EVALUATION OF SAFETY HEALTH AND ENVIRONMENT AT CONSTRUCTION

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ORIGINAL LITERARY WORK DECLARATION

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Evaluation of Safety Health Environment at Construction site

Field of Study:

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Abstract

Due to the complexity and unpredictability of the operations, the construction industry has a high prevalence of serious and fatal occupational injuries. Efforts to reduce workplace accidents through various safety improvement methods have reached a roadblock after decades of effort. Department of Occupational Safety and Health (DOSH) reports that the construction industry's safety has improved, but a closer examination indicates that it still lags below most other industries. Statistics also shows a decrease in the number of the recorded cases since 2019 but it was only because most construction projects were put on hold due to COVID-19. Accidents in construction site impacts the project performance, including delays in project completion, increases in project costs, decreased productivity, and poor perceptions of the company. Accidents result from a combination of contributing causes and in order to improve the overall safety performance, it is necessary to investigate the root causes. This study examined reported accident cases kept by DOSH and carried out questionnaires survey to the construction team to collect data. The finding of this study identified the category of the factors; unsafe method, human element, unsafe equipment, job site conditions, management and unique nature of the industry. The results concluded that the main cause of construction accidents are worker's attitude, negligence, poor site management, failure to use PPE and working at high level.

Keywords: Construction, Accident, Causes, Safety, Hazards

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CHAPTER 1: INTRODUCTION

1.1 Background of Study

Construction industry has been recognized as one of the primary economic engines in Malaysia's development toward being a developed nation by 2020. Unfortunately, high accident and fatality rates have tainted the company's name and image. Construction is still regarded as one of the most dangerous industries in the world (Hinze, 2008). As a result, researchers and practitioners continue to struggle with the issue of construction safety. Due to the construction industry's poor safety performance, Malaysia's society and economy have incurred human and financial losses. Figure 1 below from Department of Statistics Malaysia shows the overall occupational fatalities and accidents occurred over the years in Malaysia for all sectors. Meanwhile Figure 2 shows the occupational accidents by sector in Malaysia reported by the Department of Occupational Safety and Health (DOSH). As can be seen, construction has the highest number of deaths as of 2013.

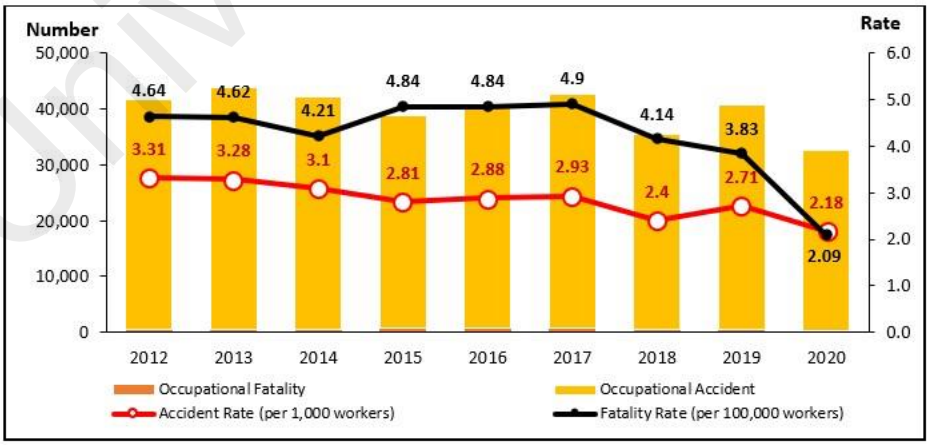

Figure 1: Occupational Fatalities

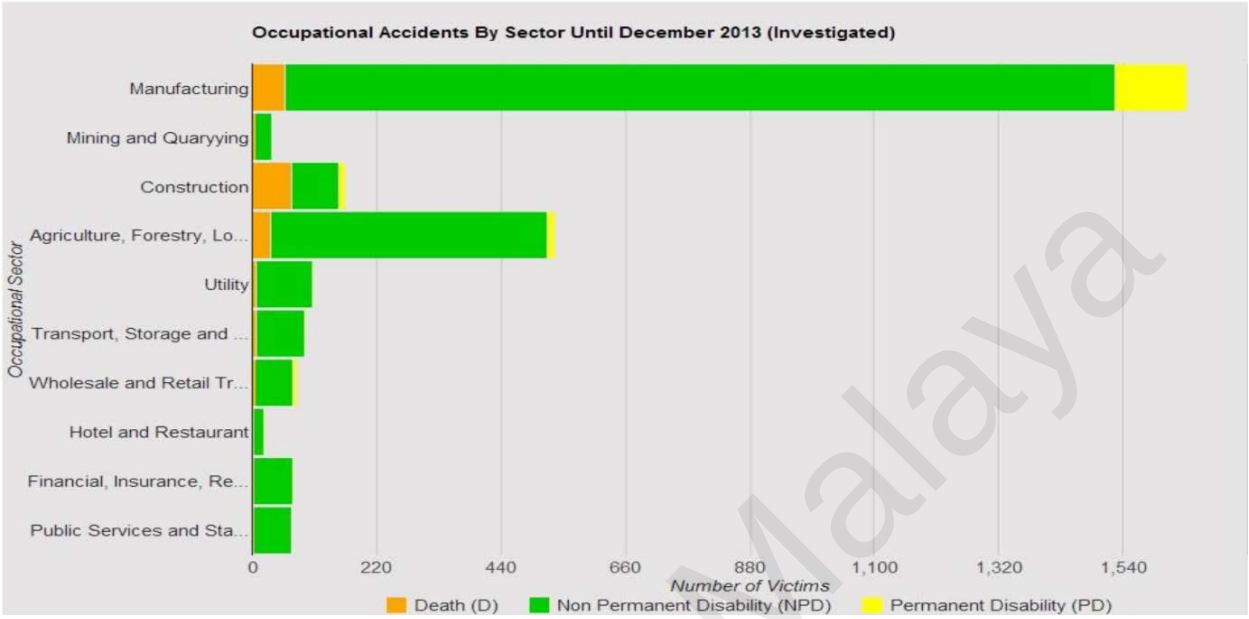

Figure 2: Occupational Accidents by Sector

In their study of construction sites in Honduras, Jaselskis and Suazo (1994) discovered a notable lack of understanding or focus for safety at practically almost all levels of the business. In the construction business, the Department of Safety and Health (DOSH) has established comprehensive safety rules. However, the level of awareness and application during the past five years has fallen short of expectations.

Construction projects are complicated in terms of technology and organisation. Work can be 'decomposed' into its constituent pieces, according to traditional occupational health and safety (OHS) risk management procedures. The risk of each of these components is then assessed, and appropriate control strategies are chosen. Deconstruction of complicated systems using this technique has limited application when system components are in constant dynamic touch with one another. (Cooke-Davis et al., 2007). At the configuration between organisations, technology,

components, or activities, it is nearly difficult to forecast whether such contact would produce new OHS dangers. These dangers are uncontrollable if they go undiscovered.

The interests and effects of multiple project contributors and stakeholders, who either knowingly or unconsciously have an impact on OHS, must be managed in the construction industry. It might be very challenging to coordinate activities for project that has participants or contributor since each one will be affected by their connections and associations with other project participants while also pursuing their own commercial or personal objectives on behalf of their organisation. Therefore, according to Lingard, it is essential to ensure that a facility's components are appropriate and that the construction and installation processes implied by the pieces' designs do not expose users to elements of risk or an intolerable level of risk at their interfaces.

1.2 Problem Statement

In most construction organizations, construction safety management is not performed consistently. As a result, construction-related incidents are often in the news. According to Department of Occupational Safety and Health (DOSH), 37.85%–51.50% of 1,116 work-related accidents occurred over the period of 2011 to 2016 occurred on construction sites. Due to Malaysia's building industry's weak safety performance, both economy and society have suffered losses in terms of persons and money. Furthermore, according to statistics from the Social Security Organisation (SOCSO), the construction industry ranked fourth in terms of fatality instances in 2004.

Because there is a considerable risk of an accident occurring in the construction sector, it is considered a hazardous industry. The main causes of this are money, time, and quality, which are always given precedence over safety and that is why in the construction industry, safety is always viewed as second-class and is given less importance. Many companies may not have comprehensive accident prevention plans in place because they would rather concentrate on boosting earnings. Unaware of how much accidents could cost them until it happens, they do not put safety as high priority. As Abdul Hamid, Muhd Zaimi and Bachan Singh (2008) stated, the statistics on construction-related incidents show that the number of accident cases in Malaysia is still worrying, implying that the construction industry is still one of the important sectors that requires a massive and rapid reform of current site safety practices. In order to prevent accidents, precautions must be taken, and all concerned must understand the causes of accidents, particularly their core causes and how they relate to other sub causes in order to prevent them.

The International Labor Organization (ILO) estimates that at least 60 000 fatal incidents—or one every ten minutes—occur on construction sites worldwide each year. Construction accounts for one out of every six fatal workplace accidents each year (International Labour Organisation, 2005). Furthermore, the ILO estimates that the construction sector employs between 6% and 10% of the workforce in industrialised nations, but is responsible for between 25% and 40% of work-related deaths. These are startling figures that highlight the need for a coordinated and integrated effort to develop, implement, and evaluate innovative approaches to dealing with this tenacious problem.

This research is the first step in lowering accident rates on construction sites. In addition, this research will show the reader how far Malaysia has progressed in implementing Construction Safety Management. It also provides an overview of the current status on the construction site. This study could help spread awareness to improve safety as well as give the impression to the public that construction sites are not as dangerous as it seems if the right procedures are followed.

1.3 Objective and scope of study

The purpose of this study is:

1. To review the causes of accidents in construction

2. To investigate the elements that contribute to poor safety management in construction projects.

3. To study the existing construction safety management procedures implemented by a Malaysian construction company.

The overall focus of this research is to look into the factors of accidents at construction sites in Malaysia. Finding out the current construction safety procedures practiced by th construction company is crucial to identify factors of the accidents. This research will attempt to position safety management in construction projects as a critical component of project performance and success. The study was carried out at Hotayi, an electronic device manufacturing company located at Batu Kawan, Penang. Hotayi was developing their second building and was still under construction during the study. The second building was estimated to be completed by July 2022. The construction has started since September 2021 and construction project team consists of 260 members. The study will also underline the necessity

of safety management in construction projects and raise awareness of it.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

It is common knowledge that accidents in the construction industry can have serious financial and humanitarian implications. Construction accidents can cause a number of problems, including as worker demotivation, interruption of worksite activities that cause project delays, and a negative effect on the overall cost, productivity, and credibility of the construction sector (Mohamed, 1999). Although Hinz stated that accidents do not always cause injuries, it might be in the form of damage to equipment and materials, with injuries receiving the most concern. Nevertheless, all accidents should be taken seriously, regardless of the type of damage or how bad is the damage. Accidents with less acceptable outcomes may occur in the future as a result of incidents that do not involve material or equipment damage or injury to employees.

In developing countries, the construction industry ranks number one in terms of death rates. Many studies have found that the construction industry is one of the most dangerous, with construction employees facing a threefold increase in the chance of death and a twofold increase in the risk of injury when compared to those in other industries (Waehrer et al., 2004; Brody et al., 1990; Mohamed, 2002; Levitt and Samelson, 1993; Rubio, et al., 2008; Rivara and Thompson, 2000; Saloniemi and Oksanen, 1998). Suchismita and Ghosh (2011) claim that due to the sequential work processes, the varied levels of technology used, the interaction between workers and equipment, and the workers' varying levels of safety awareness and training make construction

sites a more complicated area. Therefore, safety has become a worry wherever construction activities take place due to the unexpected and complicated nature of building tasks.

Construction safety management is of significant importance to all stakeholders in the construction sector, given the negative consequences of accidents. Governments, unions, and insurers have spent a lot of time and effort trying to develop legislation, rules, and regulations to assist minimise the high number of "lost-work days" and the significant number of deaths and injuries (Goldsmith, 1987). However, Kin and Bonaventura (2006) states that regulation alone will not lessen accident rates unless management take proactive steps to incorporate these rules and instruction into their daily operations through the implementation of a safety management programme. Safety management is a strategy for eliminating or reducing the forces that result in losses due to injured personnel or damaged equipment and infrastructure. The primary causes of accidents can be identified by utilising accident investigation techniques such theories of accident causation and human errors, which can help prevent construction accidents.

2.2 Causes of Accident

Overall from the theories, accidents are caused and do not just happen. As mentioned by Ridley (1986), accidents are caused by risky acts, harmful conditions, or both in 99 percent of cases. The unsafe act is a breach of a generally known safe process that could lead to an accident while unsafe condition is a physical state or circumstances that could directly permit the occurrence of an accident. Although construction activities are widely varied resulting in many causes of accidents, it can be generalised and simplified. Figure 3 show types of construction accidents reported from 2010 to 2013 by DOSH.

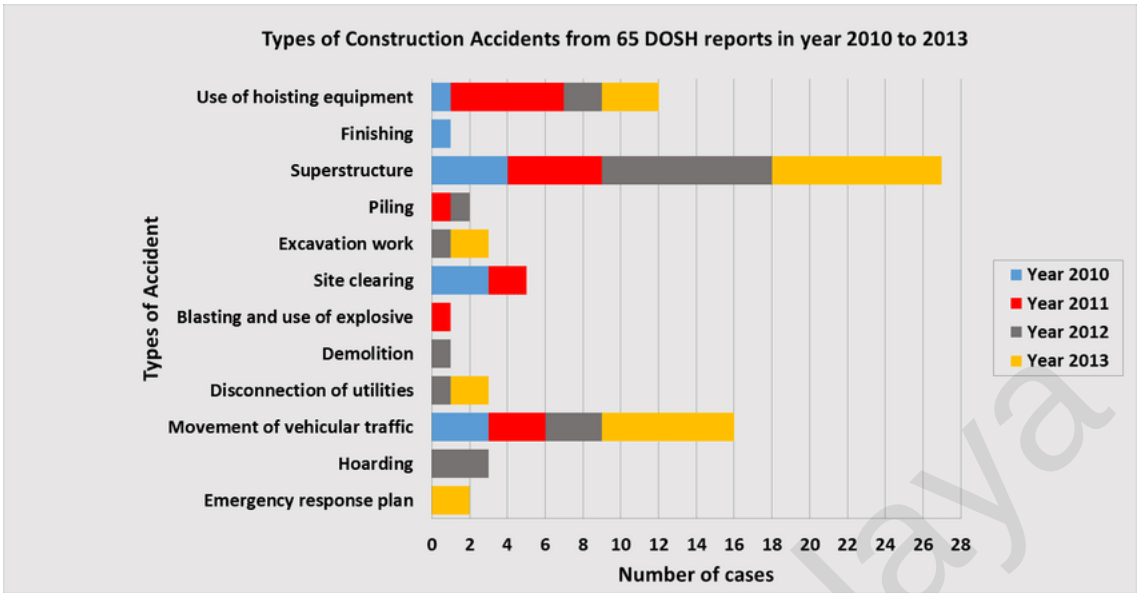

Figure 3: Types of Construction Accidents Reported From 2010 To 2013 By DOSH

2.2.1 Heinrich Domino Theory of Accident Causation

Heinrich developed the 'Domino theory,' which is based on the following five sequential factors:

I. Ancestry and social environment - The process of learning about customs and skills in the workplace is influenced by ancestry and social environment. Inadequate social and environmental conditions, as well as a lack of skills and knowledge for executing duties, will result in a person's fault.

II. Carelessness - Person flaws or carelessness are unfavourable aspects of a person's personality that can be acquired. Unsafe acts/conditions are a result of negligence.

III. Acts that are unsafe, as well as mechanical or physical conditions - Errors and technical breakdowns that cause the accident are examples of unsafe acts/conditions.

IV. Accidents - Accidents are caused by risky acts or conditions, which result in injuries.

V. Injury - Injuries are the consequences of the accidents.

Heinrich's domino hypothesis consists of five standing dominos that, if the first one falls, which is the Social Environment and Ancestry, others will fall one by one illustrated by Figure 4.

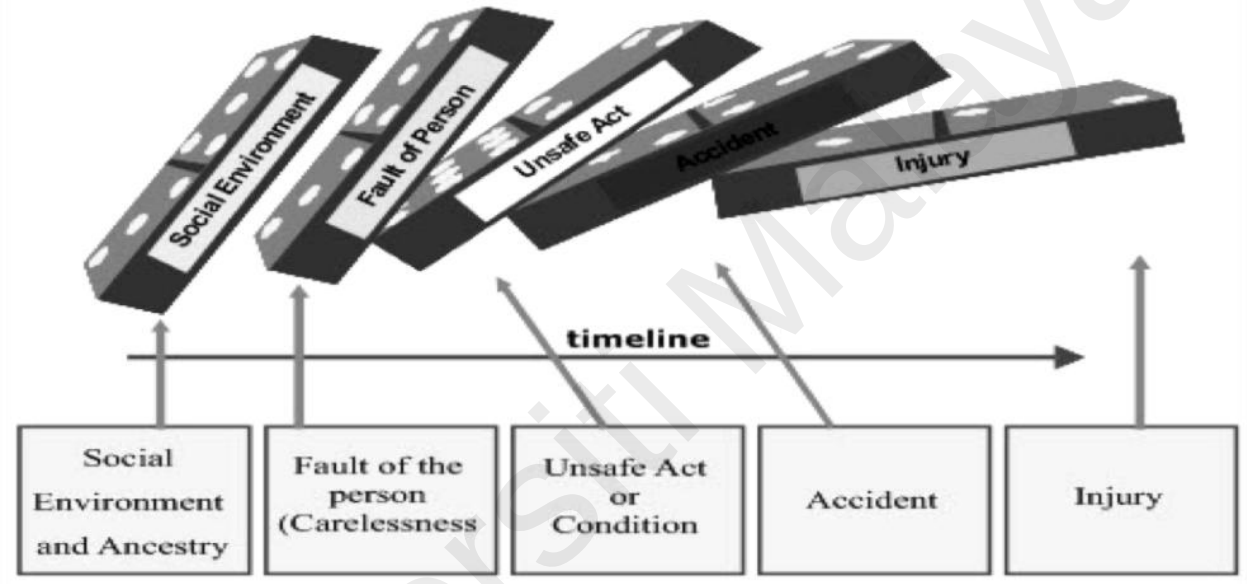

Figure 4: Domino theory of accident causation

Only if the sequence and chain of events is broken can the accident be averted; for instance, the risky conduct or condition can be stopped to lessen or even stop accidents and injuries. This theory contains two basic points: first, people are the major cause of accidents where the majority of workplace accidents are caused by a worker's mistake. Second, accident prevention should be the responsibility of the management. To protect workers from a potentially hazardous environment, management should supply them with safety equipment. According to Heinrich, the

goal of an organisation, as well as the planning and execution of specific tasks, would all have an impact on accident prevention.

2.2.2 Multiple Causation Model

Petersen (1971) developed a model based on a management system rather than individuals where he believed that a risky act and unsafe conditions are two major aspects of the events that contribute to an accident. He believed that the main culprit in an accident scenario includes numerous contributing elements, causes, sub-causes and the factors combined together in an unpredictable way, causing accidents. Using a multiple causation approach, the accident's surrounding causes would be made clear (Abdelhamid and Everett, 2000). Unsafe activities and conditions can be avoided through the identification of these many contributing causes of accidents (Hossenian, 2012).

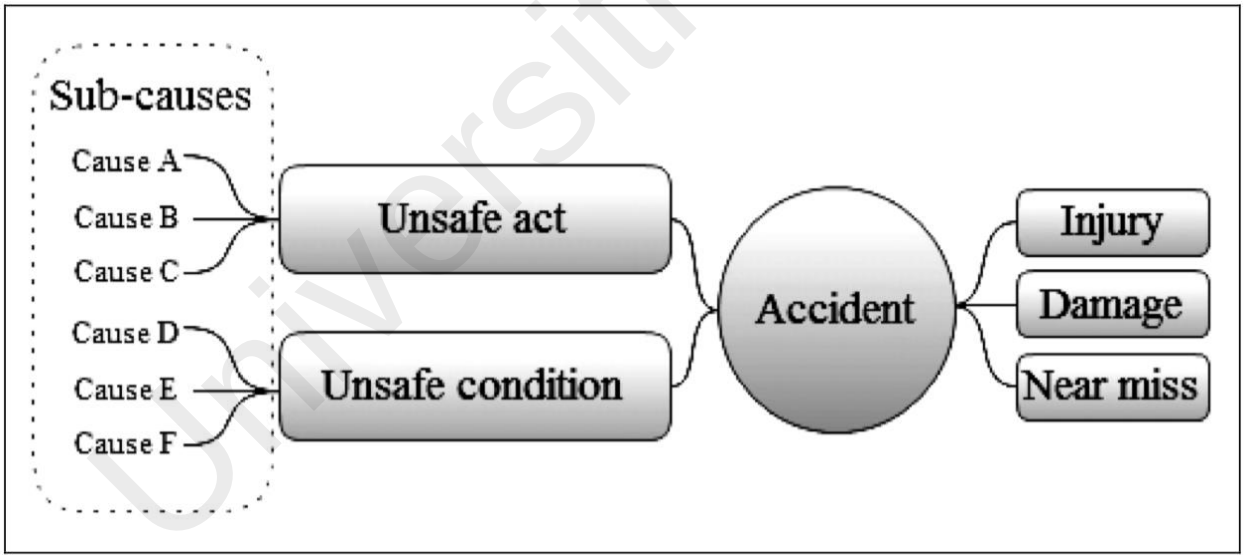

Figure 5: Multiple causation theory

2.2.3 Human Error Theories

The method taken by this hypothesis emphasizes the worker as the accident's main cause. This method examines the likelihood of people to make mistakes in a variety of situations, with the main blame resting with human (unsafe) characteristics (Abdelhamid, 2000). However, due to additional factors including workplace design and operations that disregard worker constraints that could results in accidents, this method does not deem most accidents to be the fault of the parties involved (Abdelhamid and Everett, 2000). The purpose of human error theory is to develop a better environments, tasks, innovations and technologies that are consistent with human limits. Figure 6 illustrates the elements that contribute to human errors.

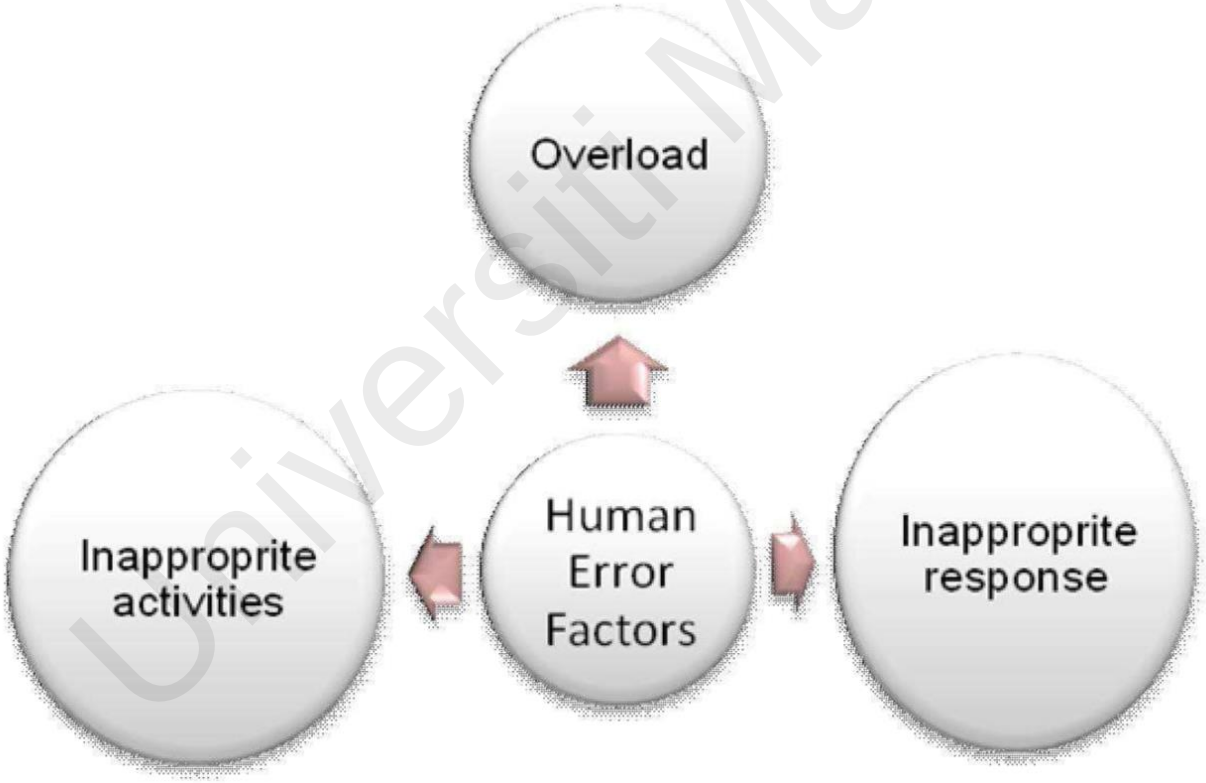

Figure 6: Human Error Factors

2.2.4 Swiss Cheese Model

James Reason (1970–1977) created the "Swiss Cheese" accident causation model as a linear accident causation model. The idea behind this model simply recommends that businesses attempt to prevent accidents from happening by defenses so that risks and hazards don't result in losses. These organizational defenses are categorized into two groups:

I. Hard defenses include physical barriers, manufactured safety devices, automatic warning systems, fuses, and other weak points built into the primary system.

II. Soft defenses that are based on individuals and procedures include laws requiring certain performance, investigations, checks, regular performance procedures, education and training, supervision, and work authorization. Operators and supervisors act as the pioneers in soft defenses as well. The possible effects of hazards in an organisation include losses to people, property, and equipment.

As illustrated in Figure 7, although there are numerous layers of defence between dangers and accidents, the Swiss cheese model of accident causation shows that when each layer has faults, if they line up, it can allow the disaster to happen.

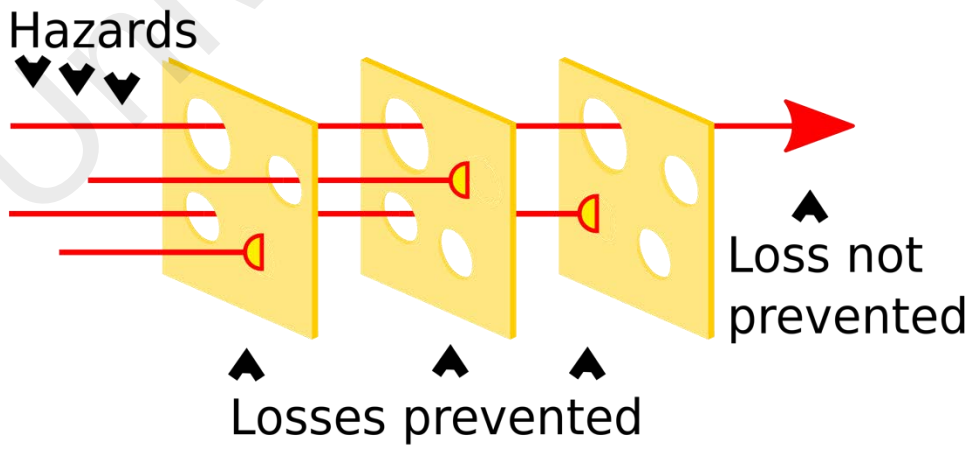

Figure 7: Swiss Cheese Model

2.2.5 Ferrel Theory

Doctor Russell Ferrel (1997) built his accident theory on a series of human causes. According to him, human mistake is the primary cause of accidents and is brought on by the following elements.

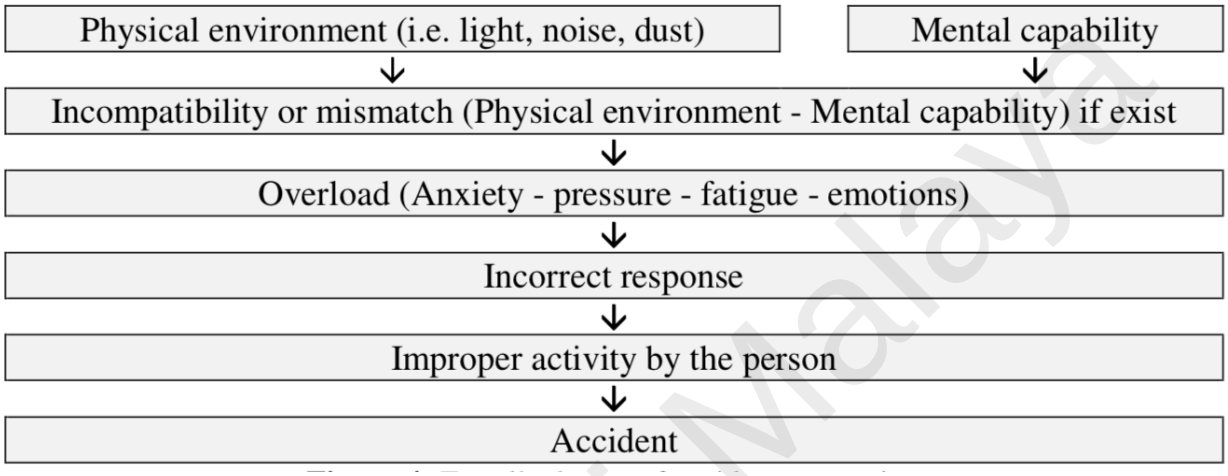

Figure 8: Ferrel Theory

I. Overload - The overload factor illustrates the discrepancy between the load and human capacity. Anxiety, pressure, and exhaustion are the results of this mismatch, and these feelings can be made worse by the actual environment the person is working in, such as dust, light, noise, odours, etc.

II. Incorrect response - The incompatibility between the environment and the individual working in is what leads to their wrong response.

III. Improper activities - Due to ignorance of the required method of performance or deliberate risk-taking, the person does the task inappropriately.

2.2.6 Other Studies

Nowadays, accident models are used to more clearly explain the causal factors so that the situation can be improved. However, the root causes of accidents must be addressed if we are to make long-term progress. Few other studies were done to discover the factors influence the causes of accidents in construction site and it has become a passion to many researchers.

I. Kartam and Bouz (1998) - Conducted a study on Kuwaiti construction and discover that workers turnover, worker's dishonesty, poor safety performance, incorrect cleaning and unusable materials, poor tool maintenance, faulty supervision, and misplacing tools were the main causes of accidents.

II. Lubega Muhamadi (2000) – Conducted a study on Uganda construction site and concluded that the main cause of accidents were due to inadequate of awareness of safety regulations, poor execution of safety regulations, lacked professionalism personnel and incompetent, lack of regard and attention for safety by those involved in construction projects, mechanical failure of construction tools and equipment, physical and mental stress, and chemical distress.

III. Pipitsupaphol and Watanabe (2000) – Conducted a study on Thailand construction site and identified the most important causes as being the peculiarities of the sector, job site conditions, unsafe equipment, unsafe procedures, human components, and managerial variables. They additionally stated that negligence to implement personal protective equipment, inappropriate loading or placement of equipment or supplies, inadequacy of courage and concern to warn or advice coworkers, unable to secure equipment, and improper equipment use were the most immediate causes.

IV. Tam et al (2004) - conducted a study on China's construction sites and revealed that poor safety awareness from top management, careless operation, a lack of certified skilled labour, subpar equipment, a lack of first aid supplies, poorly enforced organisational commitment, and low worker education levels were the main causes of accidents. Workers' safety consciousness was also lacking, and there was no technical direction or strict operational guidelines.

V. Toole (2002) – Also conducted a thorough study in the USA and concluded that the main causes of accidents included inadequate training, weak safety regulations, inadequate of safety equipment, unsafe methods or sequencing, dangerous site conditions, inability to use safety equipment provided by the management, a nonchalant attitude toward safety, and detached and sudden anomalies from advised behaviour.

2.3 Factors Affecting Safety Performance in Construction Site

Safety Training

Since training helps workers develop their skills and capacities to spot hazards, it is the most effective method for reducing risks. According to Paringga (2010), Education and training intended to stop human error that could result in accidents and give personnel the skills they need to do a repetitive task with accuracy. Tsui and Gomez-Mejia (1988) also stated that one strategy to promote employee safety is to include all employees in safety training on a regular basis through meetings with managers, supervisors, and employees. These meetings should frequently be organised by HR professionals.

Implementation of Safety Inspection

The primary instrument for keeping the workplace safe and keeping an eye on harmful practises is safety inspection. As what Hinze and Gambatese (2003) stated, one of the ways for project managers and site supervisors to learn more about the site's safety circumstances is through safety inspections. Jaseliks et al. (1996) suggested construction sites should increase their site safety checks. According to their analysis, companies with higher safety performance performed more site safety inspections than companies with lower safety performance.

Workers' Attitude

According to Aksorn and Hadikusumo (2008), attitude is the tendency to react positive or negative manner to particular people, things, or circumstances. People differ in how they perceive dangers and whether they are willing to take them. If worker attitudes are changed to be more supportive of safety, successful safety initiatives can be implemented.

Availability of Safety Equipment

Toole (2002) claims that the lack of safety equipment required to do the job safely at the construction site is the reason for some construction mishaps. To maintain a safe and healthy working environment, it is crucial to provide PPE to construction site workers as PPE can protect workers from risky incidents. Any additional accessory designed to protect workers while performing their task should also be provided.

Implementation of Emergency Plan and Procedures

Every three months, an emergency rehearsal should be held, during which all employees will receive a briefing on emergency protocols (Griffith A and Howarth T, 2001). It's also important to note the workers' attendance at the assigned assembly location to ensure they attend the session.

Safety Incentives

According to Hinze and Wilson (2000), the objective of the incentives is to provide positive reinforcement for a desired behaviour. Safety incentives are intended to affect employee behaviour such that safer employee performance is recognised and encouraged. Incentive program is better than punishment in encouraging the workers to behave better although punishment sometimes is inevitable. Based on Hinze and Gambatese (2003), various safety initiatives used by businesses to enhance worker safety and safety incentive programmes are the most frequently used.

2.4 Construction Site Safety Stakeholders

To ensure the safety application, supervising, and regulation are conducted more effectively and to ensure the number of cases of accident as well as fatality in the construction industry continue to decrease year after year, all construction stakeholders, including authorities, clients/project owners, consultants, contractors, construction workers, and insurance companies, should play their important roles and responsibilities.

Department of Occupational Safety and Health

Department of Occupational Safety and Health is under the administration of the Ministry of Human Resource. DOSH is in charge of ensuring worker's health, safety, and welfare and at the same time protecting the public from health and safety risks associated with several industry

sectors, including the construction industry. With a vision to become the organisation that leads the nation in fostering a safe and healthy work culture that enhances the quality of working life, the department is a government organization that is responsible of implementing and enforcing occupational safety and health legislation for the nation.

National institute of Occupational Safety and Health (NIOSH)

The purpose of NIOSH is to serve as a resource for employees, employers, and anyone else involved directly or indirectly in the field of occupational safety and health by way of training, consultancy services, information dissemination, and research and development. One of NIOSH's key objectives is the distribution of information, which has grown in demand by the industries. Indirectly, it shows that higher education institutions, employers, and employees in Malaysia are becoming more aware of OSH.

Construction Industry Development Board (CIDB)

The main objective of CIDB is to grow the Malaysian construction industry and make it more competitive by growing the construction sector so that it contributes significantly to the national economy and is able to produce and deliver high-quality construction works that are affordable and based on the requirements of the country. Licensing and certifying skilled construction workers and construction supervisors is one of its duties connected to construction's safety and health. The board is authorised to direct the "Safety and Health Induction Course for Construction Workers" under this specific purpose. After successfully completing the required course, the Board subsequently approves and certifies competent construction site supervisors and construction workers by awarding them the "CIDB Green Cards," which allows and give them the eligibility

for them to enter and work at construction sites. Green card holders are also qualified for Takaful Insurance protection under the terms and conditions of the insurance.

Local Authority

The Majlis Bandaraya and other local authorities have significant roles to play in ensuring that all building projects that fall under their jurisdiction are in compliance with the legislation and acts pertaining to safety measures at construction sites. They clearly need to enforce the safety aspects of the law and take whatever serious measures they feel necessary against anyone who does so.

Client

Setting safety goals, choosing safe contractors, and taking part in safety management throughout construction can all positively impact project safety performance. Before beginning their construction work on site, clients or project owners must make sure that all nominated contractors have provided and submitted for approval a thorough safety plan and implementation statement that is in compliance with OSH and other safety legislation. This is done to make sure that all construction work is carried out effectively and securely so that the project may be finished and delivered on time.

According to Samelson and Levitt's research from 1982, choosing a safe contractor using by getting the client to be involved directly had a significant impact on lowering the accident rate at construction sites. Clients should be involved in both the checking, monitoring and supervision of the contractor's safety programmes as well as the selection process. Additionally, the use of temporary permits for handling hazardous operations, the focus on safety during the initial site checking, the requirements for safety as specified in the contract requirements and site

examination, the keeping of safety records, the emphasis on the contractor's responsibility for safety as well as the importance of safety aspects and good safety records as requirements and criteria in the contractor selection process all played a role.

Contractor

Contractors are the most crucial party in making sure that all safety measures are implemented properly since they are immediately exposed to construction dangers while doing the construction operations on site. The OSH Act of 1994's Section 15 places emphasis on the general obligations of employers to protect, to the greatest extent possible, the safety, health, and welfare of all of their workers at the workplace.

Construction Workers

However, the implementation of the safety would not be a success if the doer themselves does not comply. Construction workers should be responsible of their own safety and health and other people who may be affected by their work or act at site. It is very crucial for workers to cooperate with their employers or anyone in charge of the safety. Above of all, workers should wear protective equipment and clothing provided by the employer at all times for safety and health as well as comply to all instruction and rules.

CHAPTER 3: METHODOLOGY

3.1 Literature Review

An extensive range of pertinent information from books, journals, and websites pertaining to the cause of construction accidents was gathered through the use of all available means in a literature study. This method is especially effective to achieve the first objective of this research which is to review causes of accidents in the construction industry. The outcomes of the first objective were then utilized in the evaluation of the second and third objectives. This step is critical in order to obtain general concepts and overviews of the scenario of safety management in construction projects in the past, present, and future, as well as its development and changes.

3.2 Site Observation

Figure 9: No Safety Shoes

Figure 10: No Full Body Harness

Figure 11: No PPE and No Tag at Scaffolding.

Figure 12: Usage of Prohibited Equipment

3.3 Questionnaire

Questionnaire survey was distributed to 120 members of the construction project team, and the respondents completed it anonymously since surveys about sensitive topics tend to elicit more honest responses when the respondents are not identified. The respondents include people with extensive knowledge of construction work, particularly regarding accidents at sites, such as project managers, site managers, directors, resident engineers, site engineer's safety and health officers, project executives, site supervisors, clerks of work, and foremen. The results of the questionnaire survey were then analysed.

Respondents from each site were required to fill in only one questionnaire form. The questionnaire's form was structured in three (3) sections:

Section A: Background data of the respondents and the projects (6 questions)

Section B: (2 questions)

i. Current construction safety procedures implemented by the company

ii. Type of accident frequently happen

Section C: Cause of accident at construction sites (6 parts)

i. Unsafe equipment (3 questions)

ii. Job site conditions (5 questions)

iii. Unique nature of industry (5 questions)

iv. Unsafe method (4 questions)

v. Human element (6 questions)

vi. Management (6 questions)

3.4 Data Analysis

Other than analysing the collected data from questionnaire surveys and site observation, analysing data from existing statistics are effective as well. The purpose of this study can be met by analysing the reported accident instances from 2000 to 2004 that were gathered from DOSH documentation. By DOSH investigative personnel, accident cases were documented, and known causes were identified. Those documents were thoroughly analysed, and the indicated causes were classified into the respective categories. For each case, the number of counts was calculated. Those counts were then averaged out in order to calculate the percentage frequency based on the six most influential factors i.e. unique nature of the industry; job site conditions; unsafe equipment; unsafe methods; human elements; and management factors.

Table 1: Distribution of Causes of Construction Accidents from DOSH Reports

Factor of Accidents		Count	Average Count	%
1. Unsafe equipment and hardware	• Equipment without safety devices	6	9	10
	• Equipment failure	11		
	• Unergonomic equipment	10		
2. Work site condition	• Excessive noise	2	8	8.9
	• Poor site management o Construction materials arrangement o Equipment and waste material arrangement o Slippery and muddy work surface	17		
	• Poor lighting	4		
	• Poor ventilation	8		
3. Unique nature of industry	• Limitation of working space	3	12	13.3
	• Work at a high position	17		
	• Various hazards	18		
	• Work operation o Rough Work o Mental and physical requirements o High energy required	8		
4. Unsafe method	• Incorrect procedure	45	21	23.3
	• Misunderstood procedure	10		
	• Knowledge level	8		
5. Human element	• Negligence	17	11	12.2
	• Experience	6		

	• Motivation	0		
	• Attitude	14		
	• Personal Protective Equipment (PPE)	23		
	• Body condition o Tiredness o Pain o Drug addiction o Alcohol intake	4		
6. Management	• Lack of training provided	32	29	32.2
	• Poor inspection	62		
	• Noncompliance with safety regulation	20		
	• Poor company safety policies	36		
	• Punish rather than learning	17		
	• Lack of awareness of the site condition	9		
	Total		90	100

3.5 Average Index Formula

Rating for the questionnaire is 1 – Totally Disagree, 2 – Disagree, 3 – Moderately, 4 – Agree, 5 – Totally Agree.

The Average Index Formula:

$$\text{Average Index (AI)} = \frac{\sum(\beta * n)}{N}$$

Where, ß is weighing given to each factor by respondents

n is the frequency of the respondents

N is the total number of respondents

CHAPTER 4: RESULT AND DISCUSSION

The first objective was achieved through literature review where Domino Theory Causation, Multiple Causation Theory and Human Error Theory were reviewed as the causes of accidents in construction industries. Goals 2 and 3 were addressed, respectively, through the research of construction accident reports and questionnaire surveys, which served as the foundation for the discussion and summary of the results as follow.

4.1 Causes of Construction Accidents from DOSH Reports

The findings were derived from an assessment of 130 accident cases from DOSH reports from 2018 to 2021, as indicated in Table 1 and Figure 7, which address the study's second purpose. According to the findings, the majority of the reasons for construction accidents may be traced back to inadequate management (32.2%) such as subpar inspection programs, subpar safety regulations and a dearth of safety education initiatives. The use of unsafe methods is the second most common cause (23.3%), which is mostly caused by subpar work processes. The human aspect comes in third place (12.2 %), with workers' irresponsibility and a lack of personal protective equipment contributing to the cause of accidents.

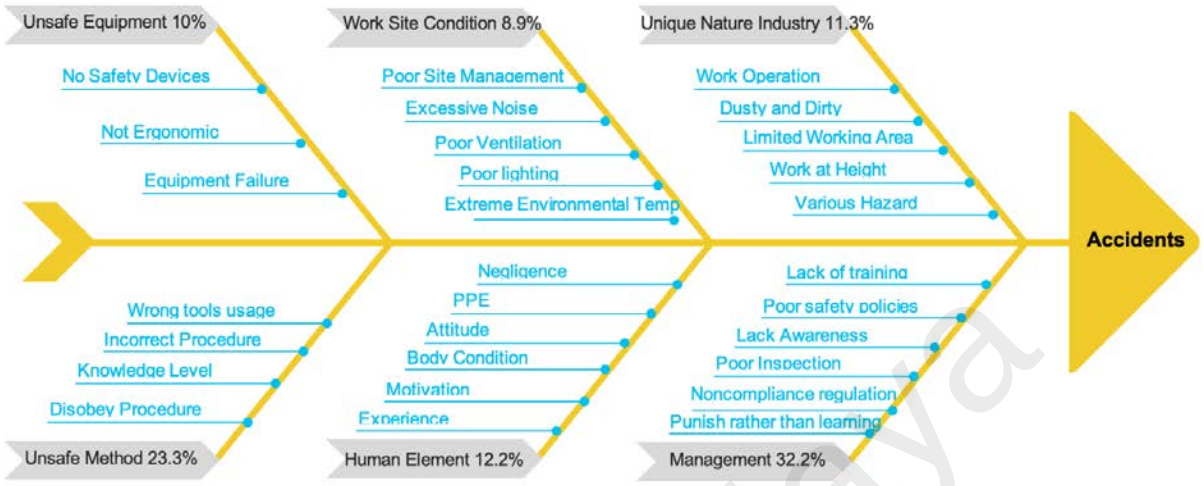

Figure 13: Causes of Accidents from 130 DOSH Reports illustrated in Causal and Effect Fish Bone Diagram

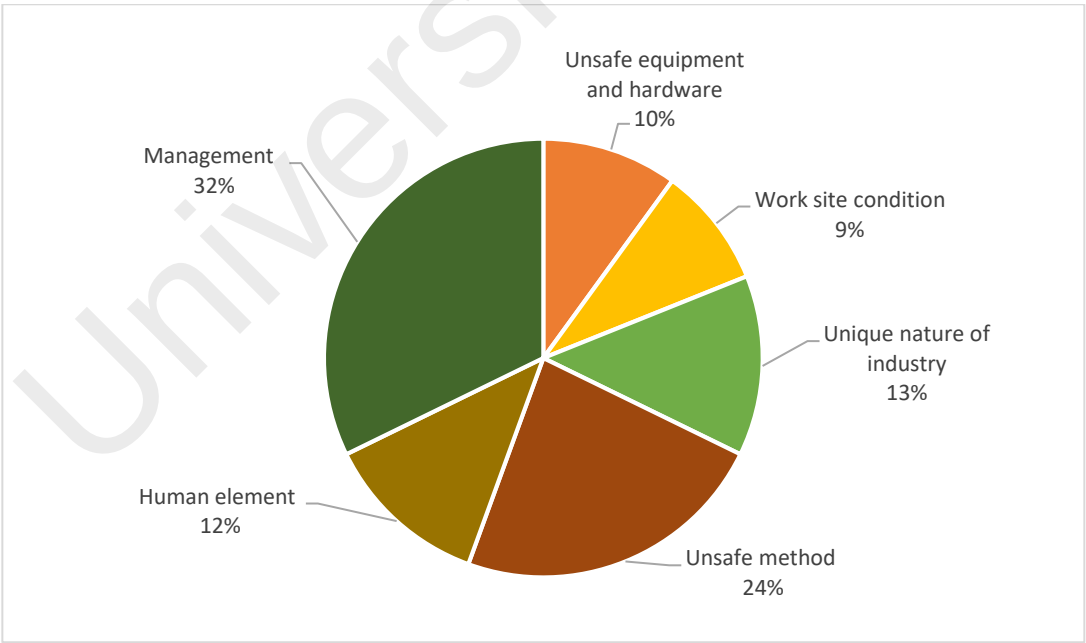

Figure 14: Causes of Accidents from 130 DOSH Reports

4.2 Results of Survey

4.2.1 Types of Accident in Construction site

As shown in Table 2, the data indicates respondents' perspectives on the types of construction-related incidents that frequently occurred. The top three most prevalent types of accidents in construction are falls (16.4%), stepping on things (15.2%), and being struck by falling objects (14.1%), according to the findings. This could be due to a lack of fall safety, poor housekeeping, or a substandard work approach, such as failing to secure goods when hauling or lifting. This finding is consistent with the most recent accident statistics from SOCSO, which shows that falls are the most common form of accident in Malaysia. According to OSHA data, the majority of deaths and injuries in the US construction sector have also been caused by falling and being wounded by falling debris. Also, according to OSHA, fall protection is the most often violated of its rules each year. It also aligns with Schriver's (1997) findings, which show that falls from roofs are the leading cause of fatalities on construction sites. Inadequate scaffolding, lack of edge protection, exposed openings in structures, lack of edge protection in roof construction, unsafe demolition work, and incorrect use of ladders and hoists are among the causes of such incidents.

Being struck by falling objects, materials, or tools is another prevalent cause of construction accidents. Lack of toe boards on scaffoldings, worker tool belts, improper storage and stacking, and poor housekeeping may all contribute to such an occurrence. A few precautions must be followed in order to avoid falling incidents. To avoid any adverse incidents, scaffolding must be correctly installed and its stability assured. To reduce fall incidents, workers working at heights

must be supplied with personal protection equipment (PPE) and all potential risks must be recognised, assessed, and removed.

Table 2: Distribution of Response to the Types of Accidents in Construction

Types of Accidents	Ranking	Score	%
Falls from high place	1	4.9	16.4
Stepping on objects	2	4.5	15.2
Struck by falling objects	3	4.2	14.1
Exposed to/contact with electric current	4	4.0	13.5
Over-exertion or intense movements	5	3.8	12.7
Caught in between objects	6	3.2	10.7
Exposed to/contact with toxic materials	7	2.9	9.7
Exposed to/contact with severe temperatures	8	2.2	7.4
Total		29.7	100

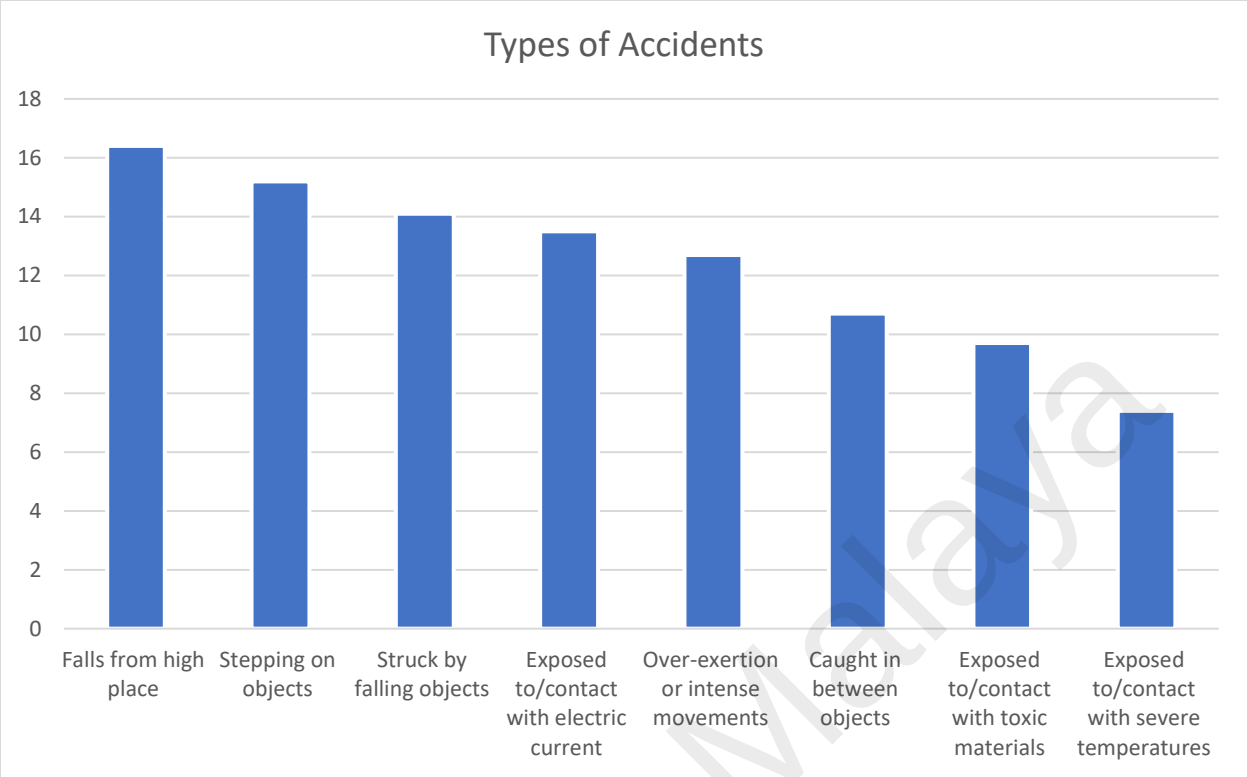

Figure 15: Types of Accidents

Exposure to or contact with electric current is another form of accident that obtained 13.5% agreement from respondents. Incorrect use of electric sockets, poor insulation of electric wires/cables, or malfunctioning electric tools are all factors in this type of mishap. Overexertion or intense movement causes weariness in the human body, as well as unbalanced bodily movement, which is ranked fifth (12.7%). The remaining four sorts of accidents in the survey, namely being caught between things (10.7%), being exposed to/contact with toxic materials (9.7%) and being exposed to/contact with severe temperatures (4.9%) are not to be taken lightly.

4.4.2 Current Practice on Construction Site

Firstly, as shown in table 3, current practice with the highest average index is equipment having a valid certificate from Department of Occupational Safety and Health. It is crucial for the company to ensure the equipment are in their best condition. Based on the survey, most respondents agreed with the wearing of PPE all the time. This means their current practice also includes wearing PPE all the time at the construction site.

The lowest percentage is from item five, followed by item number three, followed by item number six then item number four. The disagreement is most likely because the corporation did not adequately inform its workers of its safety rules. Other than that, the workers are not particularly concerned or informed about the company's safety policies. Due to this, the safety committee must take the appropriate steps to ensure that every employee is aware of the company's safety policy, current practises, and programmes being used.

Table 3: Distribution of Response to the Current Practice in Construction Site

Current Practices	Average Index	Percentage
1. Wear PPE all the time	4.13	17.3
2. All equipment including mobile cranes have a valid certificate of fitness from the Department of Occupational Safety and Health.	4.33	18.1
3. DOSH guideline is briefed to all employee	3.78	15.8
4. Conduct safety toolbox daily	4.10	17.2
5. Emergency response plan is used at site	3.56	14.9

6. HSE policy is published to all workers	4.00	16.7
Total	23.9	100

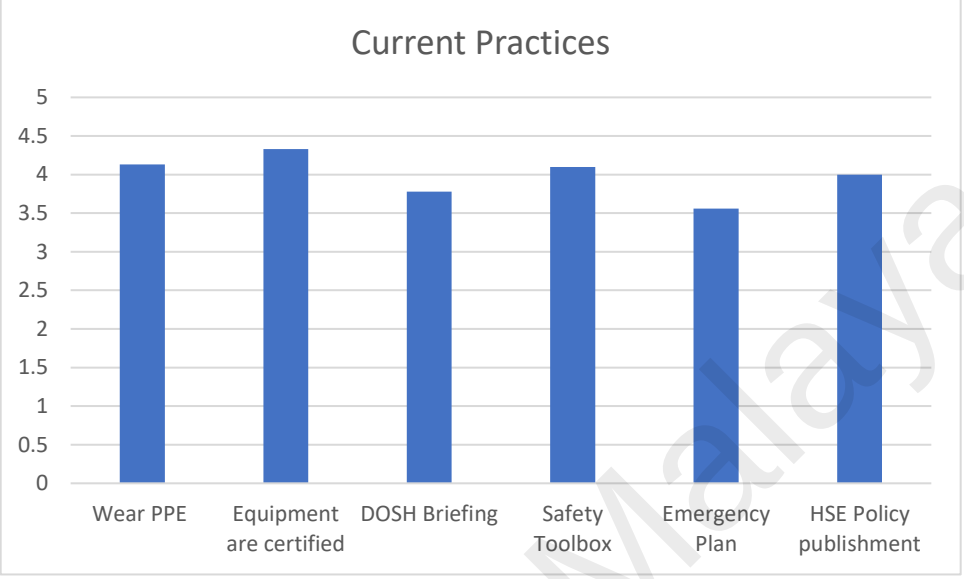

Figure 16: Average Index of Current Practices

4.4.3 Causes of Accidents in Construction Site

Table 4 illustrates the results of the questionnaire survey, which reveal the respondent's agreement towards causes of construction accidents in their workplace. According to the results of the questionnaire survey, the cause with the most respondent agreement is worker negligence, which scored 4.97. Failure to follow work procedures (4.89), working at a high elevation (4.83), equipment without safety devices (4.93), poor site management (4.89), harsh work operation (4.72), low level of workers' knowledge and skills (4.81), incorrect work procedure (4.70), attitude of the workers (4.73), and failure to use personal protective equipment (4.83) are the other top ten causes of construction accidents discovered.

Table 4: Distribution of Response of the Causes of Construction Accidents

Factor of Accidents	Instant cause of accidents	Score	Average Score	%
1. Unsafe equipment and hardware	i. Equipment without safety devices	4.93	4.3	17.6
	ii. Equipment failure	4.81		
	iii. Unergonomic equipment	3.13		
2. Work site condition	i. Excessive noise	1.57	2.8	11.4
	ii. Poor site management	4.89		
	iii. Extreme environmental temperature	3.21		
	iv. Poor lighting	2.12		
	v. Poor ventilation	2.45		
3. Unique nature of industry	i. Limitation of working space	3.91	4.1	16.8
	ii. Dusty and dirty area	2.61		
	iii. Work at a high position	4.83		
	iv. Various hazards	4.65		
	v. Work operation	4.72		
4. Unsafe method	i. Incorrect procedure	4.70	4.7	19.3
	ii. Disobey work procedure	4.89		
	iii. Wrong tools usage	4.21		
	iv. Knowledge level	4.81		
5. Human element	i. Negligence	4.97	4.5	18.4
	ii. Experience	4.39		
	iii. Motivation	4.19		
	iv. Attitude	4.73		
	v. Personal Protective Equipment (PPE)	4.83		
	vi. Body condition	4.21		
6. Management	i. Lack of training provided	4.59	4.0	16.3
	ii. Poor inspection	4.21		

	iii. Noncompliance with safety regulation	4.15		
	iv. Poor company safety policies	3.95		
	v. Punish rather than learning	3.87		
	vi. Lack of awareness of the site condition	3.67		
	Total		24.4	100

As demonstrated by the results of the factor of human elements (18.4%) and unsafe methods (19.3%) as opposed to management, the causes of accidents are more related to employees than employers (16.3%). The other criteria, such as hazardous equipment (17.6%), the unique nature of the sector (16.8%), and job site conditions (11.4%), are equally essential because their average percentage of respondent agreement is relatively close. The results are summarized and illustrated in below diagram.

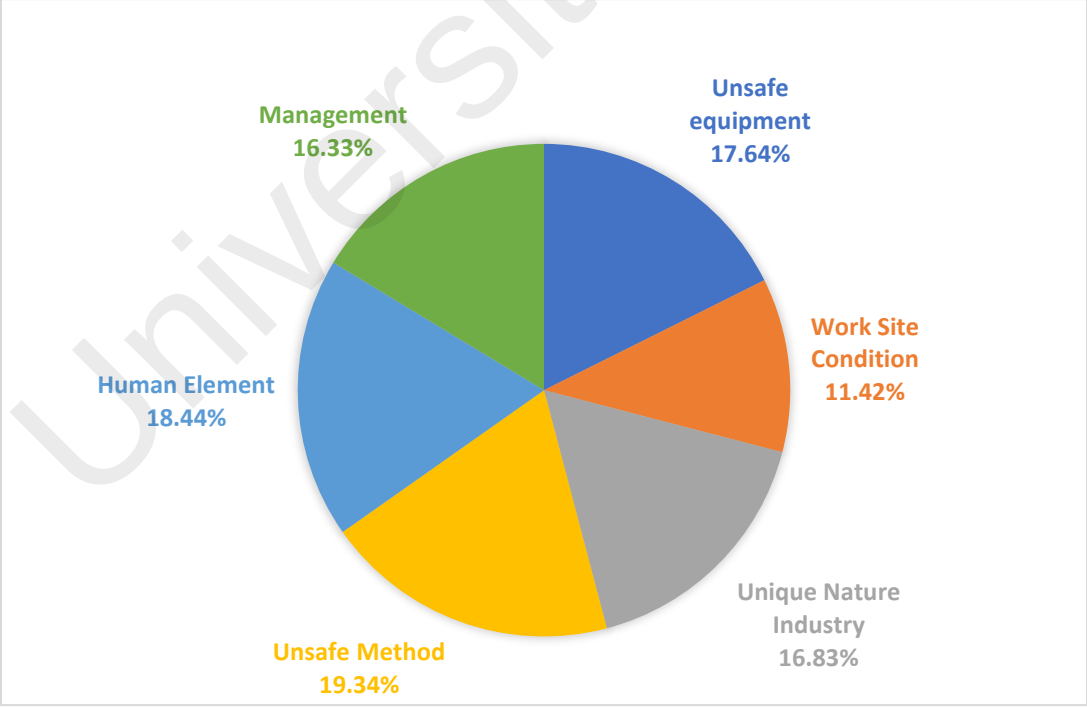

Figure 17: Causes of Construction Accidents

Workers who have adopted unsafe working practises are individuals who have adopted improper working practises. This is likely a result of management's lack of information, which encourages employees to disobey work policies. The workers' level of skill and knowledge in regard to the processes that have been provided to them will also play a role in the task's proper completion.

The accident will also be influenced by a human element or cause, such as worker incompetence when doing their tasks. Poor physical health of employees, such as exhaustion, sickness, and alcohol and drug misuse, will affect how productive they are. Workers could also experience musculoskeletal disorders that can affect their task qualities. In addition, one of the elements that impact the occurrence of accidents at work sites is the workers' experience, such as the total number of man hours and training that they have completed.

Accidents can also occur if workers do not use the personal protection equipment (PPE) provided by management, such as safety boots, safety belts, safety helmets, goggles, and other such items. As it can be seen in results from the survey for current practices, there are contradiction with the findings. In the current practice survey, most respondent agreed to waering PPE all the time but at the same time, most respondents also agreed not wearing PPE is one of the main causes of accidents in construction site. When individuals do not utilise the PPE as directed, the percentage of dangers they are exposed to is significantly higher. PPE should be worn by all employees, especially in situations where safety dangers are anticipated, and should be utilised as a supplement to administrative and engineering controls as part of a safety programme, rather than as a replacement.

Other than that, the attitudes of the workers play a big part in the occurrence of accidents. Workers who are resistant in utilising safety gear, refusing to follow workplace regulations, thinking that safety is unimportant, frequently quitting, and rapidly getting bored with certain sorts of tasks, for example, will lose attention and concentration while carrying out their duties. They might therefore be unable to control and manage the machinery as well as execute the work in a safe manner. Accidents will occur if management fails to inspect the surroundings, workers, supplies, and equipment on the job site. As a result, it is crucial for management to perform routine inspections in order to rapidly address any vulnerabilities or issues that appear on the job and take preventative action before an accident occurs. As everyone is aware, prevention is better than cure. Furthermore, inefficient, insufficient, and non-enforced company safety protocols, rules, and laws will influence the possibility of the occurrence of accidents. When management is not really interested in putting the safety protocols, standards, and regulations they created into practice, the workers tend to be unconcerned and underestimate the seriousness of accidents in constructions.

The overall examination of the respondents' perspectives revealed that all of the causes of accidents listed under each category occurred at construction sites. Respondents have all agreed anonymously on the causes on the checklist. As it can be seen, it shows that accidents are caused by a variety of contributing elements, causes, and sub-causes. There are many other possible causes that could happen in real life yet to be studied and discovered comprehensively.

This implies that the employee holds a big part in the responsibility for being involved in accidents as a result of their actions, such as negligence and failing to follow work rules. However, this isn't to imply the employers are completely blameless. Their actions, including failing to provide a safe system when operating at a high elevation, supplying equipment without safety

safeguards, skipping out on a comprehensive safety education programme, and managing the site improperly, all lead to harmful acts and conditions. As a responsible employer, companies should provide their workers with safety training and motivation programmes in order to improve their employees' knowledge and discipline.

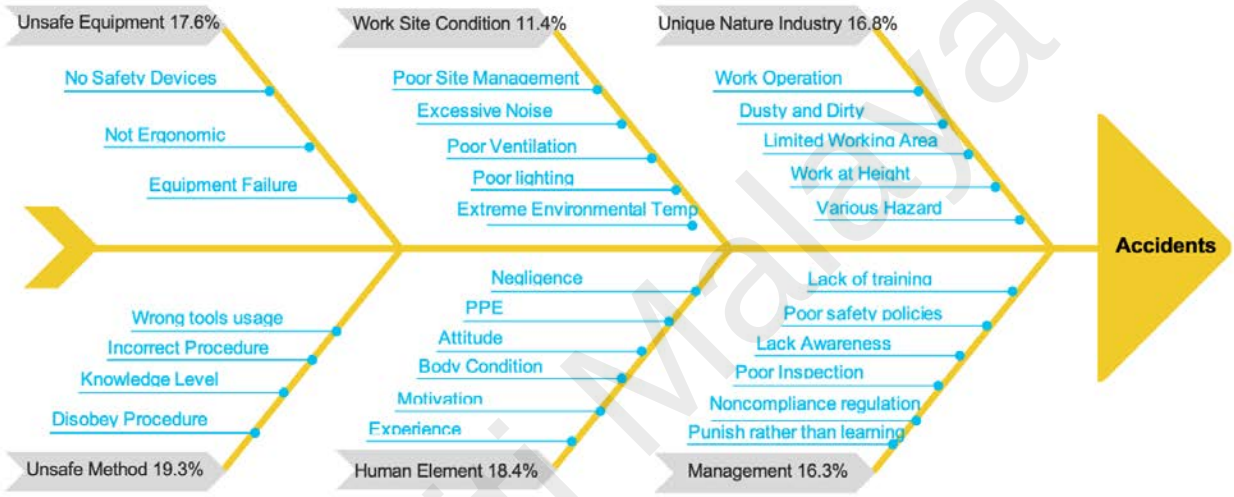

Figure 18: Causes of Accidents from Survey

CHAPTER 5: CONCLUSION AND RECOMMENDATION

In general, construction product manufacturing is a difficult, dangerous and time-consuming operation. A construction project's overall development usually consists of many different phases, each needing a different set of specialized services. Every project has crucial characteristics such as cost, time, quality, and safety. In Malaysia, the building sector has placed a higher priority on the first three characteristics at the price of safety. Due to the inadequacy of compliance and implementation with safety regulations, construction workers and the public in general have been exposed to potentially hazardous situations, resulting in an increased risk of accidents. Not only accidents can cause immediate property damage or bodily harm to people, but they can also have short- and long-term effects on the organizations involved, society at large, and ultimately the entire country.

According to the literature, accidents are caused by a variety of variables, including unsafe equipment, job site conditions, the particular nature of the industry, unsafe methods, the human element, and management. Based on the survey results, all respondents are aware of the most common causes of accidents. Numerous things contribute to accidents in the construction industry, such as worker negligence, disregard for safety protocols, working at high heights, operating equipment without safety devices, lousy site management, abrasive work practices, worker lack of knowledge and skill, disregard for personal protective equipment, and workers' negative attitudes toward safety.

The findings from this research support the multiple causation hypothesis, which states that an accident is caused by a number of contributing factors, causes, and sub causes. As a result, the employer, employees, suppliers, manufacturers, and governmental organizations must work together to try to prevent future construction accidents by addressing the core causes.

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