; Oluwatosin, 2024; Ramli et al., 2023)

Lastly, component five was assigned as 'Unforeseen Events', which significantly impacted project delivery and delayed the final accounts closing settlement. This component includes force majeure events (88.9%), weather disruptions (84.1%), regulatory and policy changes (66.2%), and material price fluctuations (63.4%). Consequently, these uncontrollable factors can cause delays, additional costs, legal claims, and economic losses, ultimately affecting the successful closing of final accounts in construction projects (Hansen, 2024; Kisi & Sulbaran, 2022; Nesarnobari et al., 2024). Developing comprehensive risk management strategies, including proper planning and sufficient budget allocation for risk management, is essential for minimising the impacts of unforeseen events in construction projects (Fadhil & Burhan, 2022; Zhang, 2024).

Additionally, the Cronbach's alpha reliability test for all components is above the recommended cut-off of 0.7, ranging from 0.755 to 0.867. This shows that the variables comprising each component have high internal consistency. In light of these validity and reliability assessments, it was confirmed that the variables used to represent the problems contributing to disputes in final account closing in the current research are appropriate.

4.2.4.2 Descriptive Analysis

The result from the EFA, as presented in Table 4.9 identified thirty (30) items were valid for assessing the specific problems in the final account closing. This research aims to identify the major problems associated with the final account closing process among three distinct respondent groups, namely, clients, G7 contractors, and quantity surveyor consultants. Furthermore, it is essential to examine whether these groups hold differing perceptions regarding the major problems related to final account closing.

Prior to this analysis, the normality of the variables was assessed using the Shapiro-Wilk test in the SPSS software. It was conducted to test the null hypothesis that the data were drawn from a normal distribution. The results of the Shapiro-Wilk test indicate that all quantitative variables were not normally distributed (p-values < 0.05), suggesting that the null hypothesis of normality can be rejected for each variable. This indicates that the data for these variables do not follow a normal distribution owing to the different number of responses collected from each group, namely clients, G7 contractors, and quantity surveyor consultants, which were 69, 107, and 81, respectively. Consequently, the application of a non-parametric method is required for the analysis.

A non-parametric analysis of the Kruskal-Wallis Test was chosen as an alternative to One-Way ANOVA for comparing mean scores across the three groups of respondents, as this analysis does not assume a normal distribution of the data. This is to determine whether there are statistically significant differences in responses between two or more groups regarding final account closing problems. The outcome of this analysis will be the basis for drawing a general conclusion about the populations. Furthermore, this can also identify the mutual perception and understanding among groups of respondents regarding the major problems in final account closing.

To determine the major problems in final account closing, this research used mean analysis to rank the problems as perceived by respondents. The respondents were asked to rate each problem on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree) to indicate its level of significance. As previously mentioned in the section 4.2.4, the variables with mean scores between 4.00 and 5.00 are considered as having 'highly significant' or 'very critical', following the rule of thumb from previous research, such as (Adedokun et al., 2013; Ismail, 2021; Shehu et al., 2014; Takim et al., 2004). These problems need to be identified earlier to prevent disputes and ensure that the final account is settled promptly. Table 4.10 shows the rank of the problems associated with the final account closing process as rated by the groups of respondents.

Table 4.10
Summary Result of Descriptive Analysis and Kruskal-Wallis Test of the Problems Associated with the Final Account Closing

Problems in Final Account Closing	Overall		Client		G7 Contractor		Consultant		Kruskal-Wallis Sig. p
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	
(C18) Delay evaluation and preparation of the final account	4.16	1	3.99	6	4.36	1	4.06	6	0.096
(C31) Complexity of claim and valuation process for variation works	4.14	2	4.01	5	4.29	2	4.06	5	0.043*
(C29) Delay approval and finalisation of variation work	4.10	3	4.16	1	4.12	6	4.44	1	0.087
(C32) Disagreement on the valuation of variation works	4.09	4	4.06	2	4.21	4	3.95	8	0.158
(C4) Lack of documents and evidence for submission of final account claim	4.08	5	4.03	3	4.17	5	4.12	2	0.121
(C2) Delay submission of final account claim	4.06	6	4.03	4	4.27	3	3.81	9	0.073
(C3) Disagreement on the valuation of final account	4.05	7	3.94	7	4.09	7	4.09	4	0.300
(C28) Cost overrun due to variation and provisional quantities	4.04	8	3.91	8	4.06	8	4.12	3	0.274
(C16) Delay certification and	3.89	9	3.81	12	3.89	9	3.99	7	0.095

Problems in Final Account Closing	Overall		Client		G7 Contractor		Consultant		Kruskal-Wallis Sig. p
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	
issuance of the final certificate									
(C20) Lack of communication and cooperation among parties in the project	3.72	10	3.71	15	3.77	13	3.67	13	0.687
(C30) Verbal instruction for variation works are not confirmed in writing	3.71	11	3.88	10	3.49	20	3.73	11	0.027*
(C1) Failure to follow procedures in the final account claim	3.69	12	3.88	9	3.50	19	3.79	10	0.009*
(C34) Lack of commitment among contracting parties to settle the final account promptly	3.64	13	3.71	14	3.79	12	3.26	15	0.001*
(C8) Incompetent and insufficient staff to handle the final account process	3.61	14	3.72	13	3.50	18	3.67	12	0.229
(C6) Inefficient planning and management of the project	3.56	15	3.87	11	3.37	22	3.56	14	0.003*
(C36) Misunderstanding of the contracting parties on the contract condition regarding the final account	3.56	16	3.48	18	3.85	11	3.23	17	0.000*

Problems in Final Account Closing	Overall		Client		G7 Contractor		Consultant		Kruskal-Wallis Sig. p
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	
(C17) Delay issuance of the Certificate of Completion Making Good Defects by consultant	3.44	17	3.51	17	3.60	15	3.16	20	0.093
(C5) Lack of experience in estimating the cost of the project	3.35	18	3.57	16	3.28	24	3.26	16	0.163
(C19) Inadequate experience of Quantity Surveyor in handling final account process	3.32	19	3.41	19	3.35	23	3.21	18	0.483
(C26) The allocation fund provided for risk and contingency events in the project is insufficient	3.30	20	3.13	20	3.52	17	3.15	22	0.015
(C12) Client imposed extra work on the contractor during the Defect Liability Period (DLP)	3.28	21	2.43	27	3.88	10	3.21	19	0.000*
(C25) Mistakes and discrepancies in the contract document	3.26	22	3.10	21	3.53	16	3.04	23	0.003*
(C22) The ambiguity and lack of clarity in the contract terms regarding the final account procedure	3.18	23	2.90	23	3.38	21	3.15	21	0.003*
(C11) Client deliberately withheld	3.06	24	2.32	28	3.70	14	2.85	24	0.000*

Problems in Final Account Closing	Overall		Client		G7 Contractor		Consultant		Kruskal-Wallis Sig. p
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	
or refused to pay the final payment without a reasonable reason									
(C24) The contractual provision for the final account aspect is not comprehensive	2.98	25	2.97	22	3.23	25	2.65	25	0.000*
(C23) The terms of the contract are too complicated to be understood by the parties in the project	2.83	26	2.75	24	3.21	26	2.41	26	0.000*
(C40) Changes in regulations and policies that caused additional costs on the project	2.55	27	2.61	25	2.63	27	2.41	27	0.194
(C37) Fluctuation of construction material prices cause cost overrun to project	2.48	28	2.57	26	2.61	28	2.25	28	0.003*
(C39) Inclement or extreme weather disrupted the construction process	2.13	29	2.22	30	2.16	29	2.01	29	0.124
(C38) Force majeure events caused a delay in the progress of work	2.12	30	2.23	29	2.13	30	2.01	30	0.096

*p-value less than 0.05 = significant difference

Based on the interpretation of the five-point Likert scale, the analysis of the survey data as presented in Table 4.10 revealed that the mean scores for the thirty (30)

problems associated with the final account closing process, as rated by overall respondents, ranged from 2.12 to 4.16. Notably, eight (8) problems were rated as 'highly significant', with mean scores exceeding 4.00. These problems includes *Delay evaluation and preparation of the final account* (M=4.16), *Complexity of claim and valuation process for variation works* (M=4.14), *Delay approval and finalisation of variation work* (M=4.10), *Disagreement on the valuation of variation works* (M=4.09), *Lack of documents evidence for submission of final account claim* (M=4.08), *Delay submission of final account claim* (M=4.06), *Disagreement on the valuation of final account* (M=4.05), *and Cost overrun due to variation and provisional quantities* (M=4.04). Meanwhile, there were sixteen (16) problems perceived to have moderate significance, with the mean scores in the range of 3.06 (withholding of final payment) to 3.89 (delay in certification and issuance of the final certificate). Furthermore, the remaining six (6) problems were perceived to have low significance associated with the final account closing, with a mean value below 3.00.

From the client's perspective, the top problems perceived to have high significance include Delay approval and finalisation variation work (M=4.16), Disagreement on the valuation of variation works (M=4.06), and Lack of documents and evidence for the submission of the final account claim (M=4.03). The quantity surveyor consultant also identified Delay approval and finalisation variation work (M=4.44), Lack of documents and evidence for the submission of the final account claim (M=4.12), and Cost overrun due to variation and provisional quantities (M=4.12) as the highest influencing factors. Meanwhile, the contractor rated Delay approval and finalisation variation work (M=4.36), the Complexity of the claim and valuation process for variation works (M=4.29), and the Delay submission of the final account claim (M=4.27) as the most significant problems associated with final account closing.

The Kruskal-Wallis test revealed significant differences in perceptions among the respondent groups for several factors based on the p-values less than 0.05. Among of these factors are, the *complexity of the valuation and claim process for variation works* (p=0.043), *verbal instructions for variation works not confirmed in writing* (p=0.027), *the contractor's failure to follow procedures in the final account claim* (p=0.009), *lack of commitment to settle the final account promptly* (p=0.001), *contractor's inefficient planning and management of the project* (p=0.003), and *misunderstanding of contract conditions regarding the final account* (p=0.000). These factors have shown statistically significant differences in opinions across the groups.

This suggests that while there are common problems pertaining to final account closing as stated in the literature, the emphasis on particular problems varies among client, contractor, and consultant, indicating a need for further research to address these issues.

Meanwhile, based on Kruskal-Wallis test for the eight (8) 'highly significance' or 'highly critical' problems as highlighted above, the p-values generally shows that there was no significant different on the mean values scored across the group of respondents except for one factor which is *complexity of claim and valuation process for variation works* (p-value=0.043). Although a statistically significant difference was observed this factor, the overall response indicates consensus that this constitutes a major problem in the final account closing process (Mean = 4.14, Std. Dev. = 0.780). Notably, G7 contractors recorded the highest mean score (M = 4.29), which is higher than both Clients (M = 4.01) and Consultants (M = 4.06). These differences are understandable given the distinct role of contractors in the variation claims process. Unlike clients or consultant quantity surveyors, contractors bear the primary responsibility for preparing, substantiating, and submitting variation claims. Furthermore, numerous studies (Ilmi & Yip, 2014; Nor et al., 2023; Othman et al., 2023; Zakaria et al., 2013a) noted the significance of variation claims as a major problem contributing to delays in the final account settlement process.

4.2.5 Discussion of Findings

From Table 4.11, eight (8) problems have been identified and agreed upon by the main parties (client, G7 contractor, and quantity surveyor consultant) as major problems associated with final account closing in the Malaysian construction industry. It can also be noted that seven of the eight major problems, fall within the 'Evaluation Process' component, that includes, *Delay in Evaluation and Preparation of the Final Account (C18)*, *Complexity of Claim and Valuation Process for Variation Works (C31)*, *Delay in Approving and Finalising Variation Work (C29)*, *Disagreement on the Valuation of Variation Works (C32)*, *Lack of Documents and Evidence for Submission of the Final Account Claim (C4)*, *Delay Submission of the Final Account Claim (C2)*, and *Disagreement on the Valuation of the Final Account (C3)*. The eighth major problem, which is *Cost Overrun due to Variation and Provisional Quantities (C28)*, belongs to the 'Contractual Management' component. The 'Evaluation Process' component explains the largest proportion of variance in the EFA solution (27.97%)

(refer to Table 4.9), confirming that the evaluation procedure of final accounts is the most critical domain requiring intervention. By contrast, the remaining three EFA components, which are 'Incompetencies of the Project Team' (10.04%), 'Professional Practice' (7.01%), and 'Unforeseen Events' (6.13%), did not produce 'highly significant' variables as rated by overall respondents, indicating that their influence is moderate rather than critical.

It is important to highlight that this research does not dismiss the EFA results in favour of a purely item-level mean score analysis. Rather, the EFA component structure and the item-level mean score analysis serve complementary and sequentially dependent functions within the sequential explanatory mixed-methods design employed in this research. The EFA fulfils its primary role of data reduction and construct validation, where it confirms that the 40 identified problems are reduced and clustered into five coherent components. The eight major problems identified through mean score analysis are not separate from the EFA results, instead, they are integrated within them.

As Table 4.11 demonstrates that seven of the eight problems reside within the 'Evaluation Process' component, and the eighth belongs to 'Contractual Management'. Rather than contradicting the EFA, the item-level mean score analysis confirms that the most problems rate by practitioners concentrated within the most dominant EFA component. The EFA analysis thus serves a dual purpose in this research. Firstly, to establish the component structure that contextualises the location of the most major problems, and secondly, to validate the coherence of the eight major problems that belong to only two components.

It is further emphasised that the EFA analysis in this study has contributed to the body of knowledge on final account closing management. Prior to this study, there was no multivariate classification of the issues contributing to final account closing disputes conducted in the literature. Previous research identified individual problems of final account closing through literature reviews (Abidoye et al., 2018; Ahzami, 2017; Ramli, 2021; Ssegawa et al., 2020; Yahaya et al., 2019; Zakaria, 2015). However, none of these studies has systematically explored the underlying dimensional structure of these issues using multivariate statistical analysis.

For the qualitative phase in Chapter 5, the decision to focus on the eight specific major problems instead of the five broad EFA components was deliberate and methodologically sound. In the explanatory sequential mixed-methods design, the qualitative phase is intended to explain and elaborate on the quantitative findings in

depth (Creswell & Clark, 2018). Organising interviews under broad component such as 'Evaluation Process' or 'Contractual Management' may generate vague data that is difficult to interpret accurately and challenging to identify specific preventive strategies for this broad component. Therefore, anchoring interviews using eight specific major problems generates focused and rich narratives about their specific root causes and preventive strategies. Sections 4.3.4.1 to 4.3.4.8 provide an in-depth discussion of each major issue in final account closing, which will serve as a variable for qualitative analysis in Chapter 5.

Table 4.11
Summary Results of Descriptive Analysis for Major Problems in Final Account Closing

Categories	Major Problems	Mean	Std. Dev.	Rank
Evaluation Process	Delay evaluation and preparation of the final account	4.16	.891	1
	Complexity of the claim and valuation process for variation works	4.14	.780	2
	Delay approval and finalisation of variation work	4.10	.920	3
	Disagreement on the valuation of variation works	4.09	.845	4
	Lack of documents and evidence for submission of the final account claim	4.08	.816	5
	Delay submission of the final account claim	4.06	.942	6
	Disagreement on the valuation of the final account	4.05	.936	7
Contractual Management	Cost overrun due to variation and provisional quantities	4.04	.896	8

4.2.5.1 Delay Evaluation and Preparation of the Final Account

The evaluation and preparation processes of the final account for a construction project are critical in project management as they ensure accurate final calculation of all expenditures and the fair settlement of claims between the contractor and the client (Ilmi & Yip, 2014; Zakaria et al., 2014). However, despite its significance, the process of evaluating and preparing final accounts for a construction project is often complex

and time-consuming, frequently extending beyond the period specified in the construction contract (Ahzami, 2017; Lew et al., 2013; Zakaria et al., 2013a). Insufficient time allocated for evaluating all final works can hinder the timely preparation of the final account (Ye & Rahman, 2010). At the management level, personnel changes can significantly impact the process. Delays can also occur when the contract administrator and quantity surveyor take longer than the contract stipulates to evaluate and prepare the final accounts (Hisham & Othman, 2021). For instance, a quantity surveyor who is responsible for the final account leaving the company due to retirement, transfer, or resignation can lead to delays. The new person taking over may require time to familiarise themselves with the project's specific requirements, potentially causing inconsistencies and additional delays (Zakaria et al., 2013b). This delays in evaluation and preparation of the final account can have significant consequences for all parties involved. Most notably, they can lead to late final payments, affecting the contractor's cash flow. The financial strain faced by the contractor can impair their ability to meet their financial obligations or take on new projects, potentially causing a ripple effect throughout the construction industry (Othman et al., 2023).

As can be seen in the Table 4.11 above, based on mixed opinions among the client, G7 contractor and quantity surveyor consultant, the majority of respondents agreed (Mean=4.16, Std. Dev.=0.891) that delay in evaluation and preparation of the final account was identified as a major problem associated with final account closing in construction projects.

4.2.5.2 Complexity of Claim and Valuation Process for Variation Works

Variations in construction projects are often inevitable, yet their management presents significant challenges due to the subjective nature of valuations and the complexity of contractual provisions (Baloi & Price, 2003; Zakaria et al., 2012). This complexity frequently leads to disputes between contractors and clients, particularly in assessing variation claims (Othman et al., 2023; Ramli, 2021). While construction contracts typically include variation clauses, their complexity or ambiguity can lead to differing interpretations among parties, fostering disputes (Memon et al., 2014; Othman et al., 2023). The contract provisions are sometimes inadequate in governing variation works, especially when the works fall outside the contract scope (Abdullah et al., 2022;

Abidoye et al., 2018). Consequently, contractors may seek to recover expenses for such works through quantum meruit or a fair valuation basis, which may potentially lead to disputes (Ilmi & Yip, 2014; Kong & Yeow, 2016). Furthermore, the basis for determining the value of variation works presents another contentious issue. While bills of quantities (BQ) are commonly used as a reference for the valuation of variation works, they may not always provide an accurate basis due to the different nature of works and quantities (Othman et al., 2023; Ramli, 2021). Furthermore, this discrepancy can result in conflicts between contractors' claims and quantity surveyors' assessments, further complicating the variation management process (Love et al., 2011). Moreover, the variation claims can be complex due to insufficient information on variation instruction and a lack of transparent communication in the assessment process (Odeyinka et al., 2011). As such, these complexities in variation claims and assessment processes can contribute to disputes and delay the final account closing process in the construction industry.

Based on the findings presented in Table 4.10, although a statistically significant difference was observed (p-value < 0.05) regarding respondents' perceptions of this factor, the overall response indicates consensus that the complexity of the valuation and claims process for variation works constitutes a major problem in the final account closing process of construction projects (Mean = 4.14, Std. Dev. = 0.780) (refer Table 4.11). Overall, variation claims have consistently been identified as the major problem contributing to delays in the final account settlement process. Numerous studies (Ilmi & Yip, 2014; Nor et al., 2023; Othman et al., 2023; Zakaria et al., 2013a) noted the significance of variation claims, particularly highlighting that complexity and dispute associated with such claims can lead to substantial prolongation of the final account closure. This finding suggests that addressing the complexities and conflicts associated with variation claims is essential for reducing delays in project completion.

4.2.5.3 Delay Approval and Finalisation Variation Work

The process of finalising variations work in construction projects is often fraught with challenges, leading to delays and disputes in closing the final account. One of the primary obstacles in finalising variations work is the delay in approval by the client or management, even if the work has already been executed on site (Romli, 2015). This can significantly impede the closure of final accounts. This delay might be due to

the client's dissatisfaction with the quality of variation works performed by the contractor (Nor et al., 2023). Furthermore, the approval process for variation works is complicated due to inadequate documentation or a lack of evidence to support variation claims (Ilmi & Yip, 2014). Verbal instructions for variation work without written confirmation can result in contractors losing their entitlement to claims, thereby leading to disputes (Othman et al., 2023; Zakaria et al., 2012).

Additionally, a considerable challenge in finalising variation works arises from questions about the scope, necessity, and justification of such variations. Specifically, it involves determining whether the variations are conducted due to genuine changes or due to design inadequacies by the consultant or work mistakes by the contractor (El-adaway et al., 2016; Offei-Nyako et al., 2016). Perera & Dewagoda (2020) further asserted that issues in approving and finalising variation works frequently arise when there is a dispute about whether the contractor has performed the work without the architect's instruction. It also concerns whether the architect's instruction constitutes unauthorised variation under the contract or whether the variations ordered by the architect are fair and reasonable in accordance with contract provisions and terms of the doctrine of fair valuation (Ilmi & Yip, 2014). As such, delays and difficulties in resolving variation orders for projects may have a material adverse impact on the contractor's financial condition, cash flows and results of operations. If this problem cannot be settled before the project is handed over to the client, the closing of the final account cannot be resolved within the period prescribed.

As can be seen in Table 4.11 above, based on the mixed opinions among the group of respondents, most respondents agreed that delay in approving and finalising variation work was identified as a major problem in final account closing in the Malaysian construction industry (Mean=4.10, Std. Dev.=0.92). Delays and difficulties in resolving variations in construction projects may have an adverse impact on the contractor's financial condition and cash flows. If this problem cannot be settled before the project is handed over to the client, the closing of final account cannot be resolved within the prescribed timeline.

4.2.5.4 Disagreement on the Valuation of Variation Works

Disagreements on the valuation of variation work constitute another major problem that hinders the timely closing of the final account and creates financial risks

and conflicts between the contracting parties (Ilmi & Yip, 2014). This problem often driven by the complexity of valuation and the subjective nature of pricing variation items, especially when Bill of Quantities (BQ) rates may not accurately reflect the actual cost due to differing methods or quantities (Ilmi & Yip, 2014; Othman et al., 2023). Clients often dispute the certified final amount, especially when variation claims result in increased costs, with the perception that the contractor intentionally inflates the claim (Ameyaw et al., 2015; El-Sayegh et al., 2020; Kenyatta, 2016). Conversely, contractors often disagree with the valuation of variation works determined by quantity surveyor or contract administrator due to different understandings of the scope of the variation works (Kong & Yeow, 2016; Ssegawa et al., 2020). For instance, the contractor believes that the variations for a particular work should be assessed at a higher rate, while the owner holds a contrary view and insists that the variation works should be valued at a lower rate (Oladapo, 2007). If either party is dissatisfied with a contract administrator's decision on valuation, the matter can be referred to a dispute resolution procedure, prolonging the final account closing (Othman et al., 2023).

In this research, (as tabulated in Table 4.11 above) most of the respondents agreed that disagreement concerning the valuation of variation was a major problem in final account closing in Malaysian construction industry (Mean=4.09, Std. Dev.=0.845). The assessment and agreement of variation claims are a precedent condition to the final account settlement (Ilmi & Yip, 2014). Therefore, it is crucial for all parties to have a clear understanding and agreement on the valuation of variation works in order to facilitate a smooth and fair final account closing process.

4.2.5.5 Lack of Documents and Evidence for Submission of Final Account Claim

The construction industry always faces significant issues with regard to inadequate documentation (Bakhary et al., 2018). In particular, poor documentation and record-keeping are major contributors to invalid claims and prolonged evaluation of final claim processes, leads to disputes and delays in final account closing (Abidoye et al., 2018; Ssegawa et al., 2020; Zakaria et al., 2013). Contractors sometimes fail to provide sufficient supporting documents or submit incomplete claims and inadequate supporting documents, hindering or slowing down the assessment process as investigating and verifying facts and evidence takes more time (Hisham & Othman, 2021; Othman et al., 2023). In such cases, contractors are required to rectify these errors

and resubmit their claims, leading to further delays in the final accounts process. The absence of supporting documentation can raise suspicion of fraudulent or inflated claims and create an environment of uncertainty and mistrust, leading to disputes and legal action (Hai, 2019; Kong & Yeow, 2016). Therefore, it is crucial to maintain good record-keeping and proper project documentation from the project's onset and throughout its execution until completion.

Accordingly, based on the findings from the Table 4.11 above, all groups of respondents agreed that lack of documents and evidence for submission the final account claim is one of the major problems in the final account closing (Mean=4.08, Std. Dev.=0.816). To address these challenges, there is a critical need for competent site staff who are skilled in maintaining proper project information. This encompasses not only good documentation and record-keeping systems but also staff awareness in how to document and submit a well-supported claim.

4.2.5.6 Delay Submission of Final Account Claim

Timely submission of the final account claim is essential in construction projects to close the final accounts efficiently and guarantee effective project management success. Contracts normally stipulate specific deadlines for submitting necessary documents for the final account, such as within six months of Practical Completion under PAM 2018. However, contractors frequently fail to adhere to these deadlines (Ilmi & Yip, 2014; Othman et al., 2023). Studies conducted by Ramli (2021) and Ssegawa et al. (2020) discovered that the delayed submission of claims by contractors is a significant factor leading to delays in closing the final accounts. One of the most frequently cited reasons for this problem is inadequate documentation and record-keeping, as well as the failure to follow procedures or guidelines in final claims (Abidoye et al., 2018; Hisham & Othman, 2021; Othman et al., 2023). In cases where the contractor fails to provide documentation, the architect or quantity surveyor may proceed to prepare the final account based on available information, potentially leading to an assessment unfavourable to the contractor. This may lead to disagreement on the final account valuation by the contractor.

Furthermore, the contractor's internal capacity and resources can significantly impact the timely submission. Inadequate experience of the contractor or their staff in preparing documentation, valuing work, or general project management can lead to

difficulties and delays in submission of the final account claim (Abidoye et al., 2018; Bakhary et al., 2015; Ssegawa et al., 2020). Additionally, an excessive workload from current or other projects, can contribute to this problem (Ssegawa et al., 2020; Zakaria et al., 2013d). The loss of key personnel responsible for the final account due to retirement, resignation or transfer can result in a loss of critical project information or substantial delays in reassembling the final account documents (Ssegawa et al., 2020).

In addition, a lack of proactive management and planning by contractors can also contribute to this problem. Contractors sometimes neglect the importance of closing final accounts within the allocated timeframe, treating it as a less pressing or minor issue that can be addressed later (Ismail et al., 2014). Failure to adopt a proactive approach in managing valuations, snagging, and defects throughout the project may lead to a backlog of issues at the final account stage, thereby complicating and delaying its submission (Othman et al., 2023).

Furthermore, financial difficulties may hinder contractors from providing sufficient funding for projects, resulting in an inability to complete work or rectify defects, particularly when the costs associated with rectifying defects exceed the remaining balance or claims (Abidoye et al., 2018; Yahaya et al., 2019). In addition, the complexity of the project and the nature of any variation work directly affect the time required to assess and compile the final account accurately (Othman et al., 2023).

As can be seen in Table 4.11, based on the mixed opinions among the respondents, most respondents agree that delay in submitting the final account claim by the contractor is a major problem contributing to disputes in final account closing in the Malaysian construction industry (Mean=4.06, Std. Dev.=0.942). In conclusion, the timely submission of the final account is a critical determinant of final account closing success. However, several challenges, ranging from inadequate record-keeping to internal organisational challenges, frequently cause delays. Addressing these challenges through improved project management and meticulous record-keeping is crucial for fostering more efficient and timely final account submissions in the construction industry.

4.2.5.7 Disagreement on the Valuation of Final Account

The valuation of the final account is a crucial process involving the calculation of the final works and adjustments of the contract sum to determine the total sum

payable for the project. Several studies emphasised that disagreements over the valuation of the final account or the certified amount in the final certificate, determined by the quantity surveyor and contract administrator, can be a major problem in the final account closing (Ameyaw et al., 2015; Ilmi & Yip, 2014; Othman et al., 2023; Ssegawa et al., 2020; Zakaria, 2015). This problem can lead to conflicts between the contractor and the client and cause delays in closing the final accounts (Kong & Yeow, 2016).

A primary cause of valuation disagreements is inadequate documentation and record-keeping throughout the project lifecycle (Abidoye et al., 2018). Contractors frequently submit claims with incomplete, incorrect, or insufficient documentation, lacking the verifiable information necessary to support valuation process (Hisham & Othman, 2021; Kong & Yeow, 2016). This documentation deficiency and errors makes it difficult for quantity surveyors to accurately assess and value the overall completed works including variations, leading revisions and resubmissions, extending the final account process (Othman et al., 2023).

Additionally, dissatisfaction with the quality of work occurring in the project may lead to disagreements on the valuation of work done or the amount in the final account (Peters et al., 2019). Furthermore, lack of trust among parties is a significant cause of disagreement over the valuation of the final account in construction projects. Clients often deduct contractors' claims because they assume the contractors are claiming more than the actual value of work done. Conversely, contractors tend to submit higher claims knowing that clients or their quantity surveyor consultant will likely reduce the amount. This mutual distrust is a major cause of disagreement in the valuation of final work done in the Malaysian construction industry (Judi & Mustaffa, 2023). Suppose there is a disagreement about the measurement or valuation of any part of the final accounts by the quantity surveyor. In that case, the disputing party can ask the contract administrator to review and decide. In addition, if the contracting parties are dissatisfied with the decision of the contract administrator, either party may refer the matter to a dispute resolution procedure in accordance with the contract, thereby prolonging the closing of the final account (Zakaria et al., 2022).

Based on findings in Table 4.11, most of the respondents from the client, G7 contractor and quantity surveyor consultant group agree that disagreement on the valuation of the final account is a significant factor in final account closing (Mean=4.05, Std. Dev.=0.936). Overall, the disagreement over the final account's valuation can lead to complex negotiations and potential disputes between the contracting parties. The

prolonged closing of the final account due to such disagreements can have significant financial implications for both the client and the contractor, potentially affecting cash flow and future project planning. Therefore, it is suggested that improving communication, documentation practices, and establishing clear valuation criteria early in the project could be crucial steps in mitigating this challenge and facilitating a smoother final account closing process.

4.2.5.8 Cost Overrun Due To Variation and Provisional Quantities

Variation works refer to changes or modifications made to the original scope of work during the construction phase, where these modifications are sometimes necessary due to design changes, unforeseen site conditions or client requests (Offei-Nyako et al., 2016). However, these variations often lead to increased costs, exceeding the initial budget and causing cost overruns (Ismail et al., 2023). Provisional quantities can also contribute to cost overruns and disputes in the final account closing (Offei-Nyako et al., 2016; Othman et al., 2023). Provisional quantities refer to estimated materials for works included in the contract but are not specifically defined or detailed during the tendering stage (Cunningham, 2017). Additionally, Hisham & Othman (2021) defined provisional quantity as the items that cannot be ascertained or calculated during the tender preparation process. Thus, it is subject to final remeasurement in order to have a fair valuation. Nevertheless, these estimates are often based on assumptions or rough calculations (Morena & Amoah, 2021).

According to Offei-Nyako et al. (2016), remeasurement creates chances for the contractor to gain more profit. Contractors may argue that they are entitled to additional payment for the extra work conducted due to variations or remeasurement of provisional quantities, while clients may dispute these claims and refuse to pay the additional costs. These disputes can result in delays in the settlement of the final account and can strain the relationship between the contractor and the client. The findings shown in Table 4.11 above, indicate that cost overrun due to variation and provisional quantities are one of the major problems in final account closing (Mean=4.04, Std. Dev.=0.896).

Overall, variation works and provisional quantities in construction projects can lead to cost overruns and disputes in the final account closing due to the potential for unforeseen changes, inaccuracies in cost estimation and disagreements between contractors and clients (Muhamad et al., 2021). Therefore, it is crucial for construction

professionals to carefully oversee, and control provisional quantities and variation works in the project to ensure transparency between all parties involved in construction projects and minimise the risk of cost overruns.

4.3 Summary

This chapter presents the analysis and findings of the quantitative data collected through a questionnaire survey, addressing research objectives one and two. The analysis involved frequency analysis to examine respondents' demographic backgrounds, descriptive analysis to identify current issues, and exploratory factor analysis (EFA) to reduce and regroup the variables related to final account closing problems into different components. The descriptive analysis and the Kruskal-Wallis test were primarily employed to identify and rank the major problems based on mean scores and to determine the consensus among the three respondent groups. The findings revealed that the final account closing process is generally perceived as challenging, that disputes are common, and that the settlement period often extends to two to three years, exceeding the period normally expected under standard contractual procedures. The EFA identified five components of problems, which consist of the evaluation process, contractual management, incompetencies of the project team, professional practice, and unforeseen events. Descriptive analysis identified eight major problems agreed upon by the respondents. This major problems includes, delay evaluation and preparation of the final account, complexity of the valuation and claim process for variation works, delay in approving and finalizing variation work, disagreements on the valuation of variation works, lack of documents and evidence for submission the final account claims, delays in submitting the final account claim, disagreement on the valuation of final work done, and cost overrun due to variation and provisional quantities. These findings serve as the foundation for formulating questions for semi-structured interviews in the qualitative phase. The purpose of the next phase of qualitative research is to identify root causes and determine preventive solutions for each major problem related to final account closing issues, which shall be analysed and discussed in Chapter 5.

CHAPTER 5
QUALITATIVE DATA ANALYSIS AND FINDINGS

5.1 Introduction

In this chapter, the results and findings from semi-structured interviews with industry practitioners regarding the final account closing in construction projects are presented. The focus is on investigating the root causes of major problems in final account closing and determining preventive solutions to address these problems and their root causes, in order to improve final account closing in the Malaysian construction industry. The research questions addressed are: "Why do problems in final account closing often arise in the Malaysian construction industry?" and "What are the preventive solutions to address the major problems and root causes, thus improving the final account closing process in the Malaysian construction industry?". The approach and technique for the interviews were detailed in Chapter 3. The interview results were analysed using Atlas.ti software version 25, by employing qualitative thematic analysis to identify patterns within the data collected. The semi-structured interviews in this chapter are primarily organised around two EFA components established in Chapter 4, namely the evaluation process and contractual management. These two components encompass all eight major problems that form the operational basis for the qualitative investigation. However, the interviews remained anchored to the eight major problems because these problems were the specific issues requiring explanation. By anchoring the interviews around the eight specific major problems, the qualitative phase generates focused, rich narratives that directly address the root causes and preventive strategies most relevant to the evaluation process and contractual management domains.

5.2 Analysis of Interview

The key informants for the interviews were carefully selected based on their backgrounds and experiences in the construction industry, as well as their knowledge of the key subjects related to the research aim and objectives. This research engaged twelve (12) informants, comprising senior and top management levels of construction

professionals from the group of Clients, G7 Contractors, and Quantity Surveyor Consultants organisation. Four (4) representatives from each group were chosen based on their professional backgrounds and expertise, meeting the criteria for interview informants as detailed in Chapter 3. These informants indicated their willingness to participate in the research and contribute their insights on the subject matter.

The rationale for having a small number of informants was based on four considerations. First, the study prioritises in-depth exploration of individual experiences (interpretive phenomenology), providing rich insights to answer the research questions (Lopez & Willis, 2004). Second, it is a common practice in phenomenological studies to engage with as few as 3 to as many as 12 informants in order to achieve "redundancy saturation" (Guest et al., 2020; Larsen & Adu, 2021). Third, regarding data saturation, a criterion-based sample typically requires six (6) to seven (7) informants to capture the majority of the themes at 80% saturation point, and eleven (11) to twelve (12) informants to reach higher degree of saturation at 95% saturation point (Guest et al., 2020). Finally, despite a small sample size of informants, the researcher therefore deployed member checking and prolonged engagement with informants to elicit the deepest and richest responses from the informants about the phenomenon (Shahruddin et al., 2024). The limited number of informants, therefore, would no longer be an issue.

5.2.1 Particulars of Informants for Interview

Table 5.1 depicts the detailed profiles of interview informants. The Clients were labelled as CL, G7 Contractors were labelled as CR, and Quantity Surveyor Consultants were labelled as CS. All informants in the interview sessions were from senior and top management levels, possessing experience ranging from 15 to 35 years in the construction industry within Malaysia. Furthermore, all participants were directly involved in managing the final account closing process across multiple projects, with experience spanning 10 to 22 years. Some participants had been engaged with the final account process since the beginning of their careers in the construction industry, while others became involved after several years in the industry.

As evidenced from the informant's background in Table 5.1, it can be summarised that the interview findings are reliable and robust because they come from experienced and knowledgeable professionals who deal with final accounts in their organisation. For qualitative data analysis, the findings will be divided into two (2) main

elements, namely as root causes and preventive solutions in the final account closing issues.

Table 5.1
Particulars of Informants for Interview

Key Informant	Position in Organisation	Type of Organisation	Experience in the Construction Industry (years)	Experience in dealing with final account (years)
CS1	Managing Director	QS Consultant	22	22
CS2	Managing Director	QS Consultant	16	15
CR3	Company Director	G7 Contractor	25	18
CR4	Company Director	G7 Contractor	20	12
CL5	Senior Manager	Client	36	20
CL6	Senior Quantity Surveyor	Client	18	15
CR7	Project Manager	G7 Contractor	15	15
CS8	Senior Quantity Surveyor	QS Consultant	16	16
CS9	Senior Quantity Surveyor	QS Consultant	15	15
CR10	Contract Manager	G7 Contractor	18	16
CL11	Assistant Manager	Client	16	16
CL12	Assistant Manager	Client	15	10

5.3 Root Causes Contributing to Major Problems in the Final Account Closing Issues

Root cause analysis is a systematic problem-solving approach used to identify the fundamental reasons behind undesirable outcomes, with the aim of preventing recurrence of problems by addressing underlying issues rather than symptoms (Paulsen, 2021; Rosenfeld, 2013). In the context of this research, root causes are the underlying factors that drive the eight major problems in final account closing identified through the quantitative survey in Chapter 4. These major problems are predominantly clustered

within the Evaluation Process EFA component (seven problems) and the Contractual Management EFA component (one problem).

This research systematically analysed the root causes of eight (8) major problems in final account closing, identified earlier through a questionnaire survey, as detailed in Chapter 4 (Section 4.2.5). In this research, root causes are a key component in developing a Preventive Solution Framework to improve final account closing. The root causes highlighted here address research question three (3), which explores why disputes in final account closing frequently arise and are prevalent in the Malaysian construction industry. Consequently, understanding the root causes is essential for creating an effective framework to address the major problems in final account closing.

5.3.1 Findings and Discussion of Root Causes Contributing to Major Problems in the Final Account Closing Issues

Through the structured process of thematic analysis, following the methodology of Braun & Clarke (2006), as stated in Chapter 3 (Section 3.5.2.4 a), several themes and codes were identified and organised in Table 5.2. The data were analysed from interview transcripts, which involved data familiarising, assigning specific codes, grouping the interrelated codes into themes, reviewing and refining the themes, as well as interpreting and reporting the themes. This process allows for a comprehensive understanding of the underlying issues contributing to major problems in the final account closing issue. The codes and themes identified in the analysis are closely related to the eight (8) major problems in the final account closing.

Consequently, as part of the research objectives to investigate the root causes contributing to major problems in the final account closing, an in-depth interview was conducted. The informants were informed of the survey results that list the eight (8) major problems; (1) Delay in evaluation and preparation of the final account; (2) Complexity of the valuation and claim process for variation works; (3) Delay in approving and finalising variation work; (4) Disagreement among contracting parties on the valuation of variation works; (5) Lack of documents for the submission of the final account claim; (6) Delay in submitting the final account claim; (7) Disagreement with the valuation of the final work done; and (8) Cost overrun due to variation and provisional quantities. All informants agreed with these eight (8) major problems and were then subsequently asked to elaborate on these issues based on their experience in

handling the final account closing process. In addition, informants were also asked to elaborate on other problems that may contribute to the final account closing.

The analysis involved identifying patterns from the interview data, assigning codes, generating themes, and interpreting how these themes relate to each major problem. The results of this analysis provide valuable insights into the underlying causes of problems in final account closing as well as their impact on the construction industry. As a result, with reference to Table 5.2, the analysis identified ten (10) themes and twenty-three (23) codes that emerged from the interview, pertaining to root causes contributing to major problems in the final account closing issues. Table 5.3 further presents a thematic analysis of the root causes in final account closing issues, categorised into several themes and codes, with input from multiple informants (CS1 to CL12). Section 5.5 below provides a detailed explanation of each theme and code contributing to the root causes of the major problems in the final account closing issue. The developed themes and codes for root causes are derived from semi-structured interviews conducted with experts in final account management in the construction industry.

Table 5.2
List of Themes and Codes for Root Causes

Themes	**Codes**
a) Documentation Issues	1. Insufficient Documentation and Evidence
	2. Poor Record Keeping
	3. Lack of Documentation Management System
	4. Complex Documentation Process
b) Improper Variation Order	5. Substantial Changes
	6. Lack of Formal Instruction
c) Contract Ambiguity	7. Discrepancies in Contract Document
	8. Lack of Procedures and Guidelines
d) Incompetencies	9. Lack of Knowledge and Experience
	10. Design and Estimation Error
e) Lack of Commitment	11. Resource Constraint
	12. Lack of Priority
f) Communication and Coordination Breakdown	13. Ineffective Communication and Coordination
	14. Changes of Project Personnel

Themes	Codes
g) Non-Fulfilment of Contractual Requirements	15. Outstanding Contractor's Works 16. Poor Quality Works
h) Organisational Bureaucracy	17. Inefficient Approval Process 18. Delays from Local Authorities
i) Lack of Trust and Integrity	19. Valuation Dishonesty 20. Contractor's Overclaim 21. Unethical Conduct
j) Inadequate Project Preparation	22. Insufficient Site Investigation 23. Insufficient Budget Allocation

Table 5.3
Thematic Analysis of the Root Causes in Final Account Closing Issues

THEME	CODE	INFORMANT											
		CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Documentation Issues	Insufficient Documentation and Evidence	●	●	●	●		●	●	●	●	●	●	●
	Poor Record Keeping		●	●	●		●	●	●	●		●	●
	Lack of Documentation Management System						●	●	●	●	●	●	●
	Complex Documentation Process								●				
Improper Variation Order	Substantial Changes	●	●		●	●					●	●	●
	Lack of Formal Instruction	●	●		●	●	●		●	●	●	●	●
Contract Ambiguity	Discrepancies in Contract Document		●	●		●		●		●			
	Lack of Procedures and Guidelines			●	●	●		●	●	●	●	●	●
Incompetencies	Lack of Knowledge and Experience	●			●	●	●	●	●	●			●
	Design and Estimation Error	●	●	●		●		●	●	●	●		●
Lack of Commitment	Resource Constraint	●	●	●	●	●	●	●		●	●		●
	Lack of Priority	●		●	●	●	●	●	●	●	●	●	●
Communication And Coordination Breakdown	Ineffective Communication and Coordination			●	●	●	●	●	●	●	●	●	●
	Changes of Project Personnel	●	●		●	●	●	●	●	●	●	●	●

THEME	CODE	INFORMANT											
		CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Non-Fulfilment of Contractual Requirements	Outstanding Contractor's Works	●		●			●	●	●				●
	Poor Quality of Work	●		●					●	●	●	●	
Organisational Bureaucracy	Inefficient Approval Process				●				●		●	●	●
	Delays from Local Authorities								●				●
Lack of Trust and Integrity	Valuation Dishonesty				●		●					●	
	Contractor's Overclaim	●	●		●		●				●	●	
	Client's Unethical Conduct								●		●		
Inadequate Project Preparation	Insufficient Site Investigation	●	●		●			●	●	●	●	●	●
	Insufficient Budget Allocation			●				●		●	●	●	●

5.3.2 Data Saturation of Root Causes

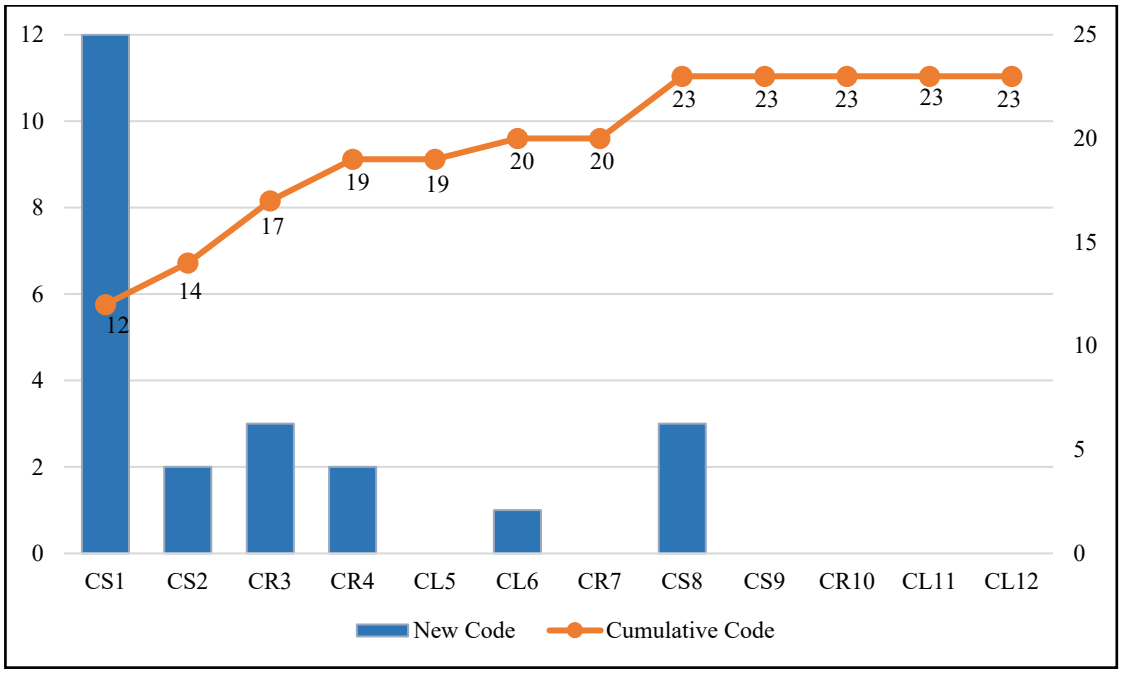


Figure 5.1 Codes for Root Causes that Emerge During the Analysis of Interviews

The above Figure 5.1 provides empirical evidence supporting the attainment of data saturation in the qualitative analysis of root causes contributing to major problems in the final account closing issues. According to Guest et al. (2020) and Hennink et al. (2017), data saturation is achieved when no new information or themes emerge from additional data collection. In the Figure 5.1, the bar graph displays the number of new codes identified from each interview, while the line chart plots the cumulative number of unique codes across all interviews. Based on the bar graph, the first interview with CS1 yielded twelve (12) new codes, representing the largest contribution to the code findings. Subsequent interview with CS contributed two (2) additional codes, and CR3 contributed three (3) new codes, bringing the cumulative total to seventeen (17) codes. This pattern suggests that the main findings of the interview were mostly captured during the initial phase of data collection.

As the interview and analysis progressed, the contribution of new codes continued to reduce. Interview with CR4 introduced two (2) new codes, increasing the cumulative codes to nineteen (19), while CL5 contributed no new codes. A further new one (1) code emerged from CL6, increasing the cumulative codes to twenty (20), whereas CR7 did not produce any new codes. This stage indicates a noticeable slowdown in code development, suggesting that the data were approaching saturation,

as subsequent interviews increasingly reinforced existing codes rather than introducing new insights. The interview with CS8 resulted in the emergence of three (3) additional codes, raising the cumulative total to twenty-three (23). Following this point, no new codes emerged from the remaining interviews (CS9 to CL12), as reflected by the flat cumulative curve in the figure that forms a plateau. A plateau indicates data saturation, which is reached when no new codes or information emerge from further data collection (Baker & Edwards, 2012; Guest et al., 2020). Therefore, in this analysis, the plateau pattern observed after eight interviews, confirmed by four additional informants (CR9 to CL12), confirms that the point of saturation has been reached and surpassed.

This saturation pattern established in this analysis is also consistent with existing saturation benchmarks from previous scholars, which suggests that data saturation often occurs within the first twelve (12) interviews, provided the sample is relatively homogeneous, and the research objectives are well defined (Guest et al., 2006, 2020; Hennink et al., 2017; Larsen & Adu, 2021). In this research, the samples were homogeneous, as the informants were among senior-level construction professionals (as explained in Section 5.2.1), and the objective was specific, which are to identify the root causes contributing to major problems with final account closing in construction projects. This specific objective should lead to saturation more quickly than a broader study. Therefore, the twelve (12) interviews conducted for this research are sufficient for a specific topic with a homogeneous sample. Furthermore, the sample size of twelve (12) informants demonstrated in this research aligns with the perspective that the sufficiency of a qualitative data relies more on information richness than on its size (Malterud et al., 2016).

5.3.3 Discussion of Themes and Codes for Root Causes

5.3.3.1 Theme 1 – Documentation Issues

The project's documentation, including construction drawings, specifications, details of quantities, rates and prices, receipts, instructions and reports, is crucial in construction projects, particularly in the final account closing process (Akintoye et al., 2024). They serve as the foundation for verifying completed work, justifying variations, substantiating claims and resolving financial obligations, which is also essential for future reference of the project (Yap et al., 2017; Zillante et al., 2014). Furthermore

Akintoye et al. (2024) and Poriya et al. (2021) assert that documentation is also essential to ensure transparency by providing evidence of what has been agreed upon and performed, as well as serving as evidence in case of disagreements.

In the context of final account closing, where all outstanding financial matters must be resolved after work completion, comprehensive and accurate documentation is crucial. In accordance with the PAM Contract 2018, as stated in Clause 30.10, the contractor shall send all necessary documents to the Architect and Quantity Surveyor for preparing the Final Account. Contractors need to submit their final claims together with all necessary documents, which include the total amount they believe is owed based on the work done, including any adjustments to the contract amount (Rasid, 2017). Disputes over the final account often arise when documentation is incomplete, inaccurate, or poorly maintained, making it difficult for consultants (Quantity Surveyor) and clients to verify the claims submitted by the contractor (Othman et al., 2023). Therefore, comprehensive documentation is necessary to support the claims made by contractors and to allow consultants and clients to assess the validity of these claims.

From the findings of thematic analysis, as shown in Table 5.3, it was identified that "Documentation Issues" emerged as one of the significant root causes for major factors contributing to disputes in the final account closing. This theme encompasses the challenges and issues pertaining to the management, maintenance, and submission of project-related documents and records throughout the construction process and during the final account preparation. The theme of documentation issues comprised several interrelated codes, including (a) insufficient documentation and evidence, (b) poor record keeping, (c) lack of documentation management systems, and (d) complex documentation processes. These codes collectively highlight the multifaceted nature of documentation issues and challenges related to the final account process in the construction industry.

a) Insufficient Documentation and Evidence

Insufficient documentation and evidence refer to the general inadequacy of necessary documents or particulars for the final account valuation and preparation. In many cases, delays in final account closing are frequently attributed to incomplete documentation or evidence to substantiate claims, as consultants need to wait for contractors to submit all necessary documents before proceeding with their evaluations.

Most of the informants (CS1, CS2, CR3, CR4, CL6, CR7, CS8, CS9, CR10, CL11 and CL12) highlighted that incomplete or insufficient documentation, such as invoices, receipts, and site records, to substantiate final account claims causes delays in the preparation of the final account. As informant CS2 noted that:

> *"To prepare the final accounts, the consultant needs all information such as RFIs, drawings and other relevant documents. When these are missing, the consultant cannot verify the final account claim" (CS2)*

This issue reflects a common problem of claim and payment in the construction industry, where contractors often fail to submit the necessary documentation, making it difficult for consultants to assess claims and prepare the final accounts (Azman et al., 2014; Mohamad et al., 2018). The consequences of insufficient documentation for the final account claim have resulted in a delay in the consultant's evaluation process, as further discussed by another informant (CS9), from the consultant:

> *"The consultant couldn't evaluate the final account claim on time because they were waiting for the contractor to provide all the supporting documents and evidence, such as invoices and receipts." (CS9)*

When contractors cannot substantiate their claims with evidence, consultants and clients may question the accuracy and validity of the claimed amounts. Without adequate documentation, it becomes challenging to verify the actual work performed and associated costs, leading to disputes during the valuation process. This statement aligned with the PAM Contract 2018 (Clause 30.10), where it clearly stated that 'the period for completion (evaluation and preparation) of the final account shall be adjusted if there is any delay by the contractor in sending the necessary documents. The absence of supporting documents often leads to disagreements over the final valuation, prolonging negotiations and thus delaying the settlement of the final account. On the other hand, the issue of incomplete documentation is not only limited to the contractor but is also contributed by the consultant. Contractor (CR3) and Client (CL11) highlighted that consultants may contribute to delays due to inadequate documentation processes, as pointed out by CR3:

"The contractor might delaying their claim submission simply because they're waiting for the consultant to provide important documents, such as a certificate of testing and commissioning" (CR3)

In construction projects, consultants are responsible for inspecting and verifying the contractor's work. Upon completion of certain work, consultants are required to provide a certificate as evidence of the contractor's work. For example, in works related to fire safety, testing and commissioning are required upon completion, and the consultant needs to prepare a specific certificate to verify that the work has passed the required test. If the consultant is late in providing that certificate, it will delay the contractor's final claim submission due to incomplete supporting documentation.

Furthermore, a lack of documentation, particularly regarding variation works, also causes difficulty for consultants to evaluate claims promptly. Some informants (CS1, CS2, CL6 and CR7) emphasised the specific challenge related to variation works where contractors sometimes proceed with variation works without obtaining the necessary approval, causing disagreements between the parties involved, as explained by CS1:

"The contractor has executed variation works without obtaining appropriate instruction, and the client has not approved or signed them" (CS1)

This perception is further elaborated by CR7, that:

"When there are disagreements about V.O. works, it can make difficult for the contractor to compile a comprehensive claim. Consequently, this often leads to delays in the submission of the final account claim." (CR7)

This statement highlights the importance of ensuring the variation order is properly authorised and approved. The absence of such approvals can lead to disagreements about the scope and validity of variation works during the final account closing process. This issue is consistent with findings by Kenyatta (2016) and Wang et al. (2023), who emphasised that unauthorised variation orders are significant sources of payment disputes in construction projects.

b) Contractor's Poor Record Keeping

Poor record keeping in this analysis refers to the contractor's failure to maintain and properly organise documentation throughout the construction project systematically. Bakhary et al. (2015) and Ilmi & Yip (2014) have pointed out that ineffective record-keeping practices create a lack of transparency and accountability, making it difficult to track project progress and ensure accurate financial settlements. Multiple informants (CS2, CR3, CR4, CL6, CR7, CS8, CS9, CL11, and CL12) noted that contractors often fail to maintain organised, up-to-date records, making it difficult to retrieve the necessary documents when final account preparation begins. This issue is further worsened by the fact that documentation is often scattered between multiple locations, making it difficult to compile records at the project's end. Informant CR4 mentioned that:

> *"Records are not kept properly and sometimes lost. Site and office staff aren't coordinated effectively, so it's a struggle for us to gather information necessary to prepare the final account." (CR4)*

When project documentation is poorly organised or incomplete, it becomes difficult to compile the comprehensive evidence required for final account submission. Furthermore, record keeping can become problematic when there is a change of personnel to handle the final account. When a key person leaves, his/her replacement may struggle to locate essential documents, leading to further delays and complications in the final account process. Informants CR4 and CR7 have pointed to a human resource aspect of the record-keeping problem. As mentioned by informants, CR4:

> *"Documents also tend to get misplaced or lost when there's staff turnover, or when different people are handling the project at different times." (CR4)*

This statement from CR4 suggests that poor record-keeping relates to knowledge transfer and the continuity of human resources in project management. Furthermore, informants CL6 and CR7 also highlighted that poor record-keeping can sometimes be attributed to intentional actions or to staff negligence due to personal issues, dissatisfaction, or mismanagement. Such attitudes and behaviours can lead to

the misplacement or loss of important documents, exacerbating the overall problem of poor documentation and record-keeping in construction projects. This was mentioned by informant CL6:

> *"In some situations, this is because of attitude or personal issues of the staff, where they may intentionally misplace or lose documents due to dissatisfaction with the company or project" (CL6)*

This issue reflects an underlying problem related to the personnel's engagement and commitment, which could arise from dissatisfaction with their working environment, project circumstances, or employer.

c) Lack of Documentation Management System

A documentation management system is a systematic approach to managing project documentation. Multiple informants from the interview (CL6, CR7, CS8, CS9, CR10, CL11, and CL12) highlighted that a lack of a systematic approach to documentation management can lead to inefficiencies, errors, and difficulties retrieving necessary information. They also indicated that the absence of a centralised, computerised document management system creates inefficiencies, increases the risk of errors and lost records, and makes it difficult to retrieve information for final accounts. Informant CS8 stated that:

> *"Managing project documents manually can be quite inefficient and often leads to mistakes. When there's no central, computerised system to keep everything organised, it results in missing or incomplete records." (CS8)*

Without such a digital documentation system, the construction team may struggle to maintain necessary records, making it difficult to compile a complete and accurate final account. Furthermore, the lack of a documentation management system throughout the project lifecycle may be attributed to the deficiency of guidelines or policies within the organisation. Informant CR10 has pointed out that:

"It seems the company doesn't have a standard system or procedure for managing documents." (CR10)

This observation highlights the absence of Standard Operating Procedures (SOPs), such as ISO 9001, for a Quality Management System (QMS) to be implemented within the organisation, which could contribute to documentation issues.

d) Complex Documentation Process

The complexity of documentation for claims in construction projects poses a significant challenge during final account closing. This complexity arises from various factors, especially in large-scale projects that involve multiple stakeholders and work scopes. In the analysis, a consultant highlighted that the volume of documentation required for large projects with high claimed amounts, involving variation works and loss and expense claims, can be substantial. This takes more time and resources for the consultant to compile the documents. Informant CS8 explained that:

"We need more time to gather all the required documentation for the final account claim, particularly the documentation about loss and expense claims" (CS8)

The complexity of documenting loss and expense claims often arises due to the need for detailed cost breakdowns, especially related to additional costs. For example, the contractors that incur additional site overhead costs (e.g., workers' salaries, plant hire, security) due to the extended duration of the project are required to justify their loss and expense claims that are directly related to such delay and affect their project's critical path. Informant CS8 added that loss and expense claims contribute to the delay in assessing the final account:

"One of the biggest problems in the final account is the loss and expense claim issue, which is frequently complicated and time-consuming with numerous records that the contractor must compile, and a lot of documents that the client must verify" (CS8)

The documentation process during final account closing can be complex and challenging, especially when it involves loss or expense and variation claims. Both contractors and consultants face significant time and resources to substantiate and verify claims, highlighting the need for improved documentation practices and processes to streamline final account settlements.

5.3.3.2 Theme 2 – Improper Variation Orders

Variations are common and often inevitable in construction projects. Under the PAM Contract 2018 (Clause 11.2), the Contract Administrator has the power to issue variation instructions, and the contractor is obligated to carry them out. However, improper instructions for variation orders can lead to disputes during final account closing, particularly where instructions are unclear, incomplete, or issued without formal written confirmation (Judi & Mustaffa, 2023).

In this analysis, improper variation order has emerged as one of the key themes of root causes contributing to disputes in the final account closing. This theme refers to situations in which the process for issuing, managing, or documenting variations is flawed, thereby complicating the valuation of variation works. The codes derived under this theme capture various dimensions of variation problems encountered in construction projects. These include (a) Substantial Changes, and (b) Lack of Formal Instruction.

a) Substantial Changes

One important issue in variation work is whether the client or architect can issue unlimited variation orders and what the limits on the amount of variation work are allowed in a contract. The PAM Contract 2018, however, does not specify any limit to the amount of variation work issued by the Architect. Majid (2017), explained that a drastic change in the original scope of work is not considered a variation. If the variation works caused a dramatic increase in the contract price, it is not something that can reasonably be expected when the employer and contractor enter a contract at the initial stage. The issuance of variation orders that fall outside the original scope of work complicates cost estimation and leads to disputes over appropriate valuations. Multiple informants (CS1, CS2, CR4, CL5, CR10, CL11, and CL12) explained that complexity

in claims and valuation of variations arises when changes involve large quantities, new items, and new designs that were not anticipated during the design stage. Informant CR10 noted that:

> *"When variation orders work beyond the original scope, it really complicates cost estimates and makes it tough to settle on a fair valuation." (CR10)*

This is consistent with the findings of Ilmi & Yip (2014), who found that disagreements may arise when a contractor uses a fair valuation or quantum meruit basis to recover costs for variation works that are not covered by the variation clause. El-adaway et al. (2016), emphasised that it is advisable for the parties to enter into a separate contract if a variation involves substantial works that alter the original scope of work.

Another problem that often arises in the variation order is when the employer arbitrarily instructs the contractor to carry out additional work, resulting in a significant increase in costs. This issue was highlighted by informants CS1 and CS2, who pointed out that excessive and uncontrolled variation orders could result in cost overruns and disputes during the settlement of the final accounts:

> *"When clients request a lot of changes or variations without really thinking about how it's going to impact the budget, it can easily cause the project to go over budget and lead to cost overruns."(CS2)*

These observations concur with the study by Ssegawa et al. (2020), which found that excessive variation orders issued for a project could unnecessarily increase the final costs of the project, leading to disputes in the final accounts.

b) Lack of Formal Instruction

Under the PAM Contract 2018, any variation work must originate from instructions from the Architect. If the contractor has executed variation work but cannot provide evidence of valid instructions for such work, the variation can be deemed invalid. This is due to the possibility that the contractor carries out work that has not

been instructed or authorised by the architect or the client. In the normal practice of construction projects, the Architect or appointed party may at any time issue instructions to the contractor for variation works, and the contractor must carry out any variation so instructed with due diligence and expedition. However, issues frequently arise concerning variation in work when such instructions are communicated verbally without written confirmation. Moreover, variations orders are sometimes issued without complete details and information. During the interviews, several informants (CS1, CS2, CR4, CL5, CL6, CR7, CS8, CS9, CR10, CL11, and CL12) noted that the variation order (VO) is often issued without providing accurate cost estimates, comprehensive instructions, or detailed specifications, leaving the scope of the variation work unclear. According to what CR7 mentioned:

> *"Sometimes we get told to do extra work just verbally, but they aren't confirmed in writing. Consultant and client might disagree later about what was included in the change, and what the price should be, because there's no complete details and information of the works" (CR7)*

Bakhary et al. (2015, 2018) also brought attention to this problem, which found that verbal instruction by the owner is the main problem in documenting a VO claim. This situation is made worse when the contractor proceeds with the work without the required paperwork and approval, as reported by informant CS1, and the instructions are given by someone other than the architect or authorised representatives, such as the client's officers or local authorities:

> *"Sometimes contractor get VO instructions from someone who doesn't actually have the authority to give instructions, and that can lead to arguments later about whether the work was even valid in the first place" (CS1)*

This informal approach to variation instructions complicates the approval process by raising questions about the work's legitimacy. According to a study by Ismail (2021), the client's officers usually give contractors and project managers several direct instructions for variation works after the site progress meeting. The contract stipulates that only the architect or authorised representatives may give such instructions. It

becomes difficult to appropriately assess and ascertain the validity of variation orders when they are not issued with explicit written documentation from an authorised party. This can lead to disagreements and disputes among construction parties during the final account closing. Therefore, it is important to obtain written instructions and approvals for variation orders before the contractor proceeds with work to avoid disputes and ensure a smooth final account closing process.

Nonetheless, under Clause 38(1) of the Contract Act 1950, if the contractor has executed the additional work without instructions from the Architect, but the client has benefited from and utilised it, the client is obliged to pay the contractor for that work. For example, the contractor has built a drain to alleviate flooding on the construction site. If the client refuses to compensate the contractor, he should instruct the contractor to stop building the drain, consequently allowing the construction site to flood. Nevertheless, the client recognises and acknowledges the drain's existence to prevent flooding. In this case, the client's behaviour clearly benefited from the additional works, indicating that he accepted the contractor's additional works. Therefore, he must compensate the contractor for the additional work.

5.3.3.3 Theme 3 – Contract Ambiguity

Contractual ambiguity, which typically arises from unclear contract terms, discrepancies across documents, and the absence of standardised procedures, is a source of disputes during the final account closing of construction projects (Chan et al., 2021; Koc & Gurgun, 2022). In this analysis, contract ambiguity refers to the lack of clarity in terms and procedures, which gives rise to different interpretations, as well as the lack of guidelines and procedures for handling variation claims and final account valuations. Both of which contribute to the contract's ambiguity, as several informants noted. The analysis identified two primary codes that emerged as contributors to contract ambiguity: (a) discrepancies in the contract documents and (b) lack of procedures and guidelines.

a) Discrepancies in Contract Documents

Discrepancies between contract documents, such as the bill of quantities (BQ), drawings, and specifications, are frequently mentioned by informants during the

interview. These discrepancies create confusion about the scope and quantities of required work, leading to disagreements over payment claims, particularly during the valuation of variation works. Several informants (CS2, CR3, CL5, CR7, and CS9) have highlighted inconsistencies and discrepancies in contract documents, such as drawings, bills of quantities, and specifications, which often create discrepancies between planned and actual work on site. As mentioned by CR7, that:

> *"Sometimes there are discrepancies in contract documents where the Bill of Quantities states one thing and the drawings state something else" (CR7)*

These inconsistencies can also result in disagreements over the scope and pricing of variation works, complicating the final account process. Furthermore, discrepancies among contract documents lead to confusion for the parties in interpreting the contract terms and understanding the scope of work, as informant CS9 pointed out:

> *"Contractors may misunderstand or misinterpret the overall scope of work required under the contract, leading them to underestimate the cost of the project and result in disagreement when the consultant values the final work done" (CS9)*

These discrepancies may cause the construction stakeholders to have different understandings of project requirements, often resulting in unexpected costs or delays. Furthermore, the contractor also described a similar challenge related to ambiguous work scope definitions, particularly regarding overlapping responsibilities and variations. Informants CR3 highlighted:

> *"Redundant or overlapping scope of work between different subcontractors, such as between the M&E works and finishing works. This can lead to disputes over which party is responsible for certain items and how they should be valued" (CR3)*

Furthermore, the client (CL5) described misunderstandings between the contracting parties pertaining to the scope of works and procedures due to unclear and incomprehensible contract terms. Abidoye et al. (2018) and Lew et al. (2013) argue that

interpretation errors and misunderstandings are prevalent in construction contracts due to the illegibility and lack of clarity of contract clauses. According to Ismail (2021), lack of clarity in the contract clauses is mainly attributable to long sentence length, poor layout, and the presence of many redundant legal expressions.

b) Lack of Procedures and Guidelines

Ambiguities in contracts were also attributed to the absence of standardised procedures and guidelines, particularly in handling the final account process. In this analysis, the code 'Lack of Procedures and Guidelines' does not imply the absence of contractual provisions within the PAM Contract 2018, which provide a general procedural framework for the final account process. This code, however, refers to the absence of specific operational and practical guidelines such as detailed documentation checklists, flowchart guides, standardised valuation templates, and submission timelines to manage the final account process consistently and effectively. Informants emphasised the need for a checklist or procedural guide to streamline documentation and ensure all necessary records are present for the final account claims. Several informants (CR3, CR4, CL5, CR7, CS8, CS9, CR10, CL11 and CL12) agree that without proper checklists or guidelines, parties may fail to submit complete and accurate records, leading to disputes over the validity of claims. Informant CL11 reported that:

> *"Lack of a proper checklist or guideline for the documentation required for the final account claim, resulting in incomplete records" (CL11)*

In addition, ambiguity in the contract may arise due to the absence of standard valuation procedures, particularly for variation works. Without a specific valuation basis or guidelines, the contractor and client may apply different valuation approaches, leading to different outcomes. This will create significant challenges in reaching fair valuations, thereby prolonging negotiations during final account settlement. This issue was highlighted by several informants (CR4, CL5, CS8, CL12), who noted that unclear contract terms and details regarding valuation procedures create complexity in the claim and valuation processes. As explained by CL5:

"The cost or rates for variation works were not established upfront in the contract or schedule of rates, making it difficult for the parties to agree on a fair valuation of variation works once the works are finished" (CL5)

Overall, contract ambiguity is significant because unclear contractual terms, discrepancies across documents, and varying interpretations often lead to disagreements among project stakeholders. Understanding these root causes is crucial to develop preventive strategies to reduce the occurrence of disputes, particularly during final account closing.

5.3.3.4 Theme 4 – Incompetencies

One of the themes that emerged from the thematic analysis was the incompetence of the project teams throughout the design, construction and final account stage. This theme highlights how the lack of necessary skills, knowledge, and experience among the project team creates significant challenges that lead to disputes during final account closing. In this analysis, incompetencies is a recognised cause of disputes in final account closing, particularly when the preparation process involves complex assessments of variations, loss and expenses, and final works done (Ismail, 2021; Romli, 2015). The theme of incompetencies in this analysis is broken down into the distinct codes: (a) Lack of Knowledge and Experience, and (b) Design and Estimation Errors.

a) Lack of Knowledge and Experience

This code indicates the project team's lack of knowledge and experience in the construction process, including tasks such as design, estimation, documentation, and assessment, leading to delays and errors in the final account. Several informants (CS1, CR4, CL5, CL6, CR7, CS8, CS9, CL12) highlighted that a lack of knowledge and experience among consultants and contractors can lead to errors in final account preparation. As stated by informant CS8:

"Insufficient experience or inadequate knowledge of staff in handling evaluation and preparation of the final account leads to errors and disagreements." (CS8)

When the person in charge lacks technical expertise in final account valuation, they may misinterpret contract provisions or fail to consider relevant factors in the valuation process, which can lead to disputes. Informants from the contractor also acknowledged similar challenges in knowledge and experience deficiencies within their organisations. A contractor CR7 stressed:

"The personnel involved in handling the final account process may have inadequate experience and expertise. When inexperienced or junior staff handle the final account, there may be a lack of familiarity with the necessary procedures and documentation for final account claims" (CR7)

When the project team or personnel lack the competence to manage project documentation, it can impact the quality and completeness of final account claim submissions. Furthermore, the impact of knowledge and experience deficiencies extends to documentation practices issues, where insufficient training and a lack of awareness result in errors in record keeping, as highlighted by multiple informants (CS1, CR4, CL6, CR10). Informant CL6 particularly mentioned that:

"Insufficient training or awareness among staff on the importance of proper documentation and record-keeping throughout the project results in a lack of diligence in maintaining complete and accurate records" (CL6)

In addition, several informants (CS1, CR4, CL5, CS9, and CR7) also indicate that a lack of knowledge and understanding of technical aspects of construction works will complicate the evaluation and approval of variation claims and lead to disputes between contractor and client, as explained by CR4:

"The client may not fully understand the nature and complexity of additional costs involved in executing the variation work, leading to disagreement on the valuation of work" (CR4)

When clients do not fully understand complex technical aspects, they may question the legitimacy of the costs associated with variation work. Similarly, if contractors lack expertise in certain areas, they might find it difficult to provide accurate valuations. This creates a knowledge gap that can lead to disagreements. The problem of poor technical knowledge is more significant in projects involving specific construction methodologies or complex technical requirements (Nanayakkara et al., 2021).

b) Design and Estimation Errors

A lack of knowledge and experience within the consultant team in preparing designs may lead to design errors. Poor design quality and incomplete information provided in specifications and drawings often lead to variations in the work during construction, contributing to cost overruns (Ameyaw et al., 2015). Several informants (CS1, CS2, CR3, CL5, CR7, CS8, CS9, CR10, and CL12) highlighted that deficiencies in project design can lead to changes or variations, which can cause cost overruns and ultimately result in disputes during the final account process. Informant CR10 highlighted that:

> *"There were some issues with the design team's performance during the design stage, leading to deficiencies in the design. As a result, significant changes had to be made through variation orders" (CR10)*

Furthermore, several informants (CS8, CR10, CL12) highlighted that design deficiencies are compounded by the fact that design teams may lack sufficient information and fail to appreciate the project's complexity, leading to frequent design changes. Informant CL12 noted that:

> *"The design team may not fully anticipate and understand the client's requirements and authority regulations, resulting in the need for design changes" (CL12)*

Another issue is errors in estimating project costs during the pre-tender stages. Consultants CS2 and CS9 agree that without adequate experience, the quantity surveyor

may struggle to measure and estimate costs accurately, which may lead to underestimation and inconsistency in the final accounts, as observed by the CS2 informants:

> *"Errors or underestimation in the initial cost estimation and tender pricing, especially for provisional sum items where the design is not finalised" (CS2)*

These errors, which often occur at the pre-construction stage, create a significant discrepancy between the initial and final costs of a construction project, leading to a dispute in the final account. Informant CR7 also pointed out that the contractor's failure to understand the full scope of the works during the tender phase contributed to the errors in their pricing:

> *"The contractor's lack of experience and understanding in estimating the cost of the project. This leads the contractor to underprice the work. Eventually, the contractor tends to create a variation work to cover its cost" (CR7)*

Poor cost estimates in the early phases of the project often lead to disputes over the final accounts and variation claims. These errors are usually attributed to a lack of understanding of the project's scope, technical requirements, or market conditions, reflecting inadequacies at both the consultant's and the contractor's levels. This is consistent with Aljohani (2017) and Offei-Nyako et al. (2016), which highlights that inaccurate estimates are the root cause of cost overruns and financial disputes.

5.3.3.5 Theme 5 – Lack of Commitment

Commitment among project team and stakeholders is critical for ensuring the timely settlement of final accounts. Previous research has consistently found that final accounts tend to be deprioritised after practical completion as parties shift focus to new projects (Ilmi & Yip, 2014; Ssegawa et al., 2020). In this analysis, the theme of 'Lack of Commitment' encompasses the fundamental issues of resource allocation, workload, and dedication to the final account closing, captured through two interconnected codes: (a) Resource Constraint and (b) Lack of Priority.

a) Resource Constraint

The code "resource constraint" encompasses the challenges and limitations faced by contractors, consultants, and clients regarding manpower, time, and capacity during the final account closing process. In this context, resource constraints refer to shortages of manpower and time allocated to manage final account processes effectively, as staff often work across multiple projects simultaneously, leading to delays and inadequate attention to final account preparation. Various informants report a shortage of manpower to handle the final account, often because they are busy with other ongoing projects. As construction projects near completion, contractors and consultants often mobilise their staff to new projects, leaving minimal resources dedicated to managing the final account. From the interview, multiple informants (CS1, CS2, CR3, CR4, CL5, CL6, CR7, CS9, CR10, and CL12) have noted that the lack of dedicated staff to manage paperwork, documentation, and valuation often leads to delays in the final account process. According to the CL5:

> *"Insufficient staff allocated for the preparation and submission of the final account claim, as the contractor tends to minimise the staff towards the completion of the project. They may also be busy handling other new projects" (CL5)*

This highlights the fact that the staff's lack of commitment leads to poor documentation, which in turn results in insufficient documentation of the final accounts. On the other hand, the lack of staff has an impact on the workload of the remaining staff, contributing to stress and reduced performance. This not only delays the final account process but also increases the likelihood of errors in claim submissions. Informant CS2 highlighted the problems caused by heavy workloads, which affected the work of consultants, and stated that:

> *"Work overload among the project team, as they have to handle other ongoing projects simultaneously, leaving little time and resources to focus on the final account" (CS2)*

This observation suggests that a reduction in resources or staff allocation in both contractor and consultant organisations after the project's completion phase may hinder efficient management and delay the settlement of final accounts. Shortages of staff lead to delays in submitting, reviewing and assessing the final accounts, as staff are stretched to handle multiple projects. This is consistent with the findings of Badroldin et al. (2016) and Bakhary et al. (2015), which highlighted the negative impact on claim processing and project performance due to resource limitations and heavy workload. Similarly, Yahaya et al. (2019) found that shortage of manpower and poor resource management were among the top causes of delays and non-settlement of final accounts in construction projects. Moreover, a study by Narayan et al. (2023) revealed that inadequate resources in terms of manpower within the organisation, as a result of cost-cutting measures, resulted in diminished commitment and dedication to claim management, especially during the final account closure.

b) Lack of Priority

A lack of priority pertains to the tendency of project teams to neglect and postpone final account tasks after the completion of the construction phase, in order to concentrate on acquiring or handling other projects. A majority of informants (CS1, CR3, CR4, CL5, CL6, CR7, CS8, CS9, CR10, CL11, and CL12) emphasised that the lack of prioritisation frequently arises due to the perception that the final account is only a small part of the entire project lifecycle, leading to a lack of motivation to settle the final account promptly. As articulated by CR7, that:

> *"The contractor may view the final account as a low priority, especially if the project has already been completed and the contractor has shifted focus to other ongoing projects" (CR7)*

Furthermore, the contractor's lack of priority or attention towards the final account closing is attributed to their perception that the remaining balance in the final account is insignificant, as highlighted by CS1:

> *"The contractor may perceive the balances in the final account to be small and not worth submitting" (CS1)*

This perception is further elaborated by CR3:

> *"The contractor may not be interested in the final account as they have received most of the payment for the project during interim payment and sees final account is just a small bonus, so there is no urgency to submit the claim" (CR3)*

Garner (2015) asserts that the final account should not be regarded as a trivial component of the project lifecycle. Rather, it is an integral part of the project's finances and obligations, which determine the overall status of the project. Neglecting this increases the risk of disputes, as unresolved financial matters may subsequently lead to contentious issues between parties.

Overall, the theme of "Lack of Commitment" contributes to delays and disputes during final account closing in the construction industry. Insufficient manpower, heavy workload, and lack of priority affected the meticulous process of final account preparation, making it susceptible to errors and disagreements, ultimately fostering disputes.

5.3.3.6 Theme 6 – Communication and Coordination Breakdown

Effective communication and coordination are foundational to successful construction project delivery and final account closing (Fateh et al., 2023). In the context of this research, breakdowns in information flow and coordination, whether through ineffective communication or disruptive personnel changes, emerged as a significant root cause of disputes. Two codes were identified within this theme: (a) Ineffective Communication and Coordination, and (b) Changes in Project Personnel.

a) Ineffective Communication and Coordination

In this analysis, ineffective communication and coordination refer to issues arising from insufficient communication and collaboration, inadequate information sharing, and misalignment of expectations among project stakeholders. The lack of effective communication and coordination among the various parties led to a poor understanding of the project's details and requirements (Nabi & El-adaway, 2022). Most

informants (CR3, CR4, CL5, CL6, CR7, CS8, CS9, CR10, CL11, and CL12) highlighted that poor communication and coordination among parties often result in misunderstandings regarding project requirements, leading to disagreements over the scope and variations, thereby delaying final account preparation. As mentioned by CR10:

> *"Insufficient communication and cooperation between the consultant and the contractor regarding the variation works, leading to disagreements on the valuation" (CR10)*

These observations highlight how communication breakdowns can lead to disputes, particularly in the valuation of variation orders. Moreover, informants (CL5, CS8, CL11, CL12) also highlighted a lack of communication and coordination regarding documentation requirements, such as checklists, timelines, and records of all variation instructions, leading to incomplete documentation in final account submissions. Without clear guidelines or well-documented agreements, each party may have different expectations regarding the financial implications of the variations, causing delays in finalising the final account.

b) Changes in Project Personnel

This code highlighted the disruptive impact of personnel changes on project coordination and communication. Frequent staff turnover, particularly among key personnel responsible for documentation and approvals, creates significant challenges for the project. New personnel often lack historical knowledge of the project, leading to delays in information retrieval, inconsistent application of procedures, and potential misinterpretations of contractual agreements (Ayodele et al., 2020; Lew et al., 2013). All informants, except CR3, reported experiences of communication and coordination breakdowns due to staff turnover. Informant CL5 mentioned that:

> *"Replacement of person in charge handling the final account may lead to delays as the new team member needs time to review everything to understand and familiarise themselves with the project details" (CL5)*

These changes in key personnel lead to a lack of continuity, incomplete handovers, and miscommunication about project status and documentation requirements. Some informants (CR7, CS9, CR10, CL11) further highlighted the influence of personnel changes on documentation issues, which are critical in final account closing. As stated by CL11, that:

> *"Frequent changes in the person in charge responsible for the final account documentation can lead to disorganisation and incomplete documentation" (CL11)*

This staff turnover presents significant challenges for new staff, who may struggle to access or understand the required documentation, ultimately complicating the evaluation and claim process. Overall, communication and coordination breakdowns in construction projects can pose significant challenges to the successful closing of final accounts. Frequent personnel changes and a lack of coordination and communication among contractors, consultants, clients, and internal project teams contribute to disputes during the final account closing. These findings align with Alaloul et al. (2015), Fateh et al. (2023) and Subramaniam et al. (2021), which highlight the critical role of effective communication and coordination as foundational elements for successful project delivery and final account closure. Effective communication and coordination throughout the project lifecycle are crucial to reduce contentiousness during the final account closing stage, ultimately contributing to more successful project outcomes and improved stakeholder relationships.

5.3.3.7 Theme 7 – Non-Fulfilment of Contractual Obligations

Non-fulfilment of contractual obligations, including incomplete contractor's work and poor quality of finished work, is a recognised source of delays and disputes in final account closing. This creates disagreements over acceptable completion and compliance with contract standards (Fatayer et al., 2022; Othman et al., 2023). This theme is broken down into two primary codes, namely (a) Outstanding Contractor's Works and (b) Poor Quality of Works.

a) Outstanding Contractor's Works

In a construction contract, practical completion refers to the works having reached completion in accordance with the contract's provisions and to the satisfaction of the contract administrator (PAM, 2022). This code describes situations in which the contractor's work is unfinished or incomplete at project completion. Several informants from the interview (CS1, CR3, CS8, CS9, CR10, and CL11) reported that it is common in construction projects for the Architect to issue a certificate of practical completion (CPC) to the contractor, even the project is not fully completed or has substantial defects. These findings align with a previous study by Yunos (2015), which found that some projects have been issued a Certificate of Practical Completion (CPC) but remain incomplete and do not comply with the contract.

Normally, the determination of practical completion should be an objective decision made by the architect in their role as contract administrator, provided that all parties involved, which are the architect, contractor, and employer, are in consensus. However, the architect frequently faces pressure to either approve premature completion or delay it. For example, contractors may seek premature practical completion for various reasons, such as a desire for payment or an intention to avoid liquidated damages. The architect may be encouraged to reassure the employer that the contractor will return to solve any outstanding work. There are also cases where employers themselves want an early CPC in order to meet a committed project delivery date to a third party, such as when the property has been leased to an operator or sold to a buyer. Consequently, the contractor may be reluctant to immediately finalise and submit their final account claim due to outstanding work that must be completed and included in the claim. This situation has been explained by informant CR3, who stated:

> *"The contractor may be reluctant to submit the final account claim until everything is completed, fearing that it could lead to deductions or rejections." (CR3)*

This premature certification creates a situation where final accounts cannot be accurately evaluated or prepared until all outstanding work is completed, potentially resulting in significant delays in submitting the final account claim. In some cases, pending items, such as extensions of performance bonds or insurance requirements, can

become barriers to final account closure. For instance, informant CS8 noted that unresolved issues related to performance bonds or insurance extensions might affect the final valuation:

> *"The contractor has unresolved issues regarding performance bonds and insurance that need to be extended in case of a time extension and other pending items that can affect the final valuation." (CS8)*

Overall, contractors may be reluctant to submit final account claims due to outstanding work, fearing deductions or rejections. Pending items, such as performance bonds and insurance extensions, can also affect the valuation of the final account.

b) Poor Quality of Works

Construction contracts typically require contractors to complete projects not only on time and within budget, but also to the specified quality standards. Failure to meet these quality requirements is considered non-fulfilment of contractual obligations (Fatayer et al., 2022). The code of "poor quality of work" captures disputes arising from disagreements over the quality of completed work. Several previous studies have identified that poor work quality is a significant cause of contractual disputes and claims in the construction industry (Antoniou & Tsioulpa, 2023; Ramachandra & Rotimi, 2011; Silva et al., 2024). Such disputes can impede the final account closing process, as client may withhold payments until quality issues are resolved, thereby delaying the closing of final accounts. During the interview, several informants (CS1, CR3, CS8, CS9, CR10, and CL11) often expressed dissatisfaction with the quality of the work or work that failed to meet contract specifications. Informants pointed out that poor quality of work may arise from poor workmanship and the use of substandard materials, as CL11 mentioned that:

> *"Lack of quality of the work done by the contractor, for example, the contractor uses a lower quality item or material in their work" (CL11)*

This issue complicates the valuation and certification of the final account, as clients may certify only partial payments if they are dissatisfied with certain aspects of the work quality. As informant CS1 noted:

> *"The client may not agree with the quality of some aspects of the work and only want to certify and pay for part of the claimed amount" (CS1)*

Moreover, informant CS8 supported that:

> *"Consultants will calculate defect rectification costs and back-charge the contractor or deduct them from final payments." (CS8)*

This approach, while justified under the PAM Contract 2018 (Clause 30.15), may create dissatisfaction among the contractor, potentially affecting the relationship between the parties. Furthermore, the subjective nature of quality assessment or the client's expectation often leads to conflicting opinions. Informants CR3 and CR10 claimed that quality issues can sometimes arise from clients' high expectations, as stated by informant CR10:

> *"There might be differing opinions regarding the quality of the final work, with the client expressing dissatisfaction with the completed task not meeting their expected standards" (CR10)*

The discussion above suggests that quality issues frequently lead to nonfulfillment of contractual requirements, ultimately contributing to inefficiency in final account closing. This observation aligns with the findings of Kong & Yeow (2016), who noted that poor work quality significantly contributes to inefficient final account closing. Poor work quality not only delays the agreement and approval of the final account but also fosters mistrust and conflict among stakeholders. Furthermore, Nordin et al. (2023) reported that poor work quality may result from corruption within the construction industry, as evidenced by the use of substandard materials, cutting corners in construction processes, or bypassing quality control measures. These corrupt practices contribute to poor-quality work, which in turn leads to inefficient closure of final accounts and creates a cycle of mistrust and conflict among stakeholders.

Moreover, unresolved defects during the defects liability period further delay the final account closing. If the contractor refuses to rectify the defects, consultants may deduct the rectification cost from the final payment. Based on Clause 30.15 of the PAM Contract 2018, the issuance of a Final Account can only be made after the issuance of a Certificate of Making Good Defects (CMGD). This is to ensure that the cost of rectifying any defects not addressed by the contractor can be deducted from the final account. Ssegawa et al. (2020) noted that contractors sometimes refuse to address defective work when the costs of rectification exceed the remaining balance of payment. This refusal can further delay the final accounts closing. Additionally, delays in obtaining client agreement and approval for final accounts, often caused by unresolved contractual issues, hinder the timely finalisation of accounts in construction projects. The situation highlights how unfulfilled contractual obligations regarding quality and workmanship directly affect the final account closing process.

5.3.3.8 Theme 8 – Organisational Bureaucracy

Organisational bureaucracy which characterised by hierarchical approval processes and rigid procedures has been identified as a significant impediment to timely final account closing. Previous research has shown that bureaucracy mainly arises during the approval process for variation works and loss and expense claims (Othman et al., 2023; Perera & Dewagoda, 2020). Karimi et al. (2020) further highlighted that bureaucracy in the construction industry manifests due to extensive regulations and procedures that govern project management, often leading to inefficiencies and delays. From the analysis conducted, two codes were derived from this theme: (a) Inefficient Approval Process and (b) Delays from Local Authorities.

a) Inefficient Approval Process

This code reflects the hierarchy problem often found within client organisations, which significantly slows down the approval of additional costs, particularly those involving variation orders and loss and expense claims in the final account. Several informants (CR4, CS8, CR10, CL11, CL12) reported that the requirement for multiple reviews and approvals across various management levels results in significant delays. As evidenced by informant CR4:

"There are excessive bureaucratic processes that cause significant delays in reviewing and approving additional costs, such as variation works and loss and expense, as documents must pass through different departments and individuals" (CR4)

Similarly, informant CS8 emphasised that:

"Multiple layers of management need to review and sign the variation work and loss and expense, which prolongs the approval and leads to delays" (CS8)

Additionally, certain variations require approval from an upper-level committee, especially when the amount exceeds the initial budget limit. This may prolong the approval and decision-making process, particularly if committee meetings are irregular and contingent upon the availability of members. This situation was highlighted by informant CL11, who noted that:

"If the amount for the variation order is over the budget limit, it needs to get the green light from a higher level committee. This process might take a while because it depends on when the committee can do a meeting" (CL11)

Such procedures frequently result in a slower approval process, especially when the upper committee lacks a comprehensive understanding of the nature and necessity of the variations that contractors have carried out. In addition, CL12 emphasised that the final account process, which includes final payment, typically requires higher-level approvals and more bureaucracy than progress payments. This inefficiency in the approval process hinders the timely settlement of final accounts and contributes to persistent disputes in the industry.

b) Delays from Local Authorities

It is common for any construction project in Malaysia to require approval from local authorities at various stages of its development. Local authority approvals in the construction industry refer to the permits and certificates required from local

government authorities to ensure compliance with regulations and building codes. For example, works related to utility connections, such as electricity, water, and sewage systems, require permits from certain local authorities. However, Hasmori et al. (2012) claim that the bureaucratic process involving local authorities or government departments adds further delays in approving the project's documentation and payment, especially when involving variation works. To submit the final claim, the contractor must finalise all works, including approval from the local authorities. If there is a delay in obtaining approval for particular works, the contractor cannot include the costs in the final account until the approval is received. Informant CS8 highlights that:

> *"Slow response and feedback from local authorities in obtaining necessary approvals and permits for specific project tasks" can severely impact project timelines, thus delaying final account closing." (CS8)*

Moreover, client CL12 emphasised:

> *"The rigidity of local authorities' procedures in terms of documentation and timeline can create substantial delays in approving work in the project" (CL12)*

The inflexibility in local authorities' procedures and processes caused project stakeholders difficulties in adhering to timelines and timely final account closures (Ssegawa et al., 2020). Although bureaucracy is often criticised for inefficiency, it can create a work structure that promotes accountability, consistency, and compliance, especially in complex construction projects. However, balancing strict bureaucratic procedures with the flexibility needed in the construction industry can be challenging (Karimi et al., 2020).

5.3.3.9 Theme 9 – Lack of Trust and Integrity

Trust and integrity are crucial elements in construction management, as they ensure transparent communication and mutual agreement, which significantly influence project outcomes and stakeholder relationships (Issa et al., 2018). Trust is the belief in and reliance on others' abilities in a construction project, and the expectation of proper

normative behaviour (Buvik & Tvedt, 2016; Chow et al., 2014; Guo et al., 2013). Integrity means following moral principles, promoting honesty and accountability within the team, ensuring commitments are met, and actions are transparent (Connelly et al., 2018; Laan et al., 2012; Lau & Rowlinson, 2011). The absence of trust and integrity among the project team and stakeholders can significantly impede the settlement of the final account. In this analysis, the lack of trust and integrity emerged as a root cause of disputes in final account closing in Malaysia, manifesting through three codes: (a) Valuation Dishonesty, (b) Contractor's Overclaim, and (c) Client's Unethical Conduct.

a) Valuation dishonesty

Valuation dishonesty may arise from inflated or biased valuation assessments provided by contractors or quantity surveyors, leading to disputes during the final account stage. Informants CR4, CL6 and CL11 reveal that clients sometimes perceive the contractor's claims and valuations as inflated or inaccurate, which results in a lack of trust from the client, as CR4 noted:

> *"There may be a lack of trust between the client and the contractor, with the client suspecting the contractor of being dishonest in the valuation" (CR4)*

This observation aligns with findings from Ramachandra & Rotimi (2015) who identified that improper valuation may contribute to dissatisfaction and disputes due to dishonesty and unethical acts. Furthermore, improper and inaccurate valuations due to dishonesty lead to unnecessary deductions by clients (Judi & Mustaffa, 2021). The situation becomes more complex when the client believes there is collusion in the valuation and assessment, as CL6 indicates:

> *"Clients may distrust the valuations proposed by contractors or quantity surveyors, fearing that the QS is colluding with the contractor to inflate costs and potentially accepting bribes" (CL6)*

When clients have doubts about the contractors' integrity, they tend to reduce or reject the contractors' claims, leading to disputes during the final account closing

process. Consequently, it will deteriorate a good relationship among the parties (Lau & Rowlinson, 2011).

b) Contractor Overclaim

The second code, 'contractor overclaim', highlights another integrity issue where contractors often exaggerate claims, particularly for variation works, which can lead to disputes. This concern has been noted by several informants (CS1, CS2, CR4, CL6, CR10, CL11), who point out that the contractor may overclaim by inflating prices, quantities, or including unnecessary costs to overcharge for variation works. Informant CS1 stated that:

> *"The contractor may overclaim or submit inflated prices for the variation works" (CS1)*

Additionally, the client is also concerned about this issue, as noted by informant CL6:

> *"Contractors may overclaim the valuation of variation works by including unnecessary costs or quantities not actually executed" (CL6).*

The contractors' overclaim raises ethical concerns that undermine the transparency and fairness necessary for the final account closing settlement. Such inflated claims can lead to client rejection, as clients perceive these actions as attempts to manipulate valuations to generate additional profits. However, contractors view the practice of overclaiming as a protective measure against anticipated deductions by clients. Informant CR10 from contractors noted that:

> *"Sometimes, contractors submit higher claims, expecting that the client may make deductions, and they want to ensure they still receive a fair payment figure after those cuts are made" (CR10)*

This illustrates how contractors anticipate a client's reduction or modification of their claims. Such actions creates a contentious atmosphere in which neither party feels

secure, thus rendering every assessment a subject of dispute. This is consistent with the observation of Judi & Mustaffa (2021) that contractors typically make higher claims to clients, while clients often attempt to reduce the amounts claimed, indicating a lack of trust between contracting parties.

c) Client's Unethical Conduct

This code encompasses the client's behaviour that deviates from standard ethical practices, often with the intention of gaining a financial advantage. The issue of unethical conduct was highlighted by informant CR10, who stated:

> *"The client's attitude of trying to get the contractor to absorb additional costs, or intentionally undervaluing work" (CR10)*

When contractors suspect that clients may manipulate the valuation, they might inflate claims to compensate for potential underpayment by the client. This cycle of mistrust leads to disagreements and disputes in the final account closing. Such practices, where clients deliberately attempt to reduce the valuation to minimise costs, represent unethical behaviour that can significantly delay the final account settlement. Informant CS8 described another case of unethical behaviour regarding payment:

> *"The client may try to pay only part of the claimed amount, promising to settle the remaining balance later, which could be inconvenient for the contractor" (CS8)*

This partial payment by the client can create financial strain for contractors and generate disputes over the fulfilment of payment obligations. Such practice reflects a lack of integrity, as it involves delaying or manipulating payments to suit the client's interests. This aligns with Vee & Skitmore (2003), who identify unethical practices as a significant factor contributing to contractual disputes in the construction industry.

5.3.3.10 Theme 10 – Inadequate Project Preparation

Inadequate project preparation emerged as a significant root cause of problems in final account closing in the Malaysian construction industry. Insufficient budgeting and site investigation can create issues that frequently lead to cost overruns and variation disputes, ultimately complicating the final account closing process (Jayarathna et al., 2023; Muhammuddin et al., 2023). This theme encompasses two codes: (a) Insufficient Budget Allocation and (b) Insufficient Site Investigation.

a) Insufficient Budget Allocation

Budget constraints often arise when the project budget does not allocate sufficient funds for risk and contingency events. This creates difficulties and cost overruns when variation occurs, or provisional quantities exceed the initial budget, or when unforeseen issues arise, as highlighted by several informants (CR3, CR7, CS9, CR10, CL11, CL12). Informant CL12 from the client has expressed this issue and stated that:

> *"Sometimes, a client's initial budget might not fully cover items such as variation works, provisional sums, or other risk contingencies. When this occurs, they usually need to go through additional approval processes to secure more funding, which can, in turn, lead to project delays" (CL12).*

These financial or budget constraints result in delays in approving variation works, even for essential variations, due to the need for additional funding requests. Tang et al. (2020) assert that effective budget allocation helps in managing risks, which in turn reduces the likelihood of disputes. Similarly, Muhammuddin et al. (2023) emphasised that proper budget allocation is crucial in addressing contract-related and time-related causes of disputes, which are significant contributors to disagreements in construction projects.

b) Insufficient Site Investigation

This code refers to inadequate investigations during the pre-construction stage, which result in inaccurate estimates and unforeseen issues during project execution. A previous study by Cakmak & Cakmak (2014) identified poor site investigation as one of the leading causes of disputes in construction projects. Similarly, most of the informants (CS1, CS2, CR4, CR7, CS8, CS9, CR10, CL11 and CL12) from the interviews have pointed out that unexpected site conditions that were not anticipated during the design stage often resulted in additional work and variation orders, leading to disputes in the final account closing. They also described that insufficient site investigation during the planning and design stages often leads to unexpected site conditions, such as discrepancies in soil reports like underground water and rocks that were not accounted for in the original estimates, which may result in cost overruns at the final cost. This situation significantly affects the contractor's work and cost, as indicated by informant CR7:

> *"If the site investigation is not done thoroughly, or if the information about the site conditions is not comprehensive, it often leads to unexpected costs to carry out additional works on the site. For example, in my project, there is a presence of underground rock which was not included in the original estimate" (CR7)*

Insufficient site investigation also has an impact on the provisional sum item allocated in the contract. As CR4 noted:

> *"Inadequate site investigation during the design stage led to inaccurate estimation for provisional sum works, requiring more additional cost than expected" (CR4).*

Inadequate site investigation affects not only project costs but also the overall project timeline, leading to disputes, particularly during the final account closing process (Cunningham, 2017; Wang et al., 2023). This finding suggests that a comprehensive site investigation during the design stage is crucial for accurate project

planning and cost estimation, thereby reducing the occurrence of disputes during the final account closing stage.

5.4 Preventive Solution for Improving the Final Account Closing Issues

In the construction industry, a preventive solution refers to actions, strategies, or methods implemented to prevent problems, defects, or failures before they occur, rather than reacting after they arise (Eskandari & Noorzai, 2021). Multiple studies in the built environment and construction industry use a preventive solution approach. These approaches are employed to enhance safety, mitigate risks, prevent accidents, and manage waste within buildings and construction projects (Hayati et al., 2023; Jiang & Wang, 2021; Samsudin et al., 2022). In this research, the preventive solution element is also a key component in establishing a preventive solution framework to improve the final account closing process. This preventive solution is developed to help construction stakeholders or practitioners take action before problems arise, thereby improving the final account closing process in the construction industry.

5.4.1 Findings and Discussion of Preventive Solution for Improving the Final Account Closing Issues

Following the analysis of the root cause in Section 5.3.1, this section further examines preventive solutions aimed at mitigating the major problems and root causes of the final account closing issues, thereby improving the final account closing process in the Malaysian construction industry. Based on a series of interviews with twelve (12) informants, the analysis has identified nine (9) themes and twenty-four (24) codes of preventive solutions, as presented in Table 5.4. Table 5.5 further presents results of thematic analysis for preventive solutions in final account closing issues, organised into several themes and codes, with input from multiple informants (CS1 to CL12). Section 5.8 below provides a detailed explanation of each theme and code for the preventive solutions of the major problems in the final account closing issue. These themes and codes for preventive solutions are derived from in-depth interviews with experts involved in final account management in the construction industry.

Table 5.4
List of Themes and Codes for Preventive Solutions

Themes	Codes
a) Contractual Compliance	1. Adherence to Contract Provisions
	2. Quality Control
	3. Cost Control
b) Comprehensive Contract Provisions & Procedures	4. Clear Guidelines and Procedure
	5. Detailed and Adequate Information
	6. Establishing Agreed Basis for Valuation of Variation
c) Proper Documentation Management	7. Sufficient Documentation
	8. Systematic Record-Keeping
	9. Formal Variation Instruction
d) Information Technology Adoption	10. Digital Documentation System
	11. Technology Utilisation for Coordination
e) Collaborative Work Approach	12. Effective Communication and Coordination
	13. Flexibility Process
	14. Collaborative Assessment
f) Effective Resource Management	15. Sufficient Manpower
	16. Sufficient Budget Allocation
g) Provide Competent Personnel	17. Knowledgeable and Experienced Staff
	18. Enhancing Staff Skills and Knowledge
h) Timely Processing	19. Early Preparation and Resolution of Final Account Issues
	20. Timely Complete Documentation
	21. Regular Updates and Follow-Up
i) Appropriate Estimation, Design and Planning	22. Planning and Design Sufficiency
	23. Accurate Estimation of Works
	24. Proper Site Investigation

Table 5.5
Thematic Analysis of the Preventive Solution to Mitigate Major Problems in the Final Account Closing Issues

THEME	CODE	INFORMANT											
		CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Contractual Compliance	Adherence to Contract Provision	●		●		●							
	Quality Control			●								●	
	Cost Control	●			●		●						
Comprehensive Contract Provisions & Procedures	Clear Guidelines and Procedure	●		●	●	●	●	●	●	●	●	●	●
	Detailed and Adequate Information		●	●		●	●	●	●	●	●	●	
	Establishing Agreed Basis for Valuation of Variation					●		●	●				
Proper Documentation Management	Sufficient Documentation	●	●	●	●	●	●	●	●	●	●	●	●
	Systematic Record Keeping		●		●		●	●	●		●		●
	Formal Variation Instruction	●	●			●		●		●			
Information Technology Adoption	Digital Documentation System	●	●	●	●	●	●	●	●	●	●	●	●
	Technology Utilisation for Coordination			●					●		●	●	
Collaborative Work Approach	Effective Communication and Coordination	●	●	●	●	●	●	●	●	●	●	●	●
	Flexibility Process								●		●		●
	Collaborative Assessment		●		●		●	●	●	●	●	●	

THEME	CODE	INFORMANT											
		CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Effective Resource Management	Sufficient Manpower		●	●	●	●	●		●	●	●		●
	Sufficient Budget Allocation				●	●	●		●	●	●	●	●
Provide Competent Personnel	Knowledgeable and Experienced Staff		●	●		●	●	●			●	●	●
	Enhancing Staff Skills and Knowledge		●		●	●	●	●	●	●	●	●	●
Timely Processing	Early Preparation and Resolution of Final Account Issues	●	●		●	●		●	●	●	●		
	Timely Complete Documentation			●	●			●					●
	Regular Updates and Follow-Up	●	●	●	●	●	●	●	●	●			
Appropriate Estimation, Design and Planning	Planning and Design Sufficiency	●	●	●		●		●	●				●
	Accurate Estimation of Works	●					●				●	●	●
	Proper Site Investigation	●	●		●	●		●	●	●	●	●	●

5.4.2 Data Saturation of Preventive Solutions

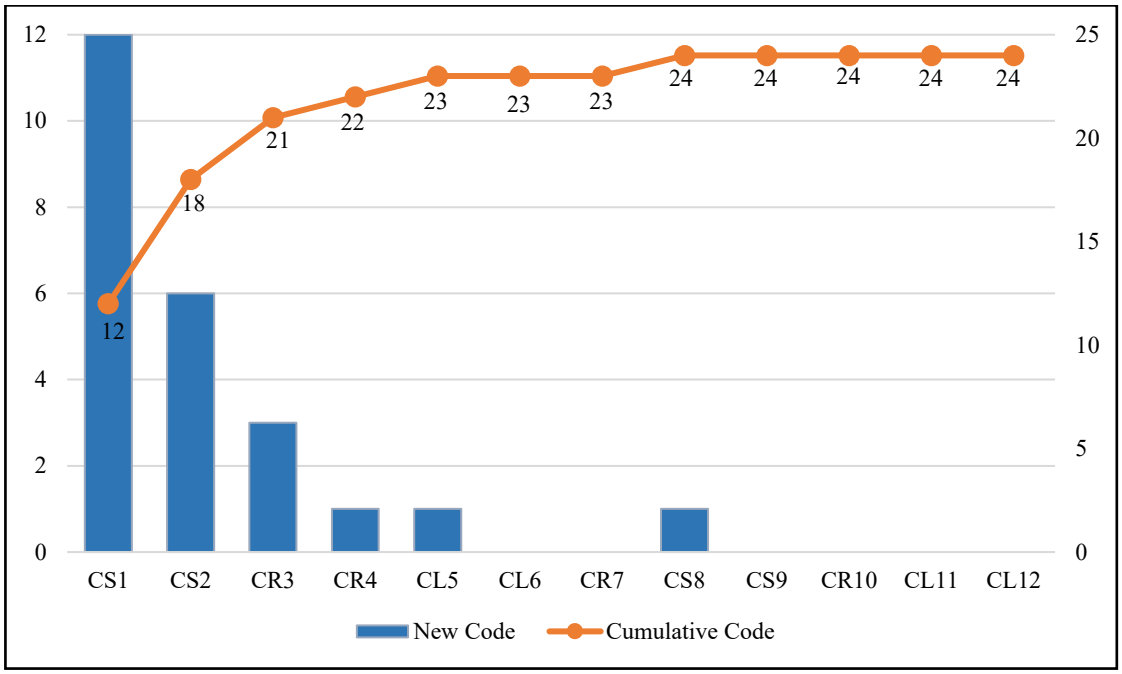


Figure 5.2 Codes for Preventive Solutions that Emerge During the Analysis of Interviews

Figure 5.2 above displays the codes that emerge throughout the analysis of twelve (12) semi-structured interviews with experienced construction professionals who are involved in the final account closing process. The figure provides evidence of data saturation regarding preventive solutions to mitigate root causes and major problems in final account closing in the Malaysian construction industry. The concept of data saturation in this analysis followed the guidelines suggested by Guest et al. (2006, 2020) and Hennink et al. (2017) as explained in Section 3.5.2.3(c). The data presented indicate that the initial interviews (CS1 – CR3) substantially contributed to the development of new emergent codes. Specifically, CS1 generated twelve (12) new codes, CS2 introduced six (6) new codes, and CR3 produced an additional three (3) new codes, resulting in a total of twenty-one (21) codes. However, the emergence of new codes decreased significantly after that. The fourth and fifth interviews (CR4 and CL5) each contributed one additional code, respectively, increasing the total number to twenty-three (23) codes. By the time CL6 and CR7 were interviewed, no new codes had emerged for a preventive solution, suggesting that saturation might have been achieved at twenty-three (23) codes. However, the interview with informant CS8 resulted in one (1) final code, increasing the total cumulative codes to twenty-four (24). The last four

interviews (CS9 to CL12) did not provide any new codes or information, confirming that data saturation has been reached, with a total of twenty-four (24) codes remaining until the final interview.

5.4.3 Discussion of Themes and Codes for Preventive Solutions

5.4.3.1 Theme 1 – Contractual Compliance

Construction contracts serve as a foundation for defining the responsibilities and rights of all parties involved in projects. In this analysis, the theme of contractual compliance emerged as a preventive strategy to minimise disputes and delays in final account closing. The term contractual compliance in this analysis refers to the requirement that all parties, including clients, contractors, and consultants, adhere to the procedures and guidelines outlined in the contract, particularly in the final account. This ensures consistency, transparency, and fairness in fulfilling contractual obligations, thereby contributing to the successful closure of the final account without disputes or delays. This theme integrates three codes encompassing a) adherence to contractual procedures, b) quality control, and c) cost control, which together form a basis for effective contractual compliance in construction projects towards the successful completion of the final account closing.

a) Adherence to Contract Requirements

Adherence to contract requirements and procedures is crucial in construction projects, particularly during the final account closing process. This adherence ensures that all financial matters are settled fairly and transparently, which is an important indicator of project success (Garner, 2015). Moreover, Rajapaksha et al. (2025) assert that adherence to the contract requirements is crucial to avoid disputes during and after construction. The interview data highlights that some informants (CS1, CR3 and CL5) emphasised the necessity of contract adherence from project inception through completion. Informant CS1 articulated that:

"All parties involved need to comply with the procedures as set out in the contract, from the beginning and through the entire construction phase."(CS1)

Additionally, the proper evaluation of variation further reinforces the importance of contract adherence, as remarked by informants from the client. Informant CL5 stated that:

"It is important to adhere to the correct procedures as specified in the contract when assessing and approving any variation to the work" (CL5)

Another informant from the contractor further emphasised that proper contract administration during critical milestones, such as the completion date, is crucial in mitigating disputes. This includes ensuring that the Certificate of Practical Completion (CPC) is not prematurely issued before all outstanding work is completed, as highlighted by CR3:

"The Contract Administrator or Architect should ensure that the Certificate of Practical Completion (CPC) is not prematurely issued before all outstanding work is completed. This is because sometimes the CPC is issued even though the outstanding work is not finished, as the contractor wants to avoid being penalised by the client for the delay" (CR3)

Informant CR3 further elaborates that the premature issuance of the CPC can lead to delays and hesitation from the contractor in submitting the final account claim due to the remaining work to be completed.

b) Quality Control

Quality control is highlighted as another crucial component of contractual compliance that can significantly prevent problems in final account closing. The quality of the work, as specified in the contract, is an essential prerequisite for payment entitlement, particularly for final payment as part of the final account closing. A study by Judi et al. (2017) on payment-related issues in Malaysia, the poor quality of work by

contractors was identified as a significant factor leading to late payment. In addition, Ismail (2021) and Muhammuddin et al. (2023) found that contractors' failure to meet the required standards of specification due to poor work quality was the most significant factor contributing to payment issues and disputes in the final account.

In this analysis, the implementation of systematic quality control measures emerged as a crucial element in preventing disputes at final account closing. During the interview, informants (CR3, CL11) emphasised the importance of implementing robust quality assurance or assessment throughout the project to ensure work is executed in accordance with contract requirements, thereby reducing the need for rectifications and disputes during the final account. Informant CL11 noted that:

> *"Implementing a quality assessment system such as QLASSIC and robust QA/QC can help to ensure that works meet contractual requirements and reduce the need for remedial works after completion. This proactive approach helps to maintain high standards throughout the project" (CL11)*

This statement illustrates that quality control measures serve as preventive tools to reduce disputes. Emphasising quality control during construction can reduce the likelihood that clients will reject or undervalue the work at the final accounting stage. The proactive implementation of quality assessment methods, such as QLASSIC, ensures compliance with contract standards, thereby reducing the possibility of disputes during final account closing (Azir et al., 2018).

c) Cost Control

Cost control is a crucial component of contractual compliance that has emerged in this analysis. It focuses on managing variations and ensuring that the project remains within budget. Effective cost control not only prevents cost overruns but also promotes trust between project stakeholders and reduces disputes arising from unexpected financial burdens. One of the cost control measures in a construction project is monitoring and controlling variations in work. Several informants (CS1, CR4, CL6) emphasised the importance of controlling and monitoring variation orders to ensure that any variation work is aligned with the original work scope, thereby avoiding substantial cost increases. They also recommended that contractors notify the client in advance

before executing any variation work that exceeds the approved budget. Informant CL6 explained that:

> *"The client should closely control and limit variation orders to prevent excessive cost increases and deviations from the original scope of work. In addition, contractors must inform the client in advance if the variation work is likely to exceed the approved budget" (CL6)*

This statement highlights the importance of managing variations, as uncontrolled variations can lead to significant cost overruns and disputes during the final account closing process. A study by Shugran & Ghazali (2024) found that uncontrolled variation orders can lead to time and cost overruns, as well as stakeholder dissatisfaction, which can result in disputes, particularly at project closure. By managing variations and communicating transparently about potential budget implications, the likelihood of disputes arising from financial discrepancies can be significantly reduced.

Overall, the theme of contractual compliance in this analysis emphasises the importance of adherence to contract procedures, quality standards, and cost controls as mechanisms to prevent problems that may lead to disputes during final account closing.

5.4.3.2 Theme 2 – Comprehensive Contract Provisions and Procedures

Comprehensive contract provisions and procedures form a critical element in mitigating problems during the final account closing stage in construction projects. As discussed in Section 5.3.3.3 above, ambiguities in contract documents and procedures have been significant challenges that contribute to disputes in the final account closing. Comprehensive contract provisions help reduce conflicts and enhance the project's overall performance, ensuring the successful completion of the final account (O. O. Akintoye et al., 2024; Romli, 2015; Ssegawa et al., 2020). Analysis of interview responses reveals that comprehensive contract provisions and procedures emerged as the main theme encompassing three interconnected codes, namely, a) Clear guidelines and procedures, b) Detailed and adequate information, and c) Establishing agreed basis for valuation.

a) Clear Guidelines and Procedures

Guidelines and procedures in construction projects are structured rules, methods, and processes designed to ensure that all project activities are carried out efficiently and in compliance with contractual and regulatory requirements (Aliyari, 2024). Asadi et al. (2023) noted that guidelines and procedures are important as they provide a standardised approach to planning, executing, monitoring, and completing construction work, improving quality, reducing risks, and enhancing coordination among stakeholders. Establishing clear guidelines and procedures is crucial for preventing disputes during the final account closing process. Well-defined procedures related to final account ensure that final accounts are settled promptly, avoiding delays that can result in extra costs and financial uncertainties for both contractors and clients (Mirzaee & Martek, 2024). Furthermore, Chan & Oppong (2017) highlighted that clear and well-written guidelines and procedures help clarify the roles, responsibilities, and expectations of all parties involved in closing the final account. This clarity promotes an efficient process and minimises disputes arising from ambiguities. Standardised procedures, timelines, and responsibilities also encourage consistency and ensure adherence to the project objectives.

During the interviews, most informants, except for CR3, emphasised the significance of establishing clear guidelines and procedures, including specific timelines and thresholds for approvals in the final account process. This approach can mitigate ambiguity and streamline the process among stakeholders. As noted by informant CS8:

> *"Establish clear processes, timelines, and responsibilities for final account closing, including creating a checklist and setting deadlines for submissions and approvals to ensure all parties adhere to the process" (CS8)*

Additionally, the informants also highlighted the importance of establishing requirements, checklists, and documentation formats for the submission and preparation of the final account, as well as ensuring that all stakeholders are informed. Informant CR7 specifically stated that:

"Provide a detailed and comprehensive checklist of documentation requirements for submission and preparation of final accounts. Ensure that the checklist is properly communicated so that both contractors and consultants understand the documentation requirements" (CR7).

These clear guidelines establish consistent documentation practices that can significantly reduce the likelihood of contractor submissions being incomplete. Furthermore, some informants (CS9, CR7, CL5) further emphasised the significance of clear contract terms, specifically for variation works, to prevent misinterpretations and reduce conflicts during assessments, as articulated by informant CL5:

"Clear and unambiguous contract terms for the assessment and approval of variation works to avoid delays and disputes in the preparation of the final account" (CL5)

b) Detailed and Adequate Information

Providing detailed and comprehensive information throughout the project lifecycle is crucial for avoiding misunderstandings and disputes during final account closing. This code highlights the importance of clearly defined scopes, responsibilities, and documentation standards in construction projects, all of which facilitate a smoother final account closing process. The majority of informants (CS2, CR3, CL5, CL6, CR7, CS8, CS9, CR10 and CL11) emphasised the need for comprehensive documentation for variation orders to ensure that all parties understand the exact scope and cost of works. Informant CR7 explained that:

"The contractor should receive detailed info for any V.O., including specifications, scopes, and cost for the works. This helps ensure they fully understand the V.O. works they need to carry out." (CR7)

Detailed instructions not only enhance compliance but also ensure alignment among all parties, thereby reducing the risk of disputes. This corresponds with the findings of Wang et al. (2023), who emphasise that clear documentation mitigates valuation conflicts in construction claims. Furthermore, several informants (CS2, CR3,

CL5, CR7, CS9) highlighted the cruciality of clarity regarding the roles and responsibilities of each party involved in the project. Informant CR3 mentioned that:

> *"The scope of work and responsibilities of all parties need to be clearly defined and communicated during the project kick-off meeting at the beginning of the project. This can help to avoid any misunderstandings or ambiguity on the works during the construction stage" (CR3)*

Early determination of responsibilities among the project team is crucial for establishing a shared understanding and helps in accurately identifying the project's requirements and the client's expectations. This aligns with Gamage & Kumar (2024), who emphasise the importance of pre-construction alignment meetings and briefings to ensure that the project meets the client's expectations and objectives.

c) Establishing Agreed Basis for Valuation

Valuation disputes are among the most contentious issues in final account closings (Kong & Yeow, 2016). Establishing an agreed basis for valuing variations at the start of the project ensures transparency and fairness in the assessment process, helping build trust among stakeholders. Several informants (CL5, CR7, CS8) emphasised the importance of reaching an early agreement on the evaluation basis and procedures to ensure transparent processes. Informant CL12 noted that:

> *"It is wise for everyone involved to come together and agree on the procedures for measuring and valuing variation right at the start of the project. This way, we can ensure clarity and help prevent any potential disputes down the line" (CL12)*

Establishing agreed-upon procedures from the outset is essential to ensure all parties share a common understanding of the variation process, minimise confusion, and prevent disputes throughout the project lifecycle. Overall, this theme emphasises the importance of comprehensive contractual provisions and procedures in preventing disputes during the final account closing stage. Each code within this theme, namely, clear guidelines and procedures, detailed and adequate information, and establishing an

agreed basis for valuation, provides insights for minimising disputes, as supported by empirical evidence from interviewees and academic literature. By implementing these measures, stakeholders can significantly reduce the likelihood of disputes in the final account closing and enhance project outcomes.

5.4.3.3 Theme 3 – Proper Documentation Management

Proper documentation management is crucial for preventing disputes during the final account closing phase of construction projects (Nor et al., 2023). This theme underscores the fundamental role of comprehensive and systematic documentation management throughout the project lifecycle. The analysis reveals that proper documentation management encompasses four interconnected codes: a) sufficient documentation, b) systematic record-keeping, and c) formal variation instruction. These codes, collectively, form a comprehensive framework for properly managing project documentation to prevent disputes during the final account stage.

a) Sufficient Documentation

Sufficient documentation in this analysis involves ensuring that all variations in construction projects are thoroughly recorded, accompanied by clear instructions, checklists, and supporting evidence to facilitate the evaluation and preparation of the final account. This practice is to ensure transparency and reduce ambiguity. In the interviews, all informants (CS1 to CL12) stressed the importance of thorough documentation, especially for variation work. As informant CR10 pointed out:

> *"Providing clear and detailed documentation, such as drawings, BQ, for V.O., will clearly define the scope and cost of variation works." (CR10)*

Informants also emphasised the regular submission of documentation and records to facilitate the finalisation of variation works. Informant CS1 has noted that:

"It is important to ensure that all variation works are documented thoroughly with clear checklists, detailed instructions, and supporting evidence. This helps maintain transparency and supports a fair evaluation and assessment of claims" (CS1)

Maintaining complete records early will help reduce confusion and establish a shared understanding of scope and costs, minimising the likelihood of disputes during final account closing. Furthermore, several informants (CS1, CS2, CL6, CS9, CR10) also emphasised the importance of regular updates and reminders for contractors regarding proper documentation to avoid disputes, as informant CS2 suggested that:

"Keep contractors updated and gently remind them about the importance of maintaining proper documentation, especially for variation works. This approach helps ensure that records are not missed and can effectively prevent any disputes regarding claims that may arise from variation work" (CS2)

These insights align with Shaikh et al. (2020), emphasising the importance of proper documentation for variation works and approvals to prevent disputes arising from unauthorised instructions.

b) Systematic Record-Keeping

Implementing systematic record-keeping ensures that project documentation is organised, accessible, and maintained throughout the project lifecycle. This concurs with the findings of Othman et al. (2023), who found that systematic record-keeping is necessary to reconcile records between contractors and clients, thus reducing the likelihood of disputes at the final closing stage of the accounts. Several informants (CS2, CR4, CL6, CR7, CS8, CR10 and CL12) emphasised the importance of proper and consistent record keeping for documentation from the project's beginning, as indicated by informant CR10:

"Ensure proper record keeping and documentation from the early stages of the project, including the maintenance of a site diary and other documents, with proper sign-off by all relevant parties" (CR10)

This approach to document management creates an organised, efficient system for retrieving and verifying documents during the final account preparation process. Furthermore, implementing formal handover procedures during personnel transitions represents another important aspect of proper documentation management. As noted by informant CR3, that:

> *"Implementing formal handover procedures during staff changes helps ensure the continuity of documentation." (CR3)*

These procedures ensure that when personnel transitions occur, the new staff receive comprehensive information about existing project documentation, helping maintain continuity in record-keeping practices. Moreover, assigning dedicated documentation responsibilities to the project team can enhance record-keeping practices. One informant (CR10) highlighted that:

> *"Designating a specific person to oversee the documentation process ensures that all records are complete and well-organised." (CR10)*

This dedicated individual's attention to documentation can significantly improve its quality and completeness throughout the project, particularly for final account submissions. Additionally, a significant number of informants also emphasised the need to incorporate technology for systematic record management in construction projects. Informant CR7 articulated that:

> *"Switching to digital with document management, using tools like cloud storage or even specific software such as 'Novad Solution', really streamlines the process. It makes your record-keeping way more efficient and easier to retrieve documents when needed" (CR7)*

These findings align with the research by Kalogeraki & Antoniou (2024), which highlights that utilising technology can enhance claim management in construction projects and prevent claim issues from escalating into disputes. Additionally, Alaloul et al. (2019) state that using digital documentation enables stakeholders to access the same, up-to-date information, which is crucial for preparing and submitting the final

account. This, in turn, reduces misunderstandings and conflicts caused by outdated or incomplete data.

c) Formal Variation Instruction

Formal variation instruction in this analysis refers to the proper written documentation of all instructions related to variation work in construction projects. This approach aims to resolve the common problem of verbal instructions issued by clients or consultants, which can lead to misunderstandings and disputes, as discussed in Section 5.3.3.2. Research by Lew et al. (2013) found that most claims for variation work in construction projects did not follow formal variation procedures, as clients often gave direct verbal instructions to contractors. By requiring formal variation instructions, written confirmations, and approvals, disputes arising from miscommunication are minimised. Multiple informants (CS1, CS2, CL5, CR7, and CS9) emphasised that all instructions should be formally provided in writing by an authorised party, and that the contractor should proactively reconfirm the instructions before proceeding with any variation work. Informants CS2 and CR7 explained that:

> *"Before proceeding with the variation works, the contractor should confirm the instructions and obtain written confirmation from an authorised party. This ensures that the instructions are valid and come from unauthorised personnel" (CS2)*

> *"All verbal instructions for variation work should be promptly followed by written confirmation and approvals, whether from the consultant or the client, to avoid misunderstandings and potential disputes. Minutes of meetings can also serve as a formal record of the variation work instruction." (CR7)*

Written instructions are essential for avoiding disputes related to variation works. Research by Memon et al. (2014) highlighted that the formal instructions for variation establish a clear and documented process for managing changes. This clarity helps to reduce conflicts and misunderstandings while effectively managing claims. It also ensures that all changes are justified and properly documented.

5.4.3.4 Theme 4 – Information Technology Adoption

The adoption of Information Technology (IT) emerged as a significant preventive strategy, representing a shift towards digital transformation in documentation, measurement, and valuation processes. Previous research highlighted that information technology helps in improving project delivery and reducing disputes, especially during the final account closing process (Boyacioglu et al., 2022; Muhammuddin et al., 2023). This analysis reveals that Information Technology Adoption encompasses two primary codes, comprising a) Digital documentation system, and b) Technology utilisation. These codes collectively represent a comprehensive approach to leveraging technology and digital tools to prevent disputes during the final account closing process.

a) Digital Documentation System

Digital documentation systems identified in this analysis aim to achieve systematic record keeping, ensuring the availability and accessibility of accurate records and thereby reducing the likelihood of missing or mismanaged documents. Cloud-based platforms and project management software facilitate systematic storage, retrieval, and organisation of documents, ensuring transparency and accountability throughout the project lifecycle. In this analysis, all informants (CS1 to CL12) emphasised the importance of digital tools in managing documents and records. This broad consensus among informants highlights the importance of digital documentation systems in enhancing record-keeping practices. Informants CS8 and CL11 noted this as follows:

> *"Use digital tools and IT systems to systematically manage and centralise documentation to improve the efficiency of record keeping and ensure that all project documents are accessible to relevant parties" (CS8)*

> *"By implementing IT applications, we can easily store and manage all the important documentation needed for the final account. This approach will help ensure that essential project documents are well-organised and also quickly accessible " (CL11)*

The statement above highlights that the digital documentation system offers streamlined processes, enhances transparency and collaboration. Such technology, including a cloud-based system, also ensures continuity even when personnel change, enhancing efficiency in the record-keeping process. Additionally, Olanipekun & Sutrisna (2021) suggested that utilising cloud-based platforms for storing records and documents aligns with current trends in digital transformation, which encourages collaboration and interaction among stakeholders in the construction supply chain. This approach helps to minimise the potential for disputes that may arise from miscommunication or lack of coordination (Prebanić & Vukomanović, 2021).

b) Technology Utilisation

The second code emphasises the use of advanced technologies to enhance accuracy, efficiency, and collaboration in the valuation and approval processes during final account closing. Technological tools, such as Building Information Modelling (BIM), drones, and laser measurements, not only streamline complex valuation works but also enhance transparency and accuracy. These technologies enable stakeholders to visualise and verify data, minimising ambiguities and the potential for disputes. Several informants (CR3, CS8, CR10, and CL11) suggested that leveraging modern tools and software enhances coordination, accelerates measurement, improves accuracy, and provides real-time progress. Informant CR3 highlighted the importance of modern measurement technologies:

> *"We can use advanced tools and technologies like laser measurements and drones to measure complex areas of the project more accurately and efficiently. This will help us reduce the time and complexity of the valuation process" (CR3)*

Furthermore, the adoption of BIM represents a significant step towards enhancing stakeholder collaboration and coordination, and improving the accuracy of cost estimation and valuation of works, as highlighted by several informants. Specifically, informant CS8 noted that:

"Implementation of BIM is significant to improve visibility, coordination and transparency in the valuation of works." (CS8)

By integrating technology, such as a BIM system, it will create a more transparent and efficient valuation process, significantly reducing the likelihood of disputes during final account closing. Additionally, tools like online meeting platforms and digital signatures simplify administrative procedures, ensuring timely approvals and effective coordination, as noted by informant CL11:

"Utilising technologies like online meetings and digital signatures can help simplify the approval process for construction projects. It not only cuts down on bureaucracy but also ensures that variation works are assessed and approved on time." (CL11)

This technological tool enhances efficiency by utilising digital tools to streamline the approval process for variation works.

Overall, the adoption of information technology aims to improve accuracy, reduce process complexity and time, enhance documentation management, and foster better visibility and coordination, ultimately contributing to fewer valuation disagreements and a smoother final account process. These findings align with previous research by Charehzehi et al. (2017) and Khawaja & Mustapha (2021), which underscores the benefits of information and digital technology, such as BIM, in facilitating better collaboration and communication among stakeholders. This can help prevent conflicts from escalating into disputes in the construction industry.

5.4.3.5 Theme 5 – Collaborative Work Approach

This theme emphasises the importance of cooperation, effective communication, and mutual understanding among stakeholders. Studies by Deep et al. (2021) and Elhag et al. (2020) indicate that collaboration among construction stakeholders facilitates early problem identification and increased trust. These factors are vital for minimising conflicts and disputes. From this analysis, the collaborative work approach theme encompasses three main codes, includes a) Effective communication and coordination, b) Flexible process, and c) Collaborative assessment.

These codes outline specific strategies and practices to promote collaboration and mitigate issues during the final account closing process.

a) Effective Communication and Coordination

Effective communication and coordination are important in minimising disputes by ensuring that all parties involved have a clear understanding of project goals, their respective roles, and responsibilities (Gamage, 2022). Furthermore, open and transparent communication among stakeholders helps build trust and reduces the likelihood of problems arising. The analysis of the interview data revealed that all informants (CS1 to CL12) emphasised the importance of clear communication and coordination among stakeholders throughout the project to promptly address issues and prevent delays in preparing the final account claim. As noted by informant CS1:

> *"Encourage open communication and flexible negotiation between all parties to resolve disagreements and find mutually agreeable solutions" (CS1)*

This clear communication fosters transparency, facilitating more efficient approval processes. Concerning variation work that often causes conflict during the valuation of the final account, informant CL6 specifically mentioned that:

> *"The contractor should inform the client if the VO work exceeds the approved budget before proceeding with the works" (CL6)*

This proactive communication helps prevent conflicts and ensures a mutual agreement on the final account valuation. Additionally, several informants (CS2, CR7, CS8, CS9) have emphasised the significance of regular follow-ups concerning final account matters to ensure alignment and resolve problems promptly. Informant CS2 from the consultant noted that:

“Regular project meetings and follow-ups between project parties, even after the project is completed, to address potential disagreements and facilitate the timely approval and submission of final account documents” (CS2)

Other informants (CR3, CL5, CL11) also highlight the importance of proactive and early coordination during the design stage to avoid discrepancies among contract documents, such as drawings, specifications, and bills of quantities. Informant CR3 has pointed out that:

"Early coordination and collaboration between the design team, client, quantity surveyor and contractor during the design phase to accurately define the scope of work. This helps to avoid discrepancies between the contract documents and minimise potential variations" (CR3)

Additionally, improving communication, particularly between site and office personnel, represents another crucial aspect of the collaborative work approach. As informants CR7 noted,

"Improving communication and coordination, specifically between site and office staff, ensures the proper transfer of all necessary documentation for final account preparation." (CR7)

The importance of maintaining positive relationships extends beyond the internal project team. As highlighted by informants CR3 and CL11, the client, consultant, and contractor should build positive relationships with local authorities to stay informed about regulatory changes and avoid unexpected variations in work due to the authorities' requirements. Early confirmation of requirements will reduce the necessity for variation works resulting from non-compliance with regulatory and authority standards (Pokharel & Joshi, 2020). This collaboration creates a supportive work environment for the final account process, facilitating information sharing, problem-solving, and mutual understanding. Furthermore, working collaboratively from the design stage onward allows for a well-defined scope, reducing the need for variations, which would increase time and cost (Wang et al., 2023b).

b) Flexibility Process

The flexibility process emerged as another important aspect of collaborative work approaches in preventing delays and disputes in the final account closing process. In this analysis, flexibility refers to modifying standard procedures appropriately to streamline the final account closing process and prevent delays. Informants (CS8, CR10, and CL12) emphasised the need for a flexible process, including simplified procedures, especially for smaller variation works, to reduce bureaucracy, which often causes delays. This approach enables urgent matters to be addressed promptly. Informant CS8 explained that:

> *"Simplify the procedure for approving variation works, especially for smaller value items. This can help reduce the bureaucracy and the number of approvals required, which often causes delays" (CS8)*

These findings align with Shahu et al. (2012), who emphasise the importance of flexibility in construction project management, as it helps reduce risks and boost the chances of project success. Furthermore, studies by Song et al. (2021) have shown that a flexible, adaptive approach to processes can foster cooperative behaviour among stakeholders, thereby preventing disputes and enhancing project performance.

c) Collaborative Assessment

Joint valuation and assessment of project work ensures a shared understanding and agreement on valuations and quality, reducing disagreements during final account closing. According to Judi & Mustaffa (2021), joint valuations promote trust-building among clients and contractors, empowering the parties to minimise misunderstandings and payment issues. In this analysis, several informants (CS2, CR4, CL6, CR7, CS8, CS9, CR10, and CL11) emphasise the importance of conducting collaborative assessments or evaluations to achieve consensus on the scope of work and quantity, thereby reducing disputes. Informants CR4 and CS9 have supported this approach and stated as follows:

"Conduct joint valuations, inspections and measurements involving the contractor, the consultant and the client to agree on the assessment of variation works and reduce the likelihood of disputes" (CR4)

"Regular communication and coordination through joint inspections and assessments and meetings between the parties to confirm the quality and quantity of the final work, enabling agreement between all parties involved and minimising disagreements" (CS9)

These joint assessment processes promote a shared understanding of the work scope and quantities, thereby minimising valuation disagreements and facilitating smoother final account settlements. Overall, the theme of a collaborative work approach as identified in this analysis can foster effective communication, flexible processes, and encourage collaborative assessment, helping mitigate disputes, improve project outcomes, and ensure a successful final account closure in construction projects.

5.4.3.6 Theme 6 – Effective Resource Management

Effective resource management is crucial in construction projects to ensure timely completion, cost efficiency, and successful final account closing. It involves optimising the use of labour, materials, and equipment to meet project goals within budget and on time (Muthuramalingam, 2008). This analysis reveals that effective resource management involves sufficient allocation and utilisation of manpower, budget, and expertise to address the complexities of documentation, variations, and project deliverables. Two primary codes were identified under this theme, namely a) Sufficient manpower and b) Sufficient budget allocation. These codes highlight the importance of having adequate staffing and financial resources to facilitate a smooth final account process.

a) Sufficient Manpower

The allocation of sufficient and competent manpower is crucial for managing the extensive documentation and coordination required during final account closing. The absence of dedicated and skilled personnel often results in delays and inaccuracies. Several informants (CS2, CR3, CR4, CL5, CL6, CS8, CS9, CR10, and CL12)

emphasised the importance of dedicated efforts to review extensive documentation to minimise errors and disputes arising from misinterpretation. As noted by informant CS2:

> *"Consultants should allocate sufficient time and resources to review the final account documents submitted by contractors thoroughly. Allocating more time and focusing on the final account process can help manage the large volume of documents and ensure accuracy" (CS2)*

Furthermore, informants (CL5, CS8, CS9, CL12) emphasised the importance of consultants and contractors providing sufficient, competent staff throughout the project and after its completion to manage the final account effectively. As informant CL12 pointed out:

> *"Consultants and contractors should provide sufficient and competent staff throughout the project and after practical completion to manage the final account effectively. This can help avoid delays in submission and preparation of the final account" (CL12)*

Additionally, several informants emphasised the importance of having sufficient staff and, when necessary, outsourcing to reputable freelance professionals, such as quantity surveyors. One informant, CL5, noted that:

> *"The client, contractor and consultants need to provide dedicated staff and consider outsourcing to credible freelance quantity surveyors when required to manage the workload efficiently and ensure timely closing of the final account" (CL5)*

These findings align with previous research that underscores the critical role of sufficient manpower in construction project management. Studies have shown that allocating adequate human resources and expertise can significantly reduce the occurrence of disputes, improve project performance, and facilitate successful project closeout (Muzaki et al., 2014; Srinivasan et al., 2023).

b) Sufficient Budget Allocation

In this analysis, sufficient budget allocation emerged as another essential aspect of effective resource management, essential for addressing unforeseen conditions, variations, and provisional sums. This proactive financial planning helps mitigate the risk of disputes arising from funding constraints. Multiple informants (CR4, CL5, CL6, CS8, CS9, CR10, CL11, and CL12) stressed that the client should allocate sufficient funds for contingency and provisional items to cover unexpected costs arising from unforeseen site conditions or necessary work changes. Such provisions are crucial for accommodating unforeseen conditions and potential variations during the project. As noted by informant CL5:

> *"It is important for clients to allocate a sufficient budget that covers contingencies, provisional items, and detailed site investigations. This financial preparedness can effectively handle unforeseen circumstances and variations, which in turn helps to prevent delays caused by funding limitations" (CL5)*

As the statement above suggests, contingency budgeting is necessary to deal with unforeseen project conditions. This highlights the importance of allocating contingency planning to manage risk and account for uncertainties, which can cause cost overruns on construction projects (Akinradewo et al., 2019).

Moreover, informants emphasised the need to allocate sufficient budget specifically for the provisional works item. They highlighted the role of quantity surveyors in this process, who should provide detailed breakdowns for these work items. This ensures both the accuracy of costs and their alignment with the client's original budgetary framework. As informant CS8 detailed:

> *"It is essential to allocate an adequate budget for a provisional item. Quantity Surveyors play a key role here by providing meticulous breakdowns for each work item. This ensures that the costs are accurate and, importantly, that they do not exceed the client's initially established budget later on" (CS8)*

Providing detailed budget breakdowns for provisional sums in preliminary construction project estimates can improve transparency and stakeholder alignment, thereby reducing the risk of disputes over cost overruns. Furthermore, informants stressed the need for thorough, accurate price calculations for variation works. Careful attention to this area is vital to avoid underestimations and resulting financial discrepancies. As informant CR4 pointed out:

> *"The contractor must ensure that their price calculation for variation works is comprehensive and based on all available information. This thoroughness is essential to avoid underestimation" (CR4)*

These findings resonate with previous research highlighting the importance of adequate budget allocation in construction project management. Previous studies have demonstrated that allocating adequate financial resources and contingencies can support efficient resource management, enhance project success, improve risk management, and deliver economic benefits (Jaselskis & Ashley, 1991; Rosenfeld, 2013).

5.4.3.7 Theme 7 – Provide Competent Personnel

This theme highlights the importance of assigning knowledgeable and skilled personnel to manage the final account process effectively. Previous research emphasised the significance of competent personnel in construction projects, particularly to improve project performance, reduce conflict and facilitate successful project closing (Amaratunga, 2016; Othman et al., 2023; Yong & Mustaffa, 2017). Through this analysis, this theme is supported by two main codes, namely a) Knowledgeable and experienced staff, and b) Enhancing staff skills and knowledge. Each code outlines specific strategies and practices to ensure the availability of competent personnel, thereby helping reduce disputes during the final account process.

a) Knowledgeable and Experienced Staff

Staff with the proper knowledge and experience are better equipped to understand and comply with contractual terms, helping prevent disputes. Such knowledgeable staff can enhance effective project management, promote good

communication and collaboration among stakeholders, ensure accuracy in estimation and valuation, and maintain proper project documentation, all of which are essential for successfully closing the final account (Amaratunga, 2016; Zakaria et al., 2013b). Multiple informants (CS2, CR3, CL5, CL6, CR7, CR10, CL11, and CL12) consistently emphasised the need for a competent project team with the necessary skills and expertise to estimate and evaluate project costs accurately, and to manage projects effectively, thereby preventing delays in closing the final account. As noted by informant CR3:

> *"A competent project team with essential skills is crucial. This team or person can estimate project costs and manage effectively, avoiding potential cost overruns." (CR3)*

Moreover, several informants emphasise the importance of assigning competent staff who are involved in all phases of the construction process to ensure continuity and minimise discrepancies in documentation and the evaluation of the final account. The involvement of experienced or senior employees in managing and overseeing the final account process was considered important for reducing the likelihood of errors. As highlighted by informant CR10:

> *"Assigning competent staff who are involved throughout the construction process is vital for proper documentation and evaluation of the final account. Additionally, having an experienced or senior employee manage and oversee the final account process can significantly reduce the chance of errors." (CR10)*

When parties use skilled personnel with experience in contract administration and technical areas, the possibility of errors and misunderstandings in valuation is significantly reduced.

b) Enhancing Staff Skills and Knowledge

Providing specific training and developing staff skills is crucial for equipping them with the necessary competencies to handle construction projects and final account

processes efficiently. Participating in continuous professional development (CPD) programmes, including training, workshops, and seminars, can help staff stay up to date with best practices in contract management, cost estimation, documentation, and claims evaluation. This is essential for reducing the risk of disputes. Existing research suggests that a lack of organisational commitment to training initiatives can hinder professional growth and skill development, leading to staff dissatisfaction and possible turnover (Ayodele et al., 2020). Many informants (CS2, CR4, CL5, CL6, CR7, CS8, CS9, CR10, CL11 and CL12) emphasised the importance of organisations offering training to their staff, particularly those in key roles, to ensure they possess the necessary knowledge and skills to manage the final account process effectively. As CR4 noted:

> *"Organisations should train staff, especially key team members, to ensure they have the knowledge and skills for effective final account management. Training should cover project documentation, cost estimation, and claims evaluation procedures." (CR4)*

Training initiatives help bridge knowledge gaps and enhance critical skills such as schedule management, time management, and supportive leadership, which are essential for construction management (Nuwan et al., 2021). By ensuring that project teams have the necessary knowledge and skills, this solution helps prevent errors in design, estimation, and variation management that can lead to cost overruns.

Moreover, informants emphasised the importance of providing all staff members involved in documentation, record-keeping, and filing procedures with sufficient training. This training was deemed essential to ensure records are properly organised and that staff are aware of best practices for documentation. Ultimately, this reduces errors during the final account process. As stated by informant CS2:

> *"Provide adequate training to all staff managing documentation and filing procedures. This ensures organised records and increases awareness of effective documentation practices, reducing errors in the final account process." (CS2)*

These findings align with previous research that emphasises the importance of enhancing staff skills and knowledge in construction project management. By

upskilling both consultant and contractor teams, mistakes and delays can be minimised, ultimately leading to a smoother final account completion. Studies have demonstrated that providing training and development opportunities for project personnel can help mitigate disputes, improve project cash flow and performance, and facilitate successful project completion (Ishak et al., 2020; Nor, 2024; Nuwan et al., 2021).

5.4.3.8 Theme 8 – Timely Processing

This theme emphasises the importance of early preparation, proactive resolution of issues, timely documentation, and regular follow-ups to prevent delays and misunderstandings that can escalate into disputes. Previous research by Azman et al. (2014) and Judi et al. (2017) has highlighted the importance of timely submission and evaluation of payment claims to prevent late payments, which can contribute to disputes in construction projects. Through the analysis, this theme integrates three key codes: a) Early preparation and resolution of final account issues, b) Timely complete documentation, and c) Regular updates and follow-up. These codes highlight strategic actions and best practices that ensure efficiency and accuracy in final account management.

a) Early Preparation and Resolution of Final Account Issues

Early preparation of documentation and proactive steps to address final account issues while construction is ongoing are crucial for minimising disputes later. Early preparation provides all parties involved with ample time to identify, assess, and resolve any discrepancies or outstanding matters before the project's completion (Umar & Ochigbo, 2024). Several informants (CS1, CS2, CR4, CL5, CR7, CS8, CS9, and CR10) emphasised that identifying and addressing any problems earlier, such as holding regular meetings to discuss and resolve outstanding matters promptly, helps mitigate issues and disputes at the final account closing stage. As noted by informant CS1:

> *"The project team should proactively address outstanding issues, such as variation orders and loss and expense during construction, instead of waiting until the final account stage." (CS1)*

Furthermore, informants emphasised the importance of contractors and consultants starting the final account process early. This early initiation is seen as vital to allow sufficient time for a thorough review and to reach agreement among all parties involved. As noted by informant CR3:

> *"Contractors, consultants, and project teams should start the final account process early, ideally around 6 months before project completion or when the project is approximately 90% completed. Regular submission and preparation of final account documents provide ample time for thorough review and ensure a smoother closing process agreement." (CR3)*

Initiating the final account process early provides sufficient time for preparation, review, and assessment, helping avoid disputes and delays in closing the final account (Hisham & Othman, 2021).

b) Timely Complete Documentation

Ensuring that all necessary documents are fully submitted and on time is crucial for avoiding delays and minimising disputes during the preparation and valuation of the final account (Abdel-Khalek et al., 2019). In the interviews, multiple informants (CR3, CR4, CR7, and CL12) stressed the importance of proactive measures to gather all required documentation promptly. As noted by informant CL12:

> *"It is important to remind contractors to submit their documents on time. We should establish a system for regular submission and review, maintaining comprehensive documentation throughout the project. This facilitates smoother valuation processes." (CL12)*

Furthermore, informants emphasised the importance of the contractor promptly submitting proper documentation. This proactive approach by the contractor, often encouraged by consultant follow-ups, is vital for expediting the final account preparation and preventing hold-ups. As emphasised by informant CR3:

> *"Contractor is encouraged to compile all the necessary documents and submit them on time. The consultant plays a vital role in reminding the contractor and following up to help speed up the process, ensuring that we can avoid any delays when preparing the final account." (CR3)*

The timely submission of all relevant documents enables an accurate calculation of the final project cost. This accuracy is essential for closing the final account without disputes, a stage that is critical for both the contractor and the client to achieve a mutual agreement on the final payment (Hisham & Othman, 2021; Zakaria et al., 2012).

c) Regular Updates and Follow-Ups

Regular updates and follow-ups were identified as another key aspect of timely processing to ensure that all final account related information is accurate and up-to-date, which supports fair and efficient resolution of disputes and claims (Umar & Ochigbo, 2024; Shaikh et al., 2020). Ongoing communication and consistent follow-ups throughout the construction period, and even after project completion, ensure that all documentation related to the final account is regularly updated. This practice also helps to prevent a heavy workload from accumulating at the final account stage. Most informants (CS1 to CS9) consistently emphasised the importance of contractors regularly submitting relevant documents for the final account and the consultants conducting regular reviews during the construction phase. This practice ensures comprehensive documentation and helps prevent last-minute paperwork issues. As noted by informant CS2:

> *"Regular submission of relevant documents by the contractor for the final account, along with reviews by the consultants during construction, is crucial. This ensures comprehensive documentation and avoids last-minute paperwork issues." (CS2)*

This statement emphasised that contractors must diligently collect and organise all relevant documentation for the final account records throughout the construction period. In addition, informants noted that the consultant also plays a role by proactively

reminding and encouraging contractors to submit final account claims and supporting documentation in a timely and regular manner. As stated by informant CS8:

> *"The consultant should also be guiding and reminding them about the timely submission of final account documentation." (CS8)*

The information shared by informants demonstrates a need for collaboration between contractors and consultants to organise documentation, which reflects best practices in construction project management. Overall, timely processing is a key strategy for preventing disputes during the final account closing. By promoting early preparation of documentation and regular follow-ups, contractors and consultants can ensure the accuracy and completeness of documentation, thereby mitigating the risks of delays and disputes. In practice, this strategy requires all stakeholders to adopt a proactive approach to problem resolution and to maintain consistent communication. These measures not only help prevent disputes but also enhance overall project efficiency and strengthen stakeholder relationships.

5.4.3.9 Theme 9 – Appropriate Estimation, Design and Planning

This theme has been identified as another key strategy to address major problems during the closing of final accounts in the construction industry. This theme emphasises the significance of accurate estimation, sufficient design and careful planning to minimise potential problems that could lead to disputes at the final account stage (Jassim et al., 2025; Mokoena et al., 2023). This theme consists of three main codes: a) Planning and design sufficiency, b) Accurate estimation of works, and c) Proper site investigation. Each of these codes represents a vital aspect of effective project management that helps prevent disputes during the final accounts closing.

a) Planning and Design Sufficiency

Effective planning and thorough design processes are fundamental to ensuring that all project requirements are clearly defined and addressed before construction work begins. Insufficient planning and ineffective design during the initial stages often lead to project complexity, scope changes, and, consequently, disputes (Ismail, 2021; Mate

& Hinge, 2015; Rauzana, 2016). The importance of sufficient planning and solid design emerged from the interviews as a crucial factor in preventing disputes during final account closing. Multiple informants (CS1, CS2, CR3, CL5, CR7, CS8, and CL12) emphasised the importance of early and comprehensive planning, as well as avoiding last-minute changes or variations during the project. As noted by informant CL12:

> *"Finalise the design and scope of work before construction starts. Avoid last-minute design changes to minimise complexity and variations during the project." (CL12)*

Furthermore, informants highlighted the importance of allocating ample time for the design and planning stages. This helps reduce errors and ensures that all project requirements are effectively addressed. As highlighted by informant CS8:

> *"Sufficient time should be allowed in the design and planning phase. This allows for thorough investigations, the preparation of detailed documentation, and adequate planning, all of which help to avoid hasty decisions and reduce errors." (CS8)*

Furthermore, the competence of the design team and the consultant is important, as highlighted by informants. This ensures the design complies with regulatory requirements and meets client expectations, thereby reducing the risk of misunderstandings and disputes. As stated by informant CR3:

> *"The design must also meet the requirements of the authorities and the client to avoid misunderstandings and additional costs in future" (CR3)*

b) Accurate Estimation of Works

Accurate cost estimation during preliminary construction project estimates is crucial for avoiding cost overruns, ensuring financial transparency, and minimising disputes over budget discrepancies. Several informants (CS1, CL6, CR10, CL11, and CL12) have emphasised the importance of detailed cost estimation in ensuring financial clarity. As Informant CR10 pointed out

"It is crucial to have an accurate and comprehensive estimate of all work, including provisional quantities, provisional sums, and prime cost sums, to prevent discrepancies and disagreements over costs" (CR10)

Furthermore, informants emphasised the necessity for both consultants and contractors to estimate and provide detailed breakdowns for provisional sum items accurately. This enhances transparency and ensures alignment with the client's budget. As stated by informant CL11:

"The consultant should accurately estimate provisional sum items, and the contractor's proposal for the design and costs of provisional items should not exceed the client's budget. A detailed breakdown of these items is essential for justification, accuracy, and identifying discrepancies between estimated and actual costs" (CL11)

These findings align with Rosenfeld (2013), who stated that comprehensive and detailed cost estimation can reduce cost overruns, mitigate disputes, and facilitate successful project completion.

c) Proper Site Investigation

A proper site investigation involves assessing the physical characteristics of the land, including soil conditions, topography, and any existing structures or utilities. This assessment provides appropriate information for the design and helps determine the project's feasibility. A thorough site investigation during the design and planning phase provides essential information for accurate planning and estimation, thereby minimising risks associated with unforeseen site conditions. In contrast, inadequate investigations can lead to unexpected ground conditions, which can escalate costs and delay project completion (Clayton & Smith, 2013; Pospíšil & Rozsypal, 2017). Most informants in this research (CS1, CS2, CR4, CL5, CR7, CS8, CS9, CR10, CL11 and CL12) emphasised the importance of a comprehensive and detailed site investigation at the design stage. This helps in understanding potential site conditions and minimises the risk of unexpected issues that could lead to variations and cost overruns in construction projects. As noted by informant CL5:

"Performing thorough front-end engineering work and site investigations during the design phase is key. This helps obtain critical information that improves design accuracy and preliminary estimates. It also reduces unexpected variations and minimises problems during construction." (CL5)

Additionally, informants emphasised the need to allocate a sufficient budget for detailed, specialised site investigations. As stated by informant CS9:

"Appropriate budget allocation is needed for detailed and specialised site investigations, such as seismic surveys. This ensures a comprehensive collection of site information and allows for accurate quantity estimation." (CS9)

Overall, appropriate estimation, design, planning, and budget allocation are crucial in construction projects, as they significantly influence project success in terms of cost, time, and quality. These elements help establish realistic budgets, timelines, and resource allocations, which are crucial for completing projects within the desired parameters. By implementing appropriate designs and planning, providing precise cost estimations, and conducting thorough site investigations, stakeholders can minimise the risks of variations, delays, and cost overruns. It also demonstrates how careful preparation and foresight can facilitate smoother project execution and simplify the final account closing process.

5.5 Mapping of EFA Components, Major Problems, Root Cause Themes, and Preventive Solution Themes

Table 5.6 presents a comprehensive mapping of the five EFA components to the eight major problems identified in Chapter 4, their associated root cause themes, and the corresponding preventive solution themes derived from the qualitative analysis in Chapter 5. This mapping demonstrates how the quantitative findings (EFA component structure and major problem rankings) and qualitative findings (root cause and preventive solution themes) are systematically integrated within the explanatory sequential mixed-methods framework. As the table illustrates, most root cause themes and preventive solutions cluster within the Evaluation Process component, which

contains seven of the eight major problems. This mapping provides a structured basis for the framework development in Chapter 6.

Table 5.6
Summary Mapping of Root Cause Themes to Preventive Solution Themes with the Major Problems

EFA Component	**Major Problem**	**Related Root Causes Themes**	**Corresponding Preventive Solution Themes**
Evaluation Process	Delay in evaluation and preparation of the final account	• Documentation Issues • Communication and Coordination Breakdown • Lack of Commitment • Incompetencies • Non-Fulfilment of Contractual Requirements	• Contractual Compliance • Comprehensive Contract Provisions & Procedures • Proper Documentation Management • Information Technology Adoption • Collaborative Work Approach • Effective Resource Management • Provide Competent Personnel • Timely Processing
Evaluation Process	Complexity of claim and valuation process for variation works	• Contract Ambiguity • Improper Variation Order • Incompetencies • Communication and Coordination Breakdown	• Collaborative Work Approach • Appropriate Design & Planning • Information Technology Adoption • Provide Competent Personnel • Comprehensive Contract Provisions & Procedures
Evaluation Process	Delay in approving and finalising variation work	• Documentation Issues • Communication and Coordination Breakdown • Improper Variation Order • Organisational Bureaucracy	• Timely Processing • Proper Documentation Management • Comprehensive Contract Provisions & Procedures • Collaborative Work Approach • Information Technology Adoption

EFA Component	Major Problem	Related Root Causes Themes	Corresponding Preventive Solution Themes
		• Inadequate Project Preparation	
Evaluation Process	Disagreement on the valuation of variation works	• Documentation Issues • Contract Ambiguity • Improper Variation Order • Incompetencies • Lack of Trust and Integrity	• Comprehensive Contract Provisions & Procedures • Proper Documentation Management • Collaborative Work Approach • Information Technology Adoption
Evaluation Process	Lack of documents and evidence for submission of the final account claim	• Documentation Issues • Lack of Commitment • Communication and Coordination Breakdown • Incompetencies	• Comprehensive Contract Provisions & Procedures • Information Technology Adoption • Provide Competent Personnel • Timely Processing • Collaborative Work Approach
Evaluation Process	Delay in submitting the final account claim	• Documentation Issues • Non-Fulfilment of Contractual Requirements • Communication and Coordination Breakdown • Organisational Bureaucracy • Lack of Commitment	• Timely Processing • Proper Documentation Management • Effective Resource Management • Collaborative Work Approach
Evaluation Process	Disagreement on the valuation of the final account	• Non-Fulfilment of Contractual Requirements • Incompetencies	• Collaborative Work Approach • Provide Competent Personnel • Proper Documentation Management

EFA Component	Major Problem	Related Root Causes Themes	Corresponding Preventive Solution Themes
		• Contract Ambiguity • Lack of Trust and Integrity • Documentation Issues	• Comprehensive Contract Provisions & Procedures • Contractual Compliance
Contractual Management	Cost overrun due to variation and provisional quantities	• Incompetencies • Contract Ambiguity • Improper Variation Order • Inadequate Project Preparation	• Appropriate Estimation, Design and Planning • Effective Resource Management • Contractual Compliance • Provide Competent Personnel • Comprehensive Contract Provisions & Procedures

5.6 Summary

This chapter presents and discusses the qualitative data and findings obtained from semi-structured interviews with twelve (12) informants, comprising experienced practitioners from the construction industry, including Clients, G7 Contractors, and Quantity Surveyors Consultants. The investigation focuses on identifying the root causes of major problems in the final account closing process in the Malaysian construction industry. Data saturation was confirmed after 12 interviews for both root causes and preventive solutions. The thematic analysis conducted identified ten (10) primary themes for root causes, such as documentation issues, improper variation orders, contract ambiguity, lack of commitment, and incompetencies. Subsequently, the interviews explore and identify several preventive solutions to mitigate the major problems and root causes. This results in the identification of nine (9) themes for preventive solutions, including enhancing contractual compliance, adopting information technology, fostering a collaborative work approach, and ensuring timely processing. These qualitative findings were linked with the major problems established in Chapter 4 to determine their relationship. Furthermore, the findings established in Chapters 4 and 5 will serve as the foundation for the development of a preventive

solution framework for improving the final account closing process, which will be elaborated in Chapter 6.

CHAPTER 6
FRAMEWORK DEVELOPMENT AND VALIDATION

6.1 Introduction

This chapter outlines the development and validation of a preventive solution framework to improve the final account closing process in construction projects. The framework developed in this study is based on the findings from the questionnaire survey detailed in Chapter 4 and the semi-structured interviews discussed in Chapter 5. The quantitative findings of this research have established one component of the framework, while the qualitative findings have established two components. The initial section of this chapter will elaborate on the framework's development, including the theoretical foundations of its components, followed by the findings from both quantitative and qualitative analyses. The subsequent section of this chapter is dedicated to the validation of the developed framework by experts or experienced construction practitioners to assess its appropriateness and practicality. The analysis and findings of data collected for validation purposes will be presented accordingly. The chapter concludes with an exploration of the application and potential implications of the framework for improving final account closing management within the construction industry.

6.2 Theoretical Foundation of the Framework Based on the Problem Solving Model

The problem solving approach is significant in construction management, as it offers a structured framework for comprehending and addressing the multitude of unique challenges encountered throughout a project's lifecycle (Bakht & El-Diraby, 2015). Problem solving is defined as a systematic process aimed at achieving a desired goal by identifying and overcoming obstacles (Hardin, 2003). Several researchers have characterised problem solving as the process of defining the problem, diagnosing its root cause, and identifying and implementing a solution (Annamalai et al., 2013; Wang & Chiew, 2010; Yu et al., 2010). The first principle of problem solving is to define the

problem clearly and specifically, which involves concentrating on the problem itself and uncovering underlying causes rather than merely addressing its symptoms (Pal & Poyen, 2017). The second principle is to diagnose the root cause of the problem, focusing on identifying the fundamental issue that initiates the chain of events leading to the problem. The third principle involves identifying and implementing a solution, which includes generating a range of potential solutions and selecting the most appropriate one based on factors such as effectiveness and feasibility (Simon, 2001).

6.2.1 Intelligent Design Choice (IDC) Model

The development of a preventive solution framework to improve the final accounts closing in the Malaysian construction industry, as examined in this study, is grounded in the Intelligence-Design-Choice (IDC) Model proposed by (Newell & Simon, 1972), as previously explained in Chapter 2, Section 2.9. This model consists of three main components: intelligence (identifying the problem), design (developing possible solutions), and choice (selecting the best solution), as illustrated in Figure 6.1.

The intelligence phase focuses on identifying and understanding the problem, in which the decision maker seeks indications that a problem exists and requires attention. This stage involves identifying and understanding the problem and its reasons and root causes. During this phase, the problem solver gathers relevant information and thoroughly analyses the situation to define the problem clearly (Uzonwanne, 2016; Wang & Chiew, 2010).

The design phase focuses on developing potential solutions to problems identified in the intelligence phase. This involves generating and exploring various alternatives or courses of action. This phase often requires creative thinking as well as leveraging past experiences and existing knowledge to formulate viable options. This phase is critical for expanding the range of possible solutions and ensuring robust decision making (Turpin & Marias, 2004; Uzonwanne, 2016).

The choice stage involved selecting the most appropriate solution from the alternatives generated in the design stage. This requires the evaluation of potential solutions against specific criteria or objectives to determine their suitability and effectiveness. The decision-making process concludes by selecting a solution for implementation (Lunenburg, 2010; Uzonwanne, 2016).

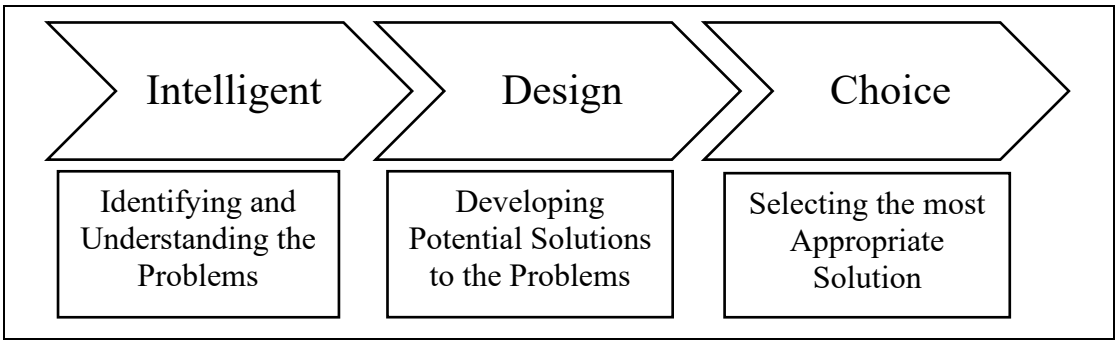


Figure 6.1 Intelligence-Design-Choice Model (IDC) (Newell & Simon, 1972)

Within the construction industry, this model can be effectively utilised to mitigate issues by anticipating potential challenges throughout the project lifecycle and formulating proactive solutions. The decision makers, such as project managers and contract managers, use analytical processes to make rational decisions. The selection of the IDC Model in this research is deemed an appropriate decision, particularly for addressing issues related to the closing of final accounts in construction projects. As noted by Wang & Chiew (2010), problem solving techniques are intricately connected to the decision making process, with many problems necessitating that individuals or groups make choices among various alternatives. Delen (2019) suggests that the components in the IDC model can be viewed as phases in the problem-solving process, with the 'choice' component representing the decision-making phase.

6.3 Developing the Framework for Improving the Final Account Closing in the Malaysian Construction Industry

A framework is a visual or written product that explains, either graphically or in narrative form, the main elements to be studied, i.e., key factors, concepts, or variables, and the presumed relationships among them (Miles & Huberman, 1994). The framework developed in this research serves as a comprehensive guide for identifying the significant problems encountered during the final account closing process in construction projects. If not addressed, these problems can lead to disputes among construction parties, thereby delaying final account closing. The framework also clarifies the underlying issues or root causes of these problems. Additionally, it suggests preventive solutions for stakeholders and decision-makers in the construction industry to address these problems proactively.

The framework is structured around three primary objectives, which are identifying the major problems associated with final account closing, analysing the root causes contributing to these problems, and developing preventive solutions or strategies to mitigate these challenges and their root causes, thereby enhancing the final account closing process in the Malaysian construction industry. Ultimately, a comprehensive framework was developed to address these objectives. To formulate a preventive solution framework for improving the final account closing process in the Malaysian construction industry, three main components were included: a) Major problems in final account closing issues, b) Root causes of these major problems, and c) Preventive solutions for these major problems. This research has specifically adapted the IDC model to fulfil its objectives, as its components align with these objectives in the following manner:

6.3.1 Intelligence Phase

This phase corresponds to the initial two research objectives, namely (1) to identify the primary issues related to final account closing in the Malaysian construction industry and (2) to investigate the root causes of these issues. In this phase, the process involves gathering information, analysing the situation, and clearly defining the problems.

6.3.2 Design Phase

This phase corresponds to the third research objective, namely (3) to identify strategies for preventing major problems and addressing their root causes to enhance the final account closing process in the Malaysian construction industry. During this stage, appropriate preventive solutions were developed for each major problem. This process involves generating and exploring various alternatives based on the major problems and root causes identified during the Intelligence Phase

6.3.3 Choice Phase

The choice phase also aligns with the third objective. This phase involves evaluating the preventive solutions developed in the Design Phase and selecting the

most appropriate solutions for each major problem, contributing to final account closing issues related to disputes and delays. Overall, the IDC model provides a valuable framework for addressing specific construction problems, particularly in preventing disputes and delays in the final account closing process within the construction industry. Figure 6.2 illustrates the application of the IDC model and the steps in developing the proposed framework to improve final account closing in the Malaysian construction industry.

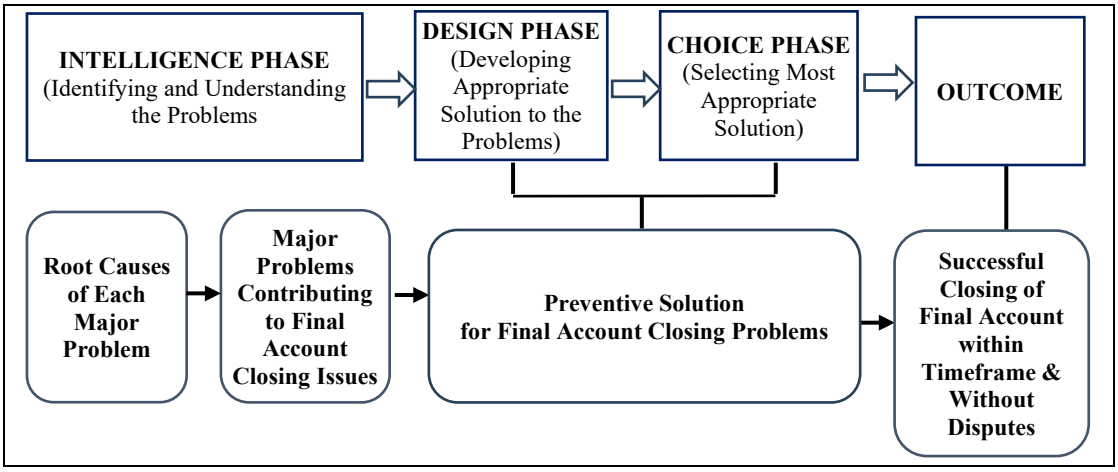


Figure 6.2 Steps in Developing Proposed Framework

6.4 Components of Major Problems in Final Account Closing Issues

Eight notable major problems during the final account closing process were identified in the quantitative survey analysis, as elaborated and presented in Chapter 4. Based on the IDC model, the identification of eight (8) major problems falls under the Intelligent Phase. These major problems include the following:

i. Delay Evaluation and Preparation of the Final Account
ii. Complexity of Claim and Valuation Process for Variation Works
iii. Delay Approval and Finalisation Variation Work
iv. Disagreement on the Valuation of Variation Works
v. Lack of Documents & Evidence for Submission Final Account Claim
vi. Delay Submission of Final Account Claim
vii. Disagreement on the Valuation of Final Account
viii. Cost Overrun due to Variation and Provisional Quantities

6.5 Components of Root Causes Contributing to Major Problems in Final Account Closing Issues

The root causes component in this framework was developed based on qualitative findings obtained through thematic analysis. According to the IDC model, the exploration of root causes also belongs to the Intelligence Phase, which emphasises understanding the underlying reasons for a problem. This understanding is crucial for developing preventive measures to mitigate the problems. Overall, there are ten (10) main themes for root causes were established, consisting of the following:

i. Documentation Issues
ii. Improper Variation Order
iii. Contract Ambiguity
iv. Incompetencies
v. Lack of Commitment
vi. Communication and Coordination Breakdown
vii. Non-Fulfilments of Contractual Requirements
viii. Organisational Bureaucracy
ix. Lack of Trust and Integrity
x. Inadequate Project Preparation

All ten (10) themes representing the root causes were derived from the major problems discussed in Chapter 4. A total of twenty-three (23) codes for root causes were established through thematic analysis as detailed in Chapter 5. These codes were subsequently grouped and aligned with the appropriate themes, with each theme potentially encompassing more than one (1) code, as organised in Figure 6.3. All identified codes and themes for root causes were found to contribute to the major problems associated with final account closing issues within the Malaysian construction industry.

It is important to highlight that the framework presented in this chapter is anchored in the two main EFA components identified in Chapter 4. The first component is the Evaluation Process, which encompasses seven major problems, and the second component is the Contractual Management component, which consists of one major problem. The ten root cause themes and nine preventive solution themes derived from the qualitative investigation in Chapter 5 were generated specifically in relation to these eight major problems, and therefore principally address the Evaluation Process and

Contractual Management EFA components. The framework developed in this chapter operationalises the EFA component structure at the specific individual major problems rather than at the broader component level, providing practitioners with targeted and actionable guidance.

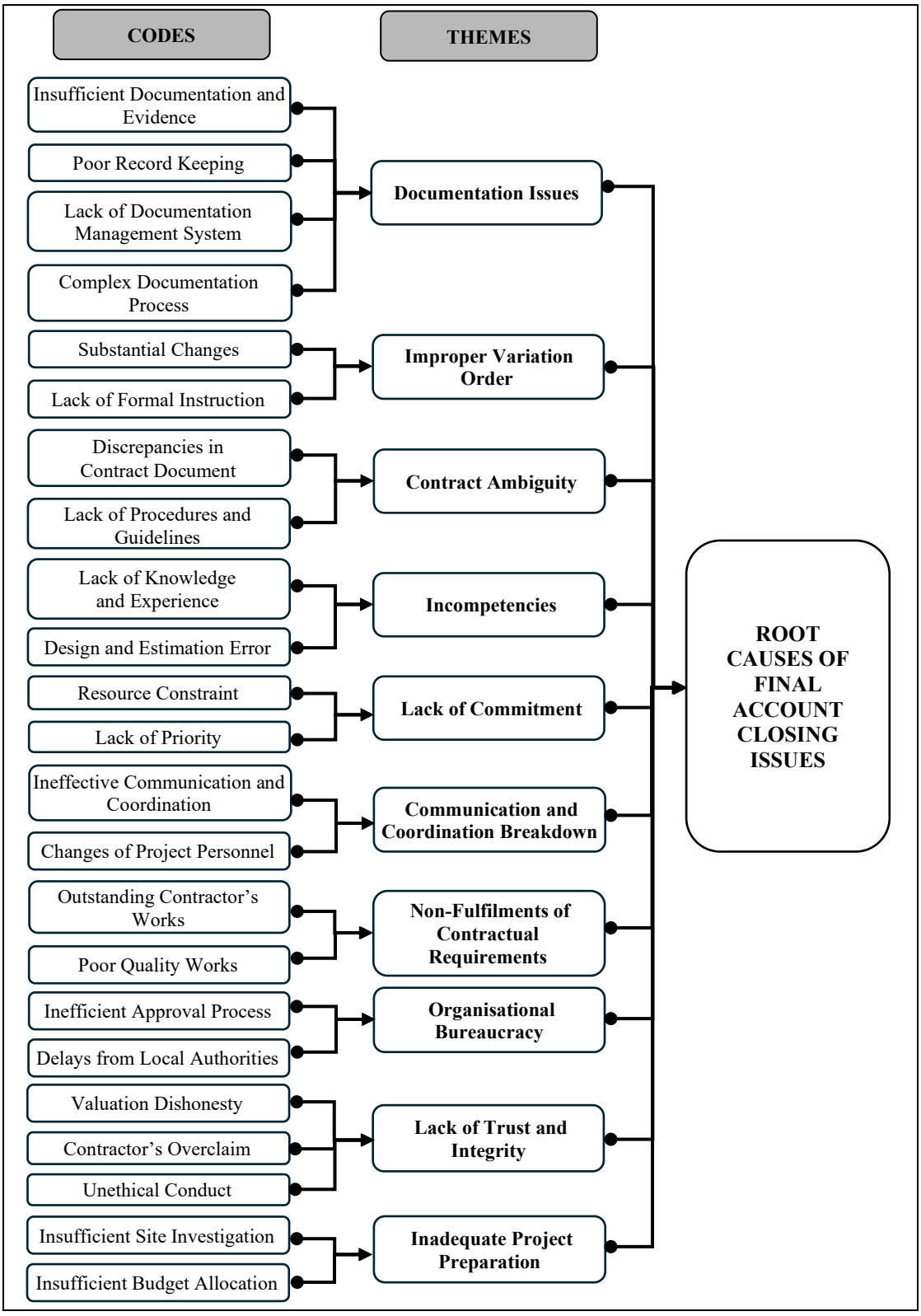


Figure 6.3 Root Causes Component Framework

6.5.1 The Relationship between Root Causes and Major Problems in the Final Account Closing Issues Framework

Figure 6.4 presents a comprehensive framework illustrating the relationships between root causes and major problems associated with final account closing issues. This framework effectively maps twelve (12) identified root causes to eight (8) major problems, which lead to final account closing issues. The root causes on the left side of the framework were identified via semi-structured interviews, as detailed in Chapter 5, while the major problems at the centre of the framework were systematically identified through a structured questionnaire survey described in Chapter 4. These identified root causes and major problems are linked by arrows of different colours to highlight their connections. Each major problem is visually connected to one or more root causes, emphasising the complexity of a particular major problem with several interdependent root causes within the final account management process.

The relationship between respective major problems and their several root causes was established during the interview sessions and the thematic analysis process, as presented in Table 6.2. Each major problem is caused by a distinct combination of root causes, with several recurring themes and codes of root causes appearing repeatedly across various major problems, thus confirming the internal coherence and depth of the framework. The recurring of specific root causes across various major problems highlights its significance in the final account closing issue. For example, the theme of *Documentation Issues* emerges as a significant root cause, associated with six (6) major problems, including, Major Problem 1 – Delay in valuation and preparation of final account, Major Problem 3 – Delay in approval and finalisation of variation work, Major Problem 4 – Disagreement between parties on valuation of variation works, Major Problem 5 – Lack of documentation for submission of final account claim, Major Problem 6 – Delay in submission of final account claim, and Major Problem 7 – Disagreement on valuation of final work done. This highlights the important role of documentation in facilitating and streamlining the final account closing process.

Overall, the framework in Figure 6.4 clarifies the relationships among several major problems related to final account closing and their root causes, and provides strategic steps to identify solutions to prevent these problems before they occur, which can lead to final account closing issues. By preventing these major problems,

stakeholders can more effectively mitigate final account closing issues and improve project closeout performance.

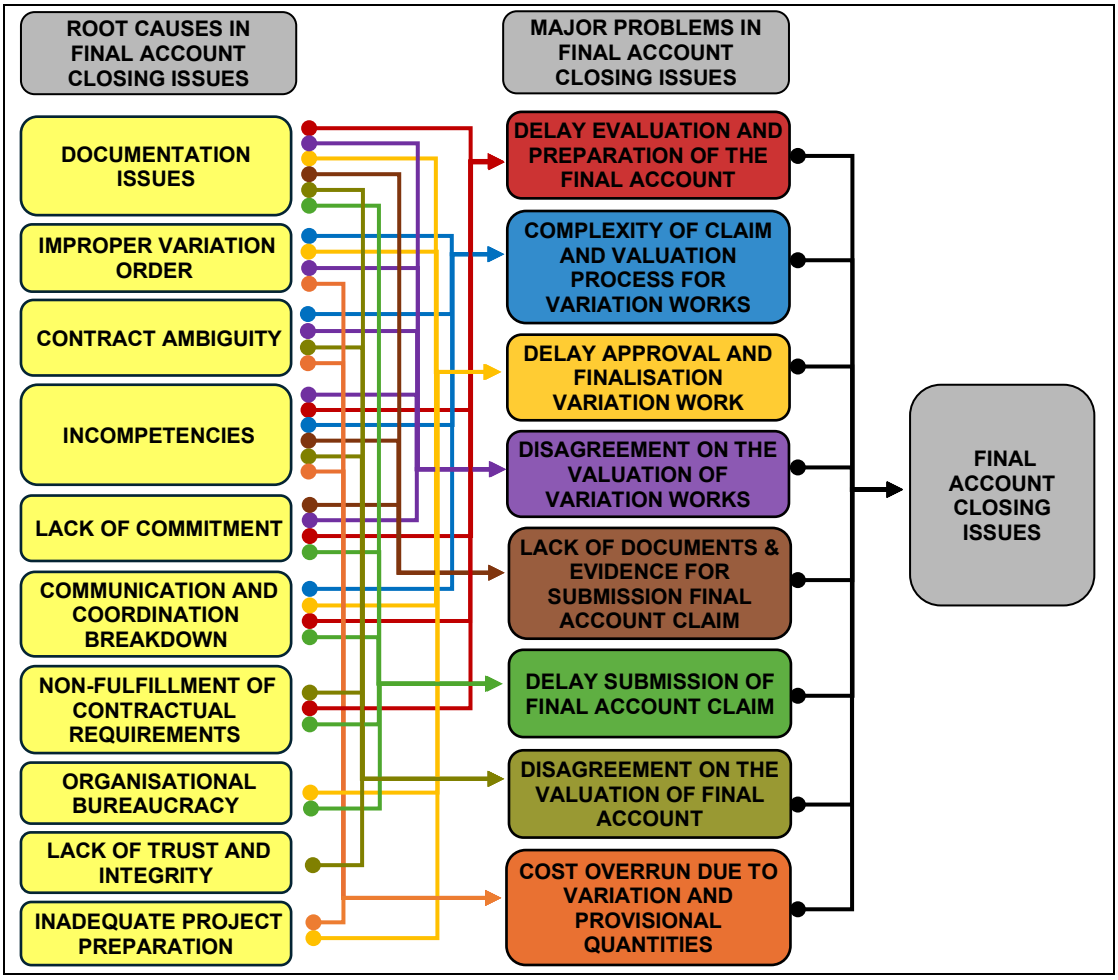


Figure 6.4 Relationship Between Root Causes and Major Problems in Final Account Closing Issues Framework

Table 6.1
Relationship of Major Problems and Root Causes in the Final Account Closing Issues

MAJOR PROBLEM	**ROOT CAUSES**		**INFORMANT**											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Delay in Evaluation and Preparation of The Final Account	Documentation Issues	Insufficient Documentation and Evidence	●	●	●			●			●		●	●
		Poor Record Keeping				●		●	●					
	Communication & Coordination Breakdown	Ineffective Communication and Coordination							●			●	●	●
		Changes in Project Personnel	●			●	●	●	●			●	●	●
	Lack of Commitment	Resource Constraint		●	●		●		●			●		●
		Lack of Priority			●	●	●	●	●	●				
	Incompetencies	Lack of knowledge and Experience						●	●	●				●
	Non-Fulfilment of Contractual Obligations	Outstanding Contractor's Works			●									

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
The Complexity of The Valuation and Claim Process for Variation Works	Contract Ambiguity	Discrepancies in Contract Documents		●	●		●		●					
		Lack of Procedures and Guidelines					●				●		●	
	Improper Variation Orders	Substantial Changes	●		●			●	●				●	●
		Lack of Formal Instruction				●	●	●		●	●	●		
The Complexity of The Valuation and Claim Process for Variation Works	Incompetencies	Lack of Knowledge and Experience	●				●		●		●			
		Design and Estimation Error												●
	Communication & Coordination Breakdown	Ineffective Communication and Coordination							●	●	●			
Delay In Approving and Finalising Variation Work	Documentation Issues	Insufficient Documentation and Evidence	●	●				●			●		●	●
		Changes in Project's Personnel	●					●						

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Disagreement Among Contracting Parties on The Valuation of Variation Works	Communication & Coordination Breakdown	Ineffective Communication and Coordination					●		●	●				
	Improper Variation Orders	Lack of Formal Instruction	●	●							●		●	●
	Organisational Bureaucracy	Inefficient Approval Process				●				●		●	●	●
		Delays from Local Authorities								●				●
	Inadequate Project Preparation	Insufficient Budget Allocation			●				●		●	●	●	●
	Documentation Issues	Insufficient Documentation and Evidence		●						●		●		
		Lack of Documentation Management Systems												●
	Contract Ambiguity	Discrepancies in Contract Documents		●	●		●		●		●			

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Lack of Documents for the Submission of the Final Account Claim		Lack of Procedures and Guidelines				●	●			●				
	Improper Variation Orders	Substantial Changes				●	●					●	●	●
		Lack of Formal Instruction						●			●		●	●
	Incompetencies	Lack of Knowledge and Experience	●			●	●		●					
	Lack of Trust and Integrity	Valuation Dishonesty				●		●						
		Contractor's Overclaim	●	●		●		●				●	●	
	Documentation Issues	Poor Record Keeping		●	●	●		●	●	●	●		●	●
		Lack of Documentation Management System									●	●		●
	Lack of Commitment	Resource Constraint			●		●	●						●
	Communication & Coordination Breakdown	Ineffective Communication and Coordination				●	●		●	●			●	●
		Changes in Project Personnel						●	●	●	●	●	●	

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
	Incompetencies	Lack of Knowledge and Experience				●		●	●		●			●
Delay In Submitting the Final Account Claim	Documentation Issues	Insufficient Documentation and Evidence	●	●	●	●		●						
		Lack of Documentation Management System						●	●	●		●	●	●
		Complex Documentation Process								●				
	Non-Fulfilment of Contractual Obligations	Outstanding Contractor's Works	●		●			●		●				●
	Communication & Coordination Breakdown	Ineffective Communication and Coordination				●			●	●			●	
		Changes in Project Personnel	●	●			●					●	●	
	Lack of Commitment	Lack of Priority	●		●	●	●	●		●	●	●	●	●
		Resource Constraint	●	●		●	●	●	●			●		

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Disagreement With the Valuation of the Final Work Done	Organisational Bureaucracy	Inefficient Approval Process				●				●		●	●	●
	Non-Fulfilment of Contractual Obligations	Outstanding Contractor's Works	●							●				
		Poor Quality of Works	●	●	●				●	●	●	●	●	
	Incompetencies	Lack of Knowledge and Experience	●			●	●		●		●			
		Design and Estimation Errors	●	●	●		●		●	●	●	●		●
	Contract Ambiguity	Discrepancies in Contract Document		●	●		●		●		●			
		Lack of Procedures and Guidelines			●	●	●				●		●	●
	Lack of Trust and Integrity	Contractor's Overclaim						●						
		Unethical Conduct								●		●		
	Documentation Issues	Insufficient Documentation and Evidence							●	●	●	●		

MAJOR PROBLEM	ROOT CAUSES		INFORMANT											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
		Poor Record Keeping						●						●
Cost Overrun Due To Variation and Provisional Quantities	Incompetencies	Design and Estimation Errors	●	●	●		●		●	●		●		●
		Lack of Knowledge and Experience					●		●					●
	Contract Ambiguity	Discrepancies in Contract Document		●	●		●		●		●			
	Improper Variation Orders	Substantial Changes	●	●		●								
		Lack of Formal Instruction				●		●						
	Inadequate Project Preparation	Insufficient Budget Allocation			●				●		●	●		●
		Insufficient Site Investigation	●	●		●			●	●	●	●	●	

6.6 Components of Preventive Solution to Mitigate Major Problems and Root Causes in Final Account Closing Issues

The components of the preventive solution for the development of the framework in this study were established from the qualitative data and thematic analysis findings, as explained in Chapter 5. All the codes for the preventive solution have been categorised under their respective themes. Overall, there are nine (9) major themes for preventive solutions were established, consisting of the following:

i. Contractual Compliance
ii. Comprehensive Contract Provisions & Procedures
iii. Proper Documentation Management
iv. Information Technology Adoption
v. Collaborative Work Approach
vi. Effective Resource Management
vii. Provide Competent Personnel
viii. Timely Processing
ix. Appropriate Estimation, Design and Planning

All nine (9) themes of preventive solutions were produced to provide strategies in mitigating and preventing the major problems and root causes in the final account closing issue. Table 6.3 presents the themes and codes related to preventive solutions components that were analysed and identified from the semi-structured interviews. There are a total of twenty-four (24) preventive solution codes established, which were grouped and assigned to appropriate themes. Figure 6.5 visually maps the relationship between codes and themes for a preventive solution that will be integrated into the framework. It illustrates how the specific codes were grouped into the nine main themes. For instance, the codes Adherence to Contract Provisions, Quality Control, and Cost Control are grouped under the theme Contractual Compliance. The framework provides a comprehensive approach to mitigating delays and disputes in final account closing through nine interconnected themes. Its structure effectively demonstrates how specific operational practices (codes) cluster into strategic areas (themes) that collectively form a preventive solution. All these themes and codes of preventive solutions collectively contribute to the primary objective of mitigating major problems and root causes in final account closing.

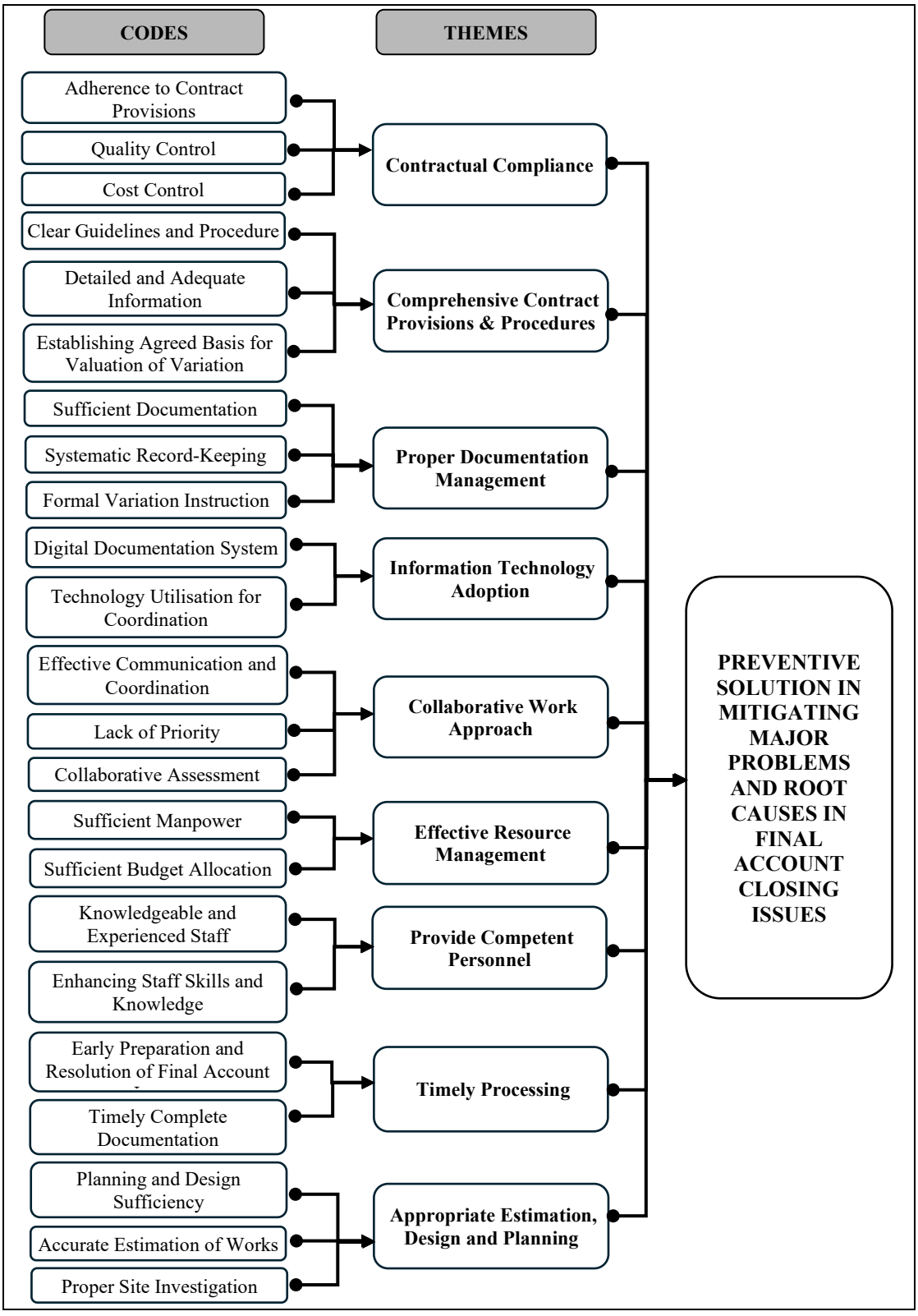


Figure 6.5 Preventive Solution Component Framework

6.6.1 The Relationship between Major Problems and Preventive Solution in the Framework

Figure 6.6 presents a systematic framework for mitigating the major problems encountered during the final account closing phase of construction projects. It visually links the major problems on the left-hand side to a corresponding set of targeted preventive solutions on the right-hand side. All the preventive solutions identified from the semi-structured interviews aim to provide strategies to mitigate major problems that cause issues during final account closing. This problem and solution structure also provides a practical roadmap for improving the final account closing process in the Malaysian construction industry. The arrows of different colours serve as the link within this framework, connecting specific problems to one or more relevant preventive solutions. The connection between a major problem and a preventive solution is not always one-to-one, where one major problem may be addressed by multiple preventive solutions working together. Likewise, one preventive solution, such as *Proper Documentation Management,* can help resolve several different major problems.

Table 6.4 presents the relationship between each major problem and its related preventive solutions, which were carefully gathered during interviews with twelve (12) experienced construction professionals involved in final account closing management for construction projects. Table 6.4 also visually maps the themes and codes of preventive solutions that relate to each major problem and shows how much agreement there is among the informants. The most recurrent solutions include *Comprehensive Contract Provisions & Procedures* and *Proper Documentation Management*, which collectively address problems such as delays in evaluation and preparation, lack of documents and evidence, and disagreements in the valuation of the final account. These solutions also directly address root causes such as documentation issues, improper variation orders, and contract ambiguities, thereby facilitating the proactive measures required for a seamless final account closing. By proactively addressing major problems through preventive strategies based on the practical experience of construction professionals, this framework offers a valuable roadmap for achieving a smoother, more efficient, and less conflict in the final account closing process in construction projects. This directly aligns with the overall aim of improving final account closing management in construction projects.

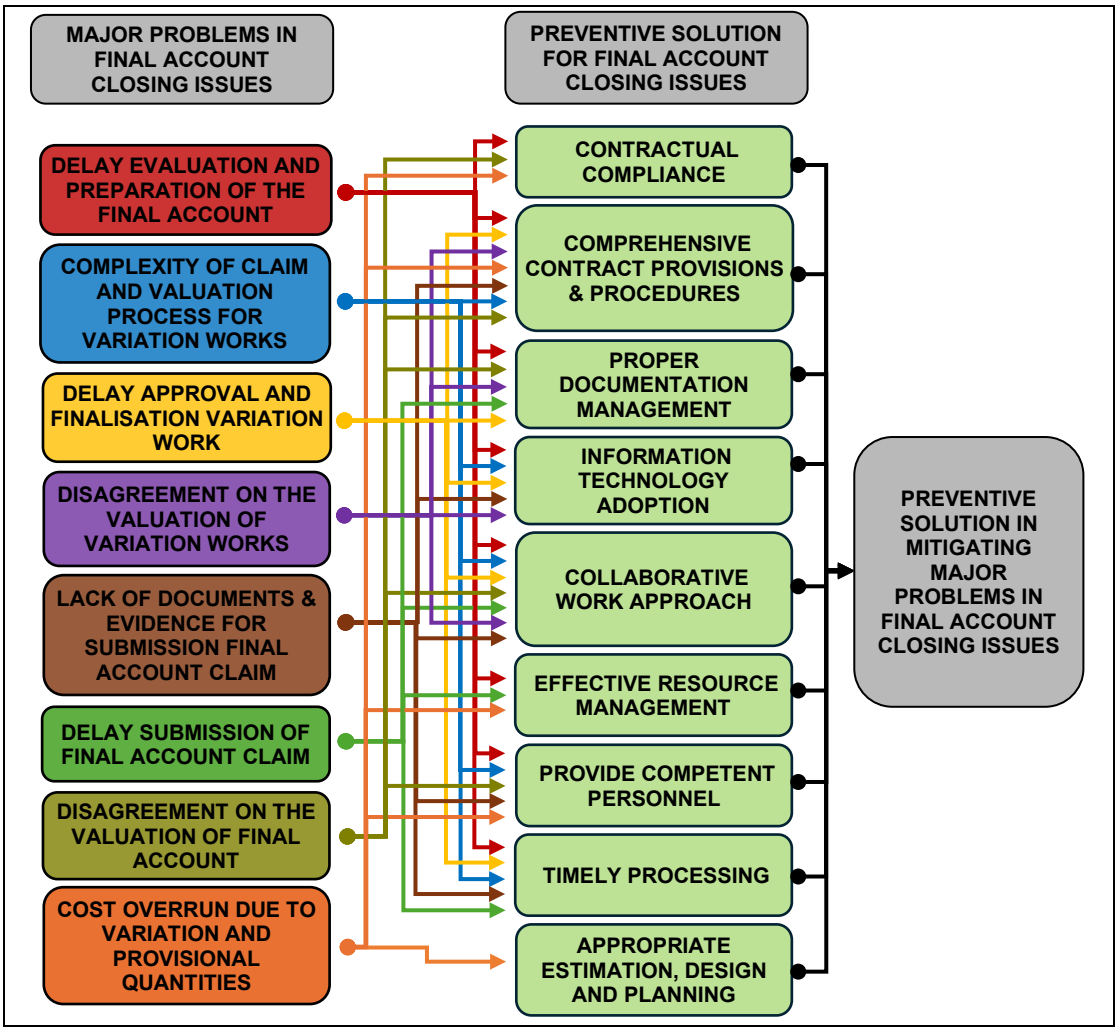


Figure 6.6 Relationship Between Major Problems and Preventive Solution in Final Account Closing Issues

Table 6.2
Relationship of Major Problems and Preventive Solution in the Final Account Closing Issues

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Delay In Evaluation and Preparation of The Final Account	Contractual Compliance	Adherence to Contractual Procedures	●		●			●		●		●		
	Comprehensive Contract Provision and Procedures	Clear Guidelines and Procedure				●				●			●	
	Proper Documentation Management	Sufficient Documentation	●	●			●	●				●		
		Formal Variation Instruction	●											
		Systematic Record-Keeping				●								●
	Information Technology Adoption	Digital Documentation System				●		●	●				●	
	Collaborative Work Approach	Effective Communication and Coordination	●				●			●	●	●	●	●
	Effective Resource Management	Sufficient Manpower	●	●			●			●	●	●		●
	Provide Competent Personnel	Knowledgeable and Experienced Staff			●		●						●	

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
		Enhancing Staff Skills and Knowledge				●		●	●					●
	Timely Processing	Early Preparation and Resolution of Final Account Issues					●		●	●				
The Complexity of the Valuation and Claim Process for Variation Works	Collaborative Work Approach	Effective Communication and Coordination	●		●		●	●	●	●			●	●
		Collaborative Assessment				●		●	●			●		
	Appropriate Estimation, Design and Planning	Planning and Design Sufficiency	●		●		●							●
	Information Technology Adoption	Technology Utilisation for Coordination			●							●	●	
	Provide Competent Personnel	Knowledgeable and Experienced Staff			●							●	●	
		Enhancing Staff Skills and Knowledge								●		●		●
	Comprehensive Contract Provision and Procedures	Detailed and Adequate Information						●		●	●	●	●	

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
		Clear Guidelines and Procedure						●			●			●
		Establishing Agreed Basis for Valuation of Variation					●		●	●				
Delay In Approving and Finalising Variation Work	Timely Processing	Early Preparation and Resolution of Final Account Issues	●	●		●	●		●	●	●	●		
		Timely Complete Documentation				●								
	Proper Documentation Management	Sufficient Documentation	●		●				●	●		●		●
		Formal Variation Instruction						●	●		●			
	Comprehensive Contract Provision and Procedures	Detailed and Adequate Information		●	●		●		●		●			
		Clear Guidelines and Procedure				●	●				●		●	●
	Collaborative Work Approach	Effective Communication and Coordination		●			●	●		●	●	●	●	

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
		Collaborative Assessment						●	●					
		Flexibility Process								●		●		●
	Information Technology Adoption	Technology Utilisation for Coordination											●	
Disagreement Among Contracting Parties on the Valuation of Variation Works	Comprehensive Contract Provision and Procedures	Clear Guidelines and Procedure					●		●			●		●
		Establishing Agreed Basis for Valuation of Variation			●					●				●
		Detailed and Adequate Information			●			●			●			
	Proper Documentation Management	Sufficient Documentation		●	●	●		●	●	●		●		●
		Formal Variation Instruction		●										
	Collaborative Work Approach	Collaborative Assessment				●		●	●	●		●		
		Effective Communication and Coordination				●	●					●	●	
	Information Technology Adoption	Technology Utilisation for Coordination			●					●			●	

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
Lack of Documents for The Submission of The Final Account Claim	Comprehensive Contract Provision and Procedures	Clear Guidelines and Procedure	●		●		●		●	●	●	●	●	●
	Information Technology Adoption	Digital Documentation System	●	●	●	●	●	●	●	●	●	●	●	●
	Proper Documentation Management	Systematic Record-Keeping		●		●		●	●	●		●		●
	Provide Competent Personnel	Enhancing Staff Skills and Knowledge		●		●	●			●	●	●	●	
		Knowledgeable and Experienced Staff												●
	Timely Processing	Regular Updates and Follow-Up	●	●	●	●	●	●	●	●	●			
	Collaborative Work Approach	Effective Communication and Coordination				●	●		●	●			●	●
Delay In Submitting the Final Account Claim	Timely Processing	Regular Updates and Follow-Up	●	●	●	●	●	●	●	●	●			
		Early Preparation and Resolution of Final Account Issues			●	●	●				●	●		

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
		Timely Complete Documentation			●				●					●
	Proper Documentation Management	Systematic Record-Keeping	●			●		●	●	●		●		
	Effective Resource Management	Sufficient Manpower			●		●				●	●		●
	Collaborative Work Approach	Effective Communication and Coordination						●		●	●			●
		Flexibility Process												●
Disagreement With the Valuation of The Final Work Done	Collaborative Work Approach	Collaborative Assessment		●		●		●	●	●	●	●	●	
		Effective Communication and Coordination	●	●	●	●	●	●	●	●		●	●	
	Provide Competent Personnel	Knowledgeable and Experienced Staff			●			●						●
	Proper Documentation Management	Systematic Record-Keeping		●		●		●	●	●		●		●
	Comprehensive Contract Provision and Procedures	Clear Guidelines and Procedure	●		●	●	●	●	●	●		●	●	●

MAJOR FACTOR	PREVENTIVE SOLUTION		INFORMANTS											
	THEME	CODE	CS1	CS2	CR3	CR4	CL5	CL6	CR7	CS8	CS9	CR10	CL11	CL12
	Contractual Compliance	Quality Control			●								●	
Cost Overrun Due to Variation and Provisional Quantities	Appropriate Estimation, Design and Planning	Proper Site Investigation	●	●		●	●		●	●	●	●	●	●
		Planning and Design Sufficiency	●	●	●				●	●				
		Accurate Estimation of Works	●					●				●	●	
	Effective Resource Management	Sufficient Budget Allocation	●			●	●	●		●	●	●	●	
	Contractual Compliance	Cost Control	●			●		●						
Cost Overrun Due to Variation and Provisional Quantities	Provide Competent Personnel	Knowledgeable and Experienced Staff			●				●				●	●
		Enhancing Staff Skills and Knowledge		●					●					
	Comprehensive Contract Provision and Procedures	Detailed and Adequate Information		●	●		●	●	●	●	●	●	●	
		Clear Guidelines and Procedure					●		●					●

6.7 Development of Preventive Solution Framework for Improving Final Account Closing in the Malaysian Construction Industry

Figures 6.7 through 6.14 below illustrate all the components included in the development of the Preventive Solution Framework for Improving Final Account Closing, as shown in Figure 6.15. The three components, which are root causes, major problems, and preventive solutions, are interconnected and represented with distinct coloured arrows corresponding to the specific major problems.

The following section (6.7.1 to 6.7.8) will clarify the relationships among the major problems identified from the quantitative findings in Chapter 4, as well as the root causes and preventive solutions derived from the qualitative findings in Chapter 5. The relationship among the major problems, root causes, and preventative solutions was established through qualitative findings obtained from semi-structured interviews with experts and professionals in the construction field. During the interviews, informants were queried about specific major problems, encouraged to share their views on the underlying root causes for the major problem, and asked to provide insights on potential strategies for proactively preventing the major problems and its root causes, thus improving the final account closing process in construction projects.

6.7.1 Root Causes and Preventive Solution for Delay in Evaluation and Preparation of The Final Account

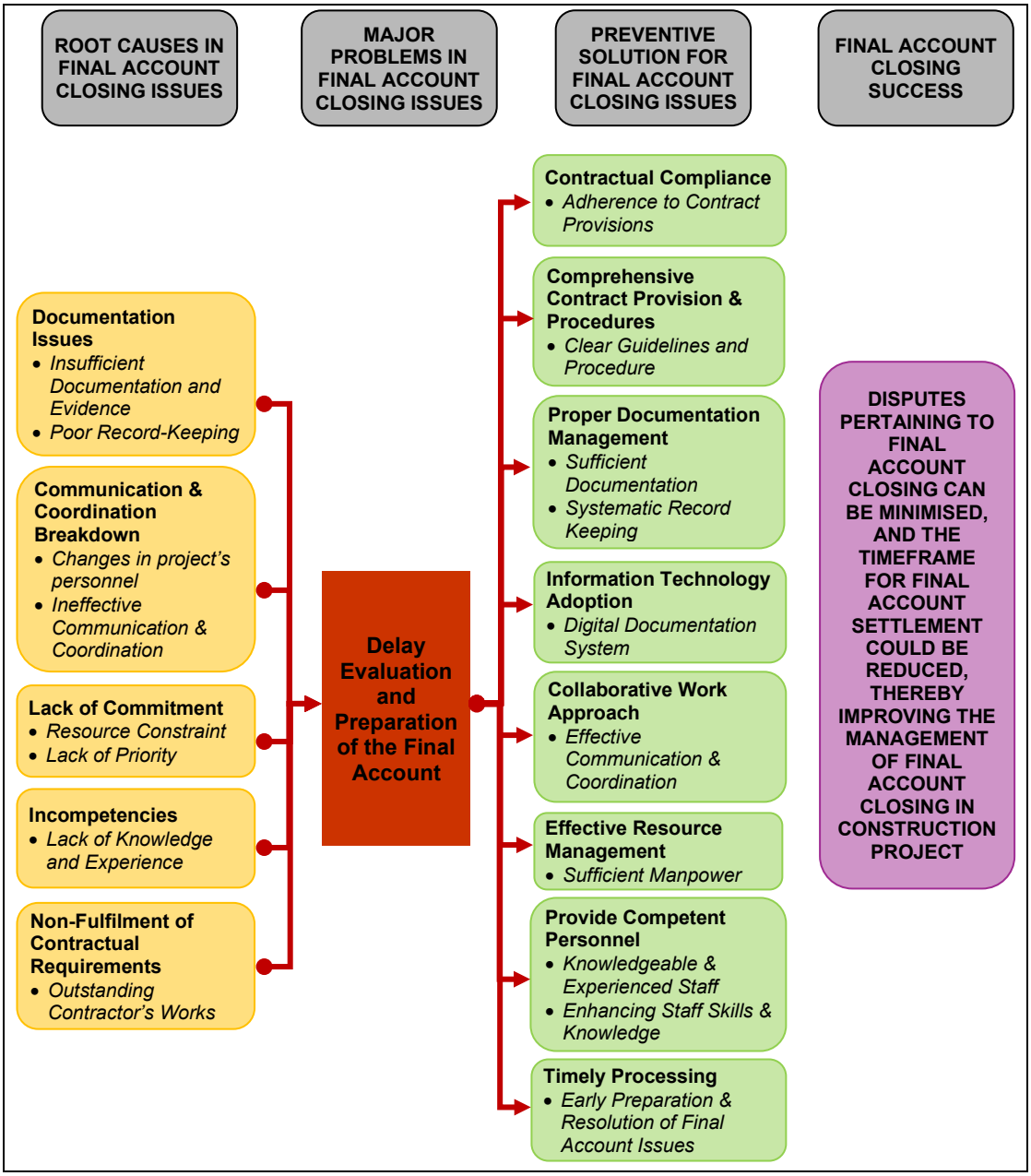


Figure 6.7 Root Causes and Preventive Solution for Delay in Evaluation and Preparation of The Final Account

The diagram illustrated in Figure 6.7 highlights a significant problem, namely, the **Delay in the Evaluation and Preparation of the Final Account**. Its various root causes are positioned on the left side of the diagram, with corresponding preventive solutions on the right side. This problem represents a critical concern in the final account

closing process within the Malaysian construction industry, as detailed in Chapter 4, Section 4.4.4.1.

The perspectives gathered from clients, contractors, and consultants confirm that this problem significantly contributes to disputes during the final account closing phase in construction projects. Delays in evaluating and preparing the final account occur when contract administrators (Architects) and consultants (Quantity Surveyors) take longer than the stipulated contractual timeframe to complete these tasks (Hisham & Othman, 2021; Romli, 2015; Ssegawa et al., 2020; Zakaria et al., 2022). Such delays can result in late final payments, disrupting contractors' cash flow and potentially impairing their ability to meet financial obligations or undertake new projects (Romli, 2015; Ye & Rahman, 2010). One reason is that the personnel responsible for the final account may no longer be in service, may have been transferred, or may have retired (Ramli, 2021; Zakaria et al., 2013a). New personnel may require time to familiarise themselves with the project requirements and may have different approaches, leading to inconsistencies and further delays. Additionally, insufficient time allocated for the evaluation of all final works is another factor causing delays in the submission and preparation of the final account (Ye & Rahman, 2010).

The left side of Figure 6.7 outlines the root causes contributing to these delays, identified through thematic analysis in Chapter 5. ***Documentation Issues*** were identified as one of the root causes contributing to this problem, particularly due to insufficient documentation and evidence of the contractor's submission. Most informants (CS1, CS2, CR3, CL6, CS9, CL11, and CL12) as can be seen in Table 6.1 expressed that *Insufficient Documentation and Evidence* from the contractor, such as variation works not properly approved or signed by the client and inadequate supporting evidence, often delay the consultant's evaluation and certification process (refer to Chapter 5, Section 5.3.3.1a). *Poor record-keeping* practices further exacerbate documentation issues. Informants CR4, CL6, and CR7 highlighted that the lack of proper record-keeping often results from poor coordination between site and office staff (refer to Chapter 5, Section 5.3.3.1b). Deficiencies in record management create additional barriers to efficient final account preparation, as contractors struggle to compile and submit the necessary information for final account claims.

Another root cause identified is the ***Communication and Coordination Breakdown***. *Changes in the Project's Personnel* disrupt continuity during the final account closing process. From the interview, all informants, except CR3, reported

communication and coordination breakdowns due to staff turnover (refer to Chapter 5, Section 5.3.3.6b). Furthermore, the majority of informants (CS1, CR4, CL5, CL6, CR7, CR10, CL11 and CL12) highlighted that *Ineffective Communication and Coordination* among parties, especially after project completion, often result in misunderstandings regarding project requirements, thereby delaying final account preparation (refer to chapter 5, Section 5.3.3.6a).

The thematic analysis also reveals that a ***Lack of Commitment*** is the root cause of the delay in the evaluation and preparation of the final account. This lack of commitment arises from *Resource Constraints* and a *Lack of Priority* to settle the final account promptly. From the interview, it was observed that both consultants and contractors are overwhelmed with multiple ongoing projects, which leads to the final account process receiving less attention. Multiple informants (CS2, CR3, CL5, CR7, CR10, and CL12) highlighted the issue of *Resource Constraints,* where a lack of dedicated personnel to manage paperwork, documentation, and valuation often leads to delays in the settlement of the final account process (refer to Chapter 5, Section 5.3.3.5a). The reason for the lack of commitment is also attributable to the *Lack of Priority* by the project team in settling the final account promptly. This has been explained by informant CR7, who stated that: *"The contractor may view the final account as a low priority, especially if the project has already been completed and the contractor has shifted focus to other ongoing projects"* (refer to Chapter 5, Section 5.3.3.5b). This lack of priority for final account work, particularly when stakeholders are focused on new or ongoing projects, creates additional barriers to the timely completion of the final account.

Incompetencies among project personnel further contribute to the delay in evaluating and preparing the final account. In some cases, the staff do not have the necessary procedural knowledge or understanding of the final account process. Several informants (CL6, CR7, CS8, CL12) highlighted that *Lack* of *Knowledge and Experience* among the consultants' and contractors' staff can cause delays and errors in final account preparation (refer to Chapter 5, Section 5.3.3.4a). This competency deficiency leads to inefficiencies and errors, which in turn prolong the evaluation and preparation process.

Additionally, ***Non-Fulfilment of Contractual Obligations***, specifically *Outstanding Contractor's Works,* also contributes to the delay in evaluation and preparation of the final account, particularly when the certificate of practical completion

is issued prematurely. However, the contractor's outstanding work remains unresolved. Informant CR3 stated that: *"The contractor may be reluctant to submit the final account claim until everything is completed, fearing that it could lead to deductions or rejections."* (refer to Chapter 5, Section 5.3.3.7a).

To mitigate these challenges, the framework proposes a number of preventive solutions (positioned on the right side of the framework) based on the thematic analysis that corresponds to the identified major problem and its root causes. ***Contractual Compliance***, particularly *Adherence to Contract Requirements*, highlights the importance of complying with contract terms and conditions. The Contract Administrator should ensure that all outstanding work is completed before issuing the Certificate of Practical Completion (CPC). As highlighted by CR3, who stated that: *"The Architect should ensure that the CPC is not prematurely issued before all outstanding work is completed. This is because sometimes the CPC is issued even though the outstanding work is not finished, as the contractor wants to avoid being penalised by the client for the delay."* (refer to Chapter 5, Section 5.4.3.1a).

The next solution to this major problem is ***Comprehensive Contract Provisions and Procedures***, specifically providing *Clear Guidelines and Procedures*, which are essential. Most informants, except for CR3, emphasised the importance of documentation requirements or checklists for submitting and preparing the final account and ensuring all stakeholders are informed (refer to Chapter 5, Section 5.4.3.2a). By understanding and following these procedures, disputes can be minimised, and the final account can be settled promptly.

Furthermore, ***Proper Documentation Management*** by ensuring *Sufficient Documentation* is important. Multiple informants (CS1, CS2, CL5, CL6, CR10) stressed the importance of sufficient documentation, especially for variation work (refer to Chapter 5, Section 5.4.3.3a). Systematic *Record Keeping* practices further enhance documentation management. Informants CR4 and CL12 emphasised the importance of proper and consistent record keeping from the project's beginning in order to prevent the delay in evaluation and preparation of the final account

Leveraging **Information Technology Adoption** through *Digital Documentation Systems* offers another solution to prevent delays in the evaluation and preparation of the final account, as emphasised by several informants (CR4, CL5, CR7, CL11), as can be seen in Table 6.1.

A ***Collaborative Work Approach***, characterised by *Effective Communication and Coordination*, is also crucial to foster an environment of shared understanding and mutual accountability that enables more efficient final accounting processing. The analysis of the interview data (Table 6.1) revealed that the many informants (CS1, CL5, CS8, CS9, CR10, CL11, CL12) emphasised the importance of clear communication and coordination between stakeholders throughout the project, to promptly address any issues and prevent delays in evaluation and preparation of the final account.

Effective Resource Management, by allocating *Sufficient Manpower* for final account tasks, will help to address the delay. Multiple informants (CS1, CS2, CL5, CS8, CS9, CR10, CL12) stressed the importance of consultants and contractors providing adequate and competent staff throughout the project to manage the final account efficiently (refer to Chapter 5, Section 5.4.3.6a).

Provide Competent Personnel by assigning *Knowledgeable and Experienced Staff* is also important. Informants CR3, CL5, and CL11 emphasised the need for a competent project team with the necessary skills and expertise to accurately estimate and evaluate project costs and manage projects effectively, thus preventing delays in closing the final account (refer to Chapter 5, Section 5.4.3.7a). Furthermore, *Enhancing Staff Skills and Knowledge* through training can prevent errors and delays associated with final account processing. Informants CR4, CL6, CR7, and CL12 further emphasised the importance of organisations offering training to their staff, particularly those in key roles, to ensure they possess the necessary knowledge and skills to manage the final account process effectively (refer to Chapter 5, Section 5.4.3.7b).

Finally, the framework identifies **Timely Processing** as another preventive solution to address delays in the evaluation and preparation of the final account. Informants CL5, CR7 and CS8 highlighted the importance of *Early Preparation and Resolution of Final Account Issues* during construction, rather than waiting until overall work is complete. Identifying and addressing any problems earlier, such as conducting regular meetings to discuss and resolve outstanding matters promptly, helps mitigate issues and disputes at the final account closing stage (refer to Chapter 5, Section 5.4.3.8a).

In conclusion, the major problem of **Delay in Evaluation and Preparation of the Final Account** arises from documentation issues, communication breakdowns, lack of commitment, competencies, and non-fulfilment of contractual requirements. This framework also advocates for preventive solutions to such major problems,

emphasising contractual compliance, clear procedures, meticulous documentation, technological adoption, collaboration, resource management, competent personnel, and timely processing.

6.7.2 Root Causes and Preventive Solutions for the Complexity of the Valuation and Claim Process for Variation Works

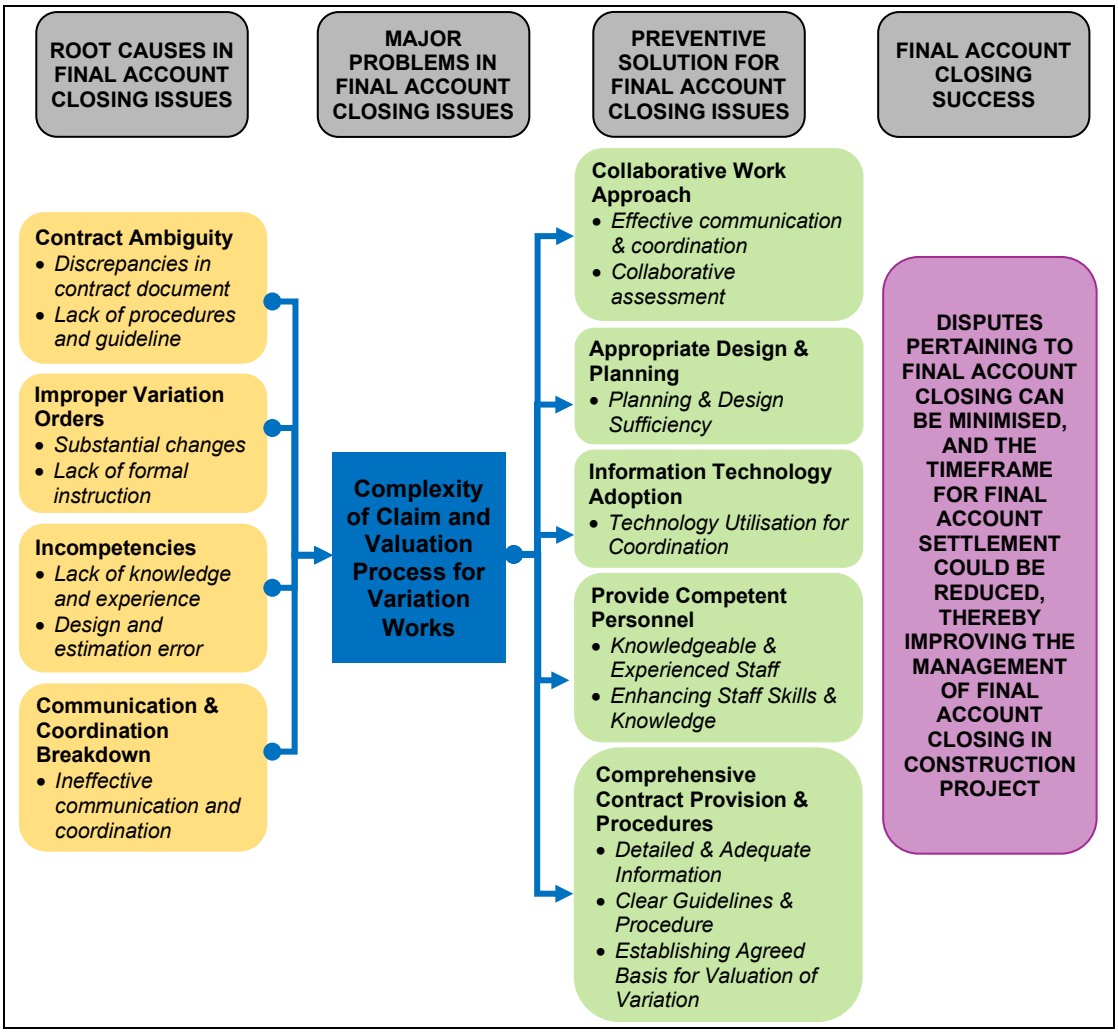


Figure 6.8 Root Causes and Preventive Solution for Complexity of the Valuation and Claim Process for Variation Works

Figure 6.8 above illustrates another major problem in final account closing, namely, the **Complexity of the Claim Valuation Process for Variation Works**. Variations are often unavoidable in construction projects and introduce significant challenges due to the subjective nature of their valuations and the complexity of contractual provisions that govern them (Baloi & Price, 2003; Zakaria et al., 2012). This subjectivity and complexity frequently lead to disputes between contractors and clients,

particularly when assessing variation claims (Othman et al., 2023; Ramli, 2021). While contracts typically include variation clauses, these provisions sometimes prove inadequate in governing variation works that fall outside the original contract scope (Ilmi & Yip, 2014). Although Bills of Quantities (BQ) are commonly used as a reference for valuation of variation works, they may not always provide an accurate basis due to the different nature of works and quantities involved (Ramli, 2021). This discrepancy often results in conflicts between contractors' claims and quantity surveyors' assessments, further complicating the variation management process (Love et al., 2011). This can lead contractors to pursue compensation through quantum meruit or fair valuation, which increases the potential for conflict. Insufficient information and details about variation work and a lack of transparent communication during the assessment further complicated the claim and valuation process in the final account (Odeyinka et al., 2011). These complexities in variation claims and assessment processes significantly contribute to disputes and delay the final account closing process in the Malaysian construction industry.

The thematic analysis in Chapter 5 of this research identified the root causes contributing to the complexity of the valuation and claim process, as located on the left side of Figure 6.8 above. One significant root cause is ***Contract Ambiguity***, which manifests from *Discrepancies in Contract Documents*. As pointed out by the informants (CS2, CR3, CL5, CR7), incomplete or inconsistent contract documents, such as drawings and the BQ, often create discrepancies between planned and actual work on site (refer to Chapter 5, Section 5.3.3.3a). Furthermore, the *Lack of Procedures and guidelines* further contributes to the issue of contract ambiguity. Informants CL5, CS9, and CL11 stated that unclear contract terms and details regarding the valuation procedures create complexity in the claim and valuation process (refer to Chapter 5, Section 5.3.3.3b). The absence of clear processes for valuing, approving, and documenting variation claims creates ambiguity for the contracting parties.

Another root cause of this major problem is ***Improper Variation Orders***, characterised by *Substantial Changes* to the original project scope. Multiple informants (CS1, CS3, CL6, CR7, CL11, and CL12) explained that complexity in claims and valuation of variation works arises when changes involve large quantities, new items, and new designs that were not anticipated during the design stage (refer to Chapter 5, Section 5.3.3.2a). Additionally, the *Lack of Formal Instruction* introduces another complexity in variation works. Several informants (CR4, CL5, CL6, CS8, CS9 and

CR10) mentioned that the variation order is often issued without providing accurate cost estimates or detailed specifications, leaving the scope of the variation work unclear (refer to Chapter 5, Section 5.3.3.2b).

Incompetencies among the project team due to a *Lack of Knowledge and Experience* also contribute to the complexity of claim and valuation for variation works. As highlighted by several informants (CS1, CL5, CR7, CS9), insufficient knowledge and understanding of the technical aspects of construction work complicate the evaluation and approval of variation claims, leading to disputes between the contractor and the client (refer to Chapter 5, Section 5.3.3.4a). Furthermore, *Design and Estimation Errors* during the pre-construction stage further complicate the valuation of variation work. Informant CL12 shared that errors in design and estimation often happen because the design teams don't have enough information or fully understand the project's complexity. This can lead to frequent changes in the design process (refer to Chapter 5, Section 5.3.3.4b).

Finally, ***Communication and Coordination Breakdown*** also contribute to the complexity of variation valuations. *Ineffective Communication and Coordination* among the contractor, consultant, and client often lead to disagreements. Informants CR7, CS8 and CS9 highlighted that poor communication and coordination among parties often result in misunderstandings regarding project requirements, which lead to disagreements on the scope and variation works, thereby contributing to the complexity and valuation of variation works (refer to Chapter 5, Section 5.3.3.6a).

The right side of Figure 6.8 above presents a series of preventive solutions to mitigate the complexity of the valuation and claim for variation works. A ***Collaborative Work Approach*** emerged as one significant preventive solution to mitigate the complexity of claims and valuation of variation works. Majority of informants (CS1, CR3, CL5, CL6, CR7, CS8, CL11, CL12) emphasises *Effective Communication and Coordination* to avoid conflicts and ensure mutual agreement on valuation. Informant CL6 specifically mentioned that: *"The contractor should inform the client if the VO work exceeds the approved budget before proceeding with the works"* (refer to Chapter 5, Section 5.4.3.5a). Furthermore, *Collaborative Assessment* involving joint evaluations and inspections, as highlighted by several informants (CR4, CL6, CR7, CR10), helps in achieving consensus on the scope of work and quantity to mitigate the complexity in valuing variation works (refer to Chapter 5, Section 5.4.3.5c).

Appropriate Estimation Design and Planning emerge as another key to mitigate the complexity of variation valuation in construction projects. Several informants (CS1, CR3, CL5, CL12) emphasised that *Planning and Design Sufficiency* during the design stage is important to prevent cost escalation due to variation in work.

The ***Information Technology Adoption*** offers another preventive solution to address the complexity of variation work valuation, specifically through technology utilisation to enhance coordination. Informant CR3 emphasised the importance of modern measurement technologies in reducing the time and complexity of the valuation process (refer to Chapter 5, section 5.4.3.4b).

Another informant highlights the necessity of ***Providing Competent Personnel*** by *Enhancing Staff Skills and Knowledge* through training, which leads to more accurate assessments. Informants CS8, CR10 and CL12 emphasised the importance of organisations offering training to their staff, particularly those in key roles, to ensure they possess the necessary knowledge and skills to manage the final account process effectively (refer to Chapter 5, Section 5.4.3.7b). Additionally, informants CR3, CR10 and CL11 highlighted the importance of involving *Knowledgeable and Experienced Staff* in all phases of the construction process to ensure continuity and reduce discrepancies in documentation and evaluation of the final account (refer to Chapter 5, Section 5.4.3.7a).

Finally, ***Comprehensive Contract Provisions and Procedures*** are essential in mitigating the complexity of valuation for variation works. Several informants (CL6, CS8, CS9, CR10, CL11) highlighted the critical importance of *Detailed and Adequate Information* for variation orders to ensure that the contractor fully understands scope and associated costs of the works (refer to Chapter 5, Section 5.4.3.20. When parties have a clear understanding of the scope and cost of the work, the occurrence of valuation disagreements can be avoided. Moreover, informants such as CL6, CS9, and CL12 emphasised the need for *Clear Guidelines and Procedures*, particularly regarding variation work, to mitigate misinterpretations and reduce conflicts during assessment processes (refer to Chapter 5, Section 5.4.3.2a). Furthermore, *Establishing Agreed Basis for Valuation of Variation* works minimises confusion and prevents disputes. Several informants (CL5, CR7, CS8) emphasised the importance of reaching an early agreement on valuation criteria and procedures, thereby fostering transparency and procedural integrity (refer to Chapter 5, Section 5.4.3.2c).

In conclusion, the **Complexity of the Valuation and Claim Process for Variation Works** arise from contract ambiguities, improper variation orders, competency issues, and communication breakdowns. The framework also presents a preventive solution, encompassing collaborative work approaches, proper documentation management, appropriate estimation design and planning, IT adoption, competent personnel, and comprehensive contractual provisions.

6.7.3 Root Causes and Preventive Solution for Delay Approving and Finalising Variation Work

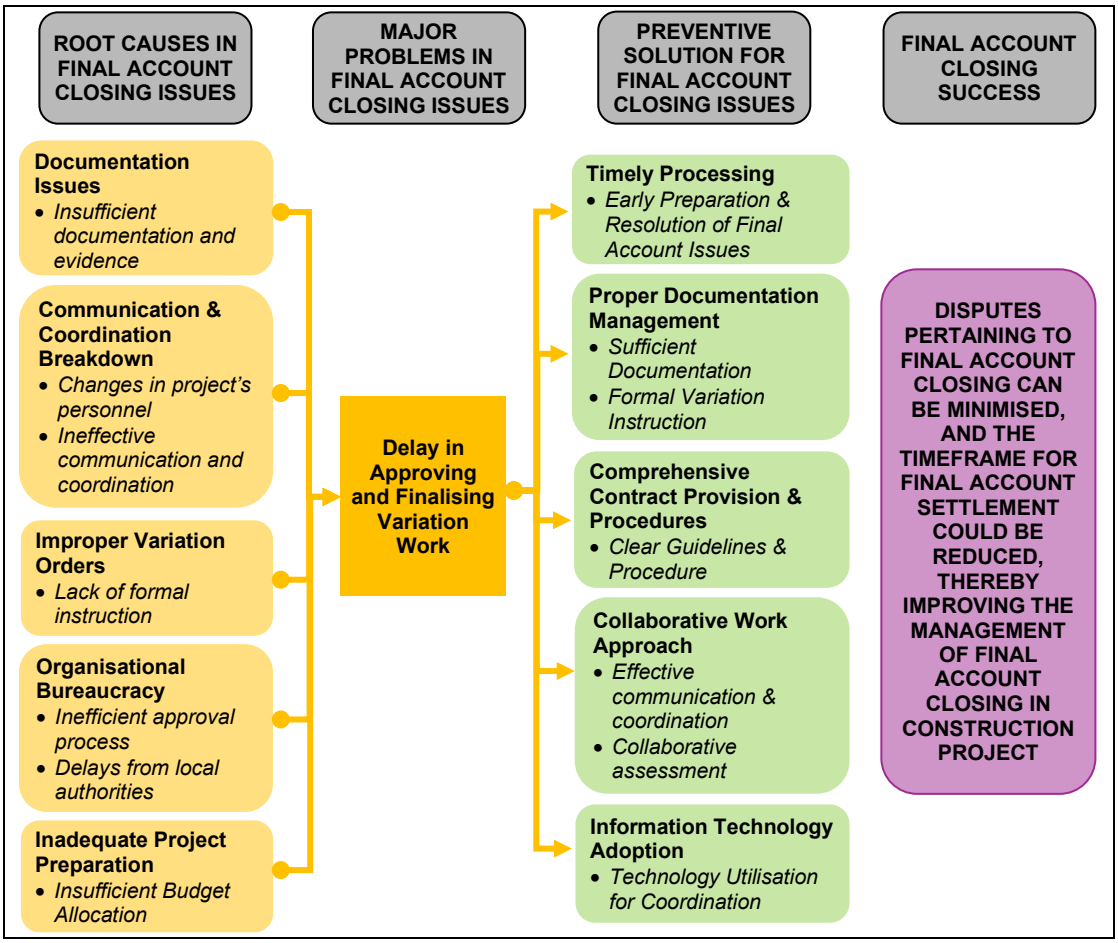


Figure 6.9 Root Causes and Preventive Solution for Delay Approving and Finalising Variation Work

Figure 6.9 presents another major problem in closing the final account for construction projects, which is **Delays in Approving and Finalising Variation Work**, as discussed in Chapter 4, Section 4.4.4.3. The process of approving and finalising variation work in construction projects poses significant challenges, often delaying the

closing of the final account. These delays frequently occur even after the work has been executed on-site, because the approval process on the client or management side takes considerable time. As highlighted by El-adaway et al. (2016), the process of finalising variation work can become complicated when questions arise about whether the variation is genuinely necessary or results from design inadequacies by consultants or contractor mistakes. Perera & Dewagoda (2020) highlighted that delays in approving and finalising variation works occur when contractors proceed with works without formal instructions from the contract administrator, thereby raising disputes over whether such instructions constitute unauthorised variations under the contract. Offei-Nyako et al. (2016) further emphasise that delays in finalising variation works are due to dissatisfaction with the quality of the variation work. These delays in approving and finalising variation works will impede the timely closing of the final account and adversely impact a contractor's cash flows and operations.

Through thematic analysis in Chapter 5, the framework identifies five root causes that contribute to delays in approving and finalising variation work, along with five corresponding preventive solutions. As shown on the left side of Figure 6.9, ***Documentation Issues*** are significant contributors, where *Insufficient Documentation and Evidence* of the contractor's claim hinder the consultant and contract administrator's ability to finalise valuations of variation works. Multiple informants (CS1, CS2, CL6, CS9, CL11, CL12) highlighted that contractors often submit incomplete documentation for variation works, which causes approval delays (refer to Chapter 5, Section 5.3.3.1a).

The framework also identifies ***Communication and Coordination Breakdown*** as a critical root cause, often resulting from *Changes in Project Personnel* and *Ineffective Communication and Coordination*. Informants CS1 and CL6, as presented in Table 6.1 explained that frequent changes of the person in charge responsible for the final account documentation can lead to incomplete documentation, thus delaying the approval process. Additionally, informants CL5, CR7, and CS8 highlighted that insufficient communication and cooperation between the consultant and the contractor regarding the variation works led to disagreements over valuation.

Improper Variation Orders, which are characterised by Lack of Formal Instruction, introduce ambiguity into the approval process. According to informant CS1, "sometimes contractors get VO instructions from someone who does not actually have the authority to give instructions, and that can lead to arguments later about

whether the work was even valid in the first place." refer to Chapter 5, section 5.3.3.2b). This informal approach to issuing variation instructions creates uncertainty regarding the legitimacy of the work, thereby complicating the approval process.

Furthermore, ***Organisational Bureaucracy***, particularly an *Inefficient Approval Process*, significantly contributes to delays in the approval and completion of variation work. Multiple informants (CR4, CS8, CR10, CL11, CL12) indicated that the requirement for multiple reviews and approvals across various management levels results in considerable delays (refer to Chapter 5, Section 5.3.3.8a).

Finally, ***Inadequate Project Preparation***, particularly due to *Insufficient Budget Allocation*, impedes the timely approval of variation works. Multiple informants (CR3, CR7, CS9, CR10, CL11, CL12) emphasised that budget constraints on the client side frequently result in delays in approving variation works, as clients often lack sufficient funds and necessitate multiple approval levels to secure additional funding (refer to Chapter 5, Section 5.3.3.10a).

The right side of Figure 6.9 delineates preventive solutions designed to mitigate this major problem. A notable preventive solution is ***Timely Processing***. Multiple informants (CS1, CS2, CR4, CL5, CR7, CS8, CS9, CR10) emphasised the importance of early identification and resolution of final account issues, such as conducting regular meetings to discuss and promptly address outstanding issues. Such measures are essential in reducing delays within the approval process (refer to Chapter 5, Section 5.4.3.8a).

The framework further emphasises the importance of ***Proper Documentation Management*** by ensuring *Sufficient Documentation* practices to mitigate delays in the approval and finalisation of variation works. Several informants (CS1, CR3, CR7, CS8, CR10, CL12) highlighted the critical role of thorough documentation, especially for variation work, to facilitate the approval and finalisation process of variation works (refer Table 6.1).

Furthermore, ***Comprehensive Contract Provisions and Procedures*** serve as another preventive solution for this major problem by establishing *Clear Guidelines and Procedures*. Informants (CR4, CL5, CS9, CL11, CL12) emphasised the importance of establishing clear processes, timelines, and responsibilities for final account closing, including creating a checklist and setting deadlines for submissions and approvals to ensure all parties adhere to the process (refer to Chapter 5, Section 5.4.3.2a). Such

structured procedures create a clear framework for approval, reducing ambiguity and streamlining the finalisation of variation works.

Moreover, the framework delineates a ***Collaborative Work Approach*** as a crucial element in enhancing the efficiency of finalising variation works. The majority of the informants, as presented in Table 6.1, emphasised the importance of Effective Communication and Coordination, which can facilitate approval. Additionally, *Collaborative Assessment* practices underpin a collaborative work approach. Informants CL6 and CR7 highlighted that conducting collaborative assessments is vital for reaching consensus on the scope and quantity of work, thereby reducing the potential for disputes. This collaborative approach promotes shared understanding and expedites the approval process for variations. Furthermore, informants CS8, CR10, and CL12 emphasised the necessity of incorporating *Flexibility Process*, such as simplified processes for minor variation works, to diminish bureaucratic hurdles and facilitate more efficient approvals.

Finally, ***Information Technology Adoption***, especially in the *Technology Utilisation for Coordination*, plays a crucial role in facilitating the approval and finalisation processes. Informant CL11 emphasised that *"the use of* current *technology, such as online meetings and digital signatures, can help to speed up the approval process and reduce bureaucracy"* [refer to Chapter 5, section 5.4.3.4(b)]. This technological approach enhances efficiency by streamlining the approval procedures for variation works through digital means.

6.7.4 Root Causes and Preventive Solution for Disagreement on The Valuation of Variation Works

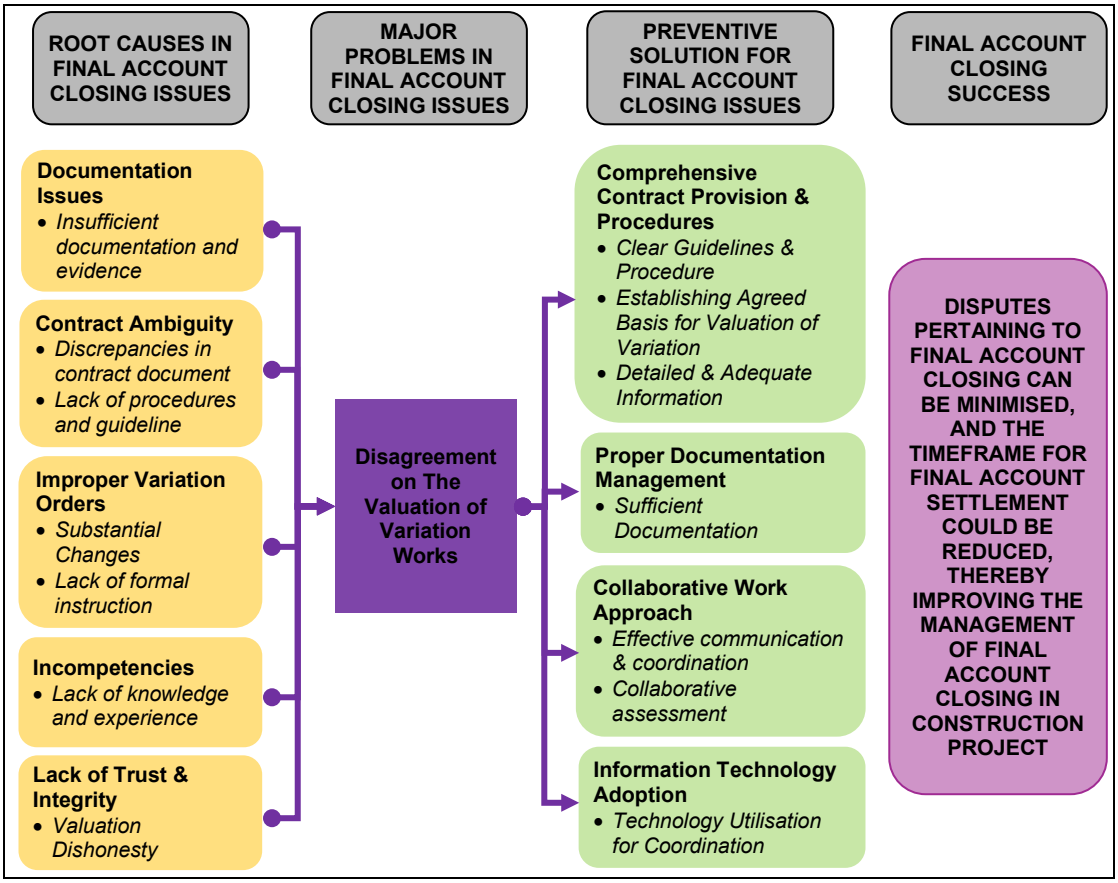


Figure 6.10 Root Causes and Preventive Solutions for Disagreement on the Valuation of Variation Works

Figure 6.10 outlines the root causes and preventive solutions for the major problem of **Disagreement on the Valuation of Variation Works**. As discussed in Chapter 4, Section 4.4.4.4, this problem significantly affects the final account closing process within the Malaysian construction industry. When disagreements arise over the valuation of variation works, determining the final project cost becomes challenging. This leads to disputes and delays in closing the final accounts. Such disputes may also result in financial losses for contractors, particularly when the cost of variation works exceeds the consultant's valuation (Oladapo, 2007). El-adaway et al. (2016) noted that uncertainty in variation works affects the contractor's financial management. Consequently, disagreement over the valuation of variations hinders the timely closure of final accounts and creates financial risks and conflicts between contracting parties (Alhilli & Rezoqi, 2021).

As illustrated in the Figure 6.10 above, one of the significant root causes leading to disagreement on the valuation of variation works is ***Documentation Issues***, particularly due to *Insufficient Documentation and Evidence*. Several informants (CS1, CS2, CS8 and CR10) highlighted the specific challenge of insufficient documentation and evidence related to variation works, where contractors sometimes proceed with variation works without obtaining the necessary approval, causing disagreements between the parties involved (refer to Chapter 5, Section 5.3.3.1a).

Contract Ambiguity also contributes to the root causes of this major problem. *Discrepancies in Contract Documents* lead to differing interpretations of the scope and value of variations. Several informants (CS2, CR3, CL5, CR7, CS9) pointed out inconsistencies and discrepancies in contract documents such as drawings, BQ, and specifications. These issues cause disagreements over the scope of variation work, as contracting parties interpret the documents differently. Furthermore, informants CR4, CL5, and CS8 highlighted that the *Lack of Procedures and Guidelines*, specifically unclear pricing bases regarding valuation rates for variation works in the contract, leads to difficulties in agreeing on fair valuations and can cause disagreements.

The framework further identifies ***Improper Variation Orders*** as another root cause contributing to this major problem, particularly due to *Substantial Changes* as highlighted by several informants (CR4, CL5, CR10, CL11, CL12). Informant CR10 specifically mentioned that, *"when variation orders work beyond the original scope, it really complicates cost estimates and makes it tough to settle on a fair valuation"* (refer to Chapter 5, Section 5.3.3.2a). Additionally, several informants (CL6, CS9, CL11, CL12) highlighted that a Lack of Formal Instruction will complicate the agreement of valuation for variation works. Informant CR7 specifically explained that *"sometimes we get told to do extra work just verbally, but it is not confirmed in writing. Consultant and client might disagree later about what was included in the change, and what the price should be, because there are no complete details and information about the work"* (refer to Chapter 5, Section 5.3.3.2b).

Incompetencies among project stakeholders are another critical root cause of disagreement over the valuation of variation works, particularly due to a *Lack of Knowledge and Experience* in handling complex variation works, which can lead to errors in evaluating claims. Informants (CS1, CR4, CL5, and CR7) indicate that a lack of knowledge and understanding of technical aspects of construction works will

complicate the evaluation and approval of variation claims and lead to disputes between contractor and client (refer to Chapter 5, Section 5.3.3.4a).

Finally, ***Lack of Trust and integrity*** is identified as a root cause contributing to disagreements over the valuation of variation work. This issue arises from *Valuation Dishonesty* and the *Contractor's Overclaims*. When clients doubt the contractor's integrity, they tend to reduce or reject the contractor's claim, resulting in disagreement over valuation. Informants CR4 and CL6 revealed that clients sometimes perceive the contractor's claims and valuations as inflated or inaccurate, especially when they involve variation works (refer to Chapter 5, Section 5.3.3.9b).

The right side of Figure 6.10 outlines preventive solutions to mitigate the major problem of disagreement on the valuation of variation works. The framework identifies ***Comprehensive Contract Provision and Procedures*** as a crucial preventive solution, through *Clear Guidelines and Procedures*. Informants CL5, CR7, CR10, and CL12 emphasised the significance of clear contract terms, specifically for variation works, to prevent misinterpretations and reduce conflicts during assessments (refer to Chapter 5, section 5.4.3.2a).

Proper Documentation Management, particularly *Sufficient Documentation*, represents another significant preventive solution to mitigate disagreements over the valuation of variation work. The majority of informants (CS2, CR3, CR4, CL6, CR7, CS6, CR10 and CL12) stressed the importance of thorough documentation, especially for variation work, to facilitate evaluation and preparation of the final account (refer to Chapter 5, Section 5.4.3.3a).

Furthermore, a ***Collaborative Work Approach*** is crucial for resolving valuation disagreements of variation works. *Collaborative Assessment*, involving joint inspections and valuations by all parties, fosters mutual agreement on the works and their cost. Several informants (CR4, CL6, CR7, CS8 and CR10) recommend conducting joint valuations and inspections involving all parties to agree on the assessment of variation works and reduce the likelihood of disputes (refer to Chapter 5, Section 5.4.3.5c).

Finally, ***Information Technology Adoption***, specifically *Technology Utilisation* for coordination, can improve collaboration and accuracy, thus mitigating valuation disagreements. Several informants (CR3, CS8, and CL11) suggested that leveraging modern tools and software enhances coordination, accelerates measurement, and improves the accuracy of valuation works (refer to Chapter 5, Section 5.4.3.4b).

6.7.5 Root Causes and Preventive Solutions for Lack of Supporting Documents for Submission of the Final Account Claim

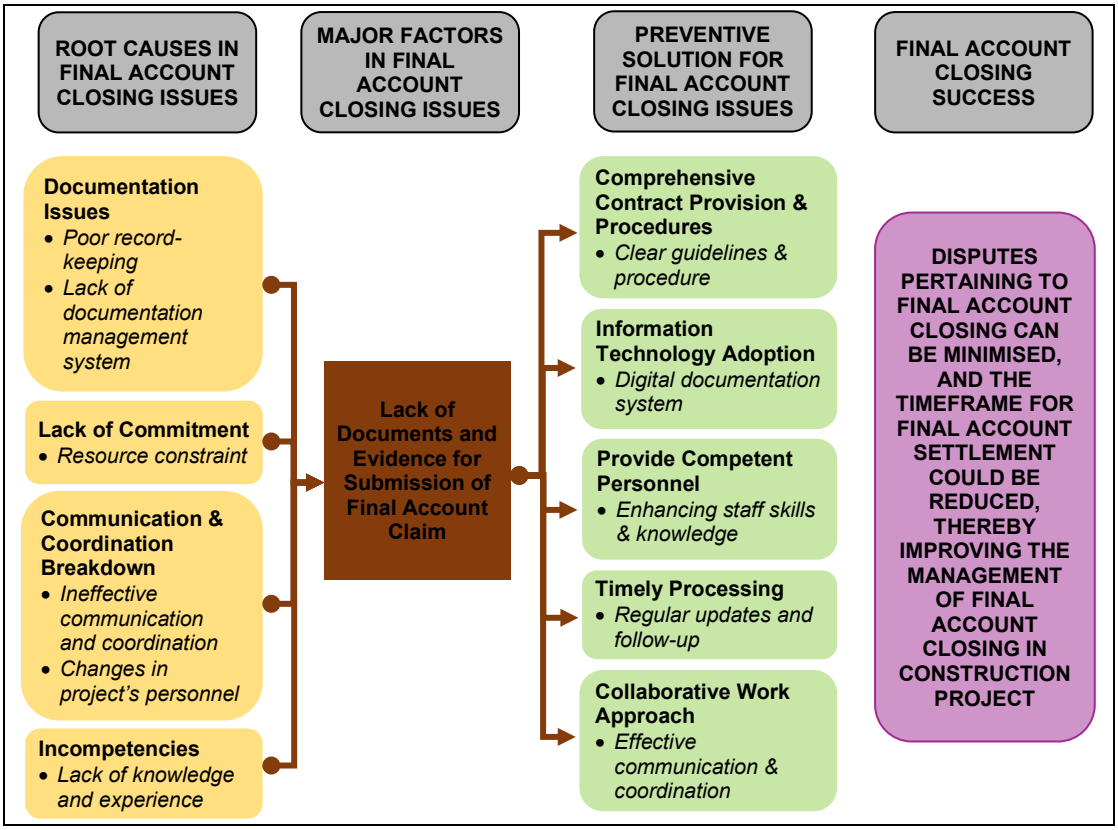


Figure 6.11 Root causes and Preventive Solution for Lack of Supporting Documents for Submission of the Final Account Claim

Figure 6.11 illustrates another major problem in final account closing, known as the **Lack of Documents and Evidence for Submission of Final Account Claim**, as discussed in Chapter 4, Section 4.4.4.5. This major problem significantly hinders the timely closure of final accounts in the construction industry. According to Bakhary et al. (2018), inadequate documentation is a widespread problem in the construction industry. When records are improperly maintained, the claim submission process becomes more complex and time-consuming. Moreover, contractors' errors in submitting final claims due to inadequate supporting documents or incomplete submissions significantly contribute to disputes and delays in closing final account. (Hai, 2019; Hisham & Othman, 2021). In such situations, contractors need to correct the errors and resubmit their claims, further prolonging the final account process. Therefore, good record-keeping and proper project documentation from the beginning to the end of a project are vital for efficient final account management.

The left side of Figure 6.11 details the root causes contributing to this major problem, identified through thematic analysis in Chapter 5. ***Documentation Issues***, particularly *Poor Record-Keeping* practices, have been identified as a significant root cause of the lack of supporting documents for final account claims. The majority of informants (CS2, CR3, CR4, CL6, CR7, CS8, CL11, CL12) highlighted that contractors often fail to maintain organised and up-to-date records, which makes it difficult to retrieve the necessary documents when they start to prepare the final account (refer to Chapter 5, Section 5.3.3.1b). Additionally, the *Lack of Documentation Management System* contributes significantly to documentation issues. Informants CS9, CR10, and CL12 highlighted that a lack of a systematic approach to documentation management can lead to inefficiencies, errors, and difficulties retrieving necessary information. (refer to Chapter 5, Section 5.3.3.1c).

Furthermore, a ***Lack of Commitment*** due to *Resource Constraints* has been also identified as a root cause of this major problem. Several informants (CR3, CL5, CL6, and CL12) noted that insufficient staff and high workloads can hinder timely and complete documentation of final account preparation (refer to Chapter 5, Section 5.3.3.5a).

Moreover, ***Communication and Coordination Breakdown*** also contribute significantly to this major problem. Informants CR4, CL5, CR7, CS8, CL11 and CL12 highlighted that there is *Ineffective Communication and Coordination* in terms of documentation requirements, such as checklists, timelines and records of all variation instructions, which lead to incomplete documentation in final account submission (refer to Chapter 5, Section 5.3.3.6a). *Changes in Project Personnel* contribute to the breakdown in communication and coordination, which complicates the documentation process, as highlighted by several informants (CL6, CR7, CS8, CS9, CR10, CL11). Informant CL11 specifically mentioned that *"frequent changes of the person in charge responsible for the final account documentation can lead to disorganisation and incomplete documentation"* (refer to Chapter 5, Section 5.3.3.6b).

Additionally, ***Incompetencies*** due to *Lack of Knowledge and Experience* among project personnel can impact the quality and completeness of final account claim submissions. Informant CR7 highlighted that *"The personnel involved in handling the final account process may have inadequate* experience *with the necessary procedures and documentation for final account claims,"* which results in errors of final account claims (refer to Chapter 5, Section 5.3.3.4a).

The right side of Figure 6.11 presents preventive solutions to mitigate the major problem related to inadequate documentation and evidence for final account claims. One important solution is establishing ***Comprehensive Contract Provisions and Procedures*** by ensuring *Clear Guidelines and Procedures* for documentation requirements. Most informants (CS1, CR3, CL5, CR7, CS8, CS9, CR10, CL11, CL12) emphasised the importance of establishing clear guidelines and procedures, including specific timelines and thresholds for approvals, for the final account process. This approach can mitigate ambiguity and streamline the process among stakeholders (refer to *Chapter 5, Section 5.4.3.2a).*

Information Technology Adoption, particularly a *Digital Documentation System*, offers a significant preventive solution to address the challenges related to lack of documentation for final account claims. All informants (CS1 – CL12) highlighted the importance of digital tools in managing documents and records (refer to Chapter 5, Section 5.4.3.4a). By leveraging digital tools, documentation can be systematically stored, shared, and updated, preventing losses and improving efficiency.

Furthermore, ***Proper Documentation Management*** through *Systematic Record-Keeping* is crucial for ensuring adequate supporting documentation for final account claims. A significant number of informants (CS2, CR4, CL6, CR7, CS8, CR10, CL12) emphasised the need to incorporate technology for systematic record management in construction projects. Informant CR7 specifically mentioned that *"using tools like cloud storage or specific software such as 'Novad Solution', really streamlines the process. It makes record-keeping more efficient and easier to retrieve documents when needed"* (refer to Chapter 5, Section 5.4.3.3b).

Providing Competent Personnel by *Enhancing Staff Skills and Knowledge* is another preventive solution for mitigating the documentation problem. Many informants (CS2, CR4, CL5, CS8, CS9, CR10, CL11) emphasised the importance of providing all staff members involved in documentation, record-keeping, and filing procedures with sufficient training. As stated by informant CS2, "*provide adequate training to all staff managing documentation and filing procedures. This ensures organised records and increases awareness of effective documentation practices, reducing errors in the final account process*" (refer to Chapter 5, Section 5.4.3.7b).

Furthermore, ***Timely Processing*** through *Regular Documentation Updates and Follow-Ups* are essential preventive solution for ensuring adequate supporting documentation. Most informants (CS1 to CS9) consistently emphasised the importance

of contractors regularly submitting relevant documents for the final account and the consultants conducting regular reviews during the construction phase. This practice ensures comprehensive documentation and helps avoid last-minute issues with paperwork (refer to Chapter 5, Section 5.4.3.8c).

Finally, a ***Collaborative Work Approach***, through *Effective Communication and Coordination*, is crucial as highlighted by several informants (CR4, CL5, CR7, CS8, CL11, CL12). Informant CR7 specifically mentioned that "*Improving communication and coordination, especially between site and office staff, ensures the proper transfer of all necessary documentation for final account preparation*" (refer to Chapter 5, 5.4.3.5a).

In conclusion, the framework in Figure 6.11 provides a structured approach for understanding the relationships between the root causes and the preventive solutions for the lack of documentation and evidence in the final account claim. By recognising these, stakeholders can develop targeted strategies for improving documentation practices for final account submissions. The improvement in documentation practices not only facilitates a more efficient final account process but also contributes to greater transparency, trust, and collaboration among project stakeholders, ultimately enhancing the overall performance of construction projects in Malaysia.

6.7.6 Root Causes and Preventive Solution for Delay in Submitting the Final Account Claim

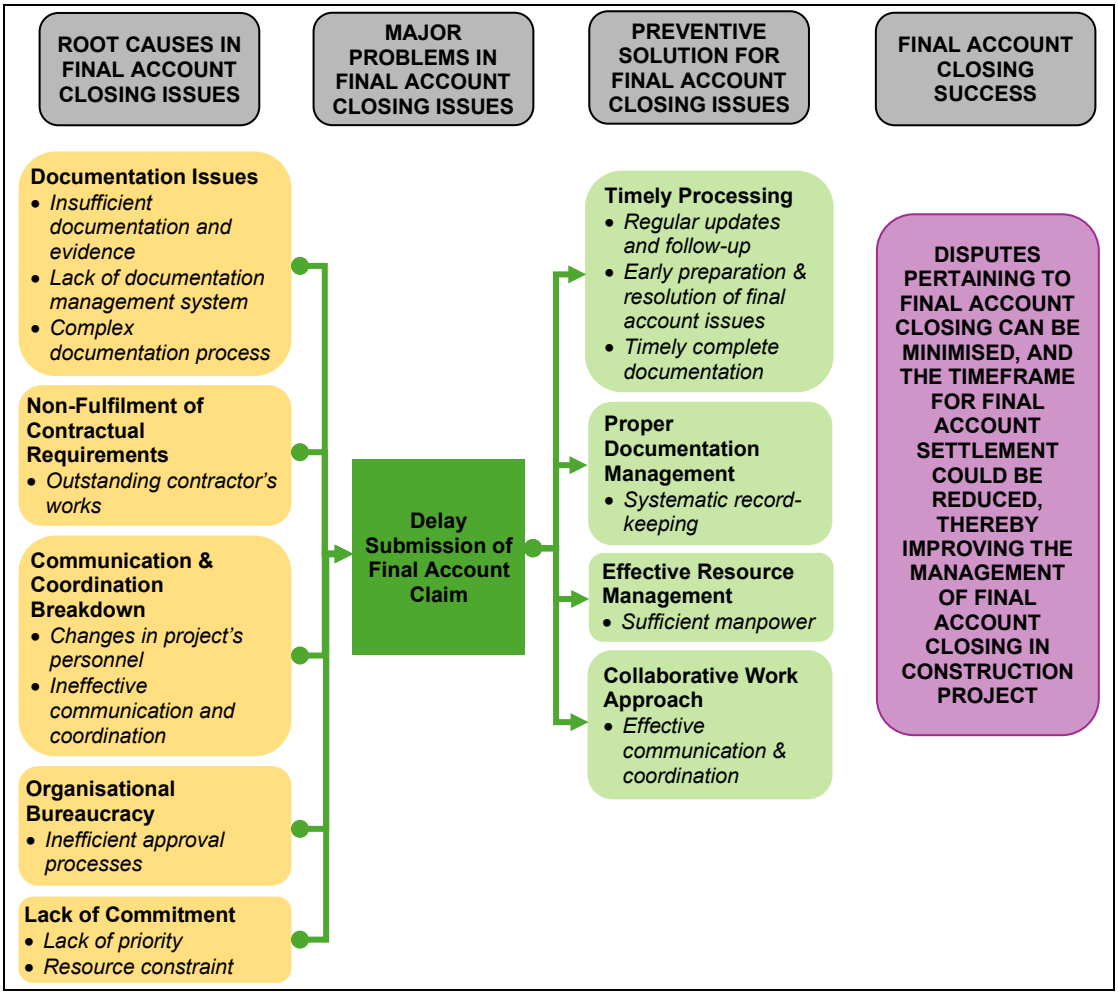


Figure 6.12 Root Causes and Preventive Solutions for the Delay Submission of the Final Account Claim

Figure 6.12 presents another framework for the major problem of Delay Submission of the Final Account Claim. The framework systematically illustrates the relationship between this major problem, their root causes, and corresponding preventive solutions. As discussed in Chapter 4, Section 4.4.4.6, timely submission of the final account claim is crucial for efficient final account closing in a construction project. Several studies identified that delays in final claim submission are a significant contributor to disputes and prolonged final account processes (Ramli, 2021; Ssegawa et al., 2020). If a contractor fails to meet the submission deadline, the Contract Administrator or Quantity Surveyor must evaluate the final account based on the available information, which may be incomplete and lead to disagreements. Factors

such as inadequate time and lack of experience among staff, as well as project complexity, can contribute to these delays (Bakhary et al., 2015). Furthermore, a lack of skilled personnel contributes to delays in claim submission (Ssegawa et al., 2020).

The left side of Figure 6.12 outlines the root causes contributing to this major problem, as identified in Chapter 5. ***Documentation Issues*** are a significant root cause of delays in submitting final account claims. One primary reason for the documentation issues is *Insufficient Documentation and Evidence* as highlighted by several informants (CS1, CS2, CR3, CR4, and CL6). Informant CR3 specifically mentioned that, "*The contractor might delay their claim submission because they are waiting for the consultant to provide important documents, such as a certificate of testing and commissioning*" (refer to Chapter 5, Section 5.3.3.1a). A *Lack of Documentation Management System* further contributes to this problem. Several informants (CL6, CR7, CS8, CR10, CL11, CL12) indicated that the lack of a centralised and computerised document management system results in inefficiencies, errors, and information loss during final account submission (refer to Chapter 5, Section 5.3.3.1c). Without such a digital documentation system, the construction team may struggle to keep track of necessary records, making it difficult to compile and submit a final account claim. Furthermore, the *Complexity of the Documentation Process* itself also presents substantial challenges. As mentioned by CS8: *"Contractors often require significant time and resources to compile the extensive documentation needed for final account claims, especially for loss and expense claims"* (refer to Chapter 5, Section 5.3.3.1d). This complexity requires significant time to prepare final account claims, ultimately delaying submission.

Non-Fulfilment of Contractual Obligations, particularly *Outstanding Contractor's Works*, emerged as another significant root cause of delays in final account claim submissions. The existence of outstanding works creates hesitation among contractors to submit the final account claim, as highlighted by several informants (CS1, CR3, CL6, CS8). Informant CR3 mentioned that, *"The contractor may be reluctant to submit the final account claim until everything is completed, fearing that it could lead to deductions or rejections"* (refer to Chapter 5, Section 5.3.3.7a). The contractor's failure to fulfil contractual obligations significantly delays the submission of the final account claim.

Furthermore, ***Communication and Coordination Breakdown*** also hinder the prompt submission of final account claims. Several informants (CS1, CS2, CL5, CR10,

CL11) pointed out that *Changes in Project Personnel* create knowledge gaps and discontinuities in the project's documentation. Informant CL5 mentioned that *"changes of person in charge handling the final account may lead to delays as the person needs time to review everything to understand and familiarise themselves with the project details"* (refer to Chapter 5, Section 5.3.3.6b).

Organisational Bureaucracy, especially due to *Inefficient Approval Processes*, was another root cause of delays in submitting final account claims. Several informants (CR4, CS8, CR10, CL11, CL12) indicated that the requirement for multiple reviews and approvals across various management levels leads to significant delays. As evidenced by informant CS8, "*Multiple layers of management need to review and sign off on the variation work and loss and expense claims. This process can sometimes take longer, which may delay the approval*" (refer to Chapter 5, Section 5.3.3.8a).

Finally, a ***Lack of Commitment*** contributes to delays in final account claim submissions because the project team prioritises other tasks over the final account process. Informant CR7 mentioned that *"The contractor may view the final account as a low priority, especially if the project* has *already been completed and the contractor has shifted focus to other ongoing projects"* (refer to Chapter 5, Section 5.3.3.5b). This lack of priority can lead to procrastination, resulting in the significant delay of the final account claim submission. Additionally, *Resource Constraints*, due to insufficient manpower, hinder the timely submission of the final account claim. Multiple informants (CS1, CS2, CR4, CL5, CL6, CR7, CR10) have pointed out that the lack of dedicated staff to manage the paperwork, documentation, and valuation often leads to delays in the final account process (refer to Chapter 5, Section 5.3.3.5a).

The right side of Figure 6.12 outlines a series of preventive solutions for this major problem. ***Timely Processing*** emerges as a critical preventive solution to address delays in final account claim submissions. *Regular Updates and Follow-Up* will create accountability and encourage project teams to submit the final account claim in a timely manner. Most informants (CS1 to CS9) consistently stressed the need for contractors to regularly submit relevant documents for the final account and for consultants to conduct regular reviews during the construction phase (refer to Chapter 5, Section 5.4.3.8c). Furthermore, *Early Preparation and Resolution of Final Account Issues* can significantly streamline the submission process. Informants CR3 suggested that *"Contractors and consultants should initiate the final account process early before project completion. For instance, they could submit and prepare final account*

documents regularly, ideally about six months before completion or when the project is around 90% done. This approach gives enough time for everyone to conduct a thorough review and come to an agreement" (refer to Chapter 5, Section 5.4.3.8a).

Proper Documentation Management, through *Systematic Record-Keeping*, represents another preventive solution to address delays in final account claim submissions. Several informants (CS1, CR4, CL6, CR7, CS8, CR10) emphasised the importance of proper and *Systematic Record Keeping* for documentation from the project's beginning. Informant CR10 specifically indicated that, *"ensure proper record keeping and documentation from the early stages of the project, including the maintenance of a site diary and other documents, with proper sign-off by all relevant parties"* (refer to Chapter 5, Section 5.4.3.3b).

Effective Resource Management, particularly ensuring *Sufficient Manpower* allocation, represents another preventive solution for addressing delays in final account claim submissions. Informants (CR3, CL5, CS9, CR10, CL12) emphasised the importance of consultants and contractors providing sufficient, competent staff throughout the project and after its completion to manage the final account effectively. Informant CL12 pointed out that *"Consultants and* contractors *should provide sufficient and competent staff throughout the project and after practical completion to manage the final account effectively. This can help avoid delays in submission and preparation of the final account"* (refer to Chapter 5, Section 5.4.3.6a).

Finally, adopting a ***Collaborative Work Approach*** with *Effective Communication and Coordination* among all project stakeholders offers another preventive solution for delays in final account claim submissions. Informant CS2 noted that, *"Regular project meetings and follow-ups between project parties, even after the project is completed, to address potential disagreements and facilitate the timely approval and submission of final account documents"* (refer to Chapter 5, Section 5.4.3.5a).

In conclusion, the major problem of delays in submitting the Final Account Claim arises from documentation issues, non-fulfilment of contractual obligations, communication breakdowns, and a lack of commitment. The framework further outlines some preventive solutions to this major problem, including timely processing, proper documentation management, and effective resource management. By implementing these preventive solutions, construction stakeholders can create more efficient and effective processes for final account management.

6.7.7 Root Causes and Preventive Solution for Disagreement on the Valuation of Final Account

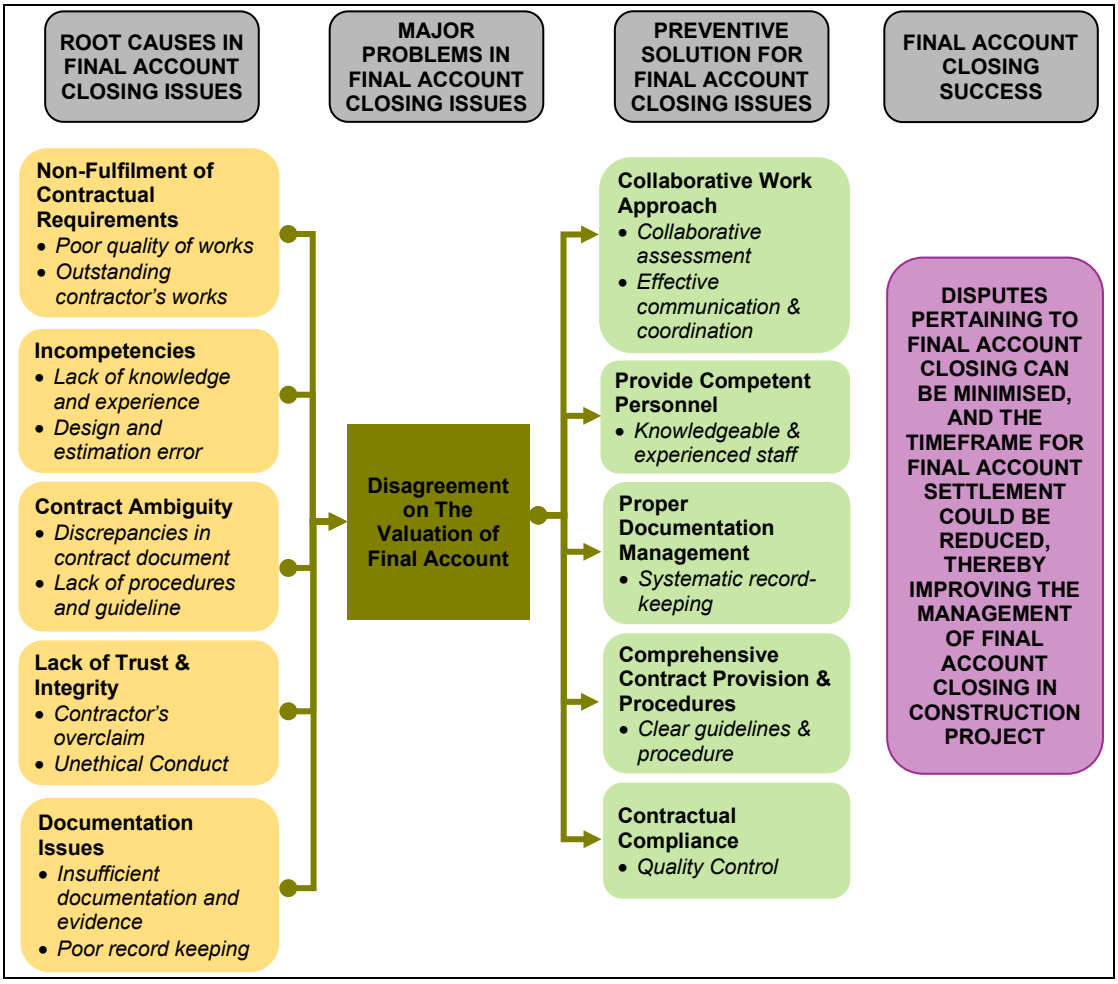


Figure 6.13 Root Causes and Preventive Solutions for Disagreement on the Valuation of the Final Account

Figure 6.13 presents the root causes and preventive solutions, focusing on the major problem of **Disagreement on the Valuation of Final Accounts**. As discussed in Chapter 4, Section 4.4.4.7, such disagreements significantly contribute to disputes during the final account closing process (Ameyaw et al., 2015; Ilmi & Yip, 2014; Ssegawa et al., 2020). Conflicts often arise from the valuation by the quantity surveyor, particularly when documentation is incomplete or unavailable (Othman et al., 2023). Dissatisfaction with work quality or the presence of defects can also lead to significant disagreements about the final valuation (Peters et al., 2019). When a party disagrees with the valuation, they may request a review from the contract administrator. If dissatisfaction persists, parties can pursue dispute resolution procedures, which may prolong the process of final account closing (Mohamad et al., 2012). These

disagreements lead to delays and increased conflict between the contractor and the client (Kong & Yeow, 2016).

The left side of Figure 6.13 details the root causes of the major problem, identified through thematic analysis in Chapter 5. The ***Non-Fulfilment of Contractual Requirements*** represents a significant root cause of disagreements on final account valuation. This primarily arises from *Poor Quality of Work*, which often creates a significant barrier to agreement on final account valuation, as highlighted by several informants (CS1, CS2, CR3, CR7, CS8, CS9, CR10, CL11). Informant CS1 specifically mentioned that, *"The client may not agree with the quality of some aspects of the work and only want to certify and pay for part of the claimed amount"* (refer to Chapter 5, Section 5.3.3.7b).

Incompetencies among the project team also constitute a root cause of disagreements in final account valuations. Several informants (CS1, CR4, CL5, CR7, CS9) indicate that a *Lack of Knowledge and Experience* on technical aspects of construction works will complicate the evaluation and approval of variation claims and lead to disputes between contractor and client, as explained by CR4 *"The client may not fully understand the nature and complexity of additional costs involved in executing the variation work, leading to disagreement on the valuation of work"* (refer to Chapter 5, Section 5.3.3.4a). Additionally, *Design and Estimation Errors*, such as discrepancies in quantity measurements or underestimation of costs, also create valuation disputes. The majority of the informants (CS1, CS2, CR3, CL5, CR7, CS8, CS9, CR10, CL12) pointed out that deficiencies in design and estimation can lead to variations, which can cause cost overruns, ultimately resulting in disagreement during the final account process (refer to Chapter 5, Section 5.3.3.4b).

Contract Ambiguity also emerged as another root cause of disagreement in final account valuation, particularly due to *Discrepancies in Contract Documents* as highlighted by multiple informants (CS2, CR3, CL5, CR7, CS9). These discrepancies caused confusion among the parties about the scope of work. Informant CS9 pointed out that, *"Contractors may misunderstand or misinterpret the overall scope of work required under the contract, leading them to underestimate the cost of the project and result in disagreement when the consultant values the final work done"* (refer to Chapter 5, Section 5.3.3.3a). The other reason for contract ambiguity is the *Lack of Procedures and Guidelines,* as highlighted by several informants (CR3, CR4, CL5, CS9, CL11 and CL12). Without specific procedural guidance for valuation works, the contractor and

consultant may apply different approaches to value the works, leading to disagreement over final account valuation (refer to Chapter 5, Section 5.3.3.3b).

Moreover, the ***Lack of Trust and Integrity*** between contracting parties emerges as another root cause of valuation disagreements in the final account. One of the main reasons for trust and integrity issues is *Contractor Overclaims,* which can cause the client to become suspicious and undermine the valuation process. As highlighted by informant CL6, "*Contractors may overclaim by including unnecessary costs or quantities not actually executed*" (refer to Chapter 5, Section 5.3.3.9b). Furthermore, *Unethical Conduct*, particularly by clients, further contributes to trust and integrity issues. Informant CR10 specifically mentioned that "*The client's attitude of trying to get the contractor to absorb additional costs, or intentionally undervaluing work*" (refer to Chapter 5, Section 5.3.3.9c). Such practices, in which clients intentionally seek to reduce the valuation to save costs, are considered unethical and can cause substantial delays in settling the final account.

Finally, ***Documentation Issues*** further contribute to disagreements on the valuation of the final account. *Insufficient Documentation and Evidence* by the contractor to substantiate claims make valuation difficult. Several informants (CR7, CS8, CS9, CR10) highlighted that incomplete and insufficient documentation, such as invoices, receipts and site records to substantiate final account claims, makes verification of claims difficult and leads to valuation disagreements (refer to Chapter 5, Section 5.3.3.1a).

The right side of Figure 6.13 outlined the preventive solutions for this major problem. A ***Collaborative Work Approach*** emerges as one of the preventive solutions for addressing final account valuation disagreements. *Collaborative Assessment* creates shared understanding and agreement of the valuation process. Multiple informants (CS2, CR4, CL6, CR7, CS8, CS9, CR10, and CL11) emphasise the importance of conducting collaborative assessments or evaluations to achieve consensus on the scope of work and quantity, thereby reducing disputes (refer to Chapter 5, Section 5.4.3.5c). *Effective Communication and Coordination* further support the collaborative approach, helping prevent conflicts and ensuring mutual agreement on the final account valuation. Informant CS2 highlighted that *"Regular project meetings and follow-ups between project parties, even after the project is completed, to address potential disagreements and facilitate the timely approval and submission of final account documents"* (refer to Chapter 5, Section 5.4.3.5a).

Providing Competent Personnel, particularly *Knowledgeable and Experienced Staff*, helps prevent errors and mistakes, which in turn reduces disagreements and disputes in valuation. Multiple informants (CR3, CL6, CL12) highlighted that the involvement of experienced or senior employees in managing and overseeing the final account process was seen as important in reducing the likelihood of errors (refer to Chapter 5, Section 5.4.3.7a).

Furthermore, ***Proper Documentation Management***, through *Systematic Record-Keeping*, is essential in addressing valuation disagreements. Several informants (CS2, CR4, CL6, CR7, CS8, CR10 and CL12) emphasised the importance of proper and consistent record keeping for documentation from the project's beginning (refer to Chapter 5, Section 5.4.3.3b). When parties maintain comprehensive records, they can substantiate their claim with evidence, reducing ambiguity and disagreement in the final account valuation.

Comprehensive Contract Provisions and Procedures are also necessary to prevent valuation disagreements through *Clear Guidelines and Procedures*. Most of the informants (CS1, CR3, CR4, CL5, CL6, CR7, CS8, CR10, CL11, CL12) emphasised the significance of clear contract terms, specifically for variation works, to prevent misinterpretations and reduce conflicts during assessments (refer to Chapter 5, Section 5.4.3.2a).

Moreover, ***Contractual Compliance*** emerges as a preventive solution for this major problem, specifically by ensuring good Quality Control to prevent quality related issues during final account valuation. Informants CR3 and CL11 emphasised the importance of implementing a robust quality assurance or assessment throughout the project, to ensure work is executed according to contract requirements, thereby reducing the need for rectifications and disputes during the final account (refer to Chapter 5, Section 5.4.3.1b).

In conclusion, disagreement over the valuation of the final account arises from several root causes, including non-fulfilment of contractual requirements, incompetence, contract ambiguity, lack of trust, and documentation issues, as outlined in the framework in Figure 6.13. The framework also outlines a comprehensive approach to prevent the major problem, emphasising a collaborative work approach, providing competent personnel, proper documentation, a comprehensive contract procedure, and contractual compliance.

6.7.8 Root Causes and Preventive Solutions for Cost Overruns Due to Variation and Provisional Quantities

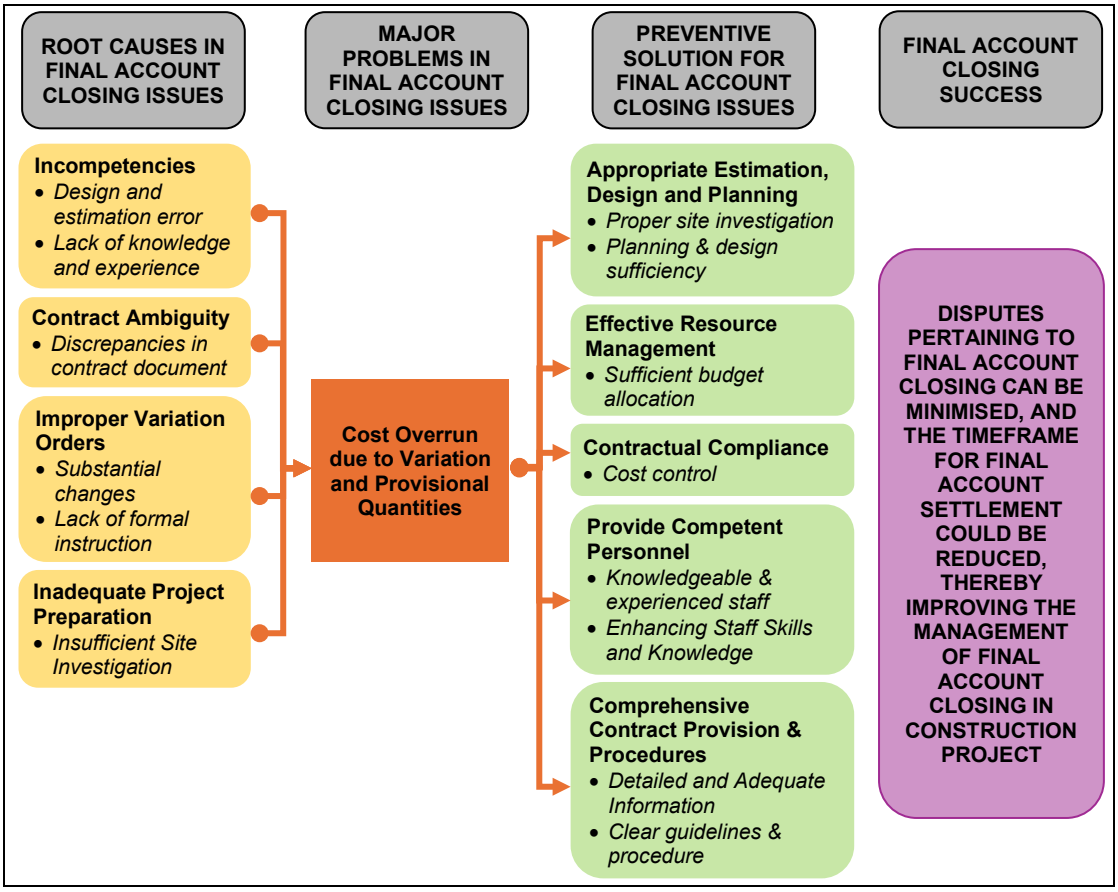


Figure 6.14 Root Causes and Preventive Solution for Cost Overruns Due to Variation and Provisional Quantities

The framework presented in Figure 6.14 illustrates the relationship between the major problem of **Cost Overrun due to Variation and Provisional Quantities**, its root causes, and the corresponding preventive solutions. As discussed in Chapter 4, Section 4.4.4.8, this major problem poses a significant financial issue in construction projects, particularly during the final account closing. Previous studies have identified that variation of works and provisional quantities in construction projects can contribute to cost overruns and disputes in final account closing (Muhamad et al., 2021). Variation works refer to changes or modifications made to the original scope of work during the construction phase (Odeyinka et al., 2010; Offei-Nyako et al., 2016). These work changes, particularly the extra work, often result in additional costs (Zakaria, 2015).

Additionally, provisional quantities can contribute to cost overruns and disputes during final account closing (Hassan, 2019). Provisional quantities refer to estimated

quantities of materials for works included in the contract but not specifically defined or detailed during the tendering stage (Cunningham, 2017). These estimates are often based on assumptions or rough calculations, which can lead to deviation and cost overrun in the final cost (Morena & Amoah, 2021). The conflict may arise when the contractor argues that they are entitled to additional payment for the extra work due to variations or remeasurement of provisional quantities, while clients may dispute these claims and refuse to pay the additional costs (Offei-Nyako et al., 2016).

As shown in Figure 6.14, one of the significant root causes contributing to this major problem is ***Incompetencies***, particularly due to *Design and Estimation Errors*. Several informants (CS1, CS2, CR3, CL5, CR7, CS8, CR10, CL12) indicated that inadequacies in project design may result in modifications or variations, which, in turn, can lead to cost overruns. Informant CR10 particularly mentioned that *"There were some issues with the design team's performance during the design stage, leading to deficiencies in the design. As a result, significant changes had to be made through variation orders"* (refer to Chapter 5, Section 5.3.3.4b). In addition, informant CS2 noted that, *"Errors or underestimation in the initial cost estimation and tender pricing, especially for provisional sum items where the design is not finalised"* (refer to Chapter 5, Section 5.3.3.4b).

Another root cause identified is ***Contract Ambiguity***, particularly *Discrepancies in Contract Documents*. Multiple informants (CS2, CR3, CL5, CR7, CS9) highlighted that discrepancies in contract documents often result in changes and additional work on site, which may result in cost overruns (refer to Chapter 5, section 5.3.3.3a).

Moreover, ***Improper Variation Orders*** also contribute to cost overruns resulting from *Substantial Changes* in work. Informants CS2, CR3, and CR7 highlighted that excessive, uncontrolled variation orders could lead to cost overruns and disputes during the settlement of final accounts. Informant CS2 specifically mentioned, *"When clients request a lot of changes without really thinking about how it is going to impact the budget, it can cause the project to go over budget"* (refer to Chapter 5, Section 5.3.3.2a).

Finally, the root cause identified in Figure 6.14 is ***Inadequate Project Preparation***. Several informants (CR3, CR7, CS9, CR10, CL12) noted that *Insufficient Budget Allocation* for risk and contingency can result in cost overruns when unforeseen events and variations occur (refer to Chapter 5, Section 5.3.3.10a). Furthermore, multiple informants (CS1, CS2, CR4, CR7, CS8, CS9, CR10, CL11) noted that

Insufficient Site Investigation during the planning and design stages often leads to unexpected site conditions, such as discrepancies in soil reports like underground water and rocks that were not accounted for in the original estimates, which may result in cost overruns at the final cost. Informant CR4 particularly mentioned that *"Inadequate site investigation during the design stage led to inaccurate estimation for provisional sum works, requiring more additional cost than expected"* (refer to Chapter 5, Section 5.3.3.10b).

The right side of Figure 6.14 presents several preventive solutions to mitigate the major problem of cost overrun due to variation and provisional quantities. ***Appropriate Estimation, Design, and Planning*** are identified as one of the preventive solutions, encompassing two primary aspects, which are *Proper Site Investigation* and *Planning and Design Sufficiency*. A comprehensive site investigation during the design and planning stages is crucial for gathering information that ensures precise planning and estimates, which helps reduce the risk of cost overruns caused by unexpected site conditions. Most informants in this research (CS1, CS2, CR4, CL5, CR7, CS8, CS9, CR10, CL11, CL12) emphasised the importance of a comprehensive and detailed site investigation, to provide an understanding of potential site conditions and minimise the risk of unexpected issues that could lead to variations and cost overruns in construction projects (refer to Chapter 5, Section 5.4.3.9c). Regarding planning and design sufficiency, informant CR3 stated that, *"The design must also meet the requirements of the authorities and the client to avoid misunderstandings and additional costs in future"* (refer to Chapter 5, Section 5.4.3.9a).

Effective Resource Management, particularly through *Sufficient Budget Allocation*, is another preventive solution to mitigate this major problem. Multiple informants (CS1, CR4, CL5, CL6, CS8, CS9, CR10, CL11) emphasised that the client should allocate adequate funds for contingency and provisional items to address potential unforeseen site conditions or necessary modifications to the work. (refer to Chapter 5, Section 5.4.3.6b).

Contractual Compliance, specifically through *Cost Control*, is another preventive solution highlighted in the framework. Several informants (CS1, CR4, CL6) emphasised the importance of controlling and monitoring variation orders to ensure that any variation works are aligned with the original scope and to prevent significant cost increases (refer to Chapter 5, Section 5.4.3.1c). Ensuring that variation orders are

properly managed with a detailed cost breakdown helps prevent major cost overruns and disputes during the final account closure process.

Another preventive solution identified in the framework is ***Providing Competent Personnel*** by involving a *Knowledgeable and Experienced Staff* in the project. Informant CR3 stated that, "A competent project team with essential skills is crucial. This team or person can estimate project costs and manage effectively, avoiding potential cost overruns" (refer to Chapter 5, Section 5.4.3.7a).

The final preventive solution outlined in the framework is the ***Comprehensive Contract Provision and Procedures***, particularly regarding *Detailed and Adequate Information*. The majority of informants (CS2, CR3, CL5, CL6, CR7, CS8, CS9, CR10, CL11) emphasised the importance of comprehensive documentation for variation orders to ensure the parties know the exact scope and cost of works (refer to Chapter 5, Section 5.4.3.20.

In conclusion, the framework presented in Figure 6.14 provides a comprehensive understanding of the final account closing problem in construction projects caused by cost overruns. By identifying root causes and corresponding preventive solutions, this framework offers valuable insights for practitioners seeking to improve the final account closing process. The findings from this framework align with previous research on variation works and provisional quantities in construction projects, which emphasise thorough site investigation, accurate estimation, competent personnel, and clear contract documentation.

6.8 Preventive Solution Framework for Improving Final Account Closing in The Malaysian Construction Industry

The Preventive Solution Framework for Improving Final Accounts Closing in the Malaysian Construction Industry, as illustrated in Figure 6.15, represents the outcome of this research. This framework provides a systematic understanding of the major problems encountered during the final account closing process in the Malaysian construction industry, including their root causes and preventive solutions to mitigate them.

This framework was developed using a systematic approach combining both quantitative and qualitative data collection methods. Initially, the major problems in the final account closing were identified using quantitative data analysis in Chapter 4.

Subsequently, a qualitative investigation was conducted utilising semi-structured interviews and thematic analysis, as presented in Chapter 5, to investigate the root causes and determine an appropriate preventive solution.

The framework is systematically organised into three main components, comprising the major problem, the root cause and the preventive solution, outlining a clear sequence of causal and solution orientations. This sequence aligns with a problem solving approach rooted in the Intelligent Design Choice (IDC) model, which serves as the theoretical underpinning of this study. As shown in Figure 6.15, the framework is structured around three interconnected columns, read from left to right. The left column (highlighted in yellow) presents the root causes for final account closing issues. These root causes lead to major problems in the final account closing. The middle column presents the eight major problems that have been identified and ranked by construction practitioners in the Malaysian construction industry. Each major problem is designated a distinct colour to facilitate clear differentiation of issues. Furthermore, these major problems are categorised into two main EFA components, namely the evaluation process and contractual management. The right column (highlighted in green) presents the preventive solutions that should be adopted to address each major problem and its root causes. The colour coded arrows link specific major problems to their root causes, indicating that these problems are caused by the identified root causes. Similarly, arrows connect specific major problems to their corresponding preventive solutions. The interconnected relationship among the major problem, its root causes, and preventive solutions indicates the direction of the causal and solution relationship that leads to the goal of achieving final account closing success. This framework also indicates that a single major problem may be linked to multiple root causes and multiple preventive solutions, reflecting the complex, interconnected nature of final account closing issues.

6.8.1 Practical Application of the Framework

This framework provides significant benefits for practitioners in the Malaysian construction industry, including clients, contractors, and consultants. It can serve as a diagnostic tool to identify potential problems within final account processes and help implement best practices to improve final account closing management in construction projects. The developed framework can be applied throughout the construction process, from the planning stage to completion.

At the pre-contract or planning stage, the framework should be used to anticipate possible final account issues before construction begins. The practitioners should review the root causes shown in the framework, such as 'Documentation Issues', due to Insufficient documentation and evidence, or 'Contract Ambiguity' due to a lack of procedures and guidelines. Based on the review of those particular root causes, the parties should agree on preventive measures, such as providing clear final account submission requirements, a standard documentation checklist, and agreed basis for valuing variation works. The contractor should also use the framework at this stage to understand what evidence is required later to support final claims. The client, at this stage, should ensure adequate budget allocation not only for construction costs, but for provisional items and contingencies. If the client allocates insufficient budget for unforeseen provisional sum and contingency sum, it may result in cost overrun for the project. Therefore, the framework serves as an early-warning and planning tool to reduce uncertainty before the project enters the construction phase.

During the construction stage, the framework should be used as a monitoring and control tool. The quantity surveyor should regularly check and update documentation, including variation orders, payment records, the architect's instructions, and any supporting documents for the final account. The contractor should submit complete documents and evidence progressively rather than waiting until the end of the project. The client should give timely decisions on variation approvals, provisional sum adjustments, design changes and financial matters. For instance, the framework identifies "improper variation order" as a major problem, the QS should ensure that each variation has a valid written instruction, a valuation method, and an agreed price for a particular variation works. This avoids disputes where variation claims are only debated during final account preparation.

At the post-contract or completion stage, the contractor should prepare the final account submission based on the provided checklist and the supporting documents gathered during the project. The quantity surveyor should assess the final account systematically by reviewing and checking the available records, contract provisions and previous instructions and approvals. The client should review and respond to the final account within the agreed timeframe. This systematic process reduces disagreement, shortens the settlement timeframe and supports successful final account closure.

Therefore, the framework supports final account closing by shifting industry practice from a reactive approach to a preventive approach. It enables the QS, contractor

and client to identify risks early, control documentation during construction, resolve valuation issues progressively, and close the final account with fewer disagreements. Its practical value lies not only in showing the relationship between root causes, major problems and preventive solutions, but also in guiding practitioners on what should be done, by whom, and at which stage of the project lifecycle. Table 6.5 summarises the practical application of the framework that can be adopted in the construction projects.

Table 6.3
Practical Guide for Applying the Framework

Project stage	Relevant party	How the framework should be used	Expected practical output
Pre-Contract / Planning	Client, QS, Contractor	Review contractual clauses, establish final account submission requirements, variation valuation basis, provisional quantities, design sufficiency, site investigation and budget allocation before project start	Clear contract documents, sufficient information, realistic budgets, risk allowances and agreed final account procedures
Construction stage	Contractor, QS, Client	Regularly check and update documentation such as variation instructions, progress photographs, minutes of meetings, and approval status. Conduct meetings and monitor unresolved claim items	Updated records, reduced backlog of variation claims, early resolution of valuation issues, and fewer unresolved claims at completion.
Post-contract/ completion	Contractor, QS and client	Check the completeness of final claim submission using the provided checklist, verify supporting documents, finalise outstanding valuation items, resolve disagreements and process final payment	Timely final account agreement, reduced dispute escalation, accurate final certificate and settlement of final payment

In conclusion, the "Preventive Solution Framework for Improving the Final Account Closing in the Malaysian Construction Industry" presented in Figure 6.15, offers a comprehensive guide for practitioners in the construction industry to enhance the management of final account closing. Its strength derives from a real world

perspective from construction practitioners, and it considers the entire process of final account closing. By systematically addressing the identified root causes and major problems through the proposed preventive solutions, it is anticipated that disputes related to final account closing can be significantly minimised, and the timeframe for final account closing can be reduced, thereby improving the final account closing process in the construction industry. In turn, this is expected to enhance the overall efficiency and success of construction projects in Malaysia.

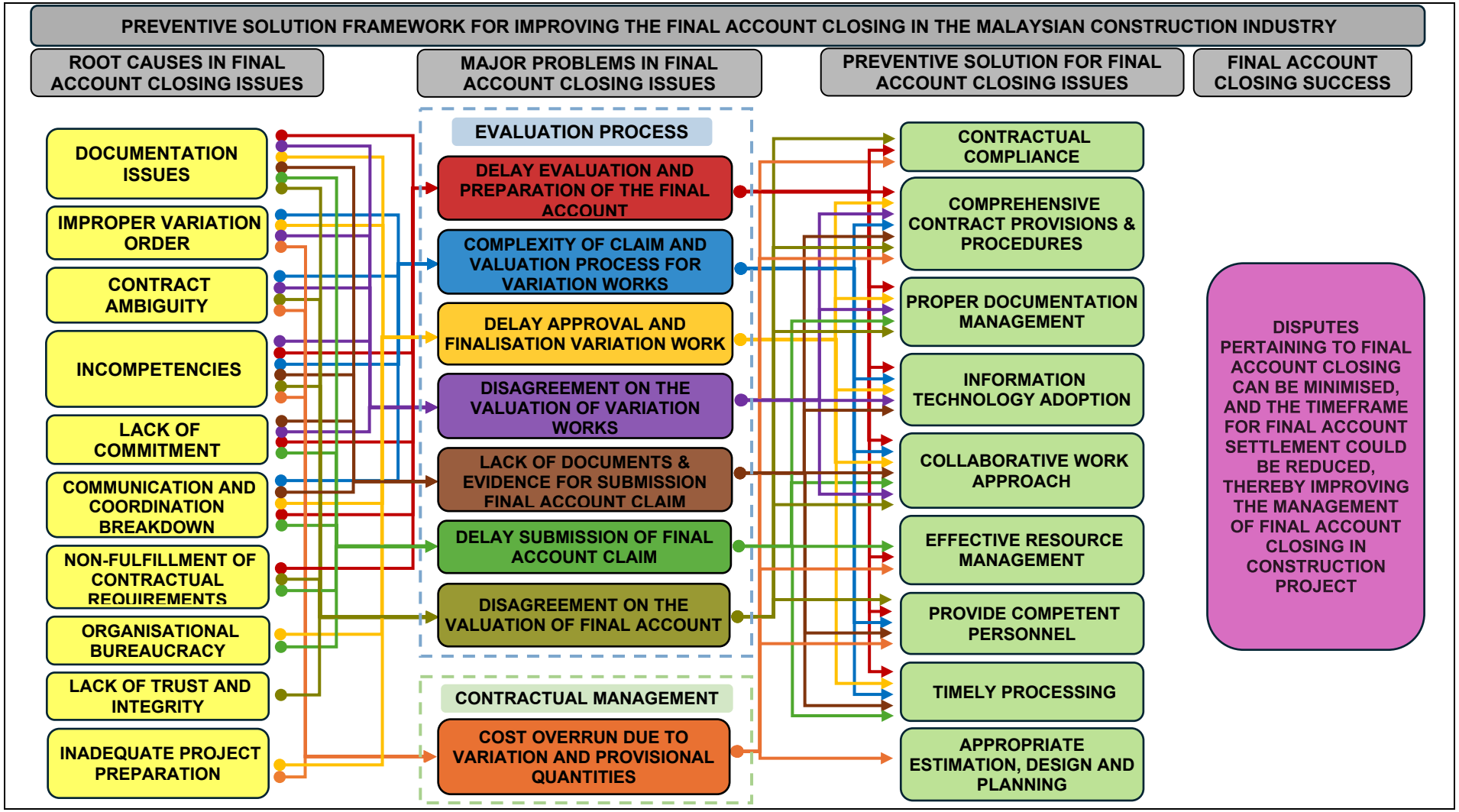


Figure 6.15 The Preventive Solution Framework for Improving the Final Account Closing in the Malaysian Construction Industry

6.9 Framework Validation

The final research objective in this research was achieved by developing the preventive solution framework for improving the final account closing, as presented in Figure 6.15. The framework developed in this research was systematically evaluated to ensure its validity and practical applicability. Accordingly, the validation process in this research aims to determine whether the framework can effectively improve final account closing management within the Malaysian construction sector. According to Elsayah, (2016), involving experts, such as experienced practitioners, during the validation process can enhance the framework's relevance and usefulness in real-world situations. Expert validation is widely adopted because it leverages the practical knowledge and experience of specific professionals to assess the framework's accuracy and effectiveness (Creswell & Poth, 2018; Merriam & Tisdell, 2016). Typically, expert review and feedback are gathered during the final research stages, providing insights into how effectively the framework meets research goals and tackles real-world challenges (Nayan, 2021). Therefore, to validate the final framework in this research, an expert review is conducted by soliciting feedback and comments from the selected experts.

6.9.1 Validation Techniques and Process

The questionnaire survey method has been selected as the validation technique for this research, as adapted from previous related research conducted by Judi (2020), Nayan (2021), and Yong (2018). The questionnaires were designed to evaluate and assess the framework's practicality, relevance, and applicability within the Malaysian context. Specific criteria were considered when developing the validation questions based on adaptations from past studies, such as (Alwee, 2023; Yusuwan, 2016). These criteria include appropriateness, completeness, practicality, beneficial use, as well as comments and suggestions for further improvement. To accomplish the aforementioned objective, the questionnaire comprises two (2) main parts and four (4) subsections (refer to Appendix 3). The first part is intended to collect the respondents' demographic background and experience. The remaining part and subsections are designed to evaluate the overall content, structure, as well as its practicality and applicability in the construction industry. In addition to evaluating the framework based on predetermined

criteria, respondents were also invited to provide suggestions and constructive feedback for the current and future enhancement of the framework.

The respondents were initially informed of the purpose of the questionnaire and were presented with the framework diagram, with a brief explanation of the components of the framework. The respondents were also asked to thoroughly review the content and composition of the framework. The 5-point Likert scale, ranging from (1) "strongly disagree" to (5) "strongly agree," was employed to assess the level of agreement and to compute the mean score for each evaluation item. The targeted respondents comprised construction professionals from client organisations, including government and developer entities, contractor companies classified as Grade 7, and consulting quantity surveying firms. These groups represent the three principal parties involved in the final accounts closing phase of construction projects. A purposive sampling method was employed to select respondents with experience in managing final accounts closing, thereby ensuring the reliability of the data due to their fundamental knowledge and judgment of the subject matter. All participants in this validation assessment were chosen based on the criteria of having a minimum of five (5) years of professional experience and possessing technical expertise in contract administration, particularly concerning the final account process.

The questionnaire was disseminated via electronic means (Google Forms) and printed copies to cater to varied respondent preferences. A total of forty (40) responses were collected from targeted respondents, comprising experienced practitioners in the construction industry, specifically engaged in final account closing management. These total responses are considered appropriate, aligned with established related precedents research as mentioned in Chapter 3 (section 0)

6.9.2 Result of Framework Validation

The results of the validation survey are divided into two (2) main sections. Section 1 of the questionnaire survey gathers background information from the respondents. This data is crucial for assessing the reliability of the responses concerning the established framework for final account closing management within the construction industry. This section comprises four (4) questions pertaining to the respondents' background profiles.

Section 2 of the survey collects feedback from respondents concerning the content, structure, practicality, and applicability of the developed framework. Consequently, pertinent questions were formulated and presented to the respondents. Furthermore, comments for enhancements and suggestions were solicited in this section.

6.9.2.1 Respondents' Background Profile

Table 6.4
Types of Organisation

Types of Organisation	**Overall Respondent**	
	Frequency	Percentage (%)
Consultant (Quantity Surveyor)	17	43
Contractor Company (G7)	12	30
Government / Regulatory Bodies	9	22
Client / Developer	2	5
Total	**40**	**100**

Table 6.4 presents the types of organisations represented by the respondents. The largest group of respondents comprises professionals from Consultant (Quantity Surveyor) organisations, constituting 42% of the total sample. This is followed by respondents from Contractor Companies (G7), who represent 30%, and those from Government or Regulatory Bodies, accounting for 22%. A smaller group, 5%, is associated with Client/Developer organisations. This distribution indicates that the survey encompasses a diverse range of industry perspectives, with significant representation from consultants and contractors, who are typically most engaged in final account processes.

Table 6.5
Position of the Respondent

Position in Organisation	**Overall Respondent**	
	Frequency	Percentage (%)
Top-Level Management	17	43
Middle-Level Management	23	57
Total	**40**	**100**

Table 6.5 display the position of respondents in the organisation. A majority (57%) of the respondents are in Middle-Level Management roles, while 43% are in Top-Level Management. This suggests that the feedback is derived from individuals who possess both practical experience and strategic oversight within their organisations, thereby enhancing the depth and credibility of their responses.

Table 6.6
Years of Experience in the Construction Industry

Experience in the construction industry	**Overall Respondent**	
	Frequency	Percentage (%)
5 – 10 years	5	12
11 – 15 years	18	45
16 – 20 years	6	15
More than 20 years	11	28
Total	**40**	**100**

Table 6.6 illustrate the respondents' years of experience in the Malaysian construction industry. Nearly half of the respondents (45%) have 11–15 years of experience in the construction industry. A significant portion (28%) have accumulated more than 20 years of experience, while 15% and 12% have 16–20 years and 5–10 years of experience, respectively. This distribution indicates that the majority of respondents are seasoned professionals, thereby enhancing the reliability of their insights.

Table 6.7
Years of Experience in Handling Final Account

Experience handling Final Account	**Overall Respondent**	
	Frequency	Percentage (%)
Less than 5 years	1	2
5 – 10 years	9	22
11 – 15 years	18	46
16 – 20 years	4	10
More than 20 years	8	20
Total	**40**	**100**

Table 6.7 illustrates the years of experience respondents have in managing final accounts for construction projects. The largest group of respondents (46%) possesses 11–15 years dealing with final account management. This is followed by 22% of respondents with 5–10 years of experience, 20% with more than 20 years, 10% with 16–20 years, and a small group (2%) with less than 5 years. This distribution reflects the general industry experience, suggesting that the majority of respondents are not only experienced in construction but also specifically in final account management. In summary, the respondents' background profiles predominantly consist of experienced professionals from consultant and contractor backgrounds, holding significant management positions and possessing substantial experience in both the construction industry and final account processes. This strong professional profile suggests that the feedback provided in the survey is both informed and relevant to the evaluation of the framework.

6.9.2.2 Evaluation of Framework Components

Table 6.8
Analysis of the Framework's Components

Statement	**Frequency**					**Mean**
Section A: Evaluation of Framework's Components	**SD**	**D**	**MA**	**A**	**SA**	
(A1) Appropriate Incorporation of Components in the framework	0	0	4 (10%)	13 (33%)	23 (58%)	4.47
(A2) Proper Identification of Major Problems in Final Account Closing Issues	0	0	9 (23%)	10 (25%)	21 (53%)	4.30
(A3) Proper Identification of Root Causes in Final Account Closing Issues	0	1 (2.5%)	4 (10%)	16 (40%)	19 (48%)	4.30
(A4) Appropriate Preventive Solution in Final Account Closing Issues	0	0	6 (15%)	14 (35%)	20 (50%)	4.35
(A5) Appropriate Relationship Between Root Causes and Major Problem	0	0	4 (10%)	16 (40%)	20 (50%)	4.40
(A6) Appropriate Relationship between Preventive Solutions to Address Root Causes and Major Problems	0	0	5 (13%)	16 (40%)	19 (48%)	4.35

Table 6.8 above presents the analysis for the survey in sections A, which evaluate the components and logical relationships within the established framework. Each section was rated by respondents on a 5-point Likert scale, where 1 indicates Strongly Disagree (SD) and 5 indicates Strongly Agree (SA). The table displays the frequency of each response and mean score for each statement, which measures the respondents' perceptions regarding the appropriateness of the framework's components and their relationships. Across all six statements, the results reveal a strong consensus among experienced practitioners in support of the framework's validity and design. For instance, in statement A1 (Appropriate Incorporation of Components in the Framework), 23 respondents (58%) strongly agreed, and 13 (33%) agreed, resulting in a high mean score of 4.47.

A similar pattern is observed in statement A2 (Proper Identification of Major Problems), where over half (53%) strongly agreed and a quarter (25%) agreed, resulting in a mean of 4.3. The remaining responses were mostly moderately agreed (23%), with no disagreement. This suggests that the framework's identification of major problems resonates well with practitioners' real-world experiences.

Statement A3 (Proper Identification of Root Causes) also demonstrates robust support, with 48% strongly agreeing and 40% agreeing. Only one respondent (2.5%) disagreed, and 10% moderately agreed, leading to a mean of 4.3. This indicates that the root causes identified in the framework are largely seen as accurate and relevant.

For statement A4 (Appropriate Preventive Solution), half of the respondents (50%) strongly agreed and 35% agreed, with a mean of 4.35. This reflects confidence in the proposed preventive solutions' practicality and effectiveness.

Statements A5 and A6, which assess the logical coherence of the framework, particularly the relationship between root causes, major problems, and preventive solutions, recorded mean values of 4.40 and 4.35, respectively. The relatively high concentration of "Agree" and "Strongly Agree" responses in these items signifies a shared confidence among respondents in the causal and solution relationship established by the framework.

The mean scores range from 4.3 to 4.47, indicating a strong consensus among experienced practitioners regarding the framework's validity in terms of its components, identification of problems and root causes, and the appropriateness of the relationships between these elements. This high level of agreement suggests that the framework is perceived as both comprehensive and logically structured, with its

preventive solutions and problem-cause relationships resonating well with industry professionals.

In summary, the validation results for section A demonstrate robust support for the framework's structure, content and logic. The high mean scores and the concentration of responses in the "Agree" and "Strongly Agree" categories indicate that the framework is perceived as both comprehensive and highly relevant to the Malaysian construction industry. This positive feedback provides a strong foundation for its practical application and further development.

6.9.2.3 Evaluation on the Appropriateness and Practicality of the Framework

Table 6.9
Analysis of the Framework's Appropriateness and Practicality

Statement	**Frequency**					**Mean**
Section B: Evaluation of Appropriateness and Practicality	**SD**	**D**	**MA**	**A**	**SA**	
(B1) Suitability of the Framework as Guidance for Enhancing Final Account Closing Management	0	0	5 (13%)	17 (43%)	18 (45%)	4.32
(B2) Practicability of the Framework for Construction Projects	0	0	4 (10%)	15 (38%)	21 (53%)	4.42
(B3) Appropriateness of the Framework in Mitigating Final Account Closing Challenges	0	0	8 (20%)	14 (35%)	18 (45%)	4.25

Table 6.9 above presents a comprehensive analysis of sections B, which evaluate the practical appropriateness and practicality of the Established Framework for Improving Final Account Closing in the Malaysian Construction Industry. These sections specifically assess the framework's suitability as guidance, its practicability for construction projects, and its appropriateness in mitigating final account closing challenges.

The results demonstrate exceptionally strong endorsement across all three dimensions of practical application. In statement B1, which assesses the suitability of the framework as a guide for enhancing final account closing management, 45% of respondents strongly agreed and 43% agreed, while only 13% moderately agreed, with

no negative responses recorded. This yields a mean score of 4.32, indicating that practitioners perceive the framework as highly suitable for providing guidance in final account closing management.

Statement B2, focusing on the framework's practicability in the context of construction projects, attained the highest mean score in this section at 4.42. This rating, supported by 38% of respondents selecting "Agree" and a notable 53% selecting "Strongly Agree," highlights a particularly strong perception of the framework's applicability in real-world project settings. Only 10% moderately agreed, with no disagreement recorded. This highly positive response suggests that practitioners perceive the framework as also practically implementable in real construction project environments.

Statement B3 evaluates the framework's appropriateness in mitigating challenges associated with final account closings, yielding a mean score of 4.25. While this score is marginally lower compared to the others in the section, it remains within the high agreement range. The frequency data show 20% of respondents moderately agreed, while the majority (35% and 45%) chose "Agree" and "Strongly Agree," respectively. This suggests that the framework is broadly regarded as a competent tool for addressing existing challenges in final account closing.

The absence of any negative responses (strongly disagree or disagree) across all three statements indicates unanimous acceptance of the framework's practical value. The concentration of responses in the upper end of the scale (agree and strongly agree categories consistently representing 80-90% of responses) demonstrates robust confidence in the framework's real-world applicability.

In summary, the validation results for this section provide strong empirical support for the framework's practical utility. The consistently high mean scores (ranging from 4.25 to 4.42) reflect practitioners' confidence that the framework can serve as effective guidance, be practically implemented in construction projects, and contribute meaningfully to mitigating final account closing challenges. These insights complement the findings from Section A, demonstrating both internal coherence and practical utility of the framework as a tool for improving final account closing processes in the Malaysian construction industry.

6.9.2.4 Evaluation on the Reliability and Usefulness of the Framework

Table 6.10
Analysis of the Framework's Reliability and Usefulness

Statement	Frequency					Mean
Section C: Evaluation of Reliability and Usefulness	**SD**	**D**	**MA**	**A**	**SA**	
(C1) Reliability of the framework to manage the final account closing process	0	0	6 (15%)	15 (38%)	19 (48%)	4.32
(C2) Effectiveness of the framework in enhancing the final account closing process	0	0	9 (23%)	10 (25%)	21 (53%)	4.30
(C3) Potential of the framework in minimising delays and disputes in final account closing	0	0	6 (15%)	16 (40%)	18 (45%)	4.30
(C4) Usefulness of the framework for overall improvement of final account closing in the construction industry	0	0	4 (10%)	13 (33%)	23 (58%)	4.47

Table 6.10 above provides an analysis of data in Section C, which evaluates the reliability and usefulness of the established framework. These sections specifically assess the framework's reliability in managing final account closing processes, its effectiveness in enhancing the processes, its potential to minimise delays and disputes, and its overall usefulness.

The findings indicate strong support across all four dimensions of reliability and usefulness. Statement C1, which evaluates the framework’s reliability in managing the final account closing process, yields a mean score of 4.32, suggesting that construction practitioners perceive the framework as highly reliable for this purpose. The distribution of responses indicates substantial confidence among respondents, with 47.5% strongly agreeing and 37.5% agreeing that the framework's reliable. Only 15% moderately agreed, and no negative responses were recorded.

Similarly, statement C2, which evaluates the framework’s effectiveness in enhancing the final account closing process, yielded a mean of 4.3. Although there was a slightly higher percentage of moderate agreement at 23%, the combined 78% of respondents who selected either “Agree” or “Strongly Agree” reflects a strong expectation of the framework's potential to enhance final account closing processes.

Statement C3, which pertains to the framework's potential to reduce delays and disputes during final account closing, also attained a mean score of 4.30. This is supported by 40% and 45% of respondents selecting "Agree" and "Strongly Agree" respectively. This suggests that practitioners believe the framework can enhance efficiency and mitigate the delays and disputes that frequently affect final account closing processes.

Finally, Statement C4 received the highest mean score of 4.47, highlighting the framework's effectiveness in enhancing the overall process of final account closing within the industry. The findings reveal strong support with 33% of respondents agreed, and a significant 58% strongly agreed. The relatively low percentage of moderate agreement (10%) and the absence of any disagreement further underscore the framework's perceived value and its potential to contribute to the overall success of final account closing in the Malaysian construction industry.

In conclusion, the overall findings presented in Sections A, B and C substantiate that the proposed framework is not only theoretically comprehensive but also widely viewed as a reliable and effective tool for managing, enhancing, and streamlining the final account closing process in the construction industry. This strong endorsement from experienced professionals validates the framework's practical applicability and advantages.

6.9.2.5 Comment and Suggestion

In addition to providing the rate for each validation item, the respondents offered comments and suggestions on the proposed framework. Table 6.10 presents the comments and suggestions by the respondents or experts involved in the validation assessment.

Table 6.11
Comments and Suggestions on the Framework

Type of respondents	Years of experience	Comments	Categories
Government / Regulatory Bodies	11 – 15 years	The components are well-structured and organised, clearly showing how issues and solutions relate to final accounts. The issues	Components and structure

Type of respondents	Years of experience	Comments	Categories
		and solutions discussed can also be applied to other areas of project management	
Consultant (Quantity Surveyor)	5 – 10 years	The framework's diagram is a bit compact, which might make it tricky for readers to understand. It could be helpful to simplify the diagram to make it clearer	Components and structure
Consultant (Quantity Surveyor)	11 – 15 years	The framework provides valuable information on the issues or conflicts encounter during the final account closing	Components and structure
Contractor Company (G7)	11 – 15 years	The issues highlighted accurately reflect the real nature of the construction industry	Components and structure
Client / Developer	11 – 15 years	The preventive solution is addressed and well explained within the frameworks	Components and structure
Government / Regulatory Bodies	16 – 20 years	Issues with defects can also complicate the process of final account	Key issues
Consultant (Quantity Surveyor)	11 – 15 years	Variation issues have a big impact on the final account because they often lead to an increase in the overall construction cost	Key issues
Contractor Company (G7)	11 – 15 years	One issue that affects the final account closing process is the problem with defects, especially when there are delays in issuing the CMGD. If the CMGD is delayed, the contractor can't receive their retention money or performance bond.	Key issues
Consultant (Quantity Surveyor)	16 – 20 years	Loss and expenses claim is a significant factor that impacts the process of assessing and approving the final account	Key issues
Consultant (Quantity Surveyor)	16 – 20 years	Incompetence can fundamentally be the root cause of all major problems in the final account. Additionally, organisational bureaucracy may contribute to the complexity of claims and valuations, as these are governed by the company's standard operating procedures and decisions made by higher authorities.	Key issues

Type of respondents	Years of experience	Comments	Categories
Consultant (Quantity Surveyor)	More than 20 years	All documents, including V.O. approval, need to be resolved before the CPC is issued.	Key issues
Consultant (Quantity Surveyor)	More than 20 years	Staffing and the person in charge of the project should be maintained to ensure a smooth and clear approach when preparing the final account.	Key issues
Contractor Company (G7)	16 – 20 years	This framework needs to be implemented for all parties involved, including the contractor, consultant, and client	Usability and Implementation
Government / Regulatory Bodies	More than 20 years	Provide specific details and explanations on how to use and the stages involved.	Recommendation
Consultant (Quantity Surveyor)	More than 20 years	The framework should include the activity and timeframe in the final account closing process	Recommendation
Client / Developer	11 – 15 years	The insights in this framework can help construction professionals streamline the final account process	Overall perception
Government / Regulatory Bodies	5 – 10 years	Good approach	Overall perception

The comment and suggestion section of the questionnaire obtained seventeen (17) responses. These comments offer feedback and suggestions regarding the framework, which has been grouped into five (5) categories: components and structure, key issues, usability and implementation, recommendations and overall perception. In terms of the framework's components and structure, many respondents appreciate the framework's organisation and how it connects problems and solutions. Respondents view the framework as a useful alert system for potential issues in final account closing. However, some respondents mention that the diagram is too compact, suggesting it should be simplified and accompanied by more detailed explanations for better understanding.

Several key issues have been elaborated by the respondents regarding the final account, which supports the findings of this research. Several respondents highlighted

that the issue of organisational bureaucracy, variations and defects is seen as a significant problem affecting the final account. The defect issue, even though not specifically displayed in the framework, was one of the findings contributing to the final account closing issues. This issue fell under the non-fulfilment of contractual requirements as described in Chapter 5, Section 5.3.3.7. In addition, claims for loss and expenses are identified as a new key issue in final account closing, as highlighted by one respondent.

In terms of recommendations, respondents suggest adding activity timelines and clear procedural guidance in the framework. This comment is taken as a future improvement of the framework. Some respondents have also given an overall perception of the framework, indicating that the framework is generally viewed as reliable and valuable for the construction industry. Respondents also believe it can help professionals streamline and improve the final account process.

6.10 Summary

In this chapter, the discussion focuses on the development and validation of the framework for the final account closing in a construction project. The development of the framework is based on the analysis results obtained in Chapters 4 and 5. The developed framework also refers to the Intelligence-Design-Choice (IDC) Model, developed by Newell & Simon (1972), as shown in Figure 6.1. Three (3) main components of the IDC model, which consist of intelligence (identifying the problem), design (developing possible solutions), and choice (selecting the best solution), have been used as a basis to develop the main components of this framework. Consequently, the framework developed in this research consists of three (3) main components, including root causes, major problems, and preventive solutions of final account closing issues.

The developed framework has gone through the validation process to ensure accuracy, reliability, and applicability in real-world contexts. The validation was conducted through a questionnaire survey involving 40 experienced construction professionals from consultant, contractor, government, and client organisations. The majority of respondents held management positions and had substantial experience in the construction industry and final account processes. The validation results demonstrated that the framework was perceived as comprehensive, logically structured,

and relevant to the Malaysian construction industry. Respondents believed the framework could enhance the final account closing process, minimise delays and disputes, and contribute to the overall success of final account closing in the Malaysian construction industry.

CHAPTER 7
CONCLUSION

7.1 Introduction

This final chapter concludes the research by summarising the key findings for each objective addressed in the previous chapters. The preceding chapters have systematically examined and analysed the issues and challenges pertaining to the final account closing process, encompassing the identification of issues, major problems, root causes, and the formulation of solutions to prevent these problems and improve the final account closing process. These findings have led to the development of a preventive solution framework for improving the final account closing process within the Malaysian construction industry, which is the main outcome of this research. Subsequently, the chapter will articulate the significant contributions of this research to the body of knowledge, practice, and policy. The limitations inherent in this research will be recognised, viewing them not as shortcomings but as opportunities to inform further investigation. This chapter concludes with recommendations towards industry stakeholders and the academic community for future research, along with a reflection on the significance and potential impact of the research.

7.2 Main Findings of the Research

This research was initiated in response to a persistent challenge and issues with the final account closing process within the Malaysian construction industry. When the final account process is not managed efficiently, it can lead to significant disputes, which in turn damage financial stability and strain relationships between clients, contractors, and other stakeholders, thereby impacting future business opportunities. Unsuccessful final account closing, particularly when it leads to disputes and financial issues, can damage the reputations of the involved parties and the construction industry as a whole.

The fundamental finding of this research is the development of a preventive solution framework that provides construction practitioners with a clear map to the

major problems, root causes, and preventive solutions that can improve the final account closing process. This enables stakeholders to take proactive measures, thereby preventing problems from escalating into disputes and saving considerable time and cost. This chapter will outline the findings from each chapter and its successful accomplishment. The findings from each objective have collectively supported the achievement of the research aim, which is to develop a preventive solution framework for improving final account closing management in the Malaysian construction industry. The objectives of this research are as follows:

i. To examine the current issues associated with final account closing within the Malaysian construction industry
ii. To identify and rank the major problems related to final account closing in the Malaysian construction industry
iii. To investigate the root causes contributing to the major problems of final account closing in Malaysia's construction industry
iv. To determine appropriate solutions for preventing the major problems and their root causes towards improving the final account closing in the Malaysian construction industry
v. To propose a preventive solution framework for improving final account closing within the Malaysian construction industry

7.3 Aim and Objectives of the Research

The research process commenced with a comprehensive literature review to identify the key issues and knowledge gaps related to the research topic. Following this, an extensive data collection process was undertaken. To achieve Objectives One and Two, a quantitative survey was conducted, with the data being analysed using descriptive and inferential statistics. The results from this survey informed the subsequent stage of data collection, which involved semi-structured interviews with experienced industry practitioners to achieve Objectives Three and Four. Thematic analysis was the approach adopted to analyse the qualitative data, from which key themes of root causes and preventive solutions were established.

A Preventive Solution Framework for Improving Final Account Closing was then developed based on the integrated findings from the quantitative analysis (Objective 2: To identify the major problems) and the thematic analysis (Objective 3:

To investigate the root causes, and Objective 4: To determine the solutions and strategies). To achieve the final objective (Objective 5), the developed framework was subjected to a rigorous validation process involving experienced industry professionals to confirm its relevance, practicality, and applicability within the Malaysian construction industry.

7.3.1 Objective One: To Examine the Current Issues Associated with Final Account Closing Within the Malaysian Construction Industry

The quantitative survey identified the current scenario of final account closing in the Malaysian construction industry, confirming that the process is fraught with challenges. The findings revealed that a significant majority of industry professionals (52%) perceive the process as 'Difficult' or 'Very Difficult'. It was also found that private-funded projects are more prone to disputes during final account closing compared to their government-funded counterparts. The impact of these issues is substantial, with 60% of respondents reporting that their organisations were moderately or very affected by final account problems. Furthermore, the duration for settlement typically extends to two or three years, far exceeding the contractually stipulated period. The analysis highlighted that problems related to the evaluation process and contractual management, particularly in documentation and the valuation of variations, are the most critical contributing factors.

7.3.2 Objective Two: To Identify and Rank the Major Problems Related to Final Account Closing in the Malaysian Construction Industry

By identifying the major problems, contractual parties can be more attentive at the early stage and during the construction stage, ensuring that delays and disputes in the final account stage can be mitigated. Based on the quantitative analysis, this research successfully identified eight (8) major problems in final account closing, as detailed in Chapter 4. These major problems consist of, (a) Delay in Evaluation and Preparation of the Final Account (b) Complexity of Claim and Valuation Process for Variation Works (c) Delay in Approving and Finalising Variation Work (d) Disagreement on the Valuation of Variation Works (e) Lack of Documents and Evidence for Submission of the Final Account Claim (f) Delay in Submission of the Final Account Claim (g)

Disagreement on the Valuation of the Final Account (h) Cost Overrun due to Variation and Provisional Quantities

7.3.3 Objective Three: To Investigate the Root Causes Contributing to the Major Problems of Final Account Closing in Malaysia's Construction Industry

The attainment of Objective Three was made through semi-structured interviews, which provided deep insights from industry practitioners experienced in final account settlement. Thematic analysis was applied to the qualitative data to understand the underlying reasons for the major problems. Ten (10) distinct themes of root causes were identified as listed below:

i. Documentation Issues
ii. Improper Variation Orders
iii. Contract Ambiguity
iv. Incompetencies
v. Lack of Commitment
vi. Communication and Coordination Breakdown
vii. Non-Fulfilment of Contractual Obligations
viii. Organisational Bureaucracy
ix. Lack of Trust and Integrity
x. Inadequate Project Preparation

7.3.4 Objective Four: To Determine Appropriate Solutions for Preventing the Major Problems and Their Root Causes Towards Improving the Final Account Closing in the Malaysian Construction Industry

The attainment of Objective Four was also achieved through the semi-structured interviews. The thematic analysis of the qualitative data provided insights into how these issues can be resolved proactively to prevent them from escalating into disputes. Ten (10) different themes for preventive solutions were identified as listed below:

i. Contractual Compliance
ii. Comprehensive Contract Provisions & Procedures
iii. Proper Documentation Management
iv. Information Technology Adoption

v. Collaborative Work Approach
vi. Effective Resource Management
vii. Provide Competent Personnel
viii. Timely Processing
ix. Appropriate Estimation, Design and Planning

7.3.5 Objective Five: To Propose the Preventive Solution Framework for Improving Final Account Closing Within the Malaysian Construction Industry

A proposed framework, the "Preventive Solution Framework for Improving Final Account Closing," was developed based on the combination of quantitative and qualitative findings. The framework is structured around three primary components: the Major Problems, their underlying Root Causes, and the corresponding Preventive Solutions. Its theoretical underpinning is based on the Intelligence-Design-Choice (IDC) Model, which provides a structured problem-solving process.

Intelligence Phase: This involves identifying the "Major Problems" and their underlying "Root Causes." The framework provides practitioners with the insight to understand potential problems and the reasons behind them. It promotes a diagnostic approach, focusing on root issues rather than just symptoms.

Design Phase: This corresponds to the "Preventive Solutions" component. For each identified major problem and its root cause, the framework offers a range of potential preventive strategies and solutions. This enables practitioners to develop a customised approach to risk mitigation that aligns with their specific project context.

Choice Phase: While the framework offers solutions, the "choice" of which specific strategies to implement lies with the project stakeholders. It enables them to make informed decisions from the start and throughout the project to proactively prevent final account issues.

For validation purposes, the framework was evaluated by 40 experienced construction professionals through a questionnaire survey. The validation aimed to assess the framework's content, structure, practicality, and applicability. The results indicated strong industry support, with respondents agreeing that the framework is comprehensive, logically structured, and highly relevant. They confirmed its potential to enhance the final account closing process, minimise delays and disputes, and

contribute to the overall success of final account management in the Malaysian construction sector.

7.4 Contributions of the Research

This research makes several significant contributions to the body of knowledge, with implications for policy, industry practice, and academia, and it directly addresses the research gaps. Previous studies on final accounts have primarily addressed issues that arise after disputes have occurred and often emphasised on public-sector or government-funded projects. In contrast, this study focuses on private-sector projects utilising the PAM Contract 2018 to develop a preventive framework to assist practitioners in identifying problems, investigating root causes, and determining appropriate preventive actions before disputes escalate.

7.4.1 Contribution to the Body of Knowledge

The main contribution of this research is the development of the Preventive Solution Framework for improving final account closing in the Malaysian construction industry. The framework developed in this research adds new knowledge by shifting from dispute resolution to dispute prevention. It emphasises that the final account closing process is not only involved after the post-completion stage, but should be managed throughout the entire construction lifecycle, including planning, construction, completion, and close-out stages. This preventive orientation strengthens the theoretical and practical understanding of final account management by showing that successful final account closing depends on early information control, timely valuation, proper variation management, contractual compliance, and collaboration among clients, contractors, and quantity surveyors.

This research also contributes theoretically by applying the Intelligence-Design-Choice (IDC) Model as a problem-solving foundation for final account closing. The IDC model supports the framework in a systematic sequence that includes the (i) intelligence phase, which identifies the major problems and their root causes, (ii) the design phase, which develops preventive solutions, and (iii) the choice phase, which assists practitioners in selecting suitable actions according to project circumstances.

This research extends the application of the IDC model into construction contract management, particularly in the context of final account closing.

Furthermore, this research employs Exploratory Factor Analysis (EFA) to categorise the problems associated with the final account closing process. The EFA conducted in this research reduced the 40 identified problems into 5 coherent latent components, namely evaluation process, contractual management, incompetencies of the project team, professional practice, and unforeseen events, thereby adding a new body of knowledge to the field. This contributes a novel finding that can inform future studies on certain aspects, such as developing research instruments and conducting comparative research on the final account across different contract types.

Additionally, this study addresses the methodological gap by employing an Explanatory Sequential Mixed-Methods (ESMM) approach, resulting in a more detailed and thorough understanding of final account closing management in construction projects. The quantitative phase provided breadth by identifying the current scenario, grouping the problems through Exploratory Factor Analysis, and ranking the most significant problems through descriptive analysis. The qualitative phase then provided depth by explaining why these major problems occur and how they may be prevented. This integration strengthens the empirical basis of the framework and provides a clearer connection between statistical patterns and practitioner experience, thereby offering a replicable framework for future researchers addressing construction management issues.

7.4.2 Contribution to Policy and Governance

The successful closing and effective management of final accounts in the construction industry can support the National Construction Policy (NCP) 2030, particularly on Thrust 6, which emphasises "Strengthening Good Governance and Adoption of Best Practices". The successful closing of final accounts without any problems reflects well-structured project management practices. It indicates that a project and its costs have been closely monitored, which is a cornerstone of good governance in the construction industry. The timely closing of the final account is also in line with the "best practices" advocated by the NCP 2030, as it has fulfilled contractual obligations in construction projects. Furthermore, successful final account closing and management align with the foundational aspect of the current Ekonomi

Madani Initiative, which emphasises governance and monitoring. It ensures transparency and accountability in financial dealings within construction projects, thereby supporting good governance practices.

7.4.3 Contribution to Industry Practice

The framework offers a practical guideline for industry professionals and stakeholders to improve final account management. It serves as a checklist from the project's start through its entire lifecycle, helping to minimise delays and disputes related to inefficient final account closing, thus avoiding unnecessary legal costs due to disputes and improving cash flow for all parties involved. Furthermore, improving final accounts can enhance a company's reputation, build trust among stakeholders, and potentially lead to more business opportunities.

7.4.4 Contribution to Academia

This study contributes to the academic literature by providing insights into final account issues in the Malaysian construction industry and fostering collaboration between academia and industry. The developed framework can be integrated into existing knowledge and provide a valuable resource for future research. The research methodology employed in this research also provides a robust template for future applied research in the construction management field.

7.5 Limitation and Delimitations of the Research

The findings of this research must be considered in light of its limitations. The study was focused on private projects in Malaysia that specifically utilised the PAM Contract 2018, and the scope was further narrowed to high-scale projects involving G7 Contractors. Therefore, the findings may not be directly generalisable to government projects, smaller-scale projects, subcontractors, or projects that use different contractual arrangements. The use of convenience sampling may also limit the broader generalisability of the results. Furthermore, the developed framework is tailored to the local context and may require adaptation for use in other countries with different cultural and regulatory environments. Finally, time and budget constraints did not

permit the framework to be tested on a real construction project, which would have provided deeper insights into its practical application and strengths.

7.6 Recommendation to the Malaysian Construction Industry

It is recommended that construction industry stakeholders, including clients, contractors, and consultants, adopt the developed framework in this research as a practical guide to enhance their final account management practices. By proactively identifying the potential problems and understanding their root causes as detailed in the framework, practitioners can implement the recommended preventive solutions from the early stages of a project. This will promote greater accountability, transparency, and trust among stakeholders. The proactive approach introduced in this framework can help to reduce the incidence of disputes and delays in final account closing, ultimately improving the reputation and efficiency of the Malaysian construction industry as a whole.

7.7 Recommendations for Future Research

Building on the findings and limitations of the present research, several directions for future research are suggested to further expand knowledge in this field. The present research focuses on the problems in final account closing in private construction projects in Malaysia, utilising the PAM Contract 2018. Future research could expand to include different types of construction projects, such as public projects, local authority projects, government-linked company projects, and others. Additionally, future research could investigate construction projects that utilise other types of contracts, such as the JKR, FIDIC, CIDB, and IEM. A comparative study between different project types and contracts would provide valuable insights into whether the major problems and their root causes differ across sectors and procedures.

Future research could also be conducted to include a wider range of stakeholders. While this research focused on private clients, G7 contractors, and quantity surveyors, future work could incorporate the perspectives of public clients, sub-contractors, suppliers, architects, and engineers. This would provide a comprehensive perspective and understanding of the interaction among the various parties throughout the contractual chain.

Moreover, it would be beneficial to conduct a similar study in the near future by using other research methods, such as the case study method, to determine whether the problems associated with final account closing remain significant. This can help in formulating and developing other strategies for the successful completion of final account closing in construction projects in Malaysia.

Since the proposed conceptual framework has only been validated by industry practitioners, examining its application in a real project is necessary to identify its strengths, weaknesses, and potential areas for improvement. Although direct testing in a project is not feasible, gathering insights from practitioners who rely on it as their reference for handling and managing the final account process can also provide valuable feedback. This would significantly enhance the validity and reliability of the conclusion regarding the developed framework for achieving successful final account closing.

REFERENCES

Abdel-Khalek, H. A., Aziz, R. F., & Abdellatif, I. A. (2019). Prepare and Analysis for Claims in Construction Projects Using Primavera Contract Management (PCM). *Alexandria Engineering Journal*, *58*(2), 487–497. https://doi.org/10.1016/j.aej.2019.05.001

Abdullah, M. N., Mustapa, S. A. H. S., Abdul, S., & Syed Mustapa, H. (2022). Factors and Parties Initiating Variation Orders of Mosques Construction in Perak, Malaysia: A Case Study. *Malaysian Construction Research Journal*, *16*(2), 103–110.

Abdul-Rahman, H., Kho, M., & Wang, C. (2014). Late Payment and Nonpayment Encountered by Contracting Firms in a Fast-Developing Economy. *Journal of Professional Issues in Engineering Education and Practice*, *140*(2). https://doi.org/10.1061/(ASCE)EI.1943-5541.0000189

Abidoye, J., Ibrahim, S., Adamu, A. D., & Olaku, A. P. (2018). Demystifying the Effects of Final Accounts Settlement On Building Contractors in Abuja, Nigeria. *Environmental Technology & Science Journal*, *9*(1), 145–154.

Aborisade, O. P. (2013). Data Collection and New Technology. *International Journal of Emerging Technologies in Learning (iJET)*, *8*(2), 48. https://doi.org/10.3991/ijet.v8i2.2157

Adedokun, O. A., Ibironke, O. T., & Babatunde, S. O. (2013). Assessment of Competitive Tendering Methods of Procuring Educational Building Projects in Nigeria. *Journal of Facilities Management*, *11*(1), 81–94. https://doi.org/10.1108/14725961311301484

Ahmad, M., & Wilkins, S. (2025). Purposive Sampling in Qualitative Research: A Framework for the Entire Journey. *Quality & Quantity*, *59*(2), 1461–1479. https://doi.org/10.1007/s11135-024-02022-5

Ahmed, S. K. (2024). The Pillars of Trustworthiness in Qualitative Research. *Journal of Medicine, Surgery, and Public Health*, *2*, 100051. https://doi.org/10.1016/j.glmedi.2024.100051

Ahmed, S. K. (2025). Sample Size for Saturation in Qualitative Research: Debates, Definitions, and Strategies. *Journal of Medicine, Surgery, and Public Health*, *5*, 100171. https://doi.org/10.1016/j.glmedi.2024.100171

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., M. Ameen, B. M., & Khdhir, R. M. (2025). Using Thematic Analysis in Qualitative Research. *Journal of Medicine, Surgery, and Public Health*, *6*, 100198. https://doi.org/10.1016/j.glmedi.2025.100198

Ahzami, E. (2017). *Factors affecting prompt settlement of final account*. Universiti Teknologi Malaysia.

AIAC. (2018). *Construction sector sees a higher number of dispute cases*. Asian International Arbitration Centre. https://www.aiac.world/news/252/Construction-sector-sees-a-higher-number-of-dispute-cases

Aibinu, A. A. (2009). Avoiding and Mitigating Delay and Disruption Claims Conflict: Role of Precontract Negotiation. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *1*(1), 47–58. https://doi.org/10.1061/(ASCE)1943-4162(2009)1:1(47)

Akinradewo, O., Aigbavboa, C., Oke, A., & Coffie, H. (2019). Appraisal of Risk Contingency Planning for Construction Projects. *IOP Conference Series: Materials Science and Engineering*, *640*(1), 012019. https://doi.org/10.1088/1757-899X/640/1/012019

Akintoye, A. (2000). Analysis of Factors Influencing Project Cost Estimating Practice. *Construction Management and Economics*, *18*(1), 77–89. https://doi.org/10.1080/014461900370979

Akintoye, O. O., Babalola, O., & Kukoyi, W. A. (2024). A Review of Importance of Construction Documents on Project Delivery. *International Journal of Latest Technology in Engineering, Management & Applied Science*, *XIII*(IV), 28–41. https://doi.org/10.51583/IJLTEMAS.2024.130405

Akomah, B. B., Mustapha, Z., Mensah, J. W., & Lawson, R. W. (2023). Variations in Building Construction Projects in Ghana: A Public Organisational Perspective. *Baltic Journal of Real Estate Economics and Construction Management*, *11*(1), 221–239. https://doi.org/10.2478/bjreecm-2023-0014

Al Nahyan, M. T., Sohal, A., Hawas, Y., & Fildes, B. (2019). Communication, Coordination, Decision-Making and Knowledge-Sharing: A Case Study in Construction Management. *Journal of Knowledge Management*, *23*(9), 1764–1781. https://doi.org/10.1108/JKM-08-2018-0503

Alaloul, W. S., Hasaniyah, M. W., & Tayeh, B. A. (2019). A Comprehensive Review of Disputes Prevention and Resolution in Construction Projects. *MATEC Web of Conferences*, *270*, 05012. https://doi.org/10.1051/matecconf/201927005012

Alaloul, W. S., Liew, M. S., & Wan Abdullah Zawawi, N. A. (2015). The Characteristics of Coordination Process in Construction Projects. *2015 International Symposium on Technology Management and Emerging Technologies (ISTMET)*, 159–164. https://doi.org/10.1109/ISTMET.2015.7359021

Alam, Md. K. (2024). Does the Relationship Between the Interviewer and Interviewee Matter in Qualitative Research? *ICRRD Quality Index Research Journal*, *5*(1). https://doi.org/10.53272/icrrd.v5i1.5

Alhilli, H. K., & Rezoqi, S. I. (2021). Investigating Variation Orders Causes in Iraqi Building Construction Projects. *E3S Web of Conferences*, *318*, 1–9. https://doi.org/10.1051/e3sconf/202131802003

Aliyari, M. (2024). Evaluating The Efficiency of Contractor's Guidelines in Improving the Success of Construction Projects. *International Journal of Modern Achievement in Science, Engineering and Technology*, *1*(3), 1–8. https://doi.org/10.63053/ijset.39

Aljohani, A. (2017). Construction Projects Cost Overrun: What Does the Literature Tell Us? *International Journal of Innovation, Management and Technology*, *8*(2), 137–143. https://doi.org/10.18178/ijimt.2017.8.2.717

Allemang, B., Sitter, K., & Dimitropoulos, G. (2022). Pragmatism as a Paradigm For Patient-Oriented Research. *Health Expectations*, *25*(1), 38–47. https://doi.org/10.1111/hex.13384

Almalki, S. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods Research—Challenges and Benefits. *Journal of Education and Learning*, *5*(3), 288. https://doi.org/10.5539/jel.v5n3p288

Almomani, M. A., Basri, S., Almomani, O., Capretz, L. F., Balogun, A., Husni, M., & Gilal, A. R. (2020). Using an Expert Panel to Validate the Malaysian SMEs-Software Process Improvement Model (MSME-SPI). In *Software Engineering Perspectives in Intelligent Systems* (Vol. 1294, pp. 844–859). Springer International Publishing. https://doi.org/10.1007/978-3-030-63322-6_72

Alrasheed, K. A., Soliman, E., & AlMesbah, F. E. (2023). Dispute Classification in Construction Projects Based on Litigation Cases. *Journal of Legal Affairs and*

Dispute Resolution in Engineering and Construction, *15*(3), 1–9. https://doi.org/10.1061/jladah.ladr-910

Alshammari, S., Al-Gahtani, K., Alhammad, I., & Braimah, N. (2017). A Systematic Method to Analyze Force Majeure in Construction Claims. *Buildings*, *7*(4), 1–22. https://doi.org/10.3390/buildings7040115

Alvi, M. H. (2016). A Manual for Selecting Sampling Techniques in Research. In *Munich Personal RePEC Archive* (Issue 2016, pp. 1–56).

Alwee, S. N. A. B. S. (2023). *The Development of A Building Information Modelling Process Protocol for Contract Administration of Design and Build Public Construction Projects in Malaysia*. Universiti Malaya Kuala Lumpur.

Amaratunga, R. (2016). *Towards Dispute Resolution in Construction Contracts in Sri Lanka: What is Quantity Surveyor's role on Dispute Avoidance rather than Dispute Resolution?*

Ameyaw, E. E., Chan, A. P. C., Owusu-Manu, D.-G., & Coleman, E. (2015). A Fuzzy Model for Evaluating Risk Impacts on Variability Between Contract Sum and Final Account in Government-Funded Construction Projects. *Journal of Facilities Management*, *13*(1), 45–69. https://doi.org/10.1108/JFM-11-2013-0055

Amoah, C., & Nkosazana, H. (2022). Effective Management Strategies for Construction Contract Disputes. *International Journal of Building Pathology and Adaptation*. https://doi.org/10.1108/ijbpa-01-2022-0004

Annamalai, N., Kamaruddin, S., Abdul Azid, I., & Yeoh, T. (2013). Importance of Problem Statement in Solving Industry Problems. *Applied Mechanics and Materials*, *421*, 857–863. https://doi.org/10.4028/www.scientific.net/AMM.421.857

Antoniou, F., & Tsioulpa, A. V. (2023). Assessing the Delay, Cost and Quality Risks of Claims on Construction Contract Performance. *Buildings*, *14*(2), 333. https://doi.org/10.20944/preprints202312.0716.v1

Antuchevičienė, J., Turskis, Z., & Zavadskas, E. K. (2006). Modelling Renewal of Construction Objects Applying Methods of the Game Theory. *Technological and Economic Development of Economy*, *12*(4), 263–268. https://doi.org/10.3846/13928619.2006.9637752

Aryal, S., & Dahal, K. R. (2018). A Review of Causes and Effects of Dispute in the Construction Projects of Nepal. *Journal of Steel Structures & Construction*, *04*(02). https://doi.org/10.4172/2472-0437.1000144

Asadi, R., Wilkinson, S., & Rotimi, J. O. B. (2023). Guidelines for Mapping Rework in the Contract Conditions of Construction Projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *15*(1). https://doi.org/10.1061/(ASCE)LA.1943-4170.0000563

Ashworth, A. (2013). *Contractual Procedures in Construction Industry*. Routledge.

Avença, I., Domingues, L., & Carvalho, H. (2024). Do the Project Manager's Soft Skills Foster Knowledge Sharing? *Project Leadership and Society*, *5*, 100139. https://doi.org/10.1016/j.plas.2024.100139

Ayodele, O. A., Chang-Richards, A., & González, V. (2020). Factors Affecting Workforce Turnover in the Construction Sector: A Systematic Review. *Journal of Construction Engineering and Management*, *146*(2). https://doi.org/10.1061/(ASCE)CO.1943-7862.0001725

Azir, K. M. A. K., Muhammad, W. M. N., Othman, M. N. F., & Daeng, D. H. (2018). The Insight on Quality Assessment System in Construction (QLASSIC) Implementation in Sarawak. *IOP Conference Series: Materials Science and Engineering*, *429*, 012103. https://doi.org/10.1088/1757-899X/429/1/012103

Azman, M. N. A., Dzulkalnine, N., Abd Hamid, Z., & Wai Beng, K. (2014). Payment Issue in Malaysian Construction Industry: Contractors' Perspective. *Jurnal Teknologi*, *70*(1), 57–63. https://doi.org/10.11113/jt.v70.2804

Azman, M. N. A., Dzulkalnine, N., Hamid, Z. A., Kamar, K. A. M., & Nawi, M. N. M. (2013). Payment Scenario in the Malaysian Construction Industry Prior to CIPAA. *Law and Dispute Resolution*.

Badroldin, M. K. A. M., Hamid, A. R. A., Raman, S. A., Zakaria, R., & Mohandes, S. R. (2016). Late Payment Practices in The Malaysian Construction Industry. *Malaysian Journal of Civil Engineering*, *162*(3), 149–162. https://doi.org/https://doi.org/10.11113/mjce.v28.16005

Baker, S. E., & Edwards, R. (2012). *How Many Qualitative Interviews is Enough? Expert Voices and Early Career Reflections on Sampling and Cases in Qualitative Research*.

Bakhary, N. A., Adnan, H., & Ibrahim, A. (2015). A Study of Construction Claim Management Problems in Malaysia. *Procedia Economics and Finance*, *23*(October 2014), 63–70. https://doi.org/10.1016/s2212-5671(15)00327-5

Bakhary, N. A., Adnan, H., & Ibrahim, A. (2018). *Construction Claim Problems in Malaysia: From the Contractors Perspective*. *02004*, 4–7.

Bakht, M. N., & El-Diraby, T. E. (2015). Synthesis of Decision-Making Research in Construction. *Journal of Construction Engineering and Management*, *141*(9), 1–18. https://doi.org/10.1061/(asce)co.1943-7862.0000984

Ballesteros-Pérez, P., Smith, S. T., Lloyd-Papworth, J. G., & Cooke, P. (2018). Incorporating The Effect of Weather in Construction Scheduling and Management With Sine Wave Curves: Application in the United Kingdom. *Construction Management and Economics*, *36*(12), 666–682. https://doi.org/10.1080/01446193.2018.1478109

Baloi, D., & Price, A. D. F. (2003). Modelling Global Risk Factors Affecting Construction Cost Performance. *International Journal of Project Management*, *21*(4), 261–269. https://doi.org/10.1016/S0263-7863(02)00017-0

Barnado, G., & Karim, R. A. (2024). *Dispute Resolution Strategies In Construction Projects To Mitigate Impacts On Time Performance – Project Owner's Perspective*. *5*(6). https://doi.org/10.46729/ijstm.v5i6.1201

Barros, G. (2010). Herbert A. Simon and The Concept of Rationality: Boundaries And Procedures. *Brazilian Journal of Political Economy*, *30*.

Bean, T. K., Mustapa, F. D., & Mustapa, M. (2019). *Research methodology: A preliminary approach for investigating the transaction cost economics in building information modeling (BIM) adopted procurement*. International Graduate Conference of Built Environment & Surveying.

Beavers, A. S., Lounsbury, J. W., Richards, J., Huck, S. W., & Skolits, G. J. (2013). Practical considerations for using exploratory factor analysis in educational research. *Practical Assessment, Research, and Evaluation*, *18*(6). https://doi.org/https://doi.org/10.7275/qv2q-rk76

Bekele, W. B., & Ago, F. Y. (2022). Sample Size for Interview in Qualitative Research in Social Sciences: A Guide to Novice Researchers. *Research in Educational Policy and Management*, *4*(1), 42–50. https://doi.org/10.46303/repam.2022.3

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the Practice of Cardiovascular Sciences*, *5*(3), 157. https://doi.org/10.4103/jpcs.jpcs_62_19

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation? *Qualitative Health Research*, *26*(13), 1802–1811. https://doi.org/10.1177/1049732316654870

Bordetsky, A., & Friman, H. (2007). Case-Studies of Decision Support Models for Collaboration in Tactical Mobile Environments. *Iccrts*, (October), 38.

Bougie, R., & Sekaran, U. (2020). Research Methods for Business A Skill-Building Approach. In *John Wiley & Sons, Inc.*

Boyacioglu, S. E., Greenwood, D., & Rogage, K. (2022). Incorporating Emerging Technologies in the Forensic Analysis of Construction Project Delays. *IOP Conference Series: Earth and Environmental Science*, *1101*(5), 052029. https://doi.org/10.1088/1755-1315/1101/5/052029

Brady, S. R. (2015). Utilizing and Adapting the Delphi Method for Use in Qualitative Research. *International Journal of Qualitative Methods*, *14*(5), 1609406915621381. https://doi.org/10.1177/1609406915621381

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2012). Thematic Analysis. *APA Handbook of Research Methods in Psychology*, *2*, 57–71.

Braun, V., & Clarke, V. (2013). *Successful Qualitative Research a practical guide for beginners*.

Braun, V., & Clarke, V. (2020). One Size Fits All? What Counts As Quality Practice in (Reflexive) Thematic Analysis? *Qualitative Research in Psychology*, *18*(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Burns, T., & Roszkowska, E. (2016). Rational Choice Theory: Toward a Psychological, Social, and Material Contextualization of Human Choice Behavior. *Theoretical Economics Letters*, *06*(02), 195–207. https://doi.org/10.4236/tel.2016.62022

Buvik, M. P., & Tvedt, S. D. (2016). The Impact of Commitment and Climate Strength on the Relationship Between Trust and Performance in Cross-Functional Project Teams. *Team Performance Management*, *22*(3/4), 114–138. https://doi.org/10.1108/TPM-02-2015-0011

Byrne, D. (2021). A Worked Example of Braun And Clarke's Approach to Reflexive Thematic Analysis. *Quality & Quantity*, *56*(3), 1391–1412. https://doi.org/10.1007/s11135-021-01182-y

Cakmak, E., & Cakmak, P. I. (2014). An Analysis of Causes of Disputes in the Construction Industry Using Analytical Network Process. *Procedia - Social and Behavioral Sciences*, *109*, 183–187. https://doi.org/10.1016/j.sbspro.2013.12.441

Cakmak, P. I. (2016). Causes of Disputes in the Turkish Construction Industry: Case of Public Sector Projects. *A/Z ITU Journal of the Faculty of Architecture*, *13*(3), 109–118. https://doi.org/10.5505/itujfa.2016.69885

Campbell, K., Orr, E., Durepos, P., Nguyen, L., Li, L., Whitmore, C., Gehrke, P., Graham, L., & Jack, S. (2021). Reflexive Thematic Analysis for Applied Qualitative Health Research. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2021.5010

Carson, L. D., & Carson, L. D. (2014). *Deterring Corruption: Beyond Rational Choice Theory*. (December 2014).

Chamuwange, S. K., & Yan, N. (2022). Identifying the Factors Affecting the Cost Management of Road Construction Projects in Tanzania: Review Paper. *Journal of Civil, Construction and Environmental Engineering*, *7*(3), 35. https://doi.org/10.11648/j.jccee.20220703.13

Chan, A. P. C., & Oppong, G. D. (2017). Managing the Expectations of External Stakeholders in Construction Projects. *Engineering, Construction and Architectural Management*, *24*(5), 736–756. https://doi.org/10.1108/ECAM-07-2016-0159

Chan, E. E., Nik-Bakht, M., & Han, S. H. (2021). Sources of Ambiguity in Construction Contract Documents, Reflected by Litigation in Supreme Court Cases. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *13*(4). https://doi.org/10.1061/(asce)la.1943-4170.0000498

Chang, P. L., & Yu, W. der. (2016). Developing a General Model for Construction Problem Solving for an Engineering Consulting Firm. *KSCE Journal of Civil Engineering*, *20*(6), 2143–2153. https://doi.org/10.1007/s12205-016-0346-3

Charehzehi, A., Chai, C. S., Md Yusof, A., Chong, H. Y., & Loo, S. C. (2017). Building Information Modeling in Construction Conflict Management. *International*

Journal of Engineering Business Management, *9*. https://doi.org/10.1177/1847979017746257

Charoenngam, C., & Maqsood, T. (2001). A Qualitative Approach in Problem Solving Process Tracing of Construction Site Engineers. *17th Annual ARCOM Conference*.

Cheah, J.-H., Ting, H., Cham, T. H., & Memon, M. A. (2019). The Effect of Selfie Promotion and Celebrity Endorsed Advertisement on Decision-Making Processes: A Model Comparison. *Internet Research*, *29*(3), 552–577. https://doi.org/10.1108/IntR-12-2017-0530

Chen, S., Stubblefield, A., & Stoner, J. A. (2021). Oversampling of Minority Populations Through Dual-Frame Surveys. *Journal of Survey Statistics and Methodology*, *9*(3), 626–649. https://doi.org/10.1093/jssam/smz054

Cheron, C., Salvagni, J., & Colomby, R. K. (2022). The Qualitative Approach Interview in Administration: A Guide for Researchers. *Revista de Administração Contemporânea*, *26*(4), e210011. https://doi.org/10.1590/1982-7849rac2022210011.en

Cheung, S. O., & Yiu, T. W. (2006). Are construction disputes inevitable? *IEEE Transactions on Engineering Management*, *53*(3), 456–470. https://doi.org/10.1109/TEM.2006.877445

Chow, P. T., Cheung, S. O., & Chan, K. Y. (2014). Trust Building in Construction Contracting. In *Construction Dispute Research* (pp. 123–146). Springer International Publishing. https://doi.org/10.1007/978-3-319-04429-3_8

Christou, P. A. (2022). How to Use Thematic Analysis in Qualitative Research. *Journal of Qualitative Research in Tourism*, *3*(2), 79–95. https://doi.org/10.4337/jqrt.2023.0006

CIDB. (2016). CIDB Construction Law Report 2015. In *ARK Knowledge Solutions*.

CIDB. (2022). *National Construction Policy 2030*. Construction Industry Development Board (CIDB) Malaysia. https://www.cidb.gov.my/eng/national-construction-policy-ncp-2030/

Clayton, C. R., & Smith, D. M. (2013). *Effective Site Investigation (Site Investigation in Construction Series)*. Thomas Telford Ltd. https://doi.org/10.1680/esi.35058

Coenen, M., Stamm, T. A., Stucki, G., & Cieza, A. (2012). Individual interviews and focus groups in patients with rheumatoid arthritis: A Comparison of Two

Qualitative Methods. *Quality of Life Research*, *21*(2), 359–370. https://doi.org/10.1007/s11136-011-9943-2

Coleman, P. (2021). Validity and Reliability within Qualitative Research in the Caring Sciences. *International Journal of Caring Sciences*, *14*(3), 2041–2045.

Connelly, B. L., Crook, T. R., Combs, J. G., Ketchen, D. J., & Aguinis, H. (2018). Competence- and Integrity-Based Trust in Interorganizational Relationships: Which Matters More? *Journal of Management*, *44*(3), 919–945. https://doi.org/10.1177/0149206315596813

Connelly, L. M. (2008). Pilot studies. *Medsurg Nursing : Official Journal of the Academy of Medical-Surgical Nurses*, *17*(6), 411–412.

Cooper, D. R., & Schindler, P. S. (2014). *Business Research Methods*. McGraw-Hill/Irwin.

Costello, A. B., & Osborne, J. W. (2005). Best Practices In Exploratory Factor Analysis: Four Recommendations For Getting The Most From Your Analysis. *Practical Assessment, Research and Evaluation*, *10*(7). https://doi.org/https://doi.org/10.7275/jyj1-4868

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitaive, and Mixed Method Approaches*. SAGE Publications, Inc.

Creswell, J. W., & Clark, V. L. P. (2018). *Designing and conducting mixed methods research* (Third). SAGE Publications Inc.

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative and Mixed Method Approaches*. SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry & Research Design, Choosing among Five Approaches*. SAGE Publications, Inc.

Cunningham, T. (2017). *What Causes Cost Overruns on Building Projects? - An Overview*. ARROW@TU Dublin. https://arrow.tudublin.ie/beschreoth/68/

Curran, N. (2016). Commercial Management of Construction. In *Royal Institution of Chartered Surveyors* (Vol. 1st, Issue 1, pp. 1–62). e Royal Institution of Chartered Surveyors (RICS).

Deep, S., Gajendran, T., & Jefferies, M. (2021). A Systematic Review of 'Enablers of Collaboration' Among the Participants in Construction Projects. *International Journal of Construction Management*, *21*(9), 919–931. https://doi.org/10.1080/15623599.2019.1596624

Delen, D. (2019). *Prescriptive Analytics: The Final Frontier for Evidence-Based Management and Optimal Decision Making*. Pearson FT Press.

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The Qualitative Research Interview. *Medical Education*, *40*(4), 314–321. https://doi.org/10.1111/j.1365-2929.2006.02418.x

Dogbegah, R., Owusu-Manu, D., & Omoteso, K. (2011). A Principal Component Analysis of Project Management Competencies for the Ghanaian Construction Industry. *Australasian Journal of Construction Economics and Building*, *11*(1), 26–40.

Dordevic-Emeritus B., & Miletic S. (2010). *Management Decision-Making: Types and Styles*. https://doi.org/10.22004/AG.ECON.289228

DOSM. (2025). *Construction Statistics Second Quarter of 2025*.

Dostál, J. (2015). Theory of Problem Solving. *Procedia - Social and Behavioral Sciences*, *174*, 2798–2805. https://doi.org/10.1016/j.sbspro.2015.01.970

Dulaimi, M. F., Ling, F. Y. Y., & Bajracharya, A. (2003). Organizational Motivation and Inter-Organizational Interaction in Construction Innovation in Singapore. *Construction Management and Economics*, *21*(3), 307–318. https://doi.org/10.1080/0144619032000056144

Dzulkalnine, N., Azman, M. N. A., Bing, K. W., & Hamid, Z. A. (2017). Payment Issue of Industrialised Building System (IBS) in Malaysian Construction Industry. *Malaysian Construction Research Journal*, *2*(Special Issue 2), 36–47.

El-adaway, I., Fawzy, S., Allard, T., & Runnels, A. (2016). Change Order Provisions under National and International Standard Forms of Contract. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *8*(3), 1–12. https://doi.org/10.1061/(asce)la.1943-4170.0000187

Eldh, A. C., Årestedt, L., & Berterö, C. (2020). Quotations in Qualitative Studies: Reflections on Constituents, Custom, and Purpose. *International Journal of Qualitative Methods*, *19*. https://doi.org/10.1177/1609406920969268

Elhag, T., Eapen, S., & Ballal, T. (2020). Moderating Claims and Disputes Through Collaborative Procurement. *Construction Innovation*, *20*(1), 79–95. https://doi.org/10.1108/CI-02-2019-0020

Elsayah, O. S. (2016). *A Framework for Improvement of Contractor Selection Procedures on Major Construction Project in Libya*. School of Engineering and

the Built Environment, Edinburgh Napier University, Edinburgh UK & Ireland, PHD (July).

El-Sayegh, S., Ahmad, I., Aljanabi, M., Herzallah, R., Metry, S., & El-Ashwal, O. (2020). Construction Disputes in the UAE: Causes and Resolution Methods. *Buildings*, *10*(10), 171. https://doi.org/10.3390/buildings10100171

Elziny, A. A., Mohamadien, M. A., Ibrahim, H. M., & Abdel Fattah, M. K. (2016). An Expert System to Manage Dispute Resolutions in Construction Projects in Egypt. *Ain Shams Engineering Journal*, *7*(1), 57–71. https://doi.org/10.1016/j.asej.2015.05.002

Eskandari, N., & Noorzai, E. (2021). Offering a Preventive Solution to Defects in Commercial Building Facility System Using BIM. *Facilities*, *39*(13/14), 859–887. https://doi.org/10.1108/F-04-2020-0037

Etikan, I. (2017). Sampling and Sampling Methods. *Biometrics & Biostatistics International Journal*, *5*(6). https://doi.org/10.15406/bbij.2017.05.00149

Fadhil, G. A., & Burhan, A. M. (2022). Developing Crisis Management System for Construction Projects in Iraq. *Journal of Engineering*, *28*(1), 33–51. https://doi.org/10.31026/j.eng.2022.01.03

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses. *The FASEB Journal*, *22*(2), 338–342. https://doi.org/10.1096/fj.07-9492LSF

Fatayer, F. A., Issa, A. Z., Abunemeh, M., & Dwikat, M. A. M. (2022). Investigating the Causes Preventing the Fulfillment of Construction Contract Requirements. *Engineering, Construction and Architectural Management*, *29*(7), 2577–2598. https://doi.org/10.1108/ECAM-01-2021-0083

Fateh, M. A. M., Arshad, R. A., Ahmad Marzuki, S. M., & Yusof, M. R. (2023). Improvements of the Communication Between Consultants And Contractors During The Construction Phase In Malaysia. *Planning Malaysia*, *21*(July), 1–23. https://doi.org/10.21837/pm.v21i26.1261

Fateh, M. A. M., & Nijar, N. N. (2019). Perspective Analysis on IBS Provision in Standard Form of Contract in Malaysia. *Malaysian Construction Research Journal (MCRJ)*, *6*(Special Issue).

Fateh, M. A. M., Nik Mat, N. A. A., & Abd Rahman, R. (2024). Payment Predicaments: Exploring Factors And Remedies For Main Contractor-Subcontractor Dynamics

In Malaysia. *ASEAN Engineering Journal*, *14*(2), 91–101. https://doi.org/10.11113/aej.v14.20767

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Fellows, R., & Liu, A. (2015). Research Method for Construction. In *John Wiley & Sons, Ltd*.

Field, A. (2009). *Discovering Statistics Using SPSS*. SAGE Publications, Inc.

Fisher, G., Wisneski, J. E., & Bakker, R. M. (2020). Root-Cause Analysis. In *Strategy in 3D* (pp. 101–107). Oxford University PressNew York. https://doi.org/10.1093/oso/9780190081478.003.0012

Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology & Health*, *25*(10), 1229–1245. https://doi.org/10.1080/08870440903194015

Fuchs, K. (2023). A Systematic Guide for Conducting Thematic Analysis in Qualitative Tourism Research. *Journal of Environmental Management and Tourism*, *14*(6), 2696. https://doi.org/10.14505/jemt.v14.6(70).17

Fusch, P., & Ness, L. (2015). Are We There Yet? Data Saturation in Qualitative Research. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2015.2281

Gamage, A. N. K. K. (2022). Importance of Effective Communication to Minimize Disputes in Construction Projects. *Scholars Journal of Engineering and Technology*, *10*(7), 128–140. https://doi.org/10.36347/sjet.2022.v10i07.002

Gamage, A. N. K. K. (2025). Research Design, Philosophy, and Quantitative Approaches in Scientific Research Methodology. *Scholars Journal of Engineering and Technology*, *13*(02), 91–103. https://doi.org/10.36347/sjet.2025.v13i02.004

Gamage, A. N. K. K., & Kumar, S. (2024). An Empirical Study on the Effects of Disputes on Successful Completion of Construction Projects. *Scholars Journal of Engineering and Technology*, *12*(07), 89–100. https://doi.org/10.36347/sjet.2024.v12i02.007

Gao, S., & Low, S. P. (2013). The Toyota Way Problem-Solving Model: Lessons for Large Chinese Construction Firms. *International Journal of Construction Management*, *13*(1), 79–103. https://doi.org/10.1080/15623599.2013.10773207

Garner, J. (2015). *RICS professional guidance: Final Account Procedures* (1st edn). Royal Institution of Chartered Surveyors (RICS). www.rics.org

Garvey, C., & Jones, R. (2021). Is There a Place for Theoretical Frameworks in Qualitative Research? In *International Journal of Qualitative Methods*. https://doi.org/10.1177/1609406920987959

Gasemagha, A. A., & Kowang, T. O. (2021). Project Manager Role in Project Management Success. *International Journal of Academic Research in Business and Social Sciences*, *11*(3). https://doi.org/10.6007/IJARBSS/v11-i3/9230

Ghosh, B., & Karmakar, S. (2024). Digitalized Document Management System for Construction Claims and Disputes to Enhance the Smoothness of Advanced Construction Projects Using the Building Information Modeling Integrated Framework. *American Society of Civil Engineers*, *17*(1). https://doi.org/10.1061/JLADAH.LADR-1203

Giebelhausen, M., Lawrence, B., & Chun, H. H. (2021). Doing Good While Behaving Badly: Checkout Charity Process Mechanisms. *Journal of Business Ethics*, *172*(1), 133–149. https://doi.org/10.1007/s10551-019-04413-3

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Gledson, B. (2022). Enhanced Model of The Innovation-Decision Process, for Modular-Technological-Process Innovations in Construction. *Construction Innovation*, *22*(4), 1085–1103. https://doi.org/10.1108/CI-02-2021-0021

Głuszak, M., & Leśniak, A. (2015). Construction Delays in Clients Opinion – Multivariate Statistical Analysis. *Procedia Engineering*, *123*, 182–189. https://doi.org/10.1016/j.proeng.2015.10.075

Goh, K. Z. H., Wong, S. Y., & Low, W. W. (2023). Factors Causing Dispute In Construction Industry: Contractors' Perspectives. *Journal of Surveying, Construction & Property*, *14*(1), 14–26. https://doi.org/10.22452/jscp.vol14no1.2

Golzar, J., & Noor, S. (2022). Defining Convenience Sampling in a Scientific Research. *International Journal of Education and Language Studies*, *1*(November), 72–77.

Gorsuch, R. L. (2013). *Factor Analysis* (0 edn). Psychology Press. https://doi.org/10.4324/9780203781098

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Guest, G., Namey, E., & Chen, M. (2020). A Simple Method to Assess and Report Thematic Saturation in Qualitative Research. *PLOS ONE*, *15*(5), e0232076. https://doi.org/10.1371/journal.pone.0232076

Guo, S., Lu, P., & Song, Y. (2013). The Effects of Trust and Contractual Mechanism on Working Relationships—An Empirical Study in Engineering Construction Projects. *American Journal of Industrial and Business Management*, *03*(06), 539–548. https://doi.org/10.4236/ajibm.2013.36062

Hai, D. T. (2019). Assessment of Contractors' Claims on Construction Projects in Vietnam. *The Open Civil Engineering Journal*, *13*(1), 218–228. https://doi.org/10.2174/1874149501913010218

Hai, D. T. (2020). Assessment of Contractors' Claims on Construction Projects in Vietnam. *The Open Civil Engineering Journal*, *13*(1), 218–228. https://doi.org/10.2174/1874149501913010218

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis*. Cengage Learning, EMEA.

Hair, J. F., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial Least Squares Structural Equation Modeling (PLS-SEM): An Emerging Tool in Business Research. *European Business Review*, *26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hanák, T., & Vítková, E. (2022). Causes and Effects of Contract Management Problems: Case Study of Road Construction. *Frontiers in Built Environment*, *8*. https://doi.org/10.3389/fbuil.2022.1009944

Hansen, S. (2024). Contractual Implications of The War on Construction Projects. *3rd Conference on Innovation in Technology and Engineering Science 2022, CITES 2022*, 060014. https://doi.org/10.1063/5.0200921

Hardin, L. E. (2003). Problem-Solving Concepts and Theories. *Journal of Veterinary Medical Education*, *30*(3), 226–229. https://doi.org/10.3138/jvme.30.3.226

Hasmori, M. F., Ismail, I., & Said, I. (2012). Issues of Late and Non-Payment Among Contractors In Malaysia. *3rd International Conference on Business And Economic Research*, (2), 82–93.

Hassan, W. N. M. M. (2019). *Cause Of Delay In Final Account Settlement*. Universiti Teknologi Malaysia.

Hatcher, L. (with O'Rourke, N.). (2014). *A step-by-step approach to using SAS for factor analysis and structural equation modeling* (2nd ed). SAS Institute.

Haukås, Å., & Tishakov, T. (2024). Sharing Interview Questions in Advance: Methodological Considerations in Applied Linguistics Research. *European Journal of Applied Linguistics*, *12*(1), 54–68. https://doi.org/10.1515/eujal-2023-0045

Hayati, K., & Latief, Y. (2019). Risk Analysis and Prevention System to Minimize Claim and Dispute on Construction Projects. *IOP Conference Series: Earth and Environmental Science*, *365*(1), 012030. https://doi.org/10.1088/1755-1315/365/1/012030

Hayati, K., Yulia, & Agung, D. (2023). *Preventive Modelling in Risk Management on the Construction Project*. 213–221. https://doi.org/10.4028/p-p948ap

Heffernan, K., & Teufel, S. (2018). Identifying Problems and Solutions in Scientific Text. *Scientometrics*, *116*(2), 1367–1382. https://doi.org/10.1007/s11192-018-2718-6

Hennink, M., & Kaiser, B. N. (2022). Sample Sizes for Saturation in Qualitative Research: A Systematic Review of Empirical Tests. *Social Science & Medicine*, *292*, 114523. https://doi.org/10.1016/j.socscimed.2021.114523

Hennink, M. M., Kaiser, B. N., & Marconi, V. C. (2017). Code Saturation Versus Meaning Saturation. *Qualitative Health Research*, *27*(4), 591–608. https://doi.org/10.1177/1049732316665344

Hernon, P. (2007). Theoretical Frameworks in Qualitative Research. *Library & Information Science Research*, *29*(2), 304–305. https://doi.org/10.1016/j.lisr.2006.08.004

Hertzog, M. A. (2008). Considerations in Determining Sample Size for Pilot Studies. *Research in Nursing & Health*, *31*(2), 180–191. https://doi.org/10.1002/nur.20247

Hewitt, A. (2020). *How Contractors Reduce Disputes when Doing Final Accounts on Capital Construction Projects*. *2020*. https://pmweb.com/how-contractors-reduce-disputes-when-doing-final-accounts-on-capital-construction-projects/

Hewitt-Taylor, J. (2012). Identifying, Analysing and Solving Problems in Practice. *Nursing Standard*, *26*(40), 35–41. https://doi.org/10.7748/ns2012.06.26.40.35.c9139

Hisham, N. K. K., & Othman, M. K. F. (2021). Final Account Preparation in Construction Industry: Competencies and Challenges of Quantity Surveyors. *International Journal of Service Management and Sustainability*, *6*(1), 35–50. https://doi.org/10.24191/ijsms.v6i1.12877

Hu, Y., Wu, L., Li, N., & Zhao, T. (2024). Multi-Agent Decision-Making in Construction Engineering and Management: A Systematic Review. *Sustainability (Switzerland)*, *16*(16). https://doi.org/10.3390/su16167132

Idrees, S., & Shafiq, M. T. (2021). Factors for Time and Cost Overrun in Public Projects. *Journal of Engineering, Project, and Production Management*, *11*(3), 243–254. https://doi.org/10.2478/jeppm-2021-0023

Idros, N. A. N. M., Mohamed, H., & Jenal, R. (2020). The Use of Expert Review in Component Development for Customer Satisfaction Towards E-hailing. *Indonesian Journal of Electrical Engineering and Computer Science*, *17*(1), 347. https://doi.org/10.11591/ijeecs.v17.i1.pp347-356

Ikart, E. M. (2019). Survey Questionnaire Survey Pretesting Method: An Evaluation of Survey Questionnaire via Expert Reviews Technique. *Asian Journal of Social Science Studies*, *4*(2), 1. https://doi.org/10.20849/ajsss.v4i2.565

Ilmi, H. S., & Yip, H. G. (2014). Factors Delaying the Final Account Settlement in Malaysian Construction Industry. *The 18th Pacific Association of Quantity Surveyors (PAQS) Congress 2014*, (April), 158–166.

Ishak, M. F., Alauddin, K., & Ibrahim, M. S. H. (2020). Late and Non-Payments Issues in the Malaysian Construction Industry: Perspective of Building Material Suppliers. *Malaysian Journal of Sustainable Environment*, *6*(1), 39. https://doi.org/10.24191/myse.v6i1.8674

Ismail, F., Mohd Danuri, M. S., Mohamed, O., Abdul-Karim, S. B., & Mohd Nawi, M. N. (2017). Ethics-Related Issues in the Tender Evaluation of Malaysia Public Projects. *Journal of Design and Built Environment*, *17*(2017), 166–181. https://doi.org/10.22452/jdbe.sp2017no1.14

Ismail, M. N. (2008). *Pengenalan Kepada Pentadbiran Kontrak*. UPENA, UiTM.

Ismail, N., Halim, M. H. A., Ismail, W. N. W., Isa, S. S. M., & Yusop, N. (2023). The Project Manager's Roles in Reducing the Occurrence of Variation Order (VO) on Construction Project. *International Journal of Academic Research in Business and Social Sciences*, *13*(4), 53–59. https://doi.org/10.6007/ijarbss/v13-i4/15457

Ismail, S., Zakaria, Z., & Yusof, A. M. (2014). Overview to the Processes of Successful Final Account Closing From Project Management Perspective. *International Research Conference on Business Economics and Social Science*, (April 2015), 100–105. https://doi.org/10.13140/RG.2.1.3855.4327

Ismail, W. N. W. (2021). *Contractual Behaviour Framework For Successful Civil Engineering Projects*. Universiti Teknologi MARA.

Ismail, Z., Abdullah, J., & Zin, R. M. (2008). Preliminary Findings of Alternative Dispute Resolution (ADR) Application by The G7 Contractors in The Malaysian Construction Industry. *2nd International Conference On Built Environment In Developing Countries (ICBEDC 2008)*, 2039–2052.

Issa, R. R. A., Olbina, S., & Zuppa, D. (2018). Model for developing trust on US construction projects. *Built Environment Project and Asset Management*, *8*(1), 5–23. https://doi.org/10.1108/BEPAM-03-2017-0017

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*, *18*(1), 3–20. https://doi.org/10.1177/1525822X05282260

Janghorban, R., Roudsari, R. L., & Taghipour, A. (2014). Skype interviewing: The new generation of online synchronous interview in qualitative research. *International Journal of Qualitative Studies on Health and Well-Being*, *9*(1), 24152. https://doi.org/10.3402/qhw.v9.24152

Jaselskis, E. J., & Ashley, D. B. (1991). Optimal Allocation of Project Management Resources for Achieving Success. *Journal of Construction Engineering and Management*, *117*(2), 321–340. https://doi.org/10.1061/(ASCE)0733-9364(1991)117:2(321)

Jassim, H. S. H., Hasan, M. F., Altaee, M. J., & Gamil, Y. (2025). A model for preliminary cost estimation in buildings construction projects. *Frontiers in Built Environment*, *11*. https://doi.org/10.3389/fbuil.2025.1359777

Jayarathna, H. M. M. U., Francis, M., & Liyanawatta, T. N. (2023). Building information modelling as a dispute avoidance mechanism in Sri Lankan construction projects. *16th International Research Conference - FARU 2023*, 39–47. https://doi.org/10.31705/FARU.2023.6

Jiang, H., & Wang, Z. (2021). Research on Safety Management and Preventive Measure of Construction Industry. *The 2021 7th International Conference on Industrial and Business Engineering*, 379–385. https://doi.org/10.1145/3494583.3494616

Jonassen, D. H. (2012). Designing for decision making. *Educational Technology Research and Development*, *60*(2), 341–359. https://doi.org/10.1007/s11423-011-9230-5

Judi, S. S. (2020). *Model of Proactive Preventive Solutions for Improving Late Payment and Under-Payment Issues in The Malaysian Construction Industry* (Issue August). Universiti Teknologi Malaysia.

Judi, S. S., & Mustaffa, N. E. (2021). Exploring And Improving Late Payment And Underpayment Issues In The Malaysian Construction Industry: An Exploratory Study. *Malaysian Construction Research Journal*, *35*(3), 41–56.

Judi, S. S., & Mustaffa, N. E. (2023). Development of a Proactive Preventive Late Payment and Underpayment Solution Model for the Construction Industry. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *15*(2), 1–12. https://doi.org/10.1061/JLADAH.LADR-859

Judi, S. S., Mustaffa, N. E., & Nayan, R. (2017). A framework for combating Payment-related Issues (PRI) in the Malaysian Construction Industry. *Journal of Built Environment, Technology and Engineering*, *2*(2015), 122–132.

Judi, S. S., & Rashid, R. A. (2010). Contractor's Right Of Action For Late Or Non-Payment By The Employer. *Journal of Surveying, Construction & Property*, *1*(1), 1–31. https://doi.org/10.22452/jscp.vol1no1.4

Kagioglou, M., Cooper, R., Aouad, G., & Sexton, M. (2000). Rethinking construction: The Generic Design and Construction Process Protocol. *Engineering, Construction and Architectural Management*, *7*(2), 141–153. https://doi.org/10.1108/eb021139

Kaiser, H. F. (1970). A Second Generation Little Jiffy. *Psychometrika*, *35*(4), 401–415. https://doi.org/10.1007/bf02291817

Kalogeraki, M., & Antoniou, F. (2024). Claim Management and Dispute Resolution in the Construction Industry: Current Research Trends Using Novel Technologies. *Buildings*, *14*(4), 967. https://doi.org/10.3390/buildings14040967

Kalyan, H. S., Sekar, A., Nachiar, S., & Ravichandran. (2022). Discerning Recurrent Factors in Construction Disputes through Judicial Case Studies—An Indian Perspective. *Buildings*, *12*(12), 2229. https://doi.org/10.3390/buildings12122229

Kamarul Azmi, J. (2012). Kesahan dan Kebolehpercayaan Dalam Kajian Kualitatif. *Journal Pendidikan: Maktab Perguruan Islam*, *15*(April), 61–82.

Karimi, S., Zhakfar, Z., & Sarwary, M. I. (2020). Study of Excessive Bureaucracy in Construction Projects Causes of Low Level of Competition and Lengthy Tendering Process A Case Study of Afghanistan. *International Journal of Engineering and Advanced Technology*, *10*(1), 66–73. https://doi.org/10.35940/ijeat.A1707.1010120

Karji, A., Namian, M., & Tafazzoli, M. (2020). Identifying the Key Barriers to Promote Sustainable Construction in The United States: A Principal Component Analysis. *Sustainability (Switzerland)*, *12*(12). https://doi.org/10.3390/su12125088

Kelly, L. M., & Cordeiro, M. (2020). Three Principles of Pragmatism for Research on Organizational Processes. *Methodological Innovations*, *13*(2). https://doi.org/10.1177/2059799120937242

Kenyatta, M. O. (2016). Exploring Into the Factors That Cause Payment Defaults: A Perspective of the Payment Dispute Cases in the Kenyan Construction Industry. *International Journal of Innovative Technology and Exploring Engineering*, (9), 2278–3075.

Khahro, S. H., Shaikh, H. H., Zainun, N. Y., Sultan, B., & Khahro, Q. H. (2023). Delay in Decision-Making Affecting Construction Projects: A Sustainable Decision-Making Model for Mega Projects. *Sustainability*, *15*(7), 5872. https://doi.org/10.3390/su15075872

Khalfan, M. M. A., McDermott, P., & Swan, W. (2007). Building trust in construction projects. *Supply Chain Management*, *12*(6), 385–391. https://doi.org/10.1108/13598540710826308

Khan, R. A., Liew, M. S., & Ghazali, Z. B. (2014). Malaysian Construction Sector and Malaysia Vision 2020: Developed Nation Status. *Procedia - Social and*

Behavioral Sciences, *109*, 507–513. https://doi.org/10.1016/j.sbspro.2013.12.498

Khang, D. B., & Moe, T. L. (2008). Success Criteria and Factors for International Development Projects: A Life-Cycle-Based Framework. *Project Management Journal*, *39*(1), 72–84. https://doi.org/10.1002/pmj.20034

Khangale, J., Musonda, I., Okoro, C. S., & Okoro, S. (2022). Success Rate and Implications of Contractual Claims Decisions on Contractors in South Africa. *Journal of Natural and Applied Sciences*, *5*(1), 73–89. https://doi.org/10.53974/unza.jonas.5.1.715

Khawaja, E. U. R., & Mustapha, A. (2021). Mitigating Disputes and Managing Legal Issues in the Era of Building Information Modelling. *Journal of Construction in Developing Countries*, *26*(1), 111–130. https://doi.org/10.21315/jcdc2021.26.1.6

Kisi, K. P., & Sulbaran, T. (2022). Construction Cost and Schedule Impacts Due to COVID-19. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *14*(4). https://doi.org/10.1061/(ASCE)LA.1943-4170.0000565

Koc, K., & Gurgun, A. P. (2022). Ambiguity factors in construction contracts entailing conflicts. *Engineering, Construction and Architectural Management*, *29*(5), 1946–1964. https://doi.org/10.1108/ECAM-04-2020-0254

Kong, S. K., & Yeow, W. S. (2016). The causes of disputes of final accounts: Malaysian case law analysis. *INTI Journal Special Edition – Built Environment 2016*.

Kramarenko, A. O. (2022). Effective Decision-Making: From Theory and Methods to Strategy and Leadership. *Business Inform*, *5*(532), 118–125. https://doi.org/10.32983/2222-4459-2022-5-118-125

Kumar, R. (2011). *Research Methodology—A step by step guide for beginners*. Sage Publications.

Kuoribo, E., Yomoah, R., Owusu-Manu, D.-G., Acheampong, A., John Edwards, D., & Debrah, C. (2023). Assessing The Interactive Effects of the Ethics of Construction Professionals on Project Performance in the Ghanaian Construction Industry. *Engineering, Construction and Architectural Management*, *30*(10), 5233–5252. https://doi.org/10.1108/ECAM-10-2021-0865

Kwok, C. K. (2009). *Study of Important Factors Affecting Final Account Settlement Satisfaction of Hong Kong Civil Engineering Projects: Contractors's Perspective*. City University of Hong Kong.

Laan, A., Voordijk, H., Noorderhaven, N., & Dewulf, G. (2012). Levels of Interorganizational Trust in Construction Projects: Empirical Evidence. *Journal of Construction Engineering and Management*, *138*(7), 821–831. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000495

Larsen, H. G., & Adu, P. (2021). *The Theoretical Framework in Phenomenological Research*. Routledge. https://doi.org/10.4324/9781003084259

Lau, E., & Rowlinson, S. (2011). The Implications of Trust in Relationships in Managing Construction Projects. *International Journal of Managing Projects in Business*, *4*(4), 633–659. https://doi.org/10.1108/17538371111164056

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2011). Exploratory Factor Analysis and Principal Components Analysis. In *IBM SPSS for Intermediate Statistics* (pp. 68–83). Taylor & Francis.

Lew, L. P., Tan, H. C., & Wong, S. C. M. (2013). Issues and Challenges Faced in the Management of Claims for Construction Projects. *Construction Project Management*, 1–40.

Lew, Y. L., Hassim, S., Muniandy, R., & Hua, L. T. (2018). Structural Equation Modelling for Subcontracting Practice: Malaysia Chapter. *Engineering, Construction and Architectural Management*, *25*(7), 835–860. https://doi.org/10.1108/ECAM-04-2017-0073

Li, H., & Love, P. E. D. (1998). Developing a Theory of Construction Problem Solving. *Construction Management and Economics*, *16*(6), 721–727. https://doi.org/10.1080/014461998372015

Li, Z., Zhang, C., Zhang, C., Zhang, L., & Yang, J. (2024). The Role of Cognitive Processes in Problem Solving. *Research and Commentary on Humanities and Arts*, *2*(2). https://doi.org/10.18686/rcha.v2i2.4052

Liberatore, M. J., & Wagner, W. P. (2022). Simon's Decision Phases and User Performance: An Experimental Study. *Journal of Computer Information Systems*, *62*(4), 667–679. https://doi.org/10.1080/08874417.2021.1878476

Liljefors, F., & Köhler, J. (2024). Framework for Rational Decision-Making in Bridge Maintenance. *Structure and Infrastructure Engineering*, 1–14. https://doi.org/10.1080/15732479.2024.2371607

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications Inc.

Lindseth, A., & Norberg, A. (2004). A Phenomenological Hermeneutical Method for Researching Lived Experience. *Scandinavian Journal of Caring Sciences*, *18*(2), 145–153. https://doi.org/10.1111/j.1471-6712.2004.00258.x

Liyanawatta, T. N., Francis, M., & Ranadewa, K. A. T. O. (2024). Avoiding Construction Disputes: A Comprehensive Framework for Pre-Contract Planning. *International Journal of Construction Management*, *24*(12), 1282–1294. https://doi.org/10.1080/15623599.2023.2276652

Love, P. E. D., Davis, P. R., Sai On Cheung, & Irani, Z. (2011). Causal Discovery and Inference of Project Disputes. *IEEE Transactions on Engineering Management*, *58*(3), 400–411. https://doi.org/10.1109/TEM.2010.2048907

Lunenburg, F. C. (2010). The Decision Making Process. *National Forum of Educational Administration And Supervision Journal*, *27*(4).

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*(1), 84–99. https://doi.org/10.1037/1082-989X.4.1.84

Maguire, M., & Delahunt, B. (2017). *Doing a Thematic Analysis: A Practical, Step-by-Step Guide for Learning and Teaching Scholars.*

Majid, A. Mohd. (2017). *Isu-Isu Perundangan Berkaitan Kontrak Binaan*. Dewan Bahasa dan Pustaka.

Majid, N. A. (2014). *PAM Standard Form of Contract 2006, Terjemahan dan Ulasan*.

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample Size in Qualitative Interview Studies. *Qualitative Health Research*, *26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444

Manen, M. V. (2016). *Researching Lived Experience, Second Edition: Human Science for an Action Sensitive Pedagogy*. Routledge. https://doi.org/10.4324/9781315421056

Marshall, B., Cardon, P., Poddar, A., & Fontenot, R. (2013). Does Sample Size Matter in Qualitative Research?: A Review of Qualitative Interviews in is Research. *Journal of Computer Information Systems*, *54*(1), 11–22. https://doi.org/10.1080/08874417.2013.11645667

Matarneh, S. (2024). Construction Disputes Causes and Resolution Methods: A Case Study from a Developing Country. *Journal of Construction in Developing Countries*, *29*(1), 139–161. https://doi.org/10.21315/jcdc-04-23-0043

Mate, R., & Hinge, G. A. (2015). Delay Mitigation in the Construction Industry. *International Journal of Engineering Research And*, *V4*(06), 172–176. https://doi.org/10.17577/ijertv4is060239

Mellenbergh, G. J. (2019). Nonprobability Sampling. In G. J. Mellenbergh, *Counteracting Methodological Errors in Behavioral Research* (pp. 31–37). Springer International Publishing. https://doi.org/10.1007/978-3-030-12272-0_3

Memon, A. H., Rahman, I. A., & Hasan, M. F. A. (2014). Significant Causes and Effects of Variation Orders in Construction Projects. *Research Journal of Applied Sciences, Engineering and Technology*, *7*(21), 4494–4502. https://doi.org/10.19026/rjaset.7.826

Memon, M. A., Ting, H., Cheah, J. H., Thurasamy, R., Chuah, F., & Cham, T. H. (2020). Sample Size for Survey Research: Review and Recommendations. *Journal of Applied Structural Equation Modeling*, *4*(2), i–xx. https://doi.org/10.47263/jasem.4(2)01

Merriam, S. B. (2009). *Qualitative Research: A Guide to Design and Implementation* (Second). Jossey-Bass A Wiley Imprint.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative Research: A Guide to Design and Implementation*. John Wiley & Sons, Inc.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. SAGE Publications, Inc.

Mirzaee, A. M., & Martek, I. (2024). Improving Project Management "Closeout" Phase Outcomes: Evidence from a Large General Contractor in Iran Using "X-Inefficiency Theory". *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-11-2023-1161

Mohamad, I. M., Nekooie, M., Ali, & Kamaruddin, N. C. (2012). The Adequacy of Contractual Provisions in Managing Construction Failure in Malaysia. *European Journal of Business and Management*, *4*(1), 22–38.

Mohamad, N., Suman, A. S., Harun, H., & Hashim, H. (2018). Mitigating Delay and Non-Payment in the Malaysian Construction Industry. *IOP Conference Series: Earth and Environmental Science*, *117*(1). https://doi.org/10.1088/1755-1315/117/1/012037

Mokoena, G. M., Makhanya, B. B. S., & Nel, H. (2023, March 9). Assessing Project Cost Planning in the Construction Industry. *Proceedings of the International*

Conference on Industrial Engineering and Operations Management. https://doi.org/10.46254/AN13.20230144

Morena, M., & Amoah, C. (2021). Assessment of the Mitigating Measures for Cost Overruns in the South African construction industry. *IOP Conference Series: Earth and Environmental Science*, *654*(1). https://doi.org/10.1088/1755-1315/654/1/012003

Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry*, *20*(8), 1045–1053. https://doi.org/10.1177/1077800413513733

Morse, J. M. (2015). "Data Were Saturated". *Qualitative Health Research*, *25*(5), 587–588. https://doi.org/10.1177/1049732315576699

Muhamad, K. H., Ali, N. S., & Najm, B. M. (2021). *Assessment of the Cost and Time Impact of Variation Orders on Construction Projects in Sulaimani Governorate*. *27*(2).

Muhammuddin, N. N., Mohd-Danuri, M. S., Hanid, M., Ismail, F., & Nawi, M. N. M. (2023). A Preliminary Framework For Preventing Disputes In Different Stages of Building Construction Projects. *Planning Malaysia*, *21*(5), 267–282. https://doi.org/10.21837/pm.v21i29.1370

Mullinix, K. J., Leeper, T. J., Druckman, J. N., & Freese, J. (2015). The Generalizability of Survey Experiments. *Journal of Experimental Political Science*, *2*(2), 109–138. https://doi.org/10.1017/XPS.2015.19

Mustaffa, N. E., Nayan, R., Aminuddin, F. A., & Judi, S. S. (2023). Issues Encountered in the Valuation of Interim Payment Process in Construction Projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *15*(1). https://doi.org/10.1061/(asce)la.1943-4170.0000596

Muthuramalingam, J. (2008). Effective Resources Management in Construction Industries for Success. *Modern Applied Science*, *2*(6). https://doi.org/10.5539/mas.v2n6p41

Muzaki, F. K., Widodo, A. P., & Romeo, R. (2014). *Rancang Bangun Aplikasi Perencanaan Anggaran Biaya Tenaga Kerja Pada Proyek Konstruksi Gedung*. *3*, 78–89.

Nabi, M. A., & El-adaway, I. H. (2022). Understanding Disputes in Modular Construction Projects: Key Common Causes and Their Associations. *Journal of Construction Engineering and Management*, *148*(1). https://doi.org/10.1061/(asce)co.1943-7862.0002208

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, *22*, 1–18. https://doi.org/10.1177/16094069231205789

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2024). Demystification and Actualisation of Data Saturation in Qualitative Research Through Thematic Analysis. *International Journal of Qualitative Methods*, *23*. https://doi.org/10.1177/16094069241229777

Naji, K. K., Mansour, M. M., & Gunduz, M. (2020). Methods for Modeling and Evaluating Construction Disputes: A Critical Review. *IEEE Access*, *8*, 45641–45652. https://doi.org/10.1109/ACCESS.2020.2976109

Nanayakkara, S., Perera, S., Senaratne, S., & Weerasuriya, G. T. (2021). *Blockchain and Smart Contracts: A Solution for Payment Issues*.

Narayan, S., Tan, H. C., & Jack, L. B. (2023). Claims Management: a Review of Challenges Faced. *International Journal of Construction Management*, *0*(0), 1–7. https://doi.org/10.1080/15623599.2023.2299527

Nayan, R. (2021). *Framework for The Enhancement of Valuation of Interim Payment for Quantity Surveyors*. Universiti Teknologi Malaysia.

Nayan, R., Mustaffa, N. E., & Judi, S. S. (2017). Valuation of Interim Payment: Issues Encountered By the Parties. *Journal of Built Environment Technology and Engineering*, *2*(ISSN 0128-1003), 133–141.

Nee, T. S., Nadarajan, S., & Whyte, A. (2014). Reviews of Cases of Construction Disputes in Malaysia and its Relation with Standard Form of Construction Contract. *Advanced Materials Research*, *831*(1998), 191–196. https://doi.org/10.4028/www.scientific.net/AMR.831.191

Nesarnobari, S., Shahzad, W., Jelodar, M. B., & Sutrisna, M. (2024). Investigation of the Effects of Supply Chain Disruptions on Offsite Construction Projects. *13th International Conference on Engineering, Project, and Production Management, EPPM 2023*, 161–172. https://doi.org/10.1007/978-3-031-56544-1_11

Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches* (7th edn). Pearson Education Limited.

Newell, A., & Simon, H. A. (1972). *Human Problem Solving*. Prentice-Hall.

Newman, E. (2006). Exploring the "Root Causes" of Terrorism. *Studies in Conflict & Terrorism*, *29*(8), 749–772. https://doi.org/10.1080/10576100600704069

Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence Based Nursing*, *18*(2), 34–35. https://doi.org/10.1136/eb-2015-102054

Nor, M. R. M. (2024). *A Strategic Action Plan For Alleviating Delays In Final Account Settlement*. Universiti Teknologi MARA, Shah Alam.

Nor, M. R. M., Judi, S. S., & Ismail, Z. (2023). Analyzing Pattern And Trends For Final Account Issues In The Malaysian Construction Industry: A Thematic Review. *Malaysian Construction Research Journal (MCRJ)*, *19*(2), 73–86.

Nordin, R. M., Ahnuar, E. M., Masrom, M. A. N., & Ali, N. A. (2023). Examining Corruption Issues in Malaysia Construction Industry: Partaker Perspectives. *Planning Malaysia*, *21*(2), 52–68. https://doi.org/10.21837/pm.v21i26.1259

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 1609406917733847. https://doi.org/10.1177/1609406917733847

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. McGraw-Hill. https://doi.org/https://doi.org/10.1177/0146621695019003

Nuwan, P. M. M. C., Perera, B. A. K. S., & Dewagoda, K. G. (2021). Development of Core Competencies of Construction Managers: The Effect of Training and Education. *Technology, Knowledge and Learning*, *26*(4), 945–984. https://doi.org/10.1007/s10758-020-09474-2

Odeyinka, H., Larkin, K., Cunningham, G., McKane, M., Bogle, G., & Weatherup, R. (2011). Development of Models for Assessing Risk Impacts on the Variability between Contract Sum and Final Account. *COBRA 2011 Proceedings of RICS Construction and Property Conference*, (September), 1–1917.

Odeyinka, H., Weatherup, R., Cunningham, G., McKane, M., & Larkin, K. (2010). Assessing Risk Impacts on the Variability Between Tender Sum And Final Account. *COBRA 2010 - Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors*, (November 2015).

Offei-Nyako, K., Ohene Tham, L. C., Bediako, M., Adobor, C. D., & Oduro Asamoah, R. (2016). Deviations Between Contract Sums and Final Accounts: The Case of

Capital Projects in Ghana. *Journal of Construction Engineering*, *2016*, 1–8. https://doi.org/10.1155/2016/2814126

Ofori, G., & Gang, G. (2001). ISO 9000 Certification of Singapore Construction Enterprises: Its Costs and Benefits and its Role in The Development of The Industry. *Engineering, Construction and Architectural Management*, *8*(2), 145–157. https://doi.org/10.1108/eb021177

Ogbu, C. P., & Ebiminor, V. B. (2020). Relationship Between Bill of Quantities Errors and Construction Disputes: A Multivariate Analysis. *Journal of the Nigerian of Quantity Surveyor*, *66*, 43–59.

Oladapo, A. A. (2007). A Quantitative Assessment of The Cost and Time Impact of Variation Orders on Construction Projects. *Journal of Engineering, Design and Technology*, *5*(1), 35–48. https://doi.org/10.1108/17260530710746597

Olanipekun, A. O., & Sutrisna, M. (2021). Facilitating Digital Transformation in Construction—A Systematic Review of the Current State of the Art. *Frontiers in Built Environment*, *7*. https://doi.org/10.3389/fbuil.2021.660758

Oltmann, S. M. (2016). Qualitative Interviews: A Methodological Discussion of the Interviewer and Respondent Contexts. *Forum: Qualitative Social Research*, *17*(2).

Oluwatosin, E. A. (2024). Ethical Considerations In Construction Project Management. *International Journal of Novel Research And Development (IJNRD)*, *9*(6).

Osborne, J. W. (2014). Best Practices in Exploratory Factor Analysis. (Issue August, pp. 86–99). SAGE Publications, Inc. https://doi.org/10.4135/9781412995627.d8

Ostertagová, E., Ostertag, O., & Kováč, J. (2014). Methodology and Application of the Kruskal-Wallis Test. *Applied Mechanics and Materials*, *611*, 115–120. https://doi.org/10.4028/www.scientific.net/AMM.611.115

Othman, M. K. F., Judi, S. S., Ismail, Z., & Pheng, L. S. (2023). Exploring Determinants Contributing to Disputes in the Closing of Final Accounts in the Construction Industry. *International Journal of Sustainable Construction Engineering and Technology*, *14*(5), 221–233. https://doi.org/https://doi.org/10.30880/ijscet.2023.14.05.017

Othman, M. K. F., Judi, S. S., Ismail, Z., Rais, L. A., & Pheng, L. S. (2025). Key Factors Leading to Disputes in the Final Account Closing of Construction Projects in

Malaysia. *Journal of Construction in Developing Countries*, *30*(1), 1–28. https://doi.org/https://doi.org/10.21315/jcdc.2025.30.s1.1

Pal, A., & Poyen, Er. F. B. (2017). Problem Solving Approach. *International Journal of Advanced Engineering Research and Science*, *4*(5), 184–189. https://doi.org/10.22161/ijaers.4.5.29

Pallant, J. (2020). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS* (7th edn). Routledge. https://doi.org/10.4324/9781003117452

PAM Contract Agreement and Conditins, Persatuan Arkitek Malaysia (2018).

Panyasai, P., & Ambele, E. A. (2025). Developing Interview Guide in Qualitative Research: Problems and Solutions from a Needs Analysis Doctoral Study. *rEFLections*, *32*(1), 576–594. https://doi.org/10.61508/refl.v32i1.280411

Patterson, E. A., Whelan, M. P., & Worth, A. P. (2021). The Role of Validation in Establishing the Scientific Credibility of Predictive Toxicology Approaches Intended for Regulatory Application. *Computational Toxicology*, *17*, 100144. https://doi.org/10.1016/j.comtox.2020.100144

Patton, M. Q. (2014). *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. SAGE Publications, Inc.

Paulsen, M. (2021). Root Cause Analysis. *JAMA*, *325*(3), 225. https://doi.org/10.1001/jama.2020.24911

Peerally, M. F., Carr, S., Waring, J., & Dixon-Woods, M. (2017). The Problem With Root Cause Analysis. *BMJ Quality & Safety*, *26*(5), 417–422. https://doi.org/10.1136/bmjqs-2016-005511

Perera, B. A. K. S., & Dewagoda, K. G. (2020). Streamlining The Management of Payment Delays: The Case of Sri Lankan Government Building Construction Projects. *Journal of Financial Management of Property and Construction*, *26*(2), 236–256. https://doi.org/10.1108/JFMPC-05-2020-0041

Peters, E., Subar, K., & Martin, H. (2019). Late Payment and Nonpayment Within the Construction Industry: Causes, Effects, and Solutions. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *11*(3), 1–12. https://doi.org/10.1061/(asce)la.1943-4170.0000314

Peters, K., & Halcomb, E. (2015). Interviews in Qualitative Research: A Consideration of Two Very Different Issues in the Use of Interviews to Collect Research Data. *Nurse Researcher*, *22*(4), 6–7. https://doi.org/10.7748/nr.22.4.6.s2

Peterson, R. A., & Merunka, D. R. (2014). Convenience Samples of College Students and Research Reproducibility. *Journal of Business Research*, *67*(5), 1035–1041. https://doi.org/10.1016/j.jbusres.2013.08.010

Poh, O. P. (2010). *Profile of Construction Payment Dispute*. Universiti Teknologi Malaysia.

Pokharel, A. R., & Joshi, B. R. (2020). Impact of Variation Orders on Construction Project Cost: A case study of Land Pooling Project at Kathmandu of Ichangu Narayan, Nepal. *Saudi Journal of Engineering and Technology*, *05*(05), 203–230. https://doi.org/10.36348/sjet.2020.v05i05.003

Poriya, D., Shah, J., & Pitroda, J. (2021). Current Scenario of Documentation in Construction Sector of Surat Region. *Journal of The Institution of Engineers (India): Series A*, *102*(3), 687–695. https://doi.org/10.1007/s40030-021-00531-2

Pospíšil, P., & Rozsypal, A. (2017). Site Investigation as Tool for Elimination of Natural Hazard Impact on Construction Project. *IOP Conference Series: Materials Science and Engineering*, *236*, 012081. https://doi.org/10.1088/1757-899X/236/1/012081

Prebanić, K. R., & Vukomanović, M. (2021). Realizing the Need for Digital Transformation of Stakeholder Management: A Systematic Review in the Construction Industry. *Sustainability*, *13*(22), 12690. https://doi.org/10.3390/su132212690

Puhan, M. A., Ahuja, A., Van Natta, M. L., Ackatz, L. E., & Meinert, C. (2011). Interviewer Versus Self-Administered Health-Related Quality of Life Questionnaires—Does it matter? *Health and Quality of Life Outcomes*, *9*(1), 30. https://doi.org/10.1186/1477-7525-9-30

PWD Form 203A (Rev. 1/2010) Standard Form of Contract (with Quantities), Public Work Department, Government of Malaysia (2010).

Qabaja, M., & Tenekeci, G. (2024). Influence of Inflation on the Construction Sector and Economic Growth in Selected Countries: A Continental Comparison. *Ain Shams Engineering Journal*, *15*(11), 103013. https://doi.org/10.1016/j.asej.2024.103013

Rahimi, S., & Khatooni, M. (2024). Saturation in Qualitative Research: An Evolutionary Concept Analysis. *International Journal of Nursing Studies Advances*, *6*, 100174. https://doi.org/10.1016/j.ijnsa.2024.100174

Rahman, I. A., Al-Emad, N., & Nagapan, S. (2016). Categorization of Saudi Arabia's Construction Delay Factors Using Factor Analysis Technique. *Engineering Challenges for Sustainable Future - Proceedings of the 3rd International Conference on Civil, Offshore and Environmental Engineering, ICCOEE 2016*, 177–182. https://doi.org/10.1201/b21942-35

Rahman, M. M. (2019). 21st Century Skill "Problem Solving": Defining the Concept. *Asian Journal of Interdisciplinary Research*, 64–74. https://doi.org/10.34256/ajir1917

Rajapaksha, A., Perera, B. A. K. S., & Liyanawatta, T. N. (2025). Framework for Avoidance of Disputes Arising in the Construction Industry due to the Economic Crisis. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *17*(1). https://doi.org/10.1061/JLADAH.LADR-1185

Rajoo, S. (2010). The PAM 2006 Standard Form of Building Contract—A Change in Risk Allocation. *Malayan Law Journal*, *4*(10), 14.

Rajoo, S., & Harbans, S. K. S. (2012). *Construction Law in Malaysia*. Thomson Reuters Malaysia Sdn Bhd.

Ramachandra, T. (2013). *Exploring Feasible Solutions To Payment Problems In The Construction Industry in New Zealand* (Issue June). Auckland University of Technology

Ramachandra, T., & Rotimi, J. O. (2011). The Nature of Payment Problems in The New Zealand Construction Industry. *Australasian Journal of Construction Economics and Building*, *11*(2), 22–33. https://doi.org/10.5130/ajceb.v11i2.2171

Ramachandra, T., & Rotimi, J. O. B. (2015). Causes of Payment Problems in the New Zealand Construction Industry. *Construction Economics and Building*, *15*(1), 43–55. https://doi.org/10.5130/AJCEB.v15i1.4214

Ramli, A., Mamat, R. C., Aliyah, F. N., Juita, A., Rao, M., & Irham, M. K. (2023). A Study of Ethical Issues in the Construction Industry and Potential Preventive Measures. *Northern Journal of Innovation and Engineering Application*, *1*(2). myjurnal.mohe.gov.my/public/article-view.php?id=203888

Ramli, R. A. (2021). *The Key Constraints to A Successful Final Account Closing in Construction Contract*. Universiti Teknologi Malaysia.

Rasid, R. (2017). *Langkah Langkah Kritikal Untuk Mengatasi Kelewatan Dalam Penutupan Akaun Muktamad*. Universiti Teknologi Malaysia.

Rauzana, A. (2016). Causes of Conflicts and Disputes in Construction Projects. *IOSR Journal of Mechanical and Civil Engineering*, *13*(05), 44–48. https://doi.org/10.9790/1684-1305064448

Razali, N. M., & Wah, Y. B. (2011). Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, *2*(1), 21–33.

Regmi, P. R., Waithaka, E., Paudyal, A., Simkhada, P., & Van Teijlingen, E. (2017). Guide to the Design and Application of Online Questionnaire Surveys. *Nepal Journal of Epidemiology*, *6*(4), 640–644. https://doi.org/10.3126/nje.v6i4.17258

RICS. (2017). *What is Quantity Surveying?*

Romli, H. A. (2015). *Delay in Settlement of Final Account*. Universiti Teknologi Malaysia.

Root, D., & Blismas, N. (2003). *Increasing Questionnaire Responses from Industry: Practices Surrounding the use of Postal Questionnaires*.

Rosenfeld, Y. (2013). *Root-Cause Analysis of Construction-Cost Overruns*. https://doi.org/10.1061/(ASCE)CO

Rosli, N. M., Mustaffa, N. E., Tajul Ariffin, H. L., Mat Ya'acob, I. A., Rahmat, M., & Leu, K. S. (2022). Crucial Conditions of Domestic Subcontract in Malaysian Construction Industry. *E3S Web of Conferences*, *347*, 05011. https://doi.org/10.1051/e3sconf/202234705011

Rowlands, J. (2021). Interviewee Transcript Review as a Tool to Improve Data Quality and Participant Confidence in Sensitive Research. *International Journal of Qualitative Methods*, *20*, 16094069211066170. https://doi.org/10.1177/16094069211066170

Saar, C. C., Chuing, L. S., Hai, T. K., & Yusof, A. M. (2017). Modelling Dispute Management in Construction Industry. *Malaysian Journal of Civil Engineering*, *14*(1), 1–14.

Saberi, M. H., Bakar, N. A., Yusop, N., Ali, S., & Ishak, M. F. (2015). The Contractors' Attributes for the Construction Project Success. *Proceedings of Postgraduate Conference on Global Green Issues (Go Green),UiTM (Perak), Malaysia*, (October), 300–304.

Sadeghi, R., & Goerlandt, F. (2021). The State of the Practice in Validation of Model-Based Safety Analysis in Socio-Technical Systems: An Empirical Study. *Safety*, *7*(4), 72. https://doi.org/10.3390/safety7040072

Saipallah, W. (2015). *Defect Liability Period And Account Closing*. Ministry Of Health.

Samsudin, N. S., Mohammad, M. Z., Khalil, N., Nadzri, N. D., & Izam Che Ibrahim, C. K. (2022). A Thematic Review on Prevention Through Design (PTD) Concept Application in The Construction Industry of Developing Countries. *Safety Science*, *148*, 105640. https://doi.org/10.1016/j.ssci.2021.105640

Samuel, K. A. (2011). Causes and Effects of Delayed Payments by Clients on Construction Projects in Ghana. *Journal of Construction Project Management and Innovation*, *1*(1), 27–45.

Sánchez-Castany, R. (2023). Thematic analysis of technological contents in Translation and Interpreting degrees in Spain. *Bellaterra Journal of Teaching & Learning Language & Literature*, *16*(3), e1139. https://doi.org/10.5565/rev/jtl3.1139

Sandhiya, V., & Bhuvaneswari, M. (2024). Qualitative research analysis: A thematic approach. In *Design and Validation of Research Tools and Methodologies* (pp. 289–309). IGI Global. https://doi.org/10.4018/979-8-3693-1135-6.ch014

Saraswati, P., & Devi, A. (2023). Mixed Methods-Research Methodology an Overview. *Nursing and Health Care*, *5*(4). https://doi.org/10.30654/mjnh.100024

Sargent, R. G. (2013). Verification and validation of simulation models. *Journal of Simulation*, *7*(1), 12–24. https://doi.org/10.1057/jos.2012.20

Sarstedt, M., Bengart, P., Shaltoni, A. M., & Lehmann, S. (2018). The use of sampling methods in advertising research: A gap between theory and practice. *International Journal of Advertising*, *37*(4), 650–663. https://doi.org/10.1080/02650487.2017.1348329

Saunders, M. N., Lewis, P., & Thornhill, A. (2019). Research Methods for Business Students Sixth Edition Research Methods for Business Students. In *Research Methods for Business Students* (8th edn). Pearson Education Limited. Saunders, M. N., Lewis, P., & Thornhill, A. (2023). *Research methods for business students* (Ninth edition). Pearson.

Schmidt, S. K. (2022). Kruskal–Wallis Test. *The SAGE Encyclopedia of Research Design*. https://api.semanticscholar.org/CorpusID:165039968

Schultz, C. S. (2012). The Role of Problem Solving in Construction Management Practices. *28 Th Annual ARCOM Conference*, 1067–1076.

Setia, M. (2017). Methodology series module 10: Qualitative health research. *Indian Journal of Dermatology*, *62*(4), 367. https://doi.org/10.4103/ijd.IJD_290_17

Shahruddin, S., Sonet, U. N., Azmi, A., & Zainordin, N. (2024). Traversing the Complexity of Digital Construction and Beyond Through Soft Skills: Experiences of Malaysian Architects. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-01-2024-0147

Shahu, R., Pundir, A. K., & Ganapathy, L. (2012). An Empirical Study on Flexibility: A Critical Success Factor of Construction Projects. *Global Journal of Flexible Systems Management*, *13*(3), 123–128. https://doi.org/10.1007/s40171-012-0014-5

Shaikh, H. H., Zainun, N. Y., & Khahro, S. H. (2020). Claims in Construction Projects: A Comprehensive Literature Review. *IOP Conference Series: Earth and Environmental Science*, *498*(1), 012095. https://doi.org/10.1088/1755-1315/498/1/012095

Sharma, Dr. L. R., Bidari, S., Bidari, D., Neupane, S., & Sapkota, R. (2023). Exploring the Mixed Methods Research Design: Types, Purposes, Strengths, Challenges, and Criticisms. *Global Academic Journal of Linguistics and Literature*, *5*(1), 3–12. https://doi.org/10.36348/gajll.2023.v05i01.002

Shehu, Z., Endut, I. R., & Akintoye, A. (2014). Factors Contributing to Project Time and Hence Cost Overrun in The Malaysian Construction Industry. *Journal of Financial Management of Property and Construction*, *19*(1), 55–75. https://doi.org/10.1108/JFMPC-04-2013-0009

Shugran, A. A., & Ghazali, F. E. M. (2024). Understanding the Effects of Variation Orders on Construction Project Success: Insights from the Jordanian context. *International Journal of Construction Management*, 1–11. https://doi.org/10.1080/15623599.2024.2337238

Silva, P. M., Domingo, N., & Ali, N. A. N. A. (2025). *Pre-Contract Measures to Avoid Potential Disputes in The New Zealand Construction Industry*. *25*(2). https://doi.org/10.5130/AJCEB.v25i2.9259

Silva, P. M., Domingo, N., & Ameer Ali, N. A. N. (2024). Causes of Disputes in the Construction Industry – A Systematic Literature Review. *Journal of Financial Management of Property and Construction*, *29*(2), 193–210. https://doi.org/10.1108/JFMPC-03-2023-0012

Simon, H. (2001). *An Overview of the Human Decision-Making Process Simon ' s Theory of Decision-Making Decision-Making Process*.

Sing, C. P., Love, P. E. D., Smith, J., & Tam, C.-M. (2013). Factors Influencing Final Account Settlement In Construction Projects. In C. Eriksson (Ed.), *Royal Institution of Chartered Surveyors, COBRA 2013* (pp. 1–7). Royal Institute of Chartered Surveyors (RICS).

Singh, I. H. (2015). *The Adjudication Process and Recent Development on CIPAA 2012*.

Singh, K. S. (2003). Engineering and Construction Contracts Management: Post-Commencement Practice. In *Lexis-Nexis Business Solutions*. LexisNexis.

Singh, V. K., Singh, P., Karmakar, M., Leta, J., & Mayr, P. (2021). The Journal Coverage of Web of Science, Scopus and Dimensions: A comparative analysis. *Scientometrics*, *126*(6), 5113–5142. https://doi.org/10.1007/s11192-021-03948-5

Snyder, H. (2019). Literature review as a research methodology: An Overview and Guidelines. *Journal of Business Research*, *104*(March), 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Somji, Q. (2024, October 14). *What are Final Accounts in Construction?* Witan Solicitors. https://witansolicitors.co.uk/final-account-recovery-in-construction/

Song, H., Hou, J., & Tang, S. (2021). From Contractual Flexibility to Contractor's Cooperative Behavior in Construction Projects: The Multiple Mediation Effects of Ongoing Trust and Justice Perception. *Sustainability*, *13*(24), 13654. https://doi.org/10.3390/su132413654

Srinivasan, N. P., Kumar, K. S., Rahul, R., Rahulnath, S., Rajadurai, B., Kumaravel, S., & Mukesh, P. (2023). Manpower Management in Construction Projects. *E3S Web of Conferences*, *399*, 03004. https://doi.org/10.1051/e3sconf/202339903004

Ssegawa, J. K., Rwelamila, P. D., & Mogome, M. G. (2020). The Challenges of Closing Construction Projects Final Accounts in Botswana Local Authorities. *Journal of Construction Business and Management*, *4*(1), 13–23. https://doi.org/10.15641/jcbm.4.1.775

Staller, K. M. (2021). Big Enough? Sampling in Qualitative Inquiry. *Qualitative Social Work*, *20*(4), 897–904. https://doi.org/10.1177/14733250211024516

Subramaniam, C., Ismail, S., Durdyev, S., Rani, W. N. M. W. M., Bakar, N. F. S. A., & Banaitis, A. (2021). Overcoming the Project Communications Management

Breakdown amongst Foreign Workers during the COVID-19 Pandemic in Biophilia Inveigled Construction Projects in Malaysia. *Energies*, *14*(16), 4790. https://doi.org/10.3390/en14164790

Suhr, D. (2006). *200-31: Exploratory or Confirmatory Factor Analysis?*

Sürücü, L., Yikilmaz, I., & Maslakçi, A. (2022). *Exploratory factor analysis (EFA) in Quantitative Researches and Practical Considerations*. https://doi.org/https://doi.org/10.31219/osf.io/fgd4e

Tabachnick, B. G., & Fidell, L. S. (2019). *Using Multivariate Statistics*. Pearson.

Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3205040

Takim, R., Akintoye, A., & Kelly, J. (2004). Analysis of Effectiveness Measures of Construction Project Success in Malaysia. *Association of Researchers in Construction Management, ARCOM 2004*, *2*, 1123–1133. https://doi.org/10.5539/ass.v4n7p74

Tang, Y., Chen, Y., Hua, Y., & Fu, Y. (2020). Impacts of Risk Allocation on Conflict Negotiation Costs in Construction Projects: Does Managerial Control Matter? *International Journal of Project Management*, *38*(3), 188–199. https://doi.org/10.1016/j.ijproman.2020.03.002

Tantawy, M., Kosbar, M. M., Nour, S. M., Mansour, N., & Ehab, A. (2025). Leveraging BIM for Proactive Dispute Avoidance in Construction Projects. *Buildings*, *15*(9). https://doi.org/10.3390/buildings15091401

Tarmizi, J. (2018). *Kelewatan Penyediaan Perakuan Muktamad Pihak Berkuasa Tempatan (PBT)*. Universiti Teknologi Malaysia.

Tashakkori, A., & Teddlie, C. (2010). *Handbook of Mixed Methods in Social & Behavioral Research*. SAGE Publications.

Teo, T. (2013). Online and Paper-Based Survey Data: Are They Equivalent? *British Journal of Educational Technology*, *44*(6). https://doi.org/10.1111/bjet.12074

Thatcher, W. G., & Drane, J. W. (2003). On Treating a Survey of Convenience Sample as a Simple Random Sample. *Journal of Modern Applied Statistical Methods*, *2*(2), 478–480. https://doi.org/10.22237/jmasm/1067646060

Treacy, D., Spillane, J. P., & Tansey, P. (2016). Construction Disputes in Small to Medium Enterprise's in Ireland During Recession: Identification of Critical

Factors. *International Journal of Law in the Built Environment*, *8*(1), 21–41. https://doi.org/10.1108/IJLBE-10-2014-0031

Turpin, S. . M., & Marias, M. A. (2004). Decision-Making: Theory and Practice. *Decision-Making: Theory and Practice*, *20*(2), 143–160.

Umar, G. M. (2020). *A Framework of Efficient Interim Payment For Public Construction Projects in Kano State, Nigeria*. Universiti Sains Malaysia.

Umar, M. O., & Ochigbo, A. D. (2024). Comprehensive Approach to Claim Assessment in Construction Project. *International Journal of Management & Entrepreneurship Research*, *6*(7), 2201–2225. https://doi.org/10.51594/ijmer.v6i7.1291

Uzonwanne, F. C. (2016). Rational Model of Decision Making. In *Global Encyclopedia of Public Administration, Public Policy, and Governance* (pp. 1–6). Springer International Publishing. https://doi.org/10.1007/978-3-319-31816-5_2474-1

Vagias, W. M. (2006). *Likert-type scale response anchors*. Clemson International Institute for Tourism & Research Development.

Varghese, B. (2020). *Importance of Construction Industry*. LinkedIn. https://www.linkedin.com/pulse/importance-construction-industry-dr-eng-binu-varghese-mrics-uk-/

Varley, J. (2021, March 8). *A final account problem – JSM Construction v Western Power*. Thomson Reuters - Practical Law Construction. http://constructionblog.practicallaw.com/a-final-account-problem-jsm-construction-v-western-power/

Vaughan, R. (2017). Oversampling in Health Surveys: Why, When, and How? *American Journal of Public Health*, *107*(8), 1214–1215. https://doi.org/10.2105/AJPH.2017.303895

Vee, C., & Skitmore, M. (2003). Professional ethics in the construction industry. *Engineering, Construction and Architectural Management*, *10*(2), 117–127. https://doi.org/10.1108/09699980310466596

Wang, J., Zhang, S., Fenn, P., Luo, X., Liu, Y., & Zhao, L. (2023a). Adopting BIM to Facilitate Dispute Management in the Construction Industry: A Conceptual Framework Development. *Journal of Construction Engineering and Management*, *149*(1). https://doi.org/10.1061/(asce)co.1943-7862.0002419

Wang, J., Zhang, S., Fenn, P., Luo, X., Liu, Y., & Zhao, L. (2023b). Adopting BIM to Facilitate Dispute Management in the Construction Industry: A Conceptual

Framework Development. *Journal of Construction Engineering and Management*, *149*(1), 1–15. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002419

Wang, P., Wang, K., Huang, Y., Zhu, J., Fenn, P., & Zhang, Y. (2023). Payment Issues in China's Construction Industry: Nature, Causes, and a Predictive Model. *Journal of Construction Engineering and Management*, *149*(1), 04022144. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002422

Wang, Y., & Chiew, V. (2010). On the cognitive process of human problem solving. *Cognitive Systems Research*, *11*(1), 81–92. https://doi.org/10.1016/j.cogsys.2008.08.003

Watson, J. C. (2017). Establishing Evidence for Internal Structure Using Exploratory Factor Analysis. *Measurement and Evaluation in Counseling and Development*, *50*(4), 232–238. https://doi.org/10.1080/07481756.2017.1336931

Weitzman, E. A., & Weitzman, P. F. (2000). *Problem solving and decision making in conflict resolution*. Jossey-Bass/Wiley.

Williams, C. (2007). Research Methods. *Journal of Business & Economic Research*, *5*(3), 65–72.

Wolf, J. (2008). Self-Administered Questionnaire. In *Encyclopedia of Survey Research Methods* (Vol. 0, pp. 804–804). Sage Publications, Inc. https://doi.org/10.4135/9781412963947.n522

Worthington, R. L., & Whittaker, T. A. (2006). Scale Development Research: A Content Analysis and Recommendations for Best Practices. *The Counseling Psychologist*, *34*(6), 806–838. https://doi.org/10.1177/0011000006288127

Xiao, Y., & Watson, M. (2017). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, *39*(1), 93–112. https://doi.org/10.1177/0739456X17723971

Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, *39*(1), 93–112. https://doi.org/10.1177/0739456X17723971

Yahaya, I., Abidoye, J., & Saidu, I. (2019). Contributions of Contracting Parties to Non-Settlement of Final Accounts in Building Projects in Abuja, Nigeria. *Environmental Technology & Science Journal*, *10*(2). https://doi.org/http://repository.futminna.edu.ng:8080/jspui/handle/123456789/7617

Yap, J. B. H., Abdul-Rahman, H., & Chen, W. (2017). Collaborative model: Managing design changes with reusable project experiences through project learning and effective communication. *International Journal of Project Management*, *35*(7), 1253–1271. https://doi.org/10.1016/j.ijproman.2017.04.010

Ye, K. M., & Rahman, H. A. (2010). *Risk of Late Payment in the Malaysian Construction Industry*. *4*(5).

Yong, F. Y. Y. (2018). *Profiling of construction dispute in private project*. Universiti Teknologi Malaysia.

Yong, Y. C., & Mustaffa, N. E. (2017). Critical Success Factors for Malaysian Construction Projects: An Investigative Review. *International Journal of Built Environment and Sustainability*, *4*(2), 93–105. https://doi.org/10.11113/ijbes.v4.n2.180

Yu, W. D., Yang, J. B., Tseng, J. C. R., Liu, S. J., & Wu, J. W. (2010). Proactive problem-solver for construction. *Automation in Construction*, *19*(6), 808–816. https://doi.org/10.1016/j.autcon.2010.05.003

Yu, W., Yang, J., Tseng, J. C. R., & Yu, C. (2007, September 21). *Model of Proactive Problem-Solving for Construction Knowledge Management*. https://doi.org/10.22260/ISARC2007/0082

Yunos, M. H. M. (2015). *The Prevailing Practice in Deciding the Practical Completion of Construction Work*. Universiti Teknologi Malaysia.

Yusuwan, N. M. (2016). *A Procedural Framework for Extension of Time (EOT) Claim Settlement in the Malaysian Construction Industry* (Issue December).

Zahrizan, Z., Affendy, O. M., & Khalimi Johan, A. H. (2023). Exploring the barriers in implementation of qlassic in Malaysian construction industry from the perspective of contractors. *IOP Conference Series: Earth and Environmental Science*, *1140*(1). https://doi.org/10.1088/1755-1315/1140/1/012013

Zaini, N. (2012). The Construction Industry Payment and Adjudication Act (CIPAA), In *Http://www.suazconsulting.com/2012/06/construction-industry-payment-and.htm*.

Zairul, M. (2025). Enhancing Qualitative Research with Thematic Analysis Matrix (TAM): A Systematic Approach to Thematic Analysis in Architectural Research. *Alam Cipta*, *18*(1), 1–17. https://doi.org/10.47836/ac.18.1.article1

Zakaria, Z. (2015). *Final Account Closing Framework in Construction Project*. Universiti Teknologi Malaysia.

Zakaria, Z., Ismail, S., & Yusof, A. (2013a). Cause and Impact of Dispute and Delay the Closing of Final Account in Malaysia Construction Industry. *Journal of Southeast Asian Research*, 1–12. https://doi.org/10.5171/2012.975385

Zakaria, Z., Ismail, S., & Yusof, A. A. M. (2014). Modelling the Determinants Influencing the Need of Computer Simulation Framework in Improving the Closing of Final Account in Construction Projects. *Advanced Science Letters*, *20*(1), 321–325. https://doi.org/10.1166/asl.2014.5289

Zakaria, Z., Ismail, S., & Yusof, A. M. (2012). Achieving Sustainability in Construction through the Success of Final Account Closing. *2012 International Conference in Humanities, Social Sciences and Global Business Management (Issgbm 2012), Vol 7*, *7*(December), 45–52.

Zakaria, Z., Ismail, S., & Yusof, A. M. (2013b). *Buildability and Maintainability in Final Account Closing: The Greatest Challenge for Construction Industry*. https://doi.org/10.13140/RG.2.1.1758.2806

Zakaria, Z., Ismail, S., & Yusof, A. M. (2013c). Fundamental Variables of Final Account Closing Success in Construction Projects in Malaysia. *International Journal of Social, Human Science and Engineering*, *7*(10), 870–875.

Zakaria, Z., Ismail, S., & Yusof, A. M. (2013d). Toward Sustainability in Construction Industry: The Important of Final Account Closing Satisfaction. *Wulfenia Journal*, *20*(2), 118–125.

Zakaria, Z., Ismail, S., & Yusof, A. M. (2022). An overview of comparison between construction contracts in malaysia: The roles and responsibilities of contract administrator in achieving final account closing success. *Proceedings of the 2013 International Conference on Education and Educational Technologies*, *16*, 1–8. https://doi.org/10.46300/91014.2022.16.1

Zavadskas, E., Antucheviciene, J., Vilutiene, T., & Adeli, H. (2017). Sustainable Decision-Making in Civil Engineering, Construction and Building Technology. *Sustainability*, *10*(1), 14. https://doi.org/10.3390/su10010014

Zhang, Y. (2024). Application of risk management plan to technical risks in metro construction: Case study of the Grand Paris Express project. *Tunnelling and Underground Space Technology*, *147*, 105716. https://doi.org/10.1016/j.tust.2024.105716

Zhao, K. (2021). Sample representation in the social sciences. *Synthese*, *198*(10), 9097–9115. https://doi.org/10.1007/s11229-020-02621-3

Zhu, X., Meng, X., & Zhang, M. (2021). Application of multiple criteria decision making methods in construction: A systematic literature review. *Journal of Civil Engineering and Management*, *27*(6), 372–403. https://doi.org/10.3846/jcem.2021.15260

Zia, S., Khan, A., Tufail, M. M. B., Ismat, J., & Idrees, A. (2022). Impact of Social Media Marketing on Consumer-Based Brand Equity. *Journal of Marketing Strategies*, *4*(1), 120–139. https://doi.org/10.52633/jms.v4i1.188

Zillante, G., Mikucki, M., Zuo, J., & Jin, X. (2014). *Documentation Quality in Construction Projects: A Qualitative Inquiry*. 657–666. https://doi.org/10.1007/978-3-642-35548-6_68

Zulkhairi, F. H., Hussin, S. N., Saidin, M. T., Zain, F. M. Y., Hussein, E., & Khalil, N. (2022). CIPAA Implementation In The Malaysian Construction Industry: From Contractor's Perspectives. *Malaysian Construction Research Journal (MCRJ)*, *16*(Special Issue No. 2), 18–28.

APPENDICES

APPENDIX 1

Questionnaire Survey



QUESTIONNAIRE SURVEY:

PREVENTIVE SOLUTION FRAMEWORK FOR IMPROVING FINAL ACCOUNT CLOSING IN THE MALAYSIAN CONSTRUCTION INDUSTRY

Dear Participants,
It gives me great pleasure to invite you as participants in a survey conducted to investigate the final account closing issues in the Malaysian construction industry. This study aims to gain insights into the current scenario and issues related to the final account and identify the major factors contributing to delays and disputes in closing the final account in the Malaysian construction industry. The outcome of this study is to develop a framework for improving the closing of final accounts for construction projects in Malaysia. The questionnaire survey is conducted among Malaysian professionals working in **Client/Developer** organisations, **G7 Contractor** Companies, and **Quantity Surveying Consultant** Firms in Malaysia.
This questionnaire consists of THREE (3) sections:
Section 1: Respondent/organisation details
Section 2: Current scenario and issues related to final account closing in the Malaysian construction industry
Section 3: The major problems related to final account closing in the Malaysian construction industry

Your valuable input in this research would greatly help me to better understand the issues related to the Final Account Closing. Your participation in this survey is voluntary. Your information will be treated as **CONFIDENTIAL**, and your identity will be kept as **ANONYMOUS**. The findings of this survey will be used for academic purposes only.
This survey will take approximately 10 – 15 minutes to complete. Please answer the entire question. Your time and cooperation are highly appreciated. Thank you.
Sincerely,
Researcher,
Mohd Khairul Fitri Othman
Email: mohd_khairul135@uitm.edu.my
Phone:

TERM AND DEFINITION

TERM	DEFINITION
Preventive	Refers to actions or measures taken to avoid or minimise the occurrence of a particular event or problem. It involves proactive strategies and interventions to prevent negative outcomes or address potential risks before they escalate.
Final Account	A statement of account showing the value of the works executed by the contractor under the contract and all adjustments made to the original contract price to determine the actual contract price and showing the balance of the payment to which, the contractor or employer is entitled. The final account is prepared after the completion of work and is often subject to audit or review.
Final Account Closing	Conclusiveness of the final account agreed upon by contracting parties, followed by the settlement of all payment and financial transactions, including retention after the defect liability period that satisfied the key parties and stakeholders in the construction project.

Kolej
Pengajian Alam Bina

KAJI SELIDIK:

"RANGKA KERJA PENCEGAHAN DAN PENYELESAIAN UNTUK PENAMBAHBAIKAN PENUTUPAN AKAUN MUKTAMAD DALAM INDUSTRI PEMBINAAN DI MALAYSIA"

Responden yang dihormati,
Saya amat berbesar hati menjemput anda sebagai responden dalam kaji selidik yang dijalankan untuk mengkaji isu penutupan akaun muktamad dalam industri pembinaan di Malaysia. Kajian ini bertujuan untuk mendapatkan pandangan tentang senario semasa dan isu yang berkaitan dengan penutupan akaun muktamad dan menentukan faktor utama yang menyumbang kepada kelewatan dan pertikaian bagi penutupan akaun muktamad dalam industri pembinaan Malaysia. Hasil kajian ini adalah untuk membangunkan rangka kerja untuk menambah baik penutupan akaun akhir bagi projek pembinaan di Malaysia. Kaji selidik ini akan dijalankan di kalangan professional binaan di Malaysia yang bekerja di organisai atau syarikat **Majikan/Pemaju**, Kontraktor **Gred G7,** dan Firma **Perunding Ukur Bahan** di Malaysia.
Kaji selidik ini mengandungi TIGA (3) bahagian:
Bahagian 1: Maklumat responden/organisasi
Bahagian 2: Senario dan isu semasa penutupan akaun muktamad dalam industri pembinaan Malaysia
Bahagian 3: Masalah utama berkaitan penutupan akaun muktamad dalam industri pembinaan Malaysia

Penglibatan anda dalam kaji selidik ini amat dihargai, dan input yang anda berikan amat bermakna dalam memahami isu berkaitan penutupan akaun muktamad dalam industri pembinaan. Penyertaan anda dalam kaji selidik ini adalah secara sukarela. Maklumat anda akan dianggap sebagai **SULIT**, dan identiti anda akan disimpan sebagai **TANPA NAMA**. Dapatan kaji selidik ini akan digunakan untuk tujuan akademik sahaja.

Kaji selidik ini akan mengambil masa kira-kira 10 hingga 15 minit untuk diselesaikan. Sila jawab keseluruhan soalan. Kerjasama anda amatlah dihargai. Terima kasih
Yang benar,

Penyelidik,
Mohd Khairul Fitri Othman
Email: mohd khairul135@uitm.edu.my
Phone:

ISTILAH DAN DEFINISI

ISTILAH	DEFINISI
Pencegahan	Merujuk kepada tindakan atau langkah yang diambil untuk mengelakkan atau meminimumkan kejadian atau masalah tertentu. Ia melibatkan strategi dan pendekatan proaktif untuk mencegah hasil negatif atau menangani potensi risiko sebelum ia meningkat.
Akaun Muktamad	Satu penyata akaun yang menunjukkan nilai kerja yang dilaksanakan oleh kontraktor di bawah kontrak dan semua pelarasan yang dibuat kepada harga kontrak asal untuk menentukan harga kontrak sebenar dan menunjukkan baki bayaran yang kontraktor atau majikan berhak
Penutupan Akaun Muktamad	Penyata akaun muktamad yang konklusif dan dipersetujui oleh pihak yang berkontrak, diikuti dengan penyelesaian semua pembayaran dan transaksi kewangan yang dapat memenuhi kehendak pihak utama dan pihak berkepentingan dalam projek pembinaan.

SECTION 1- RESPONDENT/ ORGANISATION DETAILS
BAHAGIAN 1 - MAKLUMAT RESPONDEN / ORGANISASI
This section (Questions 1 to 4) is about your background and organisation.
Bahagian ini (Soalan 1-4) adalah mengenai latar belakang anda dan organisasi anda.

Please tick (/) the MOST appropriate answer where shown.
Sila tandakan (/) pada jawapan yang <u>PALING</u> sesuai di mana yang berkenaan.

1. Type of your organisation/company.
   Jenis organisasi/syarikat anda.

☐	Client *Majikan*	☐	Consultant *Perunding*
☐	Contractor (Grade……..) *Kontraktor (Gred……..)*	☐	Others; please specify..... *Lain-lain, Sila Nyatakan ……*

2. The designation in the organisation.
   Jawatan dalam organisasi.

☐	Director of the company *Pengarah Syarikat*	☐	Engineer *Jurutera*
☐	Contract Manager *Pengurus Kontrak*	☐	Quantity Surveyor *Juruukur Bahan*
☐	Project Manager *Pengurus Projek*	☐	Others; please specify..... *Lain-lain, Sila Nyatakan ……...*
☐	Architect *Arkitek*		

3. The working experience in the construction industry.
   Pengalaman kerja di dalam industri pembinaan.

☐	Less than 5 years *Kurang dari 5 tahun*	☐	More than 10 years *Lebih dari 10 tahun*
☐	5 – 10 years *5 – 10 tahun*		

4. How much were you involved in the final account closing process in the construction project
   Berapa banyak anda telah terlibat dalam proses penutupan akaun muktamad dalam projek pembinaan

☐	1 – 3 projects / *1 – 3 projek*	☐	7 – 10 projects / *7 – 10 projek*
☐	4 – 7 projects / *4 – 7 projek*	☐	More than 10 projects / *Lebih dari 10 projek*

5. In the last ten (10) years, what types of projects have you often been involved in?
   Apakah jenis projek yang anda sering terlibat dalam tempoh 10 tahun yang lepas?

☐	Residential Project / *Projek Perumahan*	☐	Infrastructure Project / *Projek Infrastuktur*
☐	Industrial project / *Projek Perindustrian*	☐	Educational & Institutional / *Pendidikan & Institusi*
☐	Commercial Project / *Projek Komersil*	☐	Others; (please stated) ……..

SECTION 2 - TO INVESTIGATE THE CURRENT SCENARIO AND ISSUES RELATED TO THE FINAL ACCOUNT CLOSING PROCESS IN THE MALAYSIAN CONSTRUCTION INDUSTRY ***BAHAGIAN 2 - UNTUK MENGENAL PASTI KEADAAN DAN ISU SEMASA BERKAITAN PROSES PENUTUPAN AKAUN MUKTAMAD DALAM INDUSTRI PEMBINAAN DI MALAYSIA***

This information will be based on your work experience at your current or previous organisation you are working

Maklumat ini adalah berdasarkan pengalaman kerja anda di organisasi sekarang atau sebelumnya di mana anda bekerja

Please tick (/) the MOST appropriate answer where shown.

Sila tandakan (/) pada jawapan yang PALING sesuai di mana yang berkenaan.

1. Based on your experience, how do you rate the process of final account closing in the construction project?
   Berdasarkan pengalaman anda, apakah tanggapan anda mengenai proses penutupan akaun muktamad di dalam projek pembinaan?

☐	Very Difficult / *Sangat Susah*	☐	Easy / *Mudah*
☐	Difficult / *Susah*	☐	Very Easy / *Sangat Mudah*
☐	Moderate / *Sederhana*		

2. How often do you face problems in the final account closing process?
   Berapa kerapkah anda menghadapi masalah dalam proses penutupan akaun muktamad?

☐	Very often / *Sangat kerap*	☐	Rarely / *Jarang*
☐	Often / *Kerap*	☐	Never / *Tiada*
☐	Sometimes / *Kadang-kadang*		

3. Do problems in the final account closing affect your organisation?
   Adakah masalah dalam penutupan akaun muktamad menjejaskan organisasi anda?

☐	Very affected / *Sangat terjejas*	☐	Slightly affected / *Sedikit terjejas*
☐	Moderately affected / *Sederhana terjejas*	☐	Not affected / *Tidak terjejas*
☐	Unsure / *tidak pasti*		

Use the following scale to answer questions 4 to 6
Scale : 1 Never (N); 2 Rarely(R); 3 Sometimes (S); 4 Often (O); 5 Very Often (VO)
Skala : 1 Tiada (T); 2 Jarang (J); 3 Kadang-Kadang (K-K); 4 Kerap (K); 5 Sangat Kerap (SK)

4. In your experience, how long does it usually take to settle the final account in a construction project, starting from issuing a Certificate of Practical Completion (CPC) until the Final Payment is made?
   Berdasarkan pengalaman anda, berapa lamakah masa yang biasanya diambil untuk penyelesaian akaun muktamad di dalam projek pembinaan, bermula dari Perakuan Siap Kerja sehingga Pembayaran Akhir dibuat?

Period to settle the final account / ***Tempoh penyelesaian akaun muktamad***	**N 1**	**R 2**	**S 3**	**O 4**	**VO 5**
Less than 1 year / *Kurang dari 1 tahun*					
1 – 2 years / *1 – 2 tahun*					
2 – 3 years / *2 – 3 tahun*					
3 – 4 years / *3 – 4 tahun*					
More than 4 years / *Melebihi 4 tahun*					

5. Based on your work experience, please indicate the occurrence rate of disputes in the final account closing for each project category below:
Berdasarkan pengalaman anda, sila nyatakan kadar berlakunya pertikaian dalam penutupan akaun muktamad bagi setiap kategori projek berikut:-

Project Category / *Kategori Projek*	**N 1**	**R 2**	**S 3**	**O 4**	**VO 5**
Government Funded projects / *Projek dibiayai oleh Dana Kerajaan*					
Private Funded Project / *Projek dibiayai oleh Dana Swasta*					

6. Below are the main processes of the final account closing in accordance with Pertubuhan Arkitek Malaysia (PAM) Standard Form of Contract. In your experience, indicate the occurrence rate of problems encountered in each process
Berikut adalah proses utama penutupan akaun muktamad berdasarkan Kontrak Piawai Pertubuhan Arkitek Malaysia (PAM). Mengikut pengalaman anda, sila nyatakan kadar berlakunya masalah yang dihadapi dalam setiap proses

The main process of the final account closing ***Proses utama penutupan akaun muktamad***	**N 1**	**R 2**	**S 3**	**O 4**	**VO 5**
Stage 1 – Gather and submit all relevant documentation for the final account claim by the Contractor ***Peringkat 1*** *– Mengumpul dan menyerahkan semua dokumen berkaitan bagi tujuan tuntutan akaun muktamad oleh Kontraktor*					
Stage 2 – Measurement, valuation and preparation of the final account by the Quantity Surveyor ***Peringkat 2*** *– Pengukuran, penilaian dan penyediaan akaun muktamad oleh Juruukur Bahan*					
Stage 3 – Responding to the final account draft by the Client and the Contractor ***Peringkat 3*** *– Memberi maklum balas terhadap draf akaun muktamad oleh Majikan dan Kontraktor*					
Stage 4 – Review and amendment of the final account draft by the Quantity Surveyor if being disagreed by the Client or the Contractor ***Peringkat 4*** *– Menyemak dan meminda draf akaun muktamad oleh Juruukur Bahan jika tidak dipersetujui oleh Majikan atau Kontraktor*					
Stage 5 – Formalise and certify the final account and issuance of the final certificate by the Quantity Surveyor ***Peringkat 5*** *– Memuktamadkan dan memperakukan akaun muktamad dan pengeluaran sijil bayaran muktamad oleh Juruukur Bahan*					
Stage 6 – Final payment by the Client to the Contractor in accordance with the final certificate ***Peringkat 6*** *– Bayaran akhir oleh Majikan kepada Kontraktor mengikut perakuan muktamad*					

SECTION 3 – TO IDENTIFY THE MAJOR PROBLEMS IN THE FINAL ACCOUNT CLOSING
BAHAGIAN 3 – UNTUK MENGENAL PASTI MASALAH UTAMA DALAM PENUTUPAN AKAUN MUKTAMAD

Based on the following statement, please indicate your OVERALL AGREEMENT level for each determinant for Final Account Closing Problems in the Malaysian Construction Industry.
Berdasarkan penyataan berikut, sila nyatakan tahap PERSETUJUAN KESELURUHAN anda untuk setiap penentu bagi masalah dalam Penutupan Akaun Muktamad dalam Industri Pembinaan Malaysia.

STRONGLY DISAGREE (SD) ***SANGAT TIDAK SETUJU***	**DISAGREE (DA)** ***TIDAK SETUJU***	**MODERATELY AGREE (MA)** ***SEDERHANA SETUJU***	**AGREE (A)** ***SETUJU***	**STRONGLY AGREE (SA)** ***SANGAT SETUJU***
1	**2**	**3**	**4**	**5**

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Contractor Factor / *Faktor oleh Kontraktor*	**1**	**2**	**3**	**4**	**5**
Failure to follow procedures in final account claims *Kegagalan untuk mengikuti prosedur dalam tuntutan akaun muktamad*					
Delay submission of the final account claim *Kelewatan dalam mengemukakan tuntutan akaun muktamad*					
Disagreement on the valuation of final account *Tidak bersetuju dengan penilaian akaun muktamad*					
Lack of documents and evidence for submission of final account claim *Kekurangan dokumen dan bukti sokongan dalam tuntutan akaun muktamad*					
Lack of experience in estimating the cost of the project *Kurang pengalaman dalam anggaran kerja dan pengurusan projek*					
Inefficient planning and management of the project *Perancangan dan pengurusan projek yang tidak cekap*					
Contractor's failure to repair defective works during the defect liability period *Kegagalan kontraktor untuk membaiki kerosakan semasa tempoh tanggungan kecacatan*					
Incompetent and insufficient staff to handle the final account process *Ketidakcekapan dan kekurangan staf untuk mengendalikan proses akaun muktamad*					
Excessive workload of the contractor due to involvement in other projects *Beban kerja kontraktor yang berlebihan disebabkan penglibatan dalam projek lain*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Client Factor / *Faktor oleh Majikan*	**1**	**2**	**3**	**4**	**5**
Client disagrees with the quality of executed works by the contractor *Majikan tidak bersetuju dengan kualiti dan nilai kerja yang dilaksanakan oleh kontraktor*					
Client deliberately withholding or refusing to release the final payment without a reasonable reason *Majikan sengaja menahan atau enggan membayar bayaran akhir tanpa sebab yang munasabah*					
Client imposed extra work to the contractor during the defect liability period *Majikan mengenakan kerja tambahan ke atas kontraktor semasa tempoh tanggungan kecacatan*					
Late payment or underpayment by the client to the contractor on the interim payment					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Lewat bayar / kurang bayar oleh majikan kepada kontraktor semasa bayaran interim					
Client's poor financial management *Pengurusan kewangan yang lemah di pihak majikan*					
Client's lack of financial resources *Kekurangan sumber kewangan di pihak majikan*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Management Factor / *Faktor oleh Pengurusan*	**1**	**2**	**3**	**4**	**5**
Delay in certification and issuance of the final certificate *Kelewatan dalam memperakukan dan mengeluarkan sijil muktamad*					
Delay in issuance of the Certificate of Completion Making Good Defect *Kelewatan mengemukakan Sijil Siap Membaiki Kecacatan*					
Delay in evaluation and preparation of the final account *Kelewatan dalam menilai dan menyediakan akaun muktamad*					
Inadequate experience of Quantity Surveyor in handling final account process *Kekurangan pengalaman oleh Juruukur Bahan dalam mengendalikan proses akaun muktamad*					
Lack of communication and cooperation among parties in the project *Kurang komunikasi dan kerjasama antara perunding dengan pihak lain di dalam projeki*					
The person responsible for the final account is no longer with the organisation *Individu yang bertanggungjawab dalam mengendalikan akaun muktamad tidak lagi bersama organisasi*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Contractual Factor / *Faktor oleh Kontrak*	**1**	**2**	**3**	**4**	**5**
The ambiguity and lack of clarity in the contract terms regarding the final account procedure *Terma kontrak yang kabur dan tidak jelas berkenaan prosedur akaun muktamad*					
The terms of the contract are too complicated to be understood by the parties in the project *Terma kontrak terlalu rumit untuk difahami oleh pihak di dalam projek*					
The contractual provision for the final account aspect is not comprehensive *Peruntukan kontrak dalam aspek akaun muktamad tidak menyeluruh*					
Mistakes and discrepancies in the contract document *Kesilapan dan percanggahan dalam dokumen kontrak*					
The allocation fund provided for risk and contingency events in the project is insufficient *Dana yang diperuntukkan bagi risiko dan kejadian luar jangka dalam projek tidak mencukupi*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Variation Factor / *Faktor oleh Perubahan Kerja*	**1**	**2**	**3**	**4**	**5**
Excessive variation orders that increase the overall cost of construction project *Arahan perubahan kerja yang berlebihan menyebabkan pertambahan kos keseluruhan projek pembinaan*					
Cost overrun due to variation and provisional quantities *Kos berlebihan disebabkan kerja perubahan dan kuantiti sementara*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Delay in approving and finalising variation work for the adjustment contract sum *Kelewatan dalam meluluskan dan memuktamadkan perubahan kerja untuk pelarasan harga kontrak*					
Verbal instruction for variation work not confirmed in writing *Arahan lisan yang dikeluarkan untuk perubahan kerja tidak disahkan secara bertulis*					
The complexity of the valuation and claim process for variation works *Kerumitan proses penilaian dan tuntutan terhadap perubahan kerja*					
Disagreement among contracting parties on the valuation of variation works *Penilaian terhadap perubahan kerja tidak dipersetujui oleh pihak yang berkontrak*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Human Behaviour Factor / *Faktor oleh Tingkah Laku Manusia*	**1**	**2**	**3**	**4**	**5**
Corrupt or fraudulent practices among parties in the project *Amalan rasuah dan penipuan di kalangan pihak dalam projek*					
Lack of commitment among parties to settle the final account promptly *Kurang komitmen di kalangan pihak yang berkontrak untuk menyelesaikan akaun muktamad dengan segera*					
Attitude and culture that perceived delay in final account closing were common and acceptable *Sikap dan budaya yang menganggap kelewatan dalam penutupan akaun muktamad adalah biasa dan diterima*					
Misunderstanding of the contracting parties on the contract condition regarding the final account *Ketidakfahaman oleh pihak berkontrak mengenai syarat kontrak berkenaan akaun muktamad*					

Determinants of The Final Account Closing Problems ***Penentu bagi Masalah dalam Penutupan Akaun Muktamad***	**SD**	**D**	**MA**	**A**	**SA**
Environment or External Factors / *Faktor oleh Persekitaran atau Luaran*	**1**	**2**	**3**	**4**	**5**
Fluctuation of construction material prices *Turun naik harga bahan pembinaan*					
Force majeure events caused a delay in the progress of work *'Force majeure' menyebabkan kelewatan dalam kemajuan kerja*					
Inclement or extreme weather disrupted the construction process *Cuaca buruk atau melampau yang mengganggu proses pembinaan*					
Changes in regulations and policies that caused additional costs on the project *Perubahan peraturan dan polisi yang menyebabkan pertambahan kos ke atas projek*					

APPENDIX 2

Interview / Temu Bual

"PREVENTIVE SOLUTION FRAMEWORK FOR IMPROVING FINAL ACCOUNT CLOSING IN THE MALAYSIAN CONSTRUCTION INDUSTRY"
"RANGKA KERJA PENCEGAHAN DAN PENYELESAIAN UNTUK PENAMBAHBAIKAN PENUTUPAN AKAUN MUKTAMAD DALAM INDUSTRI PEMBINAAN DI MALAYSIA"

Date of Interview Conducted:	
Venue of Interview Conducted:	
The Time the Interview Starts:	
The Time the Interview Finished:	

INTERVIEW GUIDE / *PANDUAN TEMU BUAL*
I appreciate your willingness to participate in this interview session. In order to ensure that all of the valuable information you provide can be captured and analysed, I would like permission to record this interview / *Saya menghargai kesudian anda untuk menyertai sesi temu bual ini. Untuk memastikan bahawa semua maklumat berharga yang anda berikan dapat difahami dan dianalisa, saya mohon kebenaran untuk merakam temu bual ini.*

SECTION A: RESPONDENT'S BACKGROUND / *LATAR BELAKANG RESPONDEN*
A.1. Name of Respondent / *Nama Responden*:
……..
A.2. Position/ Designation within the organisation / *Kedudukan/ Jawatan dalam organisasi*:
……..
A.3. Year of experience in the construction industry / *Tahun pengalaman dalam industri pembinaan*:
……..
A.4.Year of experience dealing with Final Account Closing / *Tahun pengalaman mengendalikan penutupan akaun akhir*:
……...
A.5. State which of the following organisation you are currently working with? /*Nyatakan manakah antara organisasi berikut yang anda sedang bekerja?*

	Client/Developer's Organisation / *Organisasi Klien/Pemaju*
	G7 Contractor / *Kontraktor G7*
	Quantity Surveyor's Firm / *Firma Juruukur Bahan*

SECTION B: CURRENT ISSUES AND SCENARIOS RELATED TO FINAL ACCOUNT CLOSING / *ISU SEMASA DAN SENARIO DALAM PENUTUPUAN AKAUN MUKTAMAD*

B.1. Do you agree with the statement that "there are many issues and problems related to the final account closing in the Malaysian construction industry /
Adakah anda bersetuju dengan kenyataan bahawa "terdapat banyak isu dan masalah berkaitan penutupan akaun muktamad dalam industri pembinaan Malaysia
……
……

B.2. Do you face any problems during handling the final account closing in the projects? Could you describe the specific issue you always encounter during handling the final account closing in construction project? / *Adakah anda pernah menghadapi sebarang masalah semasa mengendalikan penutupan akaun muktamad dalam projek pembinaan? Bolehkah anda menerangkan isu khusus dalam yang selalu anda hadapi semasa mengendalikan penutupan akaun muktamad dalam projek pembinaan?*

……
……

B.4. Could you provide more information regarding the current situation of disputes in final account closing in the Malaysian construction industry? Has the situation improved, worsened, or remained the same over the past five years? If it has worsened or remained the same, what are the reasons behind it? / *Bolehkah anda memberikan maklumat lanjut mengenai situasi semasa berkenaan pertikaian dan kelewatan penutupan akaun muktamad dalam industri pembinaan Malaysia? Adakah keadaannya bertambah baik, bertambah buruk atau kekal sama sejak lima tahun lalu? Jika ia telah menjadi lebih teruk atau kekal sama, apakah sebab di sebaliknya?*

……
……

B.5. Is there a specific procedure for handling Final Account processes within your company?/ *Adakah terdapat prosedur khusus untuk mengendalikan proses Final Account dalam syarikat anda?*

……
……

B.6. Based on main process of final account closing in PAM2018, can you explain at which stage problems typically arise? Why does this problem happen? Who causes them? / *Berdasarkan prosedur penutupan akaun muktamad, bolehkah anda terangkan pada peringkat manakah masalah biasanya timbul? Mengapa masalah ini berlaku? Siapa yang menyebabkan masalah ini berlaku?*

Main process of the final account closing ***Proses utama penutupan akaun muktamad***
Stage 1 – Gather and submit all relevant documentation for the final account claim by the Contractor ***Peringkat 1*** *– Mengumpul dan menyerahkan semua dokumen berkaitan bagi tujuan tuntutan akaun muktamad oleh Kontraktor* ……
Stage 2 – Measurement, valuation and preparation of final account by the Quantity Surveyor ***Peringkat 2*** *– Pengukuran, penilaian dan penyediaan akaun muktamad oleh Juruukur Bahan* ……
Stage 3 – Responding to the final account draft by the Client and the Contractor ***Peringkat 3*** *– Memberi maklum balas terhadap draf akaun muktamad oleh Majikan dan Kontraktor* ……
Stage 4 – Review and amendment of the final account draft by the Quantity Surveyor if being disagreed by the Client or the Contractor ***Peringkat 4*** *– Menyemak dan meminda draf akaun muktamad oleh Juruukur Bahan jika tidak dipersetujui oleh Majikan atau Kontraktor* ……
Stage 5 – Formalise and certify the final account and issuance of the final certificate by the Quantity Surveyor ***Peringkat 5*** *– Memuktamadkan dan memperakukan akaun muktamad dan pengeluaran sijil bayaran muktamad oleh Juruukur Bahan* ……
Stage 6 – Final payment by the Client to the Contractor in accordance with the final certificate ***Peringkat 6*** *– Bayaran akhir oleh Majikan kepada Kontraktor mengikut perakuan muktamad* ……

B.7. In your experience, how long does it usually take to close the final account in a construction project, starting from issuing a Certificate of Practical Completion (CPC) until the Final Payment is made?
Berdasarkan pengalaman anda, berapa lamakah masa yang biasanya diambil untuk menutup akaun muktamad di dalam projek pembinaan, bermula dari Perakuan Siap Kerja sehingga Pembayaran Akhir dibuat?

……
……

B.8. Based on your experience in the construction industry, to what extent do the final account closing disputes affect a construction project and the parties involved? / *Berdasarkan pengalaman anda dalam industri pembinaan, sejauh manakah pertikaian penutupan akaun akhir mempengaruhi projek pembinaan dan pihak yang terlibat?*

……
……

SECTION C: MAJOR PROBLEMS IN THE FINAL ACCOUNT CLOSING DISPUTE
MASALAH UTAMA DALAM PENUTUPAN AKAUN MUKTAMAD

C.1. Do you agree on the list of eight (8) major problems in final account closing as obtained from the questionnaire survey? Could you please elaborate in detail on each of these issues? Why they happen? How they happen? Who cause them? How to overcome them? /
Adakah anda bersetuju dengan senarai lapan (8) masalah utama di dalam penutupan akaun akhir seperti yang diperoleh daripada tinjauan soal selidik? Bolehkah anda menghuraikan secara terperinci tentang setiap isu ini? Mengapa ia berlaku? Bagaimana ia berlaku? Siapa yang menyebabkan mereka? Bagaimana untuk mengatasinya?

Major Problems/ ***Masalah Utama***	**Why it happens / How it happens / Who Cause it /** ***Kenapa ia berlaku / Bagaimana ia berlaku / Siapakah yang menyebabkan***	**How to Overcome / How to Prevent** ***Bagaimana untuk mengatasi / Mencegah***
1. Delay in evaluation and preparation of the final account		
2. The complexity of the valuation and claim process for variation works		
3. Delay in approving and finalising variation work for the adjustment contract sum		
4. Disagreement among contracting parties on the valuation of variation works		
5. Lack of documents for the submission of the final account claim		
6. Delay in submitting the final account claim		
7. Disagreement with the valuation of the final work done		
8. Cost overrun due to variation and provisional quantities		

What would be the initiative to be taken to achieve success in final account closing and reducing the probability of disputes and delay in closing the final account? / *Apakah inisiatif yang boleh diambil untuk mencapai kejayaan dalam penutupan akaun muktamad dan mengurangkan kebarangkalian berlaku pertikaian dan kelewatan dalam penutupan akaun muktamad?*

……

……

……

APPENDIX 3

Framework Validation Survey

PREVENTIVE SOLUTION FRAMEWORK FOR IMPROVING FINAL ACCOUNT CLOSING IN THE MALAYSIAN CONSTRUCTION INDUSTRY

Dear respondents,

The purpose of this questionnaire is to evaluate and validate the developed framework based on my research outcome, titled: **Preventive Solution Framework for Improving Final Account Closing in the Malaysian Construction Industry**. The validation process is essential for obtaining valuable feedback from experienced practitioners in the construction industry to assess the framework's practicality, relevance, and applicability within the Malaysian context.

This survey consists of two (2) parts. Part A: Respondent's Background Profile and Part B: Framework Validation. This survey will take approximately 5-10 minutes to answer. All responses will be kept **CONFIDENTIAL** and used solely for academic purposes. Your answers is highly valuable to the success of this research.

Thank you for your cooperation and participation in answering this survey.

Sincerely,

Researcher,
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OVERVIEW OF THE FRAMEWORK

Component of The Framework:

The framework is developed based on three (3) primary components, which include:

i) **Major Problems** in Final Account Closing Issues

ii) **Root Causes** in Final Account Closing Issues

iii) **Preventive Solutions** in Final Account Closing Issues

Kindly ensure to review the framework diagram provided thoroughly

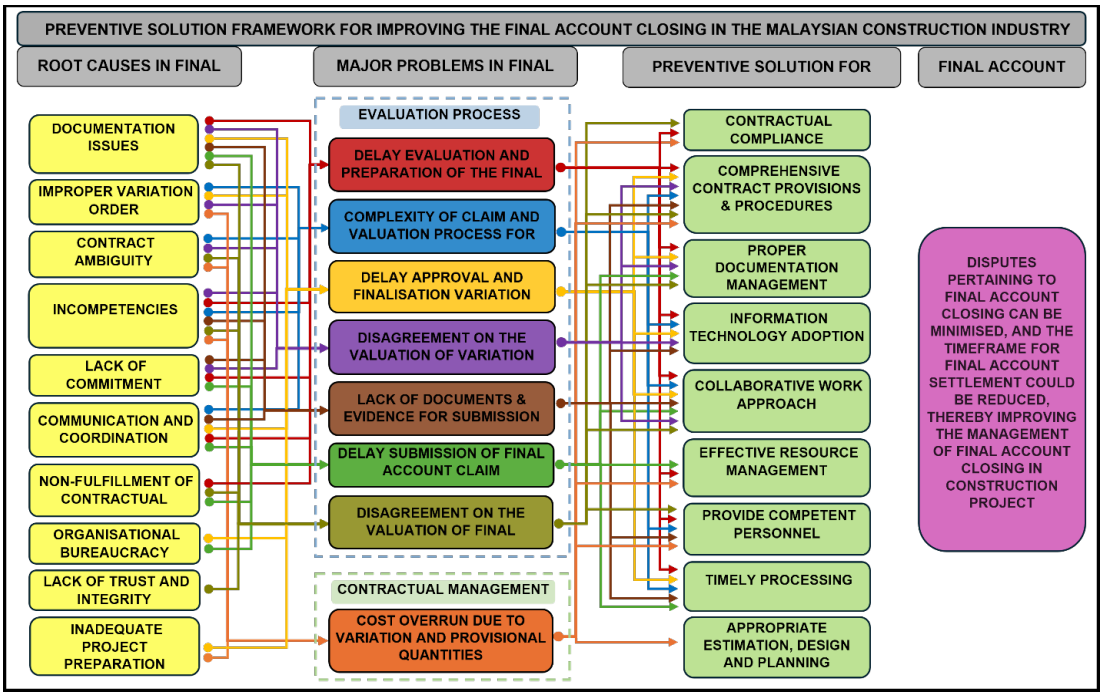


Diagram 1: Preventive Solution Framework for Improving the Closing of Final Account in the Malaysian Construction Industry

PART A: RESPONDENT'S BACKGROUND PROFILE
Please tick (/) where appropriate:

1. **Organisation:**
   [ ] Government / Regulatory Bodies
   [ ] Client / Developer
   [ ] Contractor
   [ ] Consultant (Quantity Surveyor)
   [ ] Academic Institution
   [ ] Other (Please specify): _____
2. **Years of experience in the Malaysian construction industry (including previous organisation)**
   [ ] 5 – 10 years
   [ ] 11 – 15 years
   [ ] 16 – 20 years
   [ ] More than 20 years
3. **Years of experience dealing with Contract Administration / Payment / Final Account**
   [ ] Less than 5 years
   [ ] 5 – 10 years
   [ ] 11 – 15 years
   [ ] 16 – 20 years
   [ ] More than 20 years

PART B: FRAMEWORK VALIDATION
This part aims to evaluate the 'Preventive Solution Framework for Improving Final Account Closing in the Malaysian Construction Industry'. Please refer to the framework diagram provided above.
Please indicate your level of agreement with the following statements using the scale below:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Section 1: Evaluation of Framework Components
(This section assesses the relevance and comprehensiveness of the components identified in the framework)

Statement	Level of Agreement				
1.1. The framework components (**major problems, root causes, preventive solutions**) comprehensively cover the key issues in final account closing within Malaysia's construction industry	1	2	3	4	5
1.2. The framework accurately identifies the **Major Problems** commonly encountered during final account closing in the Malaysian construction industry	1	2	3	4	5
1.3. The framework effectively identifies the **Root Causes** contributing to final account closing issues in the Malaysian construction industry	1	2	3	4	5
1.4. The framework proposes appropriate **Preventive Solutions** to address the identified Major Problems / Root Causes in Final Account Closing Issues	1	2	3	4	5
1.5. The **relationship** shown between the **Root Causes** and the **Major Problems** is logical and reflects the Malaysian construction industry scenario	1	2	3	4	5
1.6. The **relationship** shown between the **Preventive Solutions** to address the **Major Problems / Root Causes** is clear and logical	1	2	3	4	5

Section 2: Evaluation of Framework Attributes
(This section assesses the overall qualities of the framework)

Statement	Level of Agreement				
Appropriateness & Practicality					
2.1 The framework provides clear guidance for construction practitioners to enhance the management of final account closing in construction projects	1	2	3	4	5
2.2 The framework is practical and applicable within a construction project in Malaysia	1	2	3	4	5
2.3 The overall framework is appropriate for addressing final account closing challenges in the Malaysian construction industry	1	2	3	4	5
Reliability & Usefulness					
2.4 The framework offers a reliable basis for managing and improving the final account closing process	1	2	3	4	5
2.5 Implementing this framework is likely to improve the efficiency of the final account closing process	1	2	3	4	5
2.6 Implementing this framework is likely to reduce delays and disputes related to final accounts closing	1	2	3	4	5
2.7 Overall, the framework provides a useful approach for improving the management of final account closing in the Malaysian construction industry.	1	2	3	4	5

Section 3: Overall Feedback and Suggestions for Improvement

Do you have any specific suggestions for refining the framework (e.g., adding/removing components, clarifying relationships, presentation)?

_____

_____

END OF SURVEY

Thank you once again for your valuable time and contribution to this research

AUTHOR'S PROFILE



Mohd Khairul Fitri Othman obtained a Bachelor of Quantity Surveying (Hons.) in 2010 from University Teknologi MARA, Shah Alam and Master of Science in Facilities Management from University Teknologi MARA, Shah Alam, in 2014

LIST OF PUBLICATION:

Othman, M. K. F., Judi, S. S., Ismail, Z., & Pheng, L. S. (2023). Exploring Determinants Contributing to Disputes in the Closing of Final Accounts in the Construction Industry. International Journal of Sustainable Construction Engineering and Technology, 14(5), 221–233. https://doi.org/10.30880/ijscet.2023.14.05.017

Othman, M. K. F., Judi, S. S., Ismail, Z., Rais, L. A., & Pheng, L. S. (2025). Key Factors Leading to Disputes in the Final Account Closing of Construction Projects in Malaysia. *Journal of Construction in Developing Countries*, *30*(1), 1–28. https://doi.org/10.21315/jcdc.2025.30.s1.1

Othman, M. K. F., Judi, S. S., Ismail, Z., & Pheng, L. S. (2025). Principal Components of Final Accounts Closing Disputes in the Malaysian Construction Industry. *Journal of Design and Built Environment*, *Special Issue VII, 2025*, 29–44. https://samudera.um.edu.my/index.php/jdbe/article/view/65707