POLITEKNIK UNGKU OMAR

SAFETY MANAGEMENT PRACTICES AND FRAMEWORKS IN CONSTRUCTION INDUSTRY

SITI NADIRAH BINTI CHE YA

(01BCT21F3031)

CIVIL ENGINEERING DEPARTMENT

SESSION II 2023/2024

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A project report/thesis submitted in partial fulfilment of the requirement for the award of the Bachelor of Civil Engineering Technology with Honours

CIVIL ENGINEERING DEPARTMENT

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DECLARATION OF ORIGINAL AND OWNERSHIP

SAFETY MANAGEMENT PRACTICES AND FRAMEWORKS IN CONSTRUCTION INDUSTRY

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2. Hereby declare that the work in this thesis is my own except for quotations and summaries which have duly acknowledged.

3. Hereby agree to let go of the intellectual property ownership of this project to Ungku Omar Polytechnic in partial of the requirement for the award of the **Bachelor of Civil Engineering Technology with Honours.**

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APPRECIATION

In the Name of Allah SWT, Lord of the Universe. All praise is for Him alone. Thanks to God because with His abundant grace and permission, the writer was given good health and strength. So, this final year project is called Safety Management Practices And Framework In The Construction Industry. My deepest appreciation to my final year project supervisor Dr. Azuin binti Ramli for all the motivation, encouragement, help given and notes that really helped me produce a better final year project report. Without the encouragement, motivation and references given, it would have been quite difficult for me to complete this project well. I would also like to express my gratitude to the staff of CLCE Construction Sdn. Bhd for providing information and sharing their experience for implementation. And I would like to express my appreciation and thanks to my family for their support and empathy, which helped me mentally complete this project. Finally, I would also like to say a million thanks to any party that helped me in the production of this final year project directly or indirectly. Your help is greatly appreciated. May Allah SWT reward you all for your services.

ABSTRACT

The Malaysian construction sector has seen significant growth, but safety issues persist, posing threats to workers and jeopardizing the sector's sustainability. The Malaysian construction sector faces a lack of a common safety culture, with workers and management prioritizing project timeframes and cost-effectiveness over safety procedures. The sector also faces high accident rates due to inadequate safety procedures, with many companies and contractors not adhering to safety standards. Additionally, workers, particularly those in lower-skilled jobs, lack adequate safety training and awareness, resulting in limited understanding of hazards and necessary safeguards. The research analyzes safety management practices in Malaysia's construction industry, identifying strengths and weaknesses, and offering actionable recommendations. The goal is to transform safety management, fostering a safety culture, prioritizing worker well-being, and contributing to long-term sector growth, promoting safety and sustainability. The framework's structure, components, and effectiveness in addressing safety challenges will be scrutinised. The study focused on a diverse sample of professionals in the construction industry, including engineers, site supervisors, safety officers, project managers, and regulatory authorities, to gather quantitative data on safety management. Data collection methods included literature review, surveys, questionnaires, observation, case studies, document analysis, and online surveys. The literature review will also investigate Malaysian construction firms' safety culture and awareness. The report will assess safety management in Malaysia's construction sector, identify weaknesses, and propose actionable solutions. It will emphasize safety culture, worker well-being, and contribute to sector growth. The findings aim to guide policy improvements and industry practices for a safer, more sustainable environment.

KEYWORDS: controlling, welfare, hazard, engineering, policy

ABSTRAK

Sektor pembinaan Malaysia telah menyaksikan pertumbuhan yang ketara, tetapi isu keselamatan berterusan, menimbulkan ancaman kepada pekerja dan menjejaskan kemampanan sektor itu. Sektor pembinaan Malaysia menghadapi kekurangan budaya keselamatan yang sama, dengan pekerja dan pengurusan mengutamakan jangka masa projek dan keberkesanan kos berbanding prosedur keselamatan. Sektor ini juga menghadapi kadar kemalangan yang tinggi disebabkan oleh prosedur keselamatan yang tidak mencukupi, dengan banyak syarikat dan kontraktor tidak mematuhi piawaian keselamatan. Selain itu, pekerja, terutamanya mereka yang bekerja berkemahiran rendah, kekurangan latihan dan kesedaran keselamatan yang mencukupi, menyebabkan pemahaman yang terhad tentang bahaya dan perlindungan yang diperlukan. Penyelidikan menganalisis amalan pengurusan keselamatan dalam industri pembinaan Malaysia, mengenal pasti kekuatan dan kelemahan, dan menawarkan cadangan yang boleh diambil tindakan. Matlamatnya adalah untuk mengubah pengurusan keselamatan, memupuk budaya keselamatan, mengutamakan kesejahteraan pekerja, dan menyumbang kepada pertumbuhan sektor jangka panjang, menggalakkan keselamatan dan kemampanan. Struktur rangka kerja, komponen dan keberkesanan dalam menangani cabaran keselamatan akan diteliti. Kajian ini memfokuskan pada sampel pelbagai profesional dalam industri pembinaan, termasuk jurutera, penyelia tapak, pegawai keselamatan, pengurus projek dan pihak berkuasa kawal selia, untuk mengumpulkan data kuantitatif mengenai pengurusan keselamatan. Kaedah pengumpulan data termasuk kajian literatur, tinjauan, soal selidik, pemerhatian, kajian kes, analisis dokumen, dan tinjauan dalam talian. Kajian literatur juga akan menyiasat budaya dan kesedaran keselamatan firma pembinaan Malaysia. Laporan itu akan menilai pengurusan keselamatan dalam sektor pembinaan Malaysia, mengenal pasti kelemahan, dan mencadangkan penyelesaian yang boleh diambil tindakan. Ia akan menekankan budaya keselamatan, kesejahteraan pekerja, dan menyumbang kepada pertumbuhan sektor. Penemuan ini bertujuan untuk membimbing penambahbaikan dasar dan amalan industri untuk persekitaran yang lebih selamat dan mampan.

KATA KUNCI: mengawal, kebajikan, bahaya, kejuruteraan, polisi

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

OSHA	The Occupational Safety and Health
DOSH	Department of Occupational Safety and Health
HSE	Health and Safety Executive
CIDB	Building Industry Development Board
CIS	Construction Industry Standard
BIM	Building Information Modelling
IoT	Internet of Things
PPE	Personal protective equipment
SMEs	small and medium-sized enterprises
SPSS	Statistical Package for the Social Sciences
SMS	Safety Management System

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Malaysia's construction sector has grown and transformed dramatically over the last few decades, becoming a vital contribution to the country's economic development. The construction industry has been critical to infrastructural development, urbanization, and job creation (Gholamreza Dehdasht et al., 2020). However, this expansion has coincided with an alarming rise in safety problems, posing major hazards to the industry's personnel and the sector's general viability.

Outstanding to an increase in the frequency of accidents, injuries, and fatalities on building sites, safety management in the Malaysian construction sector has received more attention. These accidents not only take a human toll, but they also impose significant financial consequences on construction firms, disrupt project timetables, and damage the industry's brand. The significance of competent safety management cannot be emphasized in this environment. Recognize the necessity for safety precautions, the Malaysian government has built a comprehensive regulatory system aimed at protecting the interests of construction workers, employers, and the public. Despite these efforts, there are still obstacles in implementing and enforcing safety regulations on building sites across the country.

The results discussion would provide a comprehensive overview of the current state of safety management, critically assess strengths and weaknesses, propose actionable recommendations, emphasize the impact on safety culture and worker well-being, and highlight the broader contributions to the growth and development of the Malaysian construction sector.

Overall, the expected outcome is a comprehensive report that not only identifies challenges and weaknesses in the current safety management framework but also proposes targeted and evidence-based solutions to improve safety

outcomes in the Malaysian construction sector. The findings aim to guide policy improvements, regulatory enhancements, and industry practices for a safer and more sustainable construction environment.

Alarming and elucidate the need to conduct scientific research to find the solution to solve the problem. Safety and health issues remain critical to the construction industry due to its working environment and the complexity of working practices. To prevent an accident, hazard identification is essential to construction safety management because unidentified hazards present the most unmanageable risks. (Nur Sabrina Azmi et al., 2020). The historical background of Malaysian construction safety illustrates a trajectory from an industry predominantly focused on economic expansion with little safety safeguards to one that increasingly prioritises worker safety and health. With the construction industry expanding, the need for stringent safety standards became clear, spurring the development of governmental groups and institutions committed to this aim (Pourmazaherian & Musonda et al., 2022).

The Occupational Safety and Health Act 1994 (OSHA 1994) set the groundwork for Malaysia's present construction safety regime. This landmark legislation serves as the legal foundation for the country's safety standards, encompassing a wide range of occupational safety issues, including those unique to the construction industry. Since then, government agencies like the Department of Occupational Safety and Health (DOSH) have played an important role in the establishment, enforcement, and continuing improvement of safety standards (Zulkifly et al., 2018). Construction safety rules in Malaysia have grown to include thorough recommendations and specific standards for construction operations. These standards are intended to safeguard workers, avoid accidents, and foster a safety culture within the sector. As a result, Malaysia's construction industry today functions in a more controlled and risk-averse atmosphere. In this investigation, we will look deeper into the evolution and current situation of Malaysian building safety legislation and practises. We will also evaluate the role of government entities and agencies in enforcing these rules, as well as the effectiveness of these standards in assuring the safety of construction workers and the industry's long-term growth.

The role of government entities and agencies in implementing safety standards is critical in guaranteeing the safety and well-being of people in many

industries and workplaces. These organisations act as the guardians of public health and safety, and their functions include everything from drafting and enforcing regulations to conducting inspections and investigations and offering guidance and support to industries and enterprises. Governmental groups and agencies tasked with implementing safety legislation serve as stewards of public welfare, ensuring that specified safety standards are met, and that workplaces and activities are safe. These organisations are often vested with the legal authority to develop, oversee, and enforce legislation aimed at preventing accidents, protecting workers, customers, and the public, and mitigating environmental dangers.

In the context of occupational safety, organisations such as the Occupational Safety and Health Administration (OSHA) in the United States, the Health and Safety Executive (HSE) in the United Kingdom, and the Department of Occupational Safety and Health (DOSH) in Malaysia, among others, play critical roles in developing and enforcing regulations to protect workers' well-being in various industries (Zulkifly et al., 2018). These organisations set standards, conduct inspections, and provide teaching materials to promote safe working conditions. Their tasks include monitoring compliance, conducting investigations in the event of accidents or infractions, and implementing sanctions as needed to guarantee that safety regulations are followed. Aside from workplace safety, governmental entities and agencies are also in charge of implementing safety standards in a variety of areas, including transportation, healthcare, environmental protection, and others. They strive to create a balance between economic growth and public safety, with the goal of minimising risks and preventing harm to humans and the environment. In this essay, we will go deeper into the precise responsibilities and tasks of governmental authorities and agencies in implementing safety laws across several domains, analysing the mechanisms and consequences of their actions on public safety, industrial practises, and the larger community.

Safety standards' effectiveness is a vital cornerstone of the construction industry, defining its progress and protecting the well-being of its personnel. Safety standards are more than just regulatory measures; they are the cornerstone that keeps the industry's delicate balance between expansion and the protection of people and assets in check. These standards have a significant and far-reaching impact on the construction industry, affecting all aspects of its operations. Safety

standards serve as a guiding light in the construction industry, giving a systematic framework for best practises in risk management, accident prevention, and health preservation. These standards cover a wide range of topics, from worker safety on construction sites to building structural integrity and environmental factors. The success of these standards is directly proportional to their capacity to decrease accidents, minimise injuries, and foster a safety culture that pervades the sector (Rantsatsi et al., 2023).

The impact of construction sector safety requirements is multifaceted. They play a critical role in protecting workers' and the public's lives, lowering the financial burden connected with accidents and injuries, and improving the industry's reputation. Safer workplaces attract investment, stimulate innovation, and assure the industry's survival, so effective safety standards are entwined with economic growth and sustainability. This investigation digs into the significant impact of safety rules on the building industry. It evaluates their success in preventing accidents and injuries, saving lives, and ensuring the industry's long-term viability. It also examines the economic and social effect of these standards, putting light on their role in building a thriving, safe, and sustainable construction industry (Kim et al., 2020).

The purpose of this thorough research the paper is to analyse into the field of construction safety management in Malaysia. It explores the current state of safety practises, sheds light on the challenges encountered, and proposes recommended practises for raising safety standards. By conducting an analysis of existing literature and data, this review aims to contribute to a deeper understanding of the Malaysian construction industry's safety landscape, with the ultimate goal of promoting safer construction sites, reducing accidents, and ensuring the sector's long-term growth and development.

1.2 PROBLEM STATEMENT

Lack of a Common Safety Culture: There is a lack of a common safety culture in the Malaysian construction sector. Workers and management typically put project timeframes and cost-effectiveness over safety procedures, increasing the likelihood of an accident. To address the lack of a shared safety culture in the Malaysian construction sector, a multifaceted strategy involving several

Top management in construction enterprises should lead by example when it comes to safety. They should exhibit a strong commitment to safety and make it an organisational core value. Implement required safety training programmes for all construction workers and management. This should include safety measures, danger identification, and emergency response processes. Ensure that all employees are well-informed on the possible hazards of their jobs and how to reduce them. Safety incentives and recognition programmes for both workers and management to inspire them to prioritise safety.

The Malaysian construction sector may strive towards building a unified safety culture that prioritises safety alongside project timeframes and cost-effectiveness by following these steps. This strategy will necessitate the dedication of all stakeholders as well as ongoing efforts to make safety a core component of the industry's operations (Bahron et al., 2013). High Accident Rates: The Malaysian construction sector has consistently reported a high number of accidents, injuries, and fatalities, making it one of the most dangerous businesses in the country. Inadequate safety procedures contribute to these alarming statistics (Hamid et al., 2019).

Despite the establishment of safety standards and norms, industry enforcement and compliance remain inadequate. Many construction companies and contractors do not follow these rules, which has a significant impact on safety. Inadequate Training and Awareness: Workers, particularly those in lower-skilled jobs, typically do not get appropriate safety training and awareness. They may be unaware of the hazards they face or the safeguards they must take. In Malaysia's construction business, low regulatory compliance and a lack of safety training and awareness continue to be major issues. Many construction companies and contractors do not follow safety rules and norms, which has a significant influence on safety. Furthermore, many workers, particularly those in lower-skilled jobs, lack sufficient safety training and awareness, resulting in a limited grasp of the hazards they confront and the safeguards they must take.

Because the company employs a high number of overseas workers who may be unfamiliar with Malaysian safety standards and legislation, it is necessary to overcome language and cultural barriers in safety management. Because of its diversified workforce, Malaysia's construction sector has a particular issue, with a considerable percentage of overseas workers who may be inexperienced with

Malaysian safety standards and rules. It is vital to overcome linguistic and cultural obstacles in safety management to ensure the safety of all workers and compliance with safety standards (Flynn et al., 2014).

1.3 OBJECTIVE

1. Identify current safety management practices in the Malaysian construction industry.
2. Investigate the Malaysian construction industry's established safety management framework.
3. Evaluate the safety management framework's effectiveness in improving safety outcomes in Malaysia's construction industry.

1.4 SCOPE OF STUDY

The scope of this study focuses on various factors that influence site safety management practices and frameworks within the construction industry. By examining these factors, the study aims to identify the critical elements that contribute to effective safety management and to propose strategies for enhancing safety performance on construction sites. While for the sample are those who are professionals in the field of construction in the industry. There are also several stakeholders involved such as OSHA, DOSH and others. Questionnaires will be distributed to samples, there are 55 samples that will be given questionnaires to answer. From there the data collected will be analyzed using the descriptive data method from SPSS software. from the data results, the parameters will be sorted according to the best ranking.

1.5 SIGNIFICANCE OF THE STUDY

A significant study on construction safety management in Malaysia should strive to completely analyse the many components of safety, identify obstacles, and suggest solutions. Such research can give useful insights on how to enhance industrial safety practises.

- Explore the use of technology and innovative solutions in safety management. Investigate the feasibility and impact of implementing advanced safety measures, such as research and observation.
- Investigate the prevailing safety culture within construction companies and among workers. Assess the attitudes, beliefs, and behaviours related to safety, and identify barriers to fostering a safety-first culture.
- Conduct a thorough analysis of historical accident data, including the types of accidents, their frequency, severity, and the factors contributing to them. This data can help identify common patterns and areas in need of improvement.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

The construction industry is inherently high-risk due to the nature of its activities, which often involve working at heights, handling heavy machinery, and dealing with hazardous materials. Ensuring the safety of workers is paramount, and effective safety management practices and frameworks are essential in mitigating risks and preventing accidents. This literature review aims to explore the current safety management practices and frameworks employed in the construction industry, assess their effectiveness, and identify areas for improvement. The construction industry faces significant safety challenges, but with effective safety management practices and frameworks, many of these risks can be mitigated. Continuous improvement through training, adherence to standards, technological integration, and fostering a strong safety culture are key to achieving a safer working environment. Further research and innovation are needed to address emerging risks and enhance the effectiveness of safety management systems.

2.2. CONSTRUCTION SAFETY REGULATIONS IN MALAYSIA

Construction safety laws are critical in protecting the lives of workers and the public, as well as maintaining the quality and long-term viability of construction projects. Malaysia, a fast-developing country, has seen substantial changes in construction safety rules throughout the years. This literature study investigates

the unique safety legislation and standards that apply to the Malaysian construction sector, concentrating on their development, evolution, and significant requirements.

2.2.1. Historical Development of Malaysian Construction Safety Regulations

Construction safety laws in Malaysia can be traced back to the colonial era, but considerable developments have happened since independence (Albarkani et al., 2021). The Pre-Independence Period, before Malaysia attained independence in 1957, British colonial authorities imposed some rudimentary construction safety standards. These restrictions, however, were primitive and aimed solely at preserving the structural integrity of structures. The Post-Independence Period, the establishment of Malaysia's Department of Occupational Safety and Health (DOSH) in 1994 marked an important milestone in the development of construction safety laws. DOSH oversees developing, implementing, and enforcing safety and health rules across a variety of industries, including construction (Belia Koh et al., 2022).

2.2.2. Malaysian Safety Regulations and Standards

OSHA 1994 (Occupational Safety and Health Act), the OSHA 1994 is Malaysia's primary workplace safety and health legislation. It is critical in assuring worker safety and well-being, particularly in the construction industry. OSHA's 1994 construction safety standards include requirements for safety training, personal protection equipment, and safety committees. It also specifies penalties for noncompliance, emphasizing the need of following safety requirements (OSHA, 1994).

Building Industry Development Board (CIDB), CIDB is a vital player in regulating and promoting construction safety. They have implemented the CIDB (Construction Personnel Registration). Regulations, which require construction personnel to be registered, assuring competency and safety awareness.1967

Factories and Machinery Act Machinery safety in the construction industry is governed by the Factories and Machinery Act of 1967. This statute requires the appropriate maintenance and safe use of construction machinery (CIDB, 2022). MS1722:2011 Malaysian Standard, MS1722:2011 is a Malaysian construction safety and health standard. It offers thorough instructions for hazard identification, risk assessment, and risk reduction, supporting a systematic approach to construction site safety management. CIS 7:2014 Construction Industry Standard, CIS 7:2014 specifies and mandates construction safety equipment and personal protective equipment (PPE). It guarantees that workers are given with proper protective equipment in order to reduce the chance of accidents (CIDB, 2020).

2.2.3 The Evolution of Malaysian Safety Regulations

Malaysian construction safety standards have developed over time to address growing concerns and promote worker safety. The progression includes Modifications to Existing Laws, the Malaysian government has revised old legislation, such as OSHA 1994, on a regular basis to meet emerging safety concerns and comply with international norms. These changes demonstrate a commitment to continual improvement. Industry-Specific Rules as the construction sector has grown, there has been a shift towards industry-specific laws, such as those implemented by CIDB; to meet distinct issues and foster a safety culture and adoption of International Standards to improve safety rules, Malaysia has incorporated international standards and best practices. This evolution has been aided by collaboration with international organizations and benchmarking with advanced nations (Of, M. & Resources, H, 2006).

Finally, Malaysia's dedication to improving worker safety and the quality of construction projects is shown in the development, evolution, and essential features of construction safety rules. Construction safety regulations such as OSHA 1994, CIDB rules, and industry-specific standards illustrate a holistic approach. The continual growth of these standards demonstrates Malaysia's commitment to future safer and more sustainable construction practices.

2.3. SAFETY CULTURE AND AWARENESS IN MALAYSIAN CONSTRUCTION FIRMS

Safety culture is critical in the construction industry for worker safety and project performance. This literature study investigates the safety culture and awareness within Malaysian construction enterprises, concentrating on worker and management commitment to safety.

2.3.1 Malaysian Construction Firms' Safety Culture

The common ideas, beliefs, attitudes, and practices that shape an organization's dedication to safety are referred to as its safety culture. Safety culture in Malaysian construction enterprises has evolved significantly over the years. The evolution of safety culture in Malaysian construction enterprises can be ascribed to a variety of reasons, such as government legislation, industry standards, and increased awareness of the necessity of safety. Safety culture has shifted from a compliance-driven to a more proactive and holistic approach. Government Regulations and Standards, such as the Occupational Safety and Health Act 1994 (OSHA 1994) and the Construction Industry Development Board (CIDB) criteria, have been implemented and continuously updated by the Malaysian government. By emphasizing the need of compliance and accountability, these regulatory frameworks have helped to shape the safety culture in construction enterprises. Increased understanding of the importance of safety in the construction industry has resulted in a favorable shift in safety culture. Construction companies have invested in safety training programmers to ensure that their employees are well-versed in safety standards and best practices. Training and education have been critical in fostering a safety-conscious culture (Al-Bayati et al., 2021).

2.3.2 Worker Awareness and Commitment

Worker safety awareness and commitment are key components of a healthy safety culture in Malaysian construction enterprises. Safety Training and Education, safety training programmers have grown more accessible and

thorough, equipping workers with the knowledge and skills necessary to detect and minimize safety dangers. Workers are becoming more conscious of their safety obligations. Workers are urged to report safety occurrences, near misses, and dangers through reporting and reporting systems. Many construction organizations have established anonymous reporting systems to foster a culture in which employees feel safe reporting problems without fear of retaliation. Worker Involvement, workers actively participate in safety committees and meetings in several Malaysian construction enterprises. Their participation in safety-related decisions and debates increases their sense of responsibility and commitment to safety (Alsharef et al., 2023).

2.3.3 Management Commitment

In Malaysian construction enterprises, management commitment to safety is a cornerstone of a healthy safety culture. Safety leadership begins at the top, with senior management establishing the tone for the entire organization. Leaders that priorities safety and make themselves accountable for safety outcomes instill a sense of commitment in their followers. Management's dedication of resources to safety measures, including time, personnel, and financial resources, displays their commitment. Management's commitment to safety is shown in investments in safety measures and training programmers. Open and transparent communication channels between management and workers enable the exchange of safety-related input. The readiness of management to listen to and address workers' problems fosters a culture of trust and commitment (Niu et al., 2022).

Conclusion, Malaysian construction enterprises' safety cultures have evolved throughout time, with greater awareness and dedication to safety among both workers and management. This beneficial movement has been aided by government legislation, industry standards, and safety training programmers. Worker awareness, involvement, and reporting, as well as management commitment, are critical components of a strong safety culture in the Malaysian construction sector, ensuring worker safety and project success.

2.4. ROLE OF TECHNOLOGY IN ENHANCING CONSTRUCTION SAFETY IN MALAYSIA

Malaysia's building industry has seen considerable growth and development in recent years, as has the necessity of guaranteeing construction safety. Building Information Modelling (BIM), the Internet of Things (IoT), and safety management software have all played important roles in enhancing construction safety practices. This literature study investigates the impact of technology in improving construction safety in Malaysia, specifically BIM, IoT, and safety manage (Rebelo et al., 2019).

2.4.1 BIM (Building Information Modelling)

BIM is a digital representation of the physical and functional qualities of a structure. It allows stakeholders to cooperate on construction projects virtually, which has various safety concerns. Better Design and Planning, BIM aids in the design and planning of construction projects. Stakeholders can discover potential safety hazards and conflicts in the early phases by using 3D modelling. This enables proactive safety measures and changes, reducing the chance of building accidents. BIM assists in the detection and coordination of confrontations between various building components and systems, such as electrical, plumbing, and structural elements. Resolving these disagreements digitally before construction begins minimizes the likelihood of on-site mishaps caused by misalignments or conflicts. BIM can simulate and analyses safety situations in order to assess and mitigate hazards. It contributes to a safer construction environment by assisting in the evaluation of evacuation plans, fall protection measures, and structural stability (BIM, 2018).

2.4.2 IoT (Internet of Things)

The Internet of Things (IoT) refers to a network of interconnected gadgets and sensors that can collect and distribute data in real time. IoT has several uses in construction safety. IoT-enabled sensors can monitor conditions on construction sites for safety. They can, for example, monitor worker movements,

ambient conditions, and equipment status. These sensors can help ensure that safety measures are followed and workers are protected from adverse weather conditions in Malaysia. IoT devices may monitor the state of construction equipment to ensure that it is in good operating order. This decreases the possibility of mishaps caused by device failure. Real-time Alerts, IoT can offer site managers and workers with real-time alerts in the event of possible safety issues, allowing for fast response and preventing accidents (Umesh et al., 2018).

2.4.3 Software for Safety Management

Safety management software is intended to make safety compliance and management operations more efficient. Such software has become a vital tool for construction safety in Malaysia. Safety management software aids in the documenting of safety processes, incident reports, and compliance records, ensuring that safety protocols are well-documented and followed. Training and Education, these platforms facilitate construction workers' safety training and education, ensuring they are well-informed and follow best practices. Compliance Monitoring, safety management software enables real-time compliance monitoring, lowering the likelihood of safety violations and assuring conformity to Malaysian safety standards (Abdul et al., 2019).

Technology, such as BIM, IoT, and safety management software, plays a significant role in improving construction safety in Malaysia. These technologies have contributed to more efficient construction project design, planning, and monitoring, resulting in safer working conditions for laborer and fewer risks. As Malaysia's construction sector evolves, the integration of these technologies will be critical in maintaining high safety standards and decreasing accidents on building sites.

2.5. ACCIDENT STATISTICS AND TRENDS IN THE MALAYSIAN CONSTRUCTION INDUSTRY

Construction accidents can result in serious injuries, fatalities, and financial losses. Accident statistics, trends, and patterns must be monitored to identify risk factors and apply appropriate safety measures. This analysis of the literature looks at recent accident numbers, trends, and prevalent accident types and causes in the Malaysian construction industry (Khalid et al., 2021). Figure 2.1 show the graph that falling from heights, falling objects, and electrocution are the leading causes of fatalities in the construction industry. Worksite conditions, human behavior, and management factors also contribute to fatalities. A holistic approach to safety management, addressing worksite conditions, human behavior, and management practices, is crucial for reducing fatalities. This graph underscores the critical need for improvements across all three areas to enhance construction site safety. Emphasis should be placed on improving worksite conditions, enhancing management practices and policies, and addressing human behavior through training and awareness programs to reduce fatalities in the construction industry.

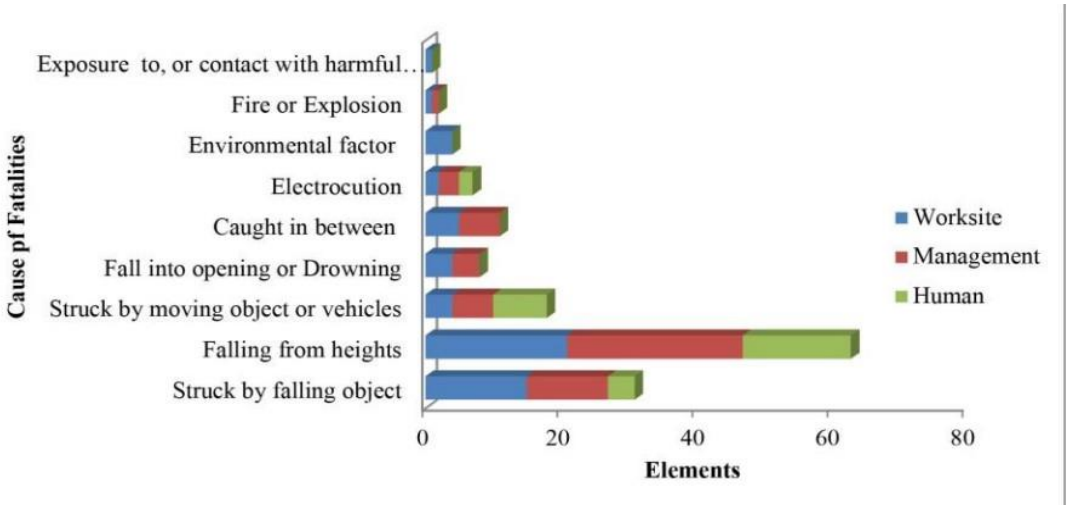

Figure 2.1: Contributing factors of construction sites fatalities (Abdul Halim et al., 2020)

Figure 2.2 show the graph of the number of accidents in the construction industry from 2014 to 2023, with a significant increase in 2019 and a decline in subsequent years. The graph highlights fluctuating trends, with peaks and troughs, and emphasizes the importance of continuous monitoring and enhancement of safety practices to maintain and reduce accidents. The graph highlights the need for further investigation into the underlying causes of the increase in 2019 and the need for better industry practices. Overall, the graph highlights the dynamic nature of safety in the construction industry over the past decade. While there have been years with higher accident rates, the general trend in the recent years shows an improvement. This underscores the importance of continuous monitoring and enhancement of safety practices to maintain and further reduce the number of accidents in the construction industry.

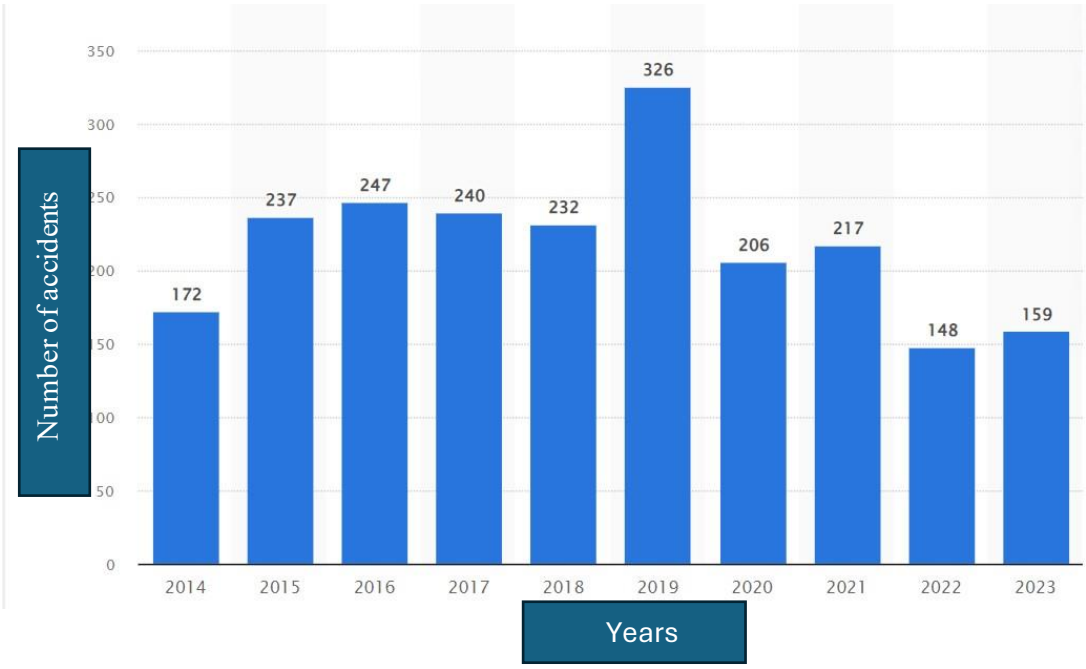

Figure 2.2: total number of construction accidents in Malaysia from 2014 to 2022. (Number of Construction Accidents in Malaysia 2014-2022, 2023)

2.5.1 Statistics on Recent Accidents

Accident statistics collection and analysis in Malaysia are critical for understanding the level of safety in the construction sector. While specific data may differ depending on the source and year, certain important tendencies have emerged. Fatalities and Injuries, over the last decade, the construction industry in Malaysia has seen a decline in the number of fatalities and injuries. This favorable trend has been aided by the government's increased emphasis on safety rules, enforcement, and public awareness programmers. Non-Fatal Injuries, non-fatal injuries continue to be a concern, with common contributors being falls, being struck by items, and mechanical accidents. Although the overall injury incidence has dropped, these instances remain common.

2.5.2 Common Accident Types

Understanding the most common forms of incidents in the Malaysian construction industry reveals where safety precautions should be prioritized. Falls, including falls from scaffolding and ladders, are among the most common injuries in Malaysia's construction industry. The major reasons are inadequate fall protection and dangerous work practices. Accidents involving being struck by things, such as falling debris or moving equipment, are common. These occurrences are exacerbated by a failure to safeguard tools and materials and a lack of suitable safety zones. Heavy machinery and equipment accidents, malfunctions, and misuse can all lead to significant injuries. Proper training and maintenance are essential for avoiding machine-related mishaps. Contact with live electrical components poses a considerable risk in the construction business. Personal protective equipment (PPE) and adherence to electrical safety regulations are critical safety considerations (Chong et al., 2014).

2.5.3 Accident Trends and Causes

Accidents in the Malaysian construction industry is caused by a variety of circumstances. Inadequate training and instruction of workers on safety regulations and practices, for example, can lead to mishaps. Although training programmers have become more common in recent years, there is still potential for improvement. Failure to comply with safety norms and standards, such as those stated in the Occupational Safety and Health Act of 1994 (OSHA 1994), remains a major cause of accidents. This problem has been addressed by increased enforcement and public awareness initiatives. Accidents can occur as a result of poor risk management, inadequate risk assessments, and inadequate safety planning. Building Information Modelling (BIM) and safety management software have helped to improve risk management practices. Lack of Safety Culture, in some construction organizations, a lack of safety culture causes to accidents. Accident prevention requires the development of a safety culture through leadership, worker involvement, and accountability (A, T., 2022).

In conclusion, recent Malaysian construction industry accident statistics show a positive trend in reducing fatalities and injuries, however non-fatal occurrences remain a worry. Common forms of accidents, such as falls, hit-and-run occurrences, mechanical accidents, and electrical mishaps, indicate where safety precautions should be reinforced. Accidents are primarily the result of inadequate training, noncompliance with safety rules, poor risk management, and a lack of a safety culture. Continued efforts to enforce rules, improve training, and create a safety culture are required to reduce accidents in Malaysia's construction industry.

2.5.4 Accident Statistics and Trends in the Malaysian Construction Industry

Implementing safety precautions in construction is critical to ensuring worker safety and project success. However, when it comes to establishing and maintaining effective safety programmers, construction enterprises frequently confront various problems and impediments. This study of the literature identifies

and analyses these barriers, which include financial, cultural, and regulatory aspects.

2.5.5 Financial Difficulties

Construction organizations, particularly small and medium-sized enterprises (SMEs), frequently work on limited budgets. When there is pressure to decrease costs and maximize profits, allocating funding for safety programmers can be difficult. This financial limitation may make it difficult to install complete safety measures. The cost of safety equipment, such as personal protective equipment, fall prevention systems, and mechanical safety modifications, can be enormous. Construction companies may have difficulty making these investments, especially if there are no immediate financial rewards. Safety educating Costs, while educating employees and management in safe practices is critical, it takes both time and money. Hiring trainers or sending staff for safety training can put a strain on a construction company's expenses (Gurría, A., 2018).

2.5.6 Cultural Difficulties

Many construction enterprises have long-standing traditions and practices that make them resistant to change. Changes to existing procedures and work processes are frequently required when implementing new safety measures. Resistance to these changes may impede the deployment of safety measures. Lack of Safety knowledge There may be a lack of knowledge or understanding of the necessity of safety in some construction organizations. A culture that values productivity over safety might jeopardize attempts to build a strong safety culture. Communication Barriers, good communication is critical for the execution of safety measures. Language obstacles, inadequate communication structures, and a lack of safety leadership, on the other hand, can stymie the flow of safety information inside a construction business (Abioye et al., 2021).

2.5.7 Regulatory Difficulties

Complex and ever-changing While rules and safety requirements are necessary, they can be complicated and susceptible to rapid modification. Keeping up with new rules and maintaining compliance may be difficult for construction companies. Regulatory Enforcement, the enforcement of safety regulations may be uneven in some circumstances. Construction companies may believe that there are no penalties for noncompliance, leading to a casual attitude to safety. Managing and verifying safety compliance may be a time-consuming administrative task. This responsibility can be onerous, especially for smaller construction enterprises with little administrative resources (OECD, 2010).

Conclusion, the proper application of safety measures in construction enterprises is critical for worker safety and project success. Firms, on the other hand, confront a slew of hurdles and roadblocks, including financial restrictions, cultural opposition to change, and regulatory complications. To overcome these problems, a multifaceted approach is required, including financial preparation, cultural reform, and a proactive attitude to staying informed of new rules. Construction organizations must priorities safety as a fundamental value, invest in training and equipment, and promote a culture of safety awareness and accountability to improve safety implementation. Furthermore, regulatory organizations should strive for uniformity in enforcement and offer assistance to reduce the administrative burden associated with safety compliance.Construction safety is a worldwide issue, and best practises have emerged throughout time to ensure worker safety and project success. This study of the literature looks at international best practises in construction safety management and considers how these practises might be applied to the Malaysian setting.

2.6 BEST PRACTICES IN CONSTRUCTION SAFETY MANAGEMENT: AN INTERNATIONAL PERSPECTIVE AND ADAPTATION TO MALAYSIA

2.6.1 International Construction Safety Management Best Practises

Safety Leadership, Safety leadership is critical to the success of any safety programme. It is widely acknowledged that safety begins at the top, with leadership setting the tone for the entire organisation. Leaders must prioritise safety, show commitment, and set a good example. Safety It is critical to develop a culture of safety. This entails instilling safety in the company's beliefs and behaviours, with a heavy focus on worker engagement, open communication, and accountability for safety. A proactive approach to risk management is a best practise in risk management. This involves conducting frequent risk assessments, identifying hazards, and developing mitigation plans. ISO 45001 and other international standards emphasise a systematic approach to risk management. Safety Education and Training All workers must get complete safety training. International best practises call for workers to be equipped with the information and skills needed to detect and manage safety threats. Continuous training and education guarantee that safety practises are up to date. Building Information Modelling (BIM), safety management software, and wearable gadgets are among the latest technologies being utilised to improve safety. BIM assists in the early detection of hazards, whereas safety management software accelerates compliance and reporting processes (Chatzimichailidou & Ma et al., 2022).

2.6.2 Making Best Practises Work in Malaysia

Cultural Adjustment While worldwide best practises are beneficial, they must be customised to the local culture and circumstances. Recognising the different cultural origins of the workforce is critical in Malaysia. Language and cultural variations should be considered in communication and training programmes. Regulatory Compliance adaption should take into account Malaysia's distinct regulatory context. It is critical to ensure compliance with local standards, such as the Occupational Safety and Health Act of 1994 (OSHA 1994).

Compliance requires collaboration with local authorities and agencies such as the Department of Occupational Safety and Health (DOSH). Worker Engagement is a worldwide best practise that encourages worker engagement. In the Malaysian setting, it is critical to involve workers from diverse cultural backgrounds and enable them to actively participate to safety measures. Multilingual training programmes and safety committees can help with this. Adopting modern safety technology should be done with respect for local skills and infrastructure. It is critical in Malaysia to adapt technology to the available resources and ensure that it matches with the demands of the local workforce. Continuous Enhancement International best practises place a premium on ongoing improvement. Firms in Malaysia should develop a culture of learning and flexibility by assessing and upgrading safety practises on a regular basis based on local experiences and changing situations (Chen et al., 2019).

International construction safety management best practises provide a beneficial foundation for ensuring worker well-being and project success. However, cultural, legislative, and technical adaptation to the Malaysian environment is critical. Malaysian construction companies should strive for a safety culture that represents local values and a varied workforce while adhering to international norms and laws. Effective implementation of these best practises will contribute to increased construction safety in Malaysia.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Safety management in the construction industry is essential to protect workers, prevent accidents, and ensure the successful completion of projects. Developing and implementing an effective safety management system involves several key steps and methodologies.

First, regulatory compliance assessment, identify and understand the relevant regulations, standards and safety codes that apply to the construction industry in Malaysia. ensure the construction site complies with all legal requirements. Next, risk assessment, be sure to conduct a comprehensive risk assessment of the construction site to identify potential hazards and risks. Prioritize risks based on severity and likelihood and consider factors such as site layout, equipment uses, materials and environmental conditions. Ensure training and Education, provide regular safety training to all employees, including new hires and subcontractors sera ensure employees are trained in proper equipment use, material handling, and emergency procedures.

Next, safety planning such as developing a site-specific safety plan for each construction project that includes details on emergency response procedures, communication plans and safety protocols. Ensure all Personal Protective Equipment (PPE) is complete, identify appropriate PPE for different tasks and ensure its availability on site as well as enforcing the use of PPE and conducting periodic inspections to ensure compliance. Always carry out safety checks and carry out regular safety checks at the construction site. Designate qualified

individuals to inspect equipment, machines, and work areas for compliance with safety standards.

Next, incident reporting and investigation, establish a clear process for reporting accidents, near misses and unsafe conditions. Investigate incidents promptly to determine cause and implement corrective actions and conduct regular training to ensure all employees know emergency procedures. Communication and Collaboration, be sure to foster a culture of open communication where employees feel comfortable reporting safety concerns and encourage collaboration between management, supervisors and employees to address safety issues.

Finally, continuous improvement, by regularly reviewing and updating security policies and procedures based on lessons learned and industry best practices and using incident reports and feedback to continuously improve the security management system. Documentation and Record Keeping, keeping detailed records of safety training, inspections, incidents and corrective actions. Use documentation to track trends, measure performance and demonstrate compliance.

3.2. RESEARCH DESIGN

Research design is a framework or blueprint for conducting a research project. It details the procedures for collecting, analyzing, and interpreting data. A well-thought-out research design ensures that the evidence obtained enables the researcher to effectively address the research problem logically and as unambiguously as possible

3.2.1. Pilot Evaluation

A pilot test with ten academics and practitioners was conducted to ensure that the draught questionnaire was practicable and unambiguous. The pilot test can detect flaws in the questionnaire's design and instrumentation, as well as provide proxy data for the selection of a likelihood sample (Cooper and Schindler, 2003). The pilot survey feedback is critical for improving quality, identifying gaps, and determining the time required to complete the exercise (Fellow and Liu,

2003). The literature review and documentation were used to create the first draught of the questionnaire. Several changes will made to create a relevant and understandable questionnaire. The improved questionnaire was then mailed or emailed to the respondents. Furthermore, two preliminary interviews will conducted in order to investigate in-depth risk management knowledge and to identify an appropriate target group of respondents. One of the preliminary interviewees was a local university academic with a strong background in risk management.

3.2.2. The Survey Questionnaire

The study employed a hybrid approach of qualitative and quantitative methods. According to Naoum (1998), quantitative data are measurements of tangible, countable, and sensory features of the world. The questionnaire is a quantitative method for gathering data from a sample of the potentially large population being studied (Cooper and Schindler, 2003). 100 or more questionnaires will be distributed to members of the Malaysia construction industry, including developers, contractors, site safety, and engineers. The preliminary interviews and pilot study results were used to select the sample. To avoid any bias or favouritism of the study to any particular party, all of the construction key players were included. The questionnaire will be distributed to respondents via email, website or direct messenger. After the study, a five-point Likert scale will be used to assess the frequency of use of risk management. A weighting of 1, 2, 3, 4 or 5 was assigned to each of "never", "rarely", "sometimes", "often", and "very often". The total product of the number of responses and the weights is divided by the total number of responses using weighted average scoring (WAS).

In the questionnaire there are 2 parts which are demographics consisting of gender, age, work experience and position. While the other part questions the selection of the best variable among 16 questions according to a five-point Likert scale which is very significant, significant, not significant, not significant and very not significant.

3.3. SAMPLING STRATEGY

The Target Population is the Primary Population consisting of construction industry professionals, including construction workers, safety officers, project managers and regulatory authorities. While the Secondary Population is a construction project of various sizes, types and geographical locations in the target area. The Target Population is the Primary Population consisting of construction industry professionals, including construction workers, safety officers, project managers and regulatory authorities. While the Secondary Population is a construction project of various sizes, types and geographical locations in the target area. there were 55 respondents who could be used as a sample, but only 32 respondents who responded to the questionnaire were distributed

Entry Criteria consists of construction workers, safety officers and project managers with at least one year of experience. Construction projects that are ongoing or have just been completed within the last two years. Regulatory authorities involved in overseeing construction safety. Exclusion criteria are individuals with less than one year of experience in the construction industry. Projects that have been inactive for more than two years. Individuals or projects outside the defined geographic scope.

Sample size exceeds 100 participants. Rationale given the diverse nature of the construction industry; a larger sample size allows for a more complete understanding of safety management practices. Provides statistical power for subgroup analyses, ensuring representation across different roles and project types. Consider the possibility of reduction or non-response.

Sampling Techniques, strata are construction workers, Engineers, Safety Officers, Project managers, Regulatory authorities, Type of project (residential, commercial, infrastructure), Geographical region, Random Sampling Within Strata are participants who will be randomly selected in each strata to ensure representatives from various segments of the construction industry.

Justification for Sampling Techniques Rationale for Stratified Random Sampling Provides a more nuanced analysis by ensuring representation from different roles, project types and regions. Increase the external validity of the study by reflecting diversity in the construction industry. Enables targeted analysis within specific strata, revealing variations in safety management practices.

Sampling Procedure, Participant Identification uses construction industry databases, professional associations and regulatory records to identify potential participants. Use a random selection process in each stratum. Contact potential participants via email or direct messenger, explaining the purpose of the study and obtaining their voluntary participation. Provide a clear picture of the study objectives and expected time commitment.

Next, Informed consent Obtain informed consent from all participants, ensuring they understand the purpose of the study, their role, and the voluntary nature of their participation. Continuous Monitoring and Adjustment, always monitor the progress of participant recruitment. Be prepared to adjust the sampling strategy if certain strata are underrepresented or if unexpected challenges arise.

By following this sampling strategy, it is possible to aim to collect a diverse and representative sample, enabling a comprehensive examination of safety management practices in the construction industry. Adjustments can be made based on practical considerations and insights that emerge during the research process.

3.4. DATA COLLECTION METHOD

When conducting research on safety management in the construction industry, it is important to use robust data collection methods to gather relevant and reliable information. The following are some of the data collection methods used in the research.

3.4.1. Literature Review

First, literature review, by reviewing the existing literature on safety management in the construction industry. This helps in understanding the current state of knowledge, identifying gaps, and formulating research questions.

3.4.2. Surveys And Questionnaires

Additionally, conduct surveys and questionnaires, such as structured surveys or questionnaires to collect quantitative data from a large sample of construction industry professionals. By making the questions clear, focused, and related to specific aspects of safety management. Conduct in-depth interviews with key stakeholders, such as construction managers, safety officers and workers. This qualitative method allows for deeper exploration of issues, providing insight into perceptions and experiences.

3.4.3. Observation

Next, observe directly at the construction site to gather first-hand information about safety practices. This method is useful for understanding actual behavior and identifying potential hazards. Next, case studies, by choosing a specific construction project or company as a case study. Analyze their security management practices, policies and results. Case studies provide a detailed understanding and specific context of security measures.

3.4.4. Document Analysis and Statistical Data Analysis

Document Analysis by examining security reports, incident records and company policies related to security. Analysing documents can provide historical data and insight into the effectiveness of security measures over time. Statistical Data Analysis, analysis of existing statistical data, such as injury and accident reports, to identify trends and patterns in safety incidents. Statistical analysis can provide quantitative evidence of the effectiveness of security measures. Online

Surveys and Social Media Analysis, by using online platforms to conduct surveys or analyse social media discussions related to safety in the construction industry. This can provide insight into public perception and emerging trends.

When choosing a data collection method, consider the. Additionally, ethical considerations, such as obtaining informed consent and ensuring participant confidentiality, should be carefully addressed in the research design.

3.5. DATA ANALYSIS TECHNIQUE

Data analysis techniques refer to the processes and methodologies used to inspect, clean, transform, and model data with the goal of discovering useful information, drawing conclusions, and supporting decision-making. In the context of safety management in the construction industry, these techniques help in understanding patterns, identifying risk factors, evaluating the effectiveness of safety interventions, and improving overall safety performance. The primary objectives of data analysis techniques in safety management are multifaceted.

Firstly, these techniques aim to convert raw data into meaningful insights, making complex information accessible and understandable. This process enables the identification of trends and patterns related to safety incidents and practices, which are crucial for pinpointing recurring issues and areas needing attention. Secondly, data analysis techniques are essential for evaluating the effectiveness of safety management strategies, allowing organizations to assess which interventions are working and which are not. This evaluation is integral to informing decision-making and policy formulation, ensuring that safety policies are based on empirical evidence rather than assumptions. Lastly, these techniques facilitate continuous improvement in safety management practices by providing a systematic way to monitor progress and identify new opportunities for enhancement. By leveraging data analysis, organizations can make informed decisions that lead to safer working environments and more efficient safety management systems.

In conclusion, data analysis techniques are crucial for evaluating and improving safety management practices in the construction industry. By systematically applying these techniques, organizations can gain valuable insights

into their safety performance, identify trends and patterns, and make informed decisions to enhance workplace safety.

3.5.1. Descriptive data

Descriptive Statistics: This technique involves summarizing and describing the main features of the data. It includes measures of central tendency (mean, median, mode), measures of variability (range, variance, standard deviation), and frequency distributions. Descriptive data techniques involve statistical methods used to describe and summarize the main features of a dataset quantitatively. The goal is to provide a clear picture of the current state of safety practices, highlight trends, and establish a foundation for further analysis. Descriptive analysis is essential in site safety management in the construction industry to summarize large data sets, identify patterns and assess effectiveness. It provides a clear picture of security practices, supports informed decision making, and enables organizations to benchmark performance against industry standards. Descriptive analytics foster communication among stakeholders, drive continuous improvement, and help maintain high safety standards by regularly analyzing data and identifying successful strategies. Figure 3.1 show flow chart methodology.

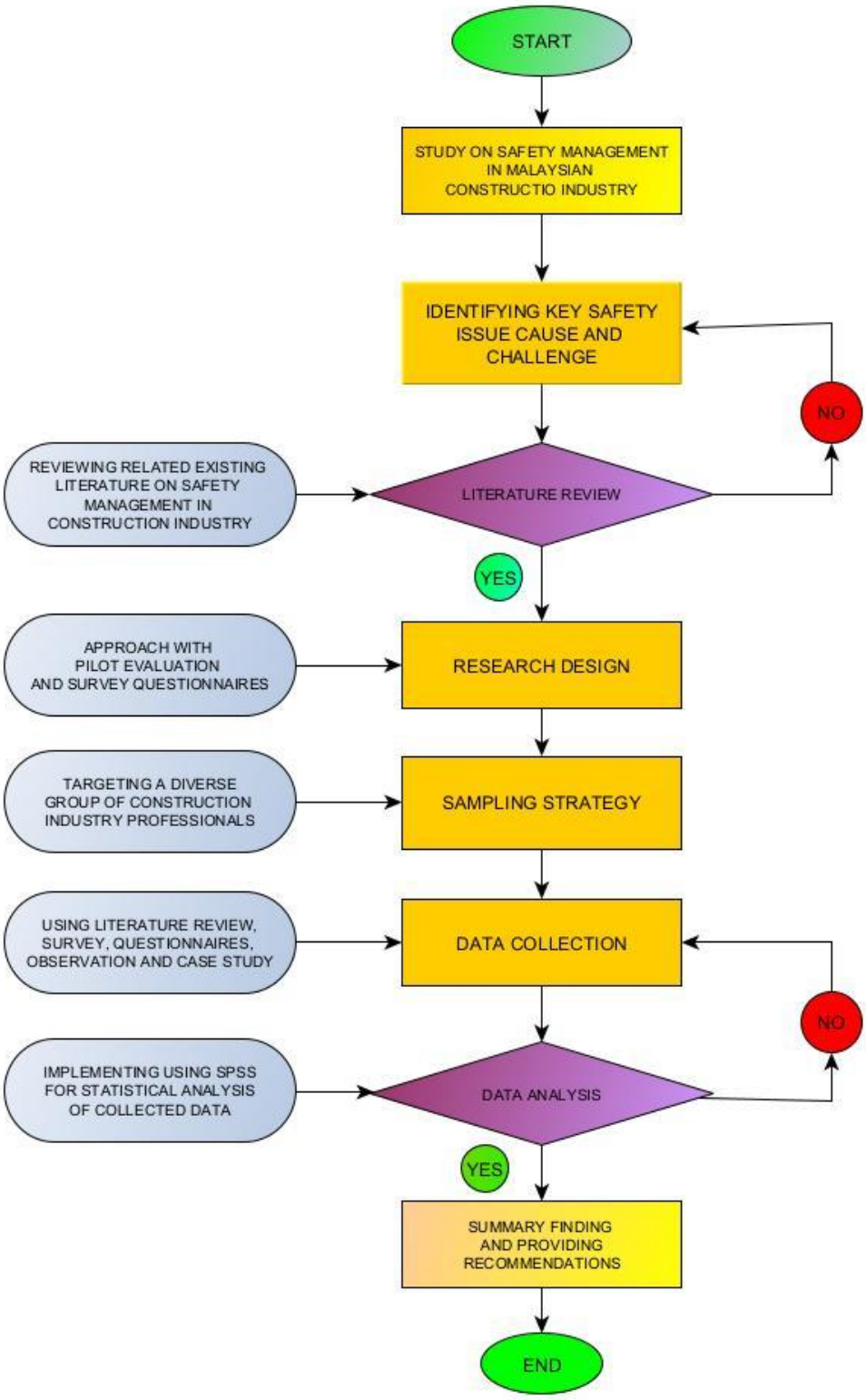

Figure 3.1: Flow chart methodology

The flowchart provided outlines a systematic research process for studying safety management in the Malaysian construction industry. Here is a detailed explanation of each step:

Start: The research process begins with this initial step, marking the commencement of the project.

Study on Safety Management in Malaysian Construction Industry: This step involves a preliminary exploration of safety management practices within the Malaysian construction industry. The goal is to define the scope and objectives of the research.

Identifying Key Safety Issue Cause and Challenge: At this stage, the researcher identifies specific safety issues, their causes, and the challenges faced in the construction industry. This involves recognizing significant problems that need addressing.

Literature Review: A thorough review of existing literature related to safety management in the construction industry is conducted. This step is crucial for understanding what has already been studied, identifying gaps in the knowledge, and ensuring that the research is built on a solid foundation of existing work. If the literature review does not support the identified safety issues and challenges, the researcher loops back to refine these issues further.

Research Design: With the support of the literature review, the researcher designs the methodology for the study. This includes deciding on a mixed-method approach, which might involve pilot evaluations and the use of survey questionnaires to gather data.

Sampling Strategy: In this step, a strategy for sampling is developed. The researcher targets a diverse group of professionals within the construction industry to ensure a representative sample. This diversity helps in capturing a wide range of perspectives and experiences.

Data Collection: The actual collection of data takes place using various methods such as literature reviews, surveys, questionnaires, observations, and case studies. This step gathers the information needed to analyse and address the research questions.

Data Analysis: Collected data is then analysed using statistical software, specifically SPSS (Statistical Package for the Social Sciences). This analysis helps in understanding patterns, relationships, and drawing meaningful conclusions from the data. If the analysis is insufficient or flawed, the process may loop back to data collection for additional or corrected data. This research will use SPSS for data analysis, a powerful tool for comprehensive data management. It offers

descriptive statistics, inferential statistics, and robust visualization options. SPSS can perform factor and cluster analysis, group similar observations, and assess survey instrument reliability and validity using measures like Cronbach's alpha. These capabilities make SPSS a powerful tool for deriving meaningful insights and supporting findings with statistical evidence.

Summary Finding and Providing Recommendations: Based on the data analysis, the researcher summarizes the findings of the study and provides recommendations. These recommendations are aimed at improving safety management practices in the Malaysian construction industry.

End: This step marks the conclusion of the research project, signifying the completion of the study and the documentation of findings and recommendations.

The study on safety management in the Malaysian construction industry has several limitations, including oversimplifying the research process, omitting iterative steps and feedback loops, lacking detailed methodologies for data collection and analysis, and not incorporating stakeholder feedback or revisiting earlier stages. The chart assumes a linear progression, not considering potential setbacks or revisiting earlier stages. It also fails to address ethical considerations in data collection and analysis for human subjects. Each step in this flowchart is critical for ensuring a comprehensive and methodical approach to studying safety management in the construction industry, ultimately leading to informed and actionable recommendations.

CHAPTER 4

RESULTS AND DISCUSSION

4.1. INTRODUCTION

The "Results and Discussion" section of a study is crucial in presenting data analysis findings and interpreting their significance in the context of existing knowledge and practical implications. It presents the quantitative and qualitative findings without bias or interpretation, such as incident rates, compliance levels, training effectiveness, and the impact of safety interventions in the construction industry. The discussion segment then interprets the results, linking them back to research questions, hypotheses, and existing literature. It assesses the effectiveness of implemented strategies, identifies potential reasons for observed trends, and suggests areas for future research or improvement. The integrated approach provides a comprehensive narrative that enables a seamless transition from data collection and analysis to meaningful conclusions and recommendations. The "Results and Discussion" section is essential in validating research hypotheses and demonstrating the practical relevance of the study. It provides a basis for comparing the study's findings with previous research, identifying consistencies or discrepancies, and proposing explanations for these patterns. In summary, the "Results and Discussion" section transforms data into knowledge, bridging the gap between raw data and actionable insights, contributing valuable information to safety management in the construction industry and beyond.

4.2. RESULT AND DISCUSSION FROM DESCRIPTIVE STATISTIC DATA

Table below shown the descriptive statistic data. The provided data represents the analysis of various factors affecting safety performance at construction sites. The data is categorized under several key areas: demographic variables (gender, age, work experience, and position), safety management at construction sites, focusing on (resource management and policy, safety management mechanisms and processes, management culture, and safety culture and climate), human factors (such as resource management and policy, safety management mechanisms and processes, management culture, safety culture and climate, experience, safety behaviour and attitude, human physical, safety skills and engagement), external factors (economy, politics and legislation, social factors), and worksite factors (equipment and material, poor site management, environment at worksite, construction tasks, worksite condition).

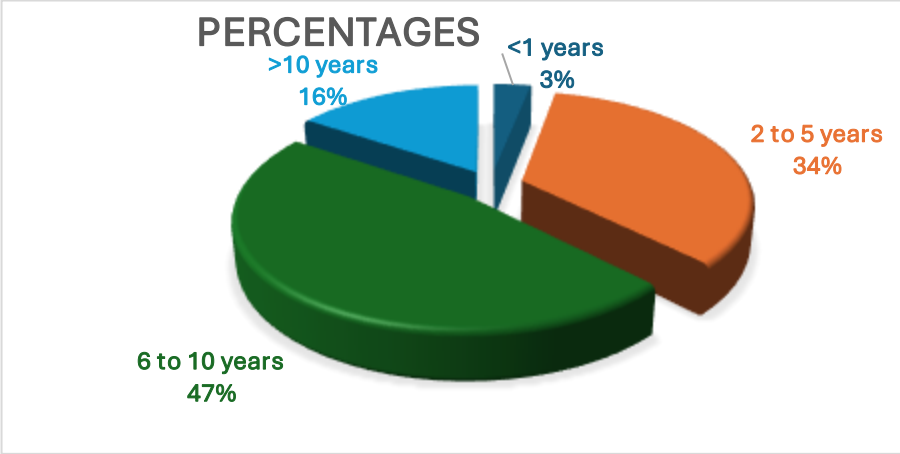

Figure 4.1: Distribution of the number of years of services among respondents.

Figure 4.1 show, the next area checked is the number of years of service construction sector among the respondents. The area has been divided into four categories namely 6 to 10 years, 2 to 5 years, >10 years, and <1 year. Referring to the information in Figure, the highest percentage is for respondents who have worked for 6 to 10 years (47%). Followed by several respondents, who have worked

in the range of 2 to 5 years which is (34%) followed by those who have worked for more than 10 years which is (16%), and lastly those who have less than a year of experience which is (3%).

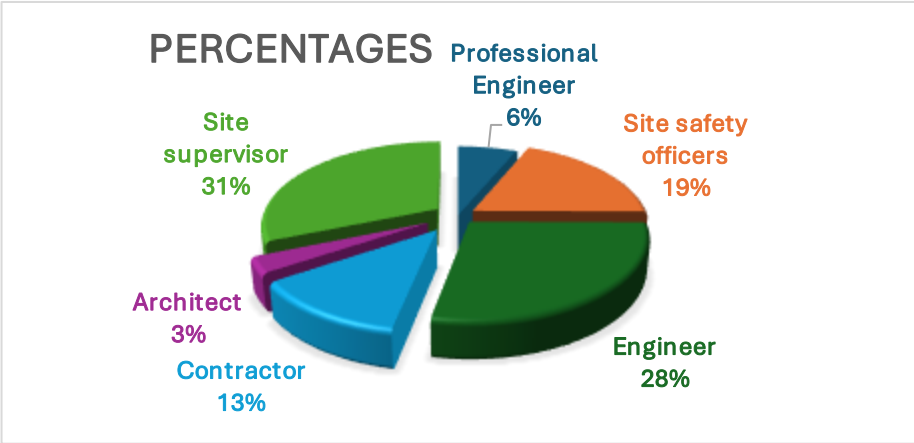

Figure 4.2: Composition of the respondents by profession

Figure 4.2 show the respondents consisted of 85 professionals from construction industry. From 32 sets of questionnaires distributed, 33 (66%) returned with complete answers. Based on the data shown in Figure, the highest number of respondents were site supervisors (31%), followed by engineers (28%), site safety officers (19%), contractors (13%), professional engineers (6%), and finally, architects (3%).\

Table 4.1: Mean and standard deviation of effectiveness level of safety management at construction sites.

Variables	Mean	Std. Deviation	Rank
Resource management and policy	4.81	0.738	1
Safety management mechanisms and processes	4.34	0.745	2
Management culture	4.09	0.963	4
Safety culture and climate	4.16	0.954	3

The table 4.1 presents the mean and standard deviation of various factors related to safety management, ranked according to their perceived importance. Resource management and policy are identified as the most crucial factor, with a mean value of 4.81 and a standard deviation of 0.738, indicating strong agreement among respondents on its significance. This underscores the critical role of effective allocation and regulation of resources in maintaining safety standards. Safety management mechanisms and processes rank second, with a mean of 4.34 and a standard deviation of 0.745, highlighting the importance of structured and well-defined procedures in ensuring safety. Safety culture and climate, with a mean of 4.16 and a standard deviation of 0.954, are ranked third, emphasizing the influence of organizational culture and the overall environment on safety performance. Lastly, management culture, which has a mean of 4.09 and a higher standard deviation of 0.863, ranks fourth, suggesting some variability in perceptions but still highlighting its importance. This factor reflects the impact of management's attitudes and practices on safety outcomes. Overall, the data indicate a clear prioritization of policy and procedural aspects over cultural factors in the context of safety management.

Table 4.2: Mean and standard deviation of human factor affecting safety performance.

Variables	Mean	Std. Deviation	Rank
Experience	4.75	0.762	1
Safety behaviour and attitude	4.22	0.751	2
Human physical	3.06	0.801	4
Safety skills and engagement	4.09	0.818	3

This table 4.2 illustrates the mean and standard deviation of various human factors that affect safety performance, ranking them based on their perceived importance. Experience emerged as the most critical factor with a mean value of 4.75 and a standard deviation of 0.762, indicating a strong consensus on its importance. This suggests that experienced individuals,

familiar with safety protocols and potential hazards, play an important role in improving safety performance. Following closely, safety behaviours and attitudes hold a mean of 4.22 and a standard deviation of 0.751, highlighting the importance of a proactive approach to safety and positive safety practices. Safety skills and involvement ranked third with a mean of 4.09 and a standard deviation of 0.818, emphasizing the need for both skills and active participation in the safety process. Finally, the human physical factor, with a mean of 3.06 and a standard deviation of 0.801, is considered the least influential but still relevant, emphasizing the role of physical condition and ability in safety performance. Positions and variability indicate a clear preference for knowledge-based and behaviour-based aspects over physical factors in ensuring workplace safety.

Table 4.3: Mean and standard deviation of external factor affecting safety performance.

Variables	Mean	Std. Deviation	Rank
Economy	4.00	0.803	1
Politics and legislation	2.97	1.257	3
Social	3.78	0.832	2

The table 4.3 highlights the mean and standard deviation of various contextual factors impacting safety performance, ranked by their perceived importance. The economy is ranked as the most influential factor, with a mean value of 4.00 and a standard deviation of 0.803, indicating that economic conditions significantly affect safety performance. This may be due to the availability of financial resources necessary for implementing safety measures and investing in safety training and equipment. Social factors rank second, with a mean of 3.78 and a standard deviation of 0.832, reflecting the importance of societal influences, such as community norms and social support systems, in shaping safety practices and behaviours. Politics and legislation, with a mean of 2.97 and a higher standard deviation of 1.257, are ranked third, suggesting greater variability in respondents' views. This indicates that while political stability and regulatory frameworks are crucial, their impact on safety

performance might be perceived differently across various contexts. Overall, the data suggest that economic stability and social context are prioritized over political and legislative factors in influencing safety performance.

Table 4.4: Mean and standard deviation of worksites factor affecting safety performance.

Variables	Mean	Std. Deviation	Rank
Equipment and material	4.38	0.554	3
Poor site management	4.41	0.756	2
Environment at worksite	3.78	0.832	4
Construction tasks	3.66	0.827	5
Worksite condition	4.59	0.560	1

The table 4.4 presents the mean and standard deviation of factors related to construction site safety, ranked according to their perceived importance. Worksite condition is identified as the most critical factor with a mean value of 4.59 and a low standard deviation of 0.560, indicating strong consensus on its importance. This highlights the significance of maintaining optimal conditions at the worksite to ensure safety. Poor site management follows closely with a mean of 4.41 and a standard deviation of 0.756, underscoring the impact of effective management practices on safety outcomes. Equipment and material are ranked third with a mean of 4.38 and a standard deviation of 0.554, suggesting that the quality and availability of equipment and materials are vital for maintaining safety standards.

The environment at the worksite, with a mean of 3.78 and a standard deviation of 0.832, is ranked fourth, indicating that while the worksite environment is important, it is considered less critical than the top three factors. This factor encompasses elements such as noise, lighting, and weather conditions, which can influence safety but may be seen as more variable and less controllable. Lastly, construction tasks, with a mean of 3.66 and a standard deviation of 0.827, are ranked fifth, reflecting the perception that the nature and

complexity of construction tasks also play a role in safety, though to a lesser extent compared to the other factors.

Overall, the data suggest that maintaining excellent worksite conditions, effective site management, and high-quality equipment and materials are prioritized as key factors in ensuring safety in construction, with the worksite environment and specific construction tasks also contributing to overall safety performance.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

In conclusion, the Malaysian construction industry faces critical challenges due to a lack of a unified safety culture, high accident rates, and insufficient training and awareness. In the absence of a shared commitment to safety among workers and management, project timelines and cost-effectiveness have taken precedence over safety procedures, increasing the likelihood of accidents

The high number of accidents, injuries, and fatalities in the industry is a major concern, emphasising the importance of paying close attention to safety practises right away. Despite the existence of safety standards, there is insufficient enforcement and compliance, which contributes to the alarming statistics. Furthermore, inadequate safety training and awareness, particularly among lower-skilled workers and a sizable proportion of overseas workers, exacerbates the safety issues.

A multifaceted strategy is required to address these challenges and transform the Malaysian construction industry's safety management landscape. Construction executives must set a good example by demonstrating a strong commitment to safety and making it a core organisational value. Mandatory safety training programmes for all workers and management, covering safety measures, hazard identification, and emergency response processes, should be implemented. It is critical to ensure that all employees are aware of potential job hazards and have the knowledge to mitigate them.

Furthermore, safety incentives and recognition programmes can motivate both employees and management to prioritise safety. Overcoming language and cultural barriers is critical, especially given Malaysia's diverse workforce in the

construction industry. The proposed strategy aims to create a unified safety culture that prioritises safety over project timelines and cost-effectiveness.

This initiative's goals include identifying existing safety management practises, investigating the safety management practises framework for Malaysia's construction industry, and evaluating the safety management framework's effectiveness. Achieving these goals is critical to creating a safer, more efficient, and economically sustainable construction industry that prioritises worker safety. The achievement of these objectives is dependent on the commitment of all stakeholders and the ongoing effort to incorporate safety as a fundamental component of the industry's operations.

5.2 RECOMMENDATIONS

To improve safety management practices in the construction industry, a strong Safety Management System (SMS) must be implemented, which includes comprehensive policies, procedures, and regular safety audits. Continuous training and education for all employees and management levels is critical, with a focus on safety procedures, equipment use, and emergency response. Cultivating a safety-first culture, backed by leadership commitment and open communication, encourages employees to report hazards without fear of repercussions. Using technology such as Building Information Modelling (BIM), drones, and wearable devices can help to improve hazard identification and worker safety monitoring. Regular safety audits and site inspections ensure compliance while identifying potential hazards.

A systematic risk management approach that employs the Hierarchy of Controls prioritises the effective elimination and control of hazards. Ensuring compliance with local, national, and international safety regulations and staying updated with industry best practices are essential. Additionally, behavioural safety programs that focus on modifying unsafe behaviours through positive reinforcement further enhance safety culture. Integrating these strategies can significantly reduce accidents and promote a safer construction environment.

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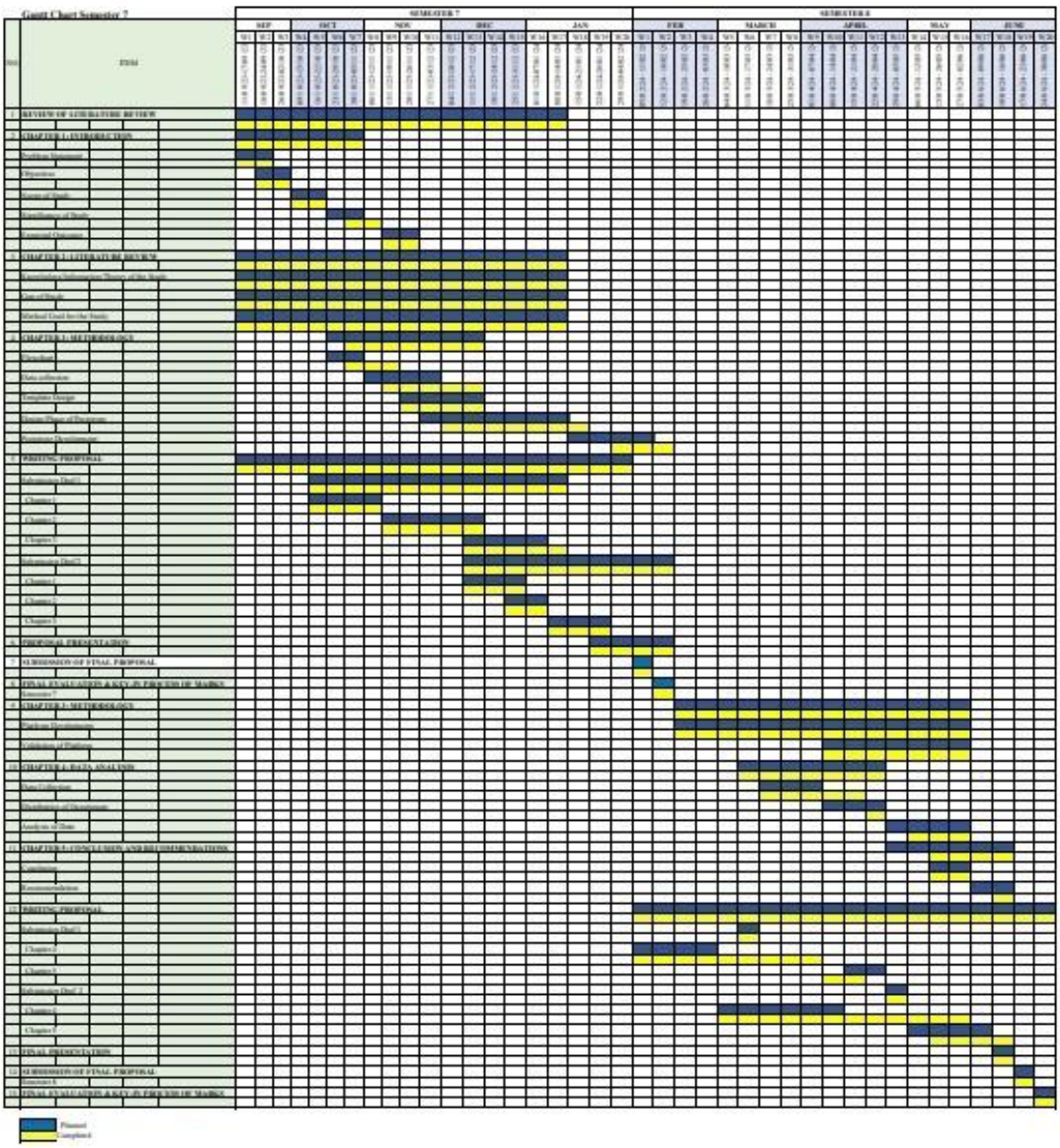
APPENDIX

APPENDIX A


Gantt Chart Semester 7
SEMESTER 7
SEMESTER 8
SEP
OCT
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JUNE
TASK
ITEM
1 REVIEW OF LITERATURE REVIEW
2 CHAPTER 1: INTRODUCTION
Problem Statement
Objectives
Research Questions
Significance of Study
Research Questions
3 CHAPTER 2: LITERATURE REVIEW
Knowledge Information Theory of the Study
Law of Study
Related Used for the Study
4 CHAPTER 3: METHODOLOGY
Flowchart
Data collection
Template Design
System Phase of Development
Resource Determinate
5 WRITING PROPOSAL
Submission Date(1)
Chapter 1
Chapter 2
Chapter 3
Submission Date(2)
Chapter 1
Chapter 2
Chapter 3
6 PROPOSAL PRESENTATION
7 SUBMISSION OF FINAL PROPOSAL
8 FINAL EVALUATION & KEY-IN PRECISION MARKS
Semester 7
9 CHAPTER 3: METHODOLOGY
Flowchart Development
Prototyping of Platform
10 CHAPTER 4: DATA ANALYSIS
Data Collection
Identification of Development
Analysis of Data
11 CHAPTER 5: CONCLUSION AND RECOMMENDATIONS
Conclusion
Recommendation
12 WRITING PROPOSAL
Submission Date(1)
Chapter 4
Chapter 5
Submission Date(2)
Chapter 4
Chapter 5
13 FINAL PRESENTATION
14 SUBMISSION OF FINAL PROPOSAL
Semester 8
15 FINAL EVALUATION & KEY-IN PRECISION MARKS
Planned
Completed

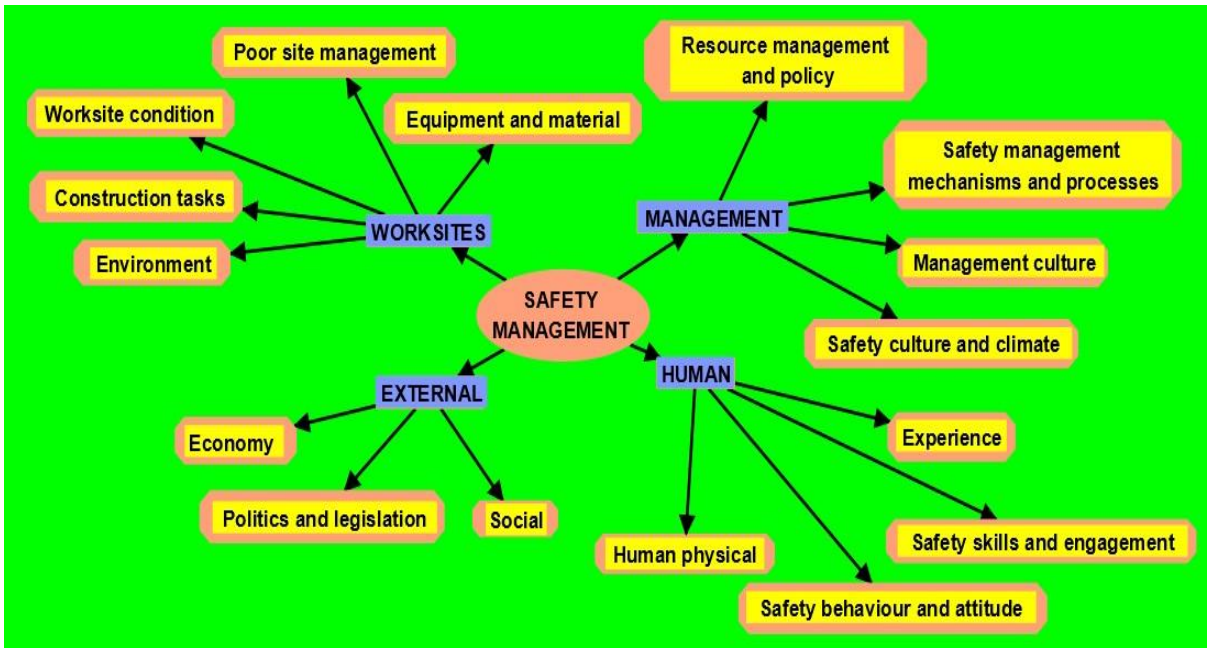
APPENDIX B

S C O P E	ITEM/ATTRIBUTE	JOURNAL
Human	Experience	(Halim, 2020), (Jazayeri, 2017), (Jin, 2019), (Gao, 2022), (Guo, 2017), (Jaafar, 2018), (Li, 2018)
	Safety behaviour and attitude	(Pourmazaherian & Musonda, 2022), (Ismail, 2023), (Khairlida, 2019), (Boon, 2019)
	Safety skills and engagement	(Li, 2018), (Zhao, 2018), (Ayob, 2018), (Sadeghi, 2020), (Othman, 2018), (Hamid Et Al, 2019)
	Human physical,	(Sadeghi, 2020), (Othman, 2018), (Hamid Et Al, 2019), (Nur Sabrina Azmi Et Al., 2020)
External	Economy	(Jin, 2019), (Jaafar, 2018), (Li, 2018), (Zhao, 2018), (Boon, 2019)
	Social	(Jin, 2019), (Jaafar, 2018), (Li, 2018), (Zhao, 2018), (Sadeghi, 2020), (Khairlida, 2019)

	Politics and legislation	**(Jin, 2019), (Guo, 2017), (Jaafar, 2018), (Li, 2018), (Zhao, 2018), (Khairlida, 2019), (Boon, 2019)**
Management	**Resource management and policy**	**(Halim, 2020), (Jazayeri, 2017), (Jin, 2019), (Guo, 2017), (Jaafar, 2018), (Li, 2018), (Zhao, 2018)**
	Management culture	**(Halim, 2020) (Jazayeri, 2017), (Jin, 2019), (Jaafar, 2018), (Li, 2018), (Zhao, 2018), (Manu, 2018)**
	Safety management mechanisms and processes	**(Mohammadi, 2018), (Pourmazaherian & Musonda, 2022), (Ismail, 2023), (Boon, 2019)**
	Safety culture and climate	**(Zhao, 2018), (Manu, 2018), (Kim,2019), (Sadeghi, 2020), (Othman, 2018), (Hamid Et Al, 2019)**
Worksite	**Poor site management**	**(Othman, 2018), (Hamid Et Al, 2019), (ISMAIL, 2023), (Omer, 2020), (Boon, 2019)**
	Equipment and material	**(Othman, 2018), (Hamid Et Al, 2019),**

		(Mohammadi, 2018),(ISMAIL, 2023), (Boon, 2019)
	Construction tasks	**(Halim, 2020), (Jin, 2019), (Gao, 2022), (Jaafar, 2018), (Li, 2018), (Zhao, 2018), (Sadeghi, 2020)**
	Environment	**(Ayob, 2018), (Sadeghi, 2020), (Othman, 2018), (Hamid,Et,Al, 2019), (Mohammadi, 2018)**
	Worksite condition	**(Halim, 2020), (Jin, 2019), (Gao, 2022), (Guo, 2017), (Jaafar, 2018), (Li, 2018), (Zhao, 2018)**

APPENDIX C


Poor site management
Resource management and policy
Worksite condition
Equipment and material
Safety management mechanisms and processes
Construction tasks
WORKSITES
MANAGEMENT
Environment
Management culture
SAFETY MANAGEMENT
Safety culture and climate
HUMAN
EXTERNAL
Economy
Experience
Politics and legislation
Social
Human physical
Safety skills and engagement
Safety behaviour and attitude

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