



Construction Safety and Performance in Malaysian Construction Industry: A Review

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Abstract: Major construction projects in Malaysia are subjected to unsafe conditions that can result in accidents and subsequently undermine the project's safety results. Despite alarming, studies examining the factors that influence the performance of the Malaysian construction industry remain scarce. Hence, this paper aims to review the literature related to construction safety performance in the Malaysian construction industry. In particular, this paper gives emphasis in reviewing the literature on construction safety and performance, safety performance in the construction industry, construction safety performances, security management, safety programme, safety policy, cost of safety, and safety training. The findings of the analysis revealed that proper construction safety activities would lead to the overall performance of the Malaysian construction industry.

Keywords: Construction, safety, performance, construction industry, Malaysia

1. Introduction

In several countries around the globe, the construction industry plays an essential role in the growth process, leading to economic growth. Even though high fatality rates in the number of accidents in the construction industry but the construction still contribute significantly to the country's economic growth (Young et al., 2019). Construction employees who were actively engaged in construction activities had a greater risk of death than workers in other industries, according to accident records (Kim et al., 2019). Malaysia's Department of Occupational Safety and Health. According to the Department of Occupational Safety and Health (DOSH), the building industry had the largest number of occupational injuries in 2017, with 15 deaths out of 70 as of May 2017 (Zikriyoev et al., 2019). Several studies have shown that "over the last five years, there has been a rapid rise in the number of injuries related to workplace safety and health (Pealozza et al., 2019).

There are many construction projects in Malaysia that are subjected to unsafe situations, which can result in accidents. The causes of accidents in the construction industry are often linked to the industry's unique design, human conduct, inappropriate site conditions, unsafe work practices, machinery, and procedures, all of which are influenced by inadequate safety management (Kim & Chi, 2019). These causes resulted in accidents, which further interrupted work and decreased efficiency (Kim & Chi, 2019). As a result, every contractor must have the training and robust safety systems that can consistently enhance safety efficiency and reduce potential hazards in construction projects. Many building "companies" do not apply construction safety management in a structured manner. As a consequence, construction site injuries are still in the press. Furthermore, according to figures from the Social Security Organization (SOCISO), the construction sector ranked fourth in terms of fatality cases in 2004.

According to Guo et al. (2019), most construction companies surveyed were still at the beginning stages of safety policy implementation in their report on 'Construction Safety Benchmarking.' They were not even close to behaving in a way that would be called an "ultimate safety programme guided by" a safety culture. According to some experts,

contractors' safety efficiency should be measured "to ensure their companies are mindful of their safety well-being." According to a study by Cheung & Zhang (2020), several factors consistently influenced contractor safety results.

Furthermore, project contractor productivity is much more important because it directly affects the prime contractor's performance on key job elements. (Antwi-Afari et al., 2019) Goal-setting and feedback approaches like Incident Rate (IR), Injury Rate (AR), and Experience Rate (ER) have historically been used to measure safety performance.

Modification Percentage (EMR). Leading metrics have been emphasised in recent years to measure the safety efficiency of building projects (Probst et al., 2019). It is claimed that a report on safety influencing factors is still missing in Malaysia. As a result, there is a gap that needs to be filled in existing research to develop a more robust safety influential factors model for the Malaysian construction industry's success. According to Yiu et al. (2019), safety and health issues are extremely important to be concerned about in all branches of industry, especially in the construction industry. Although the construction industry is still evolving as a result of new technology, equipment, and machinery, it is never without safety concerns, including fatalities (Kamoonaa et al., 2019). As a result, safety concerns are always a major concern in the construction industry (Zhou et al., 2019), especially those related to poor safety-related factors, including accidents and illnesses (Mohammad & Hadikusumo, 2017).

However, according to the Social Security Organization, there has been an uptick in construction site incidents, with 7,338 cases registered in 2016 compared to 4,330 cases in 2011, indicating a 69.47 percent increase (Zid et al., 2018). Furthermore, the building industry continues to be the source of the fatal injuries, with a fatality rate of 14.57 per 10,000 people. Several studies on safety in the construction industry have been performed, including employers' behavioural safety enforcement influences against occupational, safety, and health improvement (Razak et al., 2017), factors driving the introduction of a safety management system (Hamid et al., 2018), improving safety efficiency (Marhani et al., 2018), and occupant satisfaction and level of safety performance (Hamid et al., 2018). (Khan et al., 2019). However, there is a dearth of research into the safety factors that influence the performance of the Malaysian construction industry. Hence, the current study aims to close the gap by developing a safety influential factors model for the performance of the Malaysian construction industry.

1.1 Safety

There are several common meanings of protection in the literature. Since an entirely safe technology does not exist, meanings such as "the state of being safe from undergoing or causing hurt, injury, or failure" (Bajjou et al., 2017) may not be accurate in hazardous technologies. As a result, a better description of protection for the study would be "freedom from unreasonable risks" (Idrees et al., 2017).

1.2 Safety Hierarchy

The consistency of the various defensive barriers or layers defines an organisation's overall protection. Several models, such as James Reason's popular Swiss cheese model and the complete safety model depicted as an onion with several different layers, use this approach. Both technological and organisational considerations may be included in the layers. The process architecture is the central protective layer from a technological standpoint" (Tear et al., 2020). Fig. 1 depicts the protection onion, which depicts the steps involved in achieving safety.

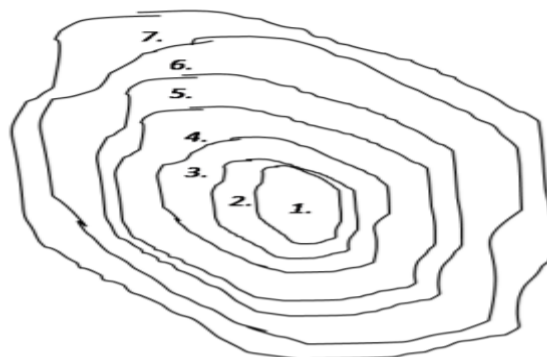


Fig. 1 - The safety onion

In order to achieve a "higher level of safety, it is common to talk about a safety hierarchy. According to Huang et al., 2020) the hierarchy is as" follows:

- Stop the danger wherever possible.
- Install passive protective equipment to keep the hazard under control; passive protective equipment does not have moving parts and must be commissioned manually or automatically.

- Incorporate active protective equipment, such as equipment with moving parts or automatically commissioned, to control the threat.
- Using operator behaviour to monitor the danger

Huang et al. (2020) suggests that the top of the hierarchy choices should be considered first. However, modifying and/or implementing routines and procedures is often the only practical (cost-effective) choice for controlling the danger (Huang et al., 2020). Consequently, the consistency of an organisation's safety routines and procedures can be considered critical to overall safety success. An accident can occur if a threat is able to penetrate all of the protective layers, including both technological and organisational layers, and make contact with the asset (e.g. a human being, property, the atmosphere).

2. Safety Performance in Construction Industry

The construction industry's safety efficiency has been improving. The importance of health and safety in the workplace has long been recognised (Abas et al., 2003). Several reports have looked at the factors that contribute to construction site incidents. The leading causes of construction accidents were listed by Toole (2002). These include inadequate preparation, insufficient safety compliance, insufficient safety equipment, unsafe methods or sequencing, unsafe site conditions, failure to use given safety equipment, a poor attitude toward safety, and isolated, abrupt deviations from prescribed actions (Lu et al., 2016). (Soon et al., 2017).

In Malaysia, the building industry has a weak safety record. The number of people injured or killed in building projects has risen over the last five years. This is because Malaysia has embarked on a massive infrastructure development programme (Sertyesilisik et al., 2016).

The authority overlooked many safety issues in construction projects due to its ignorance. This is due to the authorities' primary concern of completing as many activities as possible in order to make up for the country's lost time. Another factor contributing to the lack of safety in the Malaysian construction industry is that most construction workers are foreign nationals from other countries, so the government faces little pressure from the local community to fix the issue (Chen et al., 2017).

3. Construction Safety Performances Scenario in Developing Countries

Construction in developing countries like Pakistan and India is more labour intensive than in developed countries, requiring 2.5-10 times the number of employees per operation (Kim-Soon et al., 2016). Jobs are typically unskilled and move in groups, with or without their families, around the country in search of work. In reality, they are often split into factions. Communication issues stemming from differences in language, relationship, and culture appear to jeopardise workplace safety. There is an important distinction between large and small contractors in Pakistan. On paper, most large companies have a safety policy, but most workers are unaware of it.

Nonetheless, a number of large construction projects show regard for safety and have implemented a variety of safety procedures. They also have staff training and keep safety personnel on the job site. The majority of contractors, on the other hand, are based on growing earnings. Many building sites, both large and small, have dangerous working conditions, and workers are exposed to a number of dangers (Durdyev et al., 2017).

There are no training programmes for employees and workers on several sites, so there is no orientation for new staff or workers, no hazards are identified, and no safety meetings are held. Employees must learn from their own mistakes and experiences. In addition, remote projects are more likely to have a shortage of medical services, squalid accommodation, and poor sanitation (Awwad et al., 2016). While at work, workers take a chance, and the following issues are common:

- Accidents due to cave-ins are common when excavating in deep trenches (without adequate shoring or bracing).
- Concreting is mostly performed by labourers, and cement burns are common due to a lack of protective gloves and boots.
- Workers fall from great heights due to faulty scaffolding and the lack of safety belts; workers suffer injuries to their heads, fingers, eyes, feet, and faces as a result of the lack of personal protective equipment; and there is poor housekeeping.”

Accidents are often triggered by a lack of "understanding of the job" and poor maintenance of equipment. Although the majority of accidents go unreported, a labourer may receive first aid or medical attention if necessary. Advanced medical treatment or benefits are not available in most cases. Accidents, according to staff, are inevitable occur as a result of their own incompetence and acknowledge that construction is a hazardous profession. Nonetheless, extensive workplace injuries that result in a worker's death can be reported due to the potential for financial losses and lawsuits (Sanni-Anibire et al., 2020).

Maintenance and inspection schedules are often skipped, and equipment is only fixed when it breaks down. This approach wastes time produces unemployed workers and delays projects. Property damage is also a possibility. Concrete mixers, vibrators, water pumps, and tractors have all been known to break down in the past. Electrocution is a significant risk due to the use of substandard electrical equipment and underwater cables. Workers, especially young ones, take risks and sometimes fail to follow safety procedures or wear personal protective equipment. Additionally, staff and employees can be under the influence of alcohol or medications on occasion. Unfortunately, before and after service, crew members are not screened for drugs or alcohol” (Othman et al., 2020).

Pervasive corruption, a byproduct of bureaucratic controls, is one of the impediments to Pakistan implementing a construction "safety programme." For example, any on-site accident due to a lack of safety procedures is technically held accountable by the low-level operation supervisor (engineer/technician), not the construction manager, and may be liable to physical assault damage from the victim's community of friends in extreme situations.

In extraordinary cases, the supervisor can be charged with a crime (Gao, & Chan, 2019). Cash payments, on the other hand, are often accepted in place of pressing charges. Furthermore, since staff are typically non-residents of the region and are often unaware of their rights, injuries are frequently not reported to the appropriate authorities or are lost in the local bureaucracy if they are reported.

Owners and consultants emphasise safety before work begins, but as the project progresses, their concerns about reaching deadlines take priority, and they tend to pay little attention to safety. The owners of large projects can provide medical services on-site, but the contractors are ultimately responsible for defence. The major injuries experienced by contracting companies in Pakistan on their project sites, according to a survey conducted by Farooqui et al. (2017) and published in Farooqui (2018), are as follows, in descending order of occurrence:

- Accidents caused by falls.
- Stricken by wastage and a shortage of raw materials.
- Heat exhaustion.
- Head trauma.
- Cuts to the eyes.
- Cases that are being burned.

In the same "research," some informal studies identified a few major reasons for safety non-performance, including In terms of mechanisation and industrialisation, the construction industry is lagging behind. Insufficient and incentive-free insurance mechanisms, insufficient and incentive-free safety standards imposed by the current regulatory system, which have failed to define safety as a major industry priority, which have failed to create safety as a company survival problem and an unfavourable business environment, resulting in adversarial business relationships between stakeholders, resulting in conflicts, disagreements, lawsuits, and litigation, diverting attention away from issues such as "safety" (Isah & Ali, 2015).

4. Safety Management

Two strategies to avoid unexpected accidents are management and preparation. Effective security management can help reduce workplace injuries because accidents are unforeseen. Health management must be systematic and applicable in all aspects of the job, from the estimation phase to completion by the last worker. Everyone involved with a building project must somehow participate in the protection programme (Guo, Yu & Skitmore, 2017).

Almost all respondents in Australia agreed that “safety is the duty of both management and staff together” (Wilkes et al., 2017). Owners must ensure that the plans are secure projects in their analysis as part of their safety responsibility. He also reviews to see if the contractor has a protection programme in place. The safety programme should be included in the bidding technicalities by the owner.

The main factors affecting construction safety performance in China, according to Martnez-Aires et al. (2018), were a low level of safety awareness by the company's leaders and poor security awareness among the project managers. In Saudi Arabia, Li and Guldenmund (2018) thought the protection responsibility for the construction projects should be shared by every party involved, including the owners, designers or architects, and contractors.

In a China survey Kontogiannis et al. (2017) found that senior officials have failed to understand safety, lack of training, poor safety awareness of managers, unwillingness to provide inputs for safety, insufficient service, insufficient certified workforce capacity, poor equipment, lack of initial aid measures, insufficient or inconclusively enforced enforcement of safety regulations.

Management of construction security ensures compliance with security protocols, practices and construction sites (Wilson & Koehn, 2000). The method involves making minor or major changes to the site environment to restore regular operations according to Cheng et al. (2004). Protection should also include a management concept at any company level or part of a cross-business initiative. The management of construction should consider a security culture and a safe working environment (Flin et al., 2000). Construction management should consider a safety culture, and safety is an essential factor (Flin et al., 2000).

Work safety and safety at the building site presents a number of unique problems. Despite the challenges, well-structured and funded company safety and safety initiatives and policies minimise injuries (Salminen et al., 1993). According to Salminen et al. (1993), most companies allot minimum resources for safety management, which require contractors to select carefully from the options available. Good maintenance practices thus enhance the security efficiency of the building site. The safety-related Act, which highlights employers' responsibility to build safety and improves safety preparation and management efforts in the construction industry, has significantly enhanced construction security practices, according to Jaselskis et al. (1996). It is important, because the quality of completed projects and the safety of those who work in the industry improve construction safety efficiency (Abas, 2015).

5. Safety Performance of Construction Industry

Safety output is usually calculated using negative metrics such as the number of injuries, days lost, injury rates, and accident expense. By setting safety objectives and targets, the aim of measuring safety performance is to evaluate how effective construction firm management is at preventing accidents (Permana, 2007). Even if the size of the business does play a role in construction contractor safety, when a project has a high accident rate, the contractor involved will get a bad reputation (Wilson & Koehn 2000; Lin & Mills 2001). As a result, both large and small contractors must maintain their safety efficiency to maintain their health and safety reputations.

Jaselskis et al. (1996) presented techniques for enhancing construction safety efficiency at the project level, stressing that the most efficient way to assess safety performance is to use both "quantitative and qualitative" safety metrics. Although quantitative indicators like lost time, severity rates, and the Experience Modification Rating (EMR) – a metric for measuring insurance premiums for workers involved in injuries – are used, qualitative measures like exceptional, average, and below-average performance as defined by OHS assessors are also used. Jaselskis et al. (1996), presented numerical profiles of companies and projects in order to validate levels of safety performance at the organisation and project levels, and based on their results, they concluded that many factors are important in enhancing safety performance at both levels. Upper management assistance, time devoted to safety issues for the company safety supervisor, the number of safety inspections, meetings with field safety representatives and craft workers, and so on are all items to worry about at the company level. Increased project manager experience, a more optimistic upper management attitude toward protection, lower project team turnover at the project level, increased project safety representative time, and so on are all important factors (Jaselskis et al., 1996). This is confirmed by Jafri et al. (2005), who proposed using both leading and lagging metrics to assess safety performance.

Table 1 shows different authors' perspectives on safety metrics used to evaluate safety results. The impact of key indicators on safety performance is calculated, and the result is determined by the influence of those indicators on safety performance. Jafri and his colleagues (2005). By measuring safety efficiency using key metrics, possible hazards can be identified early and needless risks in life and money can be prevented using lagging measures to observe the outcome (Ng et al., 2012). Furthermore, regular auditing and analysis of management processes and operating procedures may be used to recognise current strengths and deficiencies in order to achieve high safety efficiency (Ng et al., 2012). In Australia, for example, a performance measurement system based on safety metres was developed. This tool is based on leading indicators, allowing staff to participate in the assessment process and increase site safety awareness (WorkCover 2001). As a consequence, tracking leading indicators and analysing the data would help to improve protection.

Table 1 illustrates some of the perceived safety metrics that can be used to measure safety performance. The Construction Industry Development Board's (CIDB indicators) are taken from government records rather than research sources.

Table 1 - Leading and lagging indicators when measuring safety performance

Authors	Leading indicator	Lagging indicator
Dyck D, Roithmayr T (2004)	Health audits are performed on a regular basis, and good injury records are kept.	The number of workplace incidents or the extent to which they occur, workers' compensation rates, the number of days off due to workplace accidents, the number of occupational diseases, and so on.
Salminen et al., (1993)	Health evaluations, toolbox meetings, owner promotions, pre-task preparation, medication screening, the number of close calls, and staff observation reports are all things to think about.	Analysis of accident costs and injury/incident rates.
Jafri et al. (2005)	The phrases "employee empowerment," "employee perception study," "safety audits," and "root cause analysis" are all used to characterise the safety culture.	Number of injuries, injury rates, days missed, and accident costs
Lin & Mills (2001)	Accountability in management, health and safety procedures, contract analysis,	Severity rates, lost time injury

design control, job method control, purchasing, inspection and testing, corrective and preventive action, non-conformance control, health and safety documents, health and safety auditing, statistical approaches, and training

6. Factors Affecting Safety Performance of Construction Project

According to Ng et al. (2012), the construction industry's safety performance is influenced by two levels: project level and organisational level. The following part, which is applicable to these two groups, addresses the factors that affect the safety performance of construction projects. Historical factors such as the economy, psychology, technology, process, organisation, and environmental issues all affect construction site safety (Sawacha, Naoum & Fong 1999). Ng et al., (2012) summarised the factors that influence project-level safety performance in order to establish a structure for assessing safety performance in construction projects:

Implementation of safety inspections - The most effective method for keeping the workplace safe and tracking unsafe practices is to perform safety inspections. Permana (2007) reported that safety inspection is very relevant to safety procedures based on a study he conducted in Batam, Indonesia, which is also endorsed by Kai et al. (2016)] and Tan and Razak (2014).

Implementing a safe system of work – According to Ismail (2006), any safety plan should be focused on a strategy that prioritises employee safety and a safe system of work. Besides, Ghani et al. (2010) state that strict adherence to the written policy is required, especially for high-rise building projects (2008). It is because all contractors and staff are aware of any work-related equipment or structures that may be hazardous to them or the general public.

Personal protective equipment (PPE) is worn at work to ensure a person's protection and well-being and any other accessory that is intended to protect him while performing a mission. To ensure a secure and stable working environment, construction workers must be provided with personal protective equipment (PPE) (DOSH 2005; Ahmad, 2008).

Implementing a secure working environment ensuring a safe and healthy workplace is one of the most important ways to reduce construction project costs. Failure to create a healthy working environment could result in an accident, which would raise the project's cost. Both the SHO and the SSS are named based on the project scope, which includes the project value, according to the law. Site safety monitoring and the provision of a secure environment, according to Jannadi (1996) and Lee & Halpin (1998), are factors related to the implementation of safety systems at construction sites (2003).

Security inspections, record inspections, and interviews are part of a safety audit (Nikolaos 2010). A safety audit is required to assess the extent to which the company complies with OSH laws and, as a result, to ensure a safe workplace.

A safety policy, according to Griffith & Howarth (2001), is a written statement that represents the organisation's vision and mission in terms of health and safety management.

An emergency drill in emergency plans and procedures should be conducted every three months, with all staff being briefed on emergency procedures. It's also a good idea to track who shows up at the designated assembly place.

Safety training, according to Paringga (2010), is education and training aimed at preventing the human error from causing accidents and enabling staff to perform a repetitive task with competence. Security training is the most important method for reducing risks, according to Lai et al. (2011), because it develops employees' skills and abilities to recognise hazards. Tsui & Gomez-Meji (1988) have claimed that one way to encourage employee safety is to have daily sessions with bosses, managers, and workers, which HR staff members can attend. Plan ahead. Permana (2007), Kai et al. (2016), and Tan & Razak (2014) are among the scholars who agree with this statement.

As can be shown, the most commonly cited factor at the project level that affects construction project safety efficiency is safety training. Through performing daily training on the staff for the particular project, safety efficiency can be increased and the number of injuries minimised. All construction and building site staff in a project must undergo safety training, which will raise awareness about workplace safety, in order for the training programme to be effective in improving safety efficiency.

Security reviews for site safety policies, as well as the implementation of a secure working atmosphere, safe working plant and equipment, and the implementation of a safe working environment, are all frequently discussed factors. This could be achieved by introducing initiatives such as a specific initiative to foster a safety culture, annual workplace inspections, and healthy workpractices to ensure a safe working atmosphere, factory, and equipment. Both the employer and the employee must obey all safety and health requirements at work.

Finally, based on the literature review, several factors that may influence the safety performance of construction projects at the project level have been established. Implementing these safety measures has several advantages, including a decrease in construction site injuries, increased efficiency, on-time project delivery, reduced compensation rates, and enhanced employee morale. In the construction industry, good project-level safety performance can improve safety performance.

6.1. Safety Program

According to Sim et al. (2017), a safety program "that has the most impact on-site safety" includes the management discussions on the safety issue, the provision of safety booklets, the provision of safety equipment and the appointment of a competent safety agent on the site. The role of safety systems in the top 100 US construction companies was analysed by Hunter & Baker (2017), which found that large companies have more structured safety programmes. They were also the safest of the actors. In companies that formally oriented employees to safety, gave the workers and the foremen incentives and employed full-time security officials, the accident rates were lower. After being engaged and trained by security managers, security members did better" (Soffin et al., 2019). Pitts et al. (2017) carried out surveys evaluating the effect of security programs on improved building safety performance and found at least the essential features such as Safety Policy, Safety Committees, Safety Inductions, Safety Training and Safety Inspections should be included while effective safety programs do not include all the elements involved..

6.2. Safety Policy

Celik et al. (2019) presented the findings of a postal survey of contractors in Singapore. The results showed that when there are insufficient company procedures in place, site injuries are more likely to occur (Pepin-Neff, & Wynter, 2018). The organisation's or company's non-measurable goals and measurable targets should be included in the health and safety policy statement. During policy changes, priorities are likely to remain unchanged, while targets will be checked, updated, or adjusted each year. The statement should be written in straightforward, plain language that is easy to comprehend (Adams et al., 2016).

When preparing a health and safety policy statement, the following points should be included or taken into account: The objectives should include health and safety, as well as welfare and environmental concerns. The title of a senior person in an association or corporation in charge of health and safety (usually the chief executive). The names of the health and safety advisers, as well as any safety" officials (Adams et al., 2016).

6.3. Safety Training

According to a report by Abdelhakim et al. (2019)," speciality contractors' safety efficiency is affected by various factors. Minimising personnel turnover, enforcing drug monitoring by employees and training workers all contribute to improving safety efficiency (Li et al., 2017). Manning et al. (2020) submitted that it is an essential requirement for many contractors to undergo safety training or refresher training at least eight hours on-site. Guo et al. (2017) have identified critical factors affecting the attitude of builders to healthy behaviour on construction sites. Trained operators and security supervisors are critical in improving safety awareness and success, according to the findings in their report. Various studies discussed the value of safety training in the construction industry to increase security performance (Li et al., 2017). Preparation for construction workers can be one of the best ways to improve the safety performance of construction site. The Chinese building industry was only trained in basic safety. Constructors in Li et al. (2018) described the training as the safety factor needed.

Abdelhakim et al. (2019) found in the Gaza Strip that 24 percent of respondents were receiving and benefitting from the training. The main training courses were primary aid courses, injury causes, accident prevention, safe and safe scaffolding and the use of safety equipment. Several respondents were also found to have received safety training in other countries like Saudi Arabia and the UAE.

In the United Arab Emirates (UAE) and other regions of the world, the Engineering Syndicate and the Contractor Union were taught. Ahmed (2005) discovered that 10% of respondents (out of a total of 83) had formal safety training courses, while the other 90% (75) had not been given training for their employees, engineers or laboratories.

7. Definitions and Concepts of Performance in the Construction Industry

Both public and private sector clients are worried about the construction industry's efficiency, according to Loosemore & Lim (2017). Karim et al. (2018) investigated the use of key performance metrics to assess performance (KPIs). KPIs allow you to compare various projects and businesses to see if any trends emerge. The specialist contractors hoped that the data patterns they found would shed light on some of the market's most widespread inefficiencies. They intend to use the data to expose inefficiencies and to help the industry develop" (Ofori, 2019).

In order to assess projects and organisational success throughout the construction industry, key performance indicators (KPIs) include variables such as time, expense, efficiency, client satisfaction, client improvements, business performance, and safety. This data will then be used for benchmarking and would be an integral part of every organisation's efforts to achieve best practise (Pulkka et al., 2016). According to Bon & Isah (2019), success assessment is a hot topic in academia and the business world. According to Jing et al. (2019), KPIs are critical for delivering value to stakeholders. As a result, businesses must ensure that they have the appropriate processes and skills in place. The KPIs often allow you to see the processes and capabilities that need to be differentiated in order to be competitive and which simply need to be enhanced or retained. Five primary stages have been defined in order to identify KPIs during the lifetime of a project, as shown in Figure 2.1 (Ishak & Azizan, 2018):

- Commit to Invest: This is the “point at which the client agrees in principle to invest in a project, spells out the criteria in business terms, and authorises the project team to begin conceptual design.”
- Agree to Construct: this is the stage at which the client permits the project team to begin work on the project.
- Ready for Use: the “point at which the project is ready for significant occupancy or use.” This could happen before the project is done.
- End of Defect Liability Period: the stage at which the contractor's obligation to rectify defects under the design contract expires (often 12 months from point C).
- Project End of Life: the stage at which the project's duration of use for its original or nearly original purpose comes to an end. This is a theoretical point over which terms such as total life costs can be applied since it is normally several years after the project's completion.

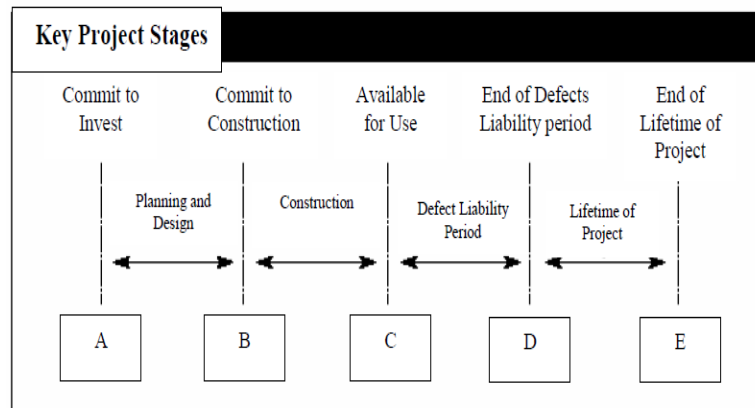


Fig. 2 - KPIs throughout the lifetime of a project
(Source: DETR, 2000)

For several years, performance “measurement” and its metrics had been researched. Performance assessment, according to Abd Jamil & Fathi (2016), is an organisational management accounting that involves both financial and non-financial performance metrics. Performance assessment, according to Boateng (2019), is the method of rethinking and reevaluating business processes in order to achieve substantial performance changes. According to Sarhan et al. (2017), performance measurement is a model that treats a project as a “complex dynamic” method.

The core "performance metrics," as described by Guo et al. (2016), are a useful measure of a project and/or company level. In certain cases, the market metric is the average of the company's project metrics. Owner satisfaction for results, according to Al-Momani (2017), is defined as the difference between what the owner expects and the level of performance they believe the contractors are providing.

According to Lehtonen (2016), success assessment is the foundation for quality improvement and control of business efficiency. Project success measurement, according to Chan & Kumaraswamy (2018), includes time, budget, protection, efficiency, and overall client satisfaction. Performance assessment, according to Thomas (2016), is the routine monitoring and control of projects. According to Kuprenas (2018), project performance measurement in the design and construction stages entails improving expense, schedule, and efficiency. According to Long et al. (2016), project success is measured using a variety of measures such as time, budget, efficiency, requirements, and stakeholder satisfaction.

According to Navon (2017), successful assessment compares expected and real results. The core performance metrics were defined by Ugwu & Haupt (2017) as site-specific and project-specific. Contractors and suppliers may provide guidance and/or practical ideas earlier through Early Contractor Involvement (ECI) and Early Supplier Involvement (ESI).

6. Malaysian Construction Industry

Malaysia is one of the 20 largest export nations in the world and is classified as an emerging industrialised region. According to the “Global Enabling Trade Study 2008,” it is ranked 29th out of 118 nations. The Malaysian construction industry is vital to the country's economy because it is intertwined with other sectors, including basic metal goods, such as the iron and steel industries and electronics (Kong et al., 2020).

In Malaysia, the construction industry is divided into two categories: general construction and speciality trade work. Building construction (both residential and commercial) and civil engineering construction are two styles of general construction (sewers, roads, highways, bridges and tunnels). The second group is special trade works, including metal fabrication, electrical work, tiling, flooring, painting, and glass fabrication, among other items (Latiffi et al., 2016). Each

type of construction project necessitates the formation of an organisation or team to prepare the structure, build it, and maintain it. 'A general contractor is anyone who performs general construction, such as building construction.' Except for specified portions of the jobs that may be transferred to special trade contractors" (subcontractor), the general contractors will assume full responsibility for the entire job (Akmam Syed Zakaria et al., 2018).

Contractors who specialise in a single occupation, such as painting, carpentry, or electrical work, are known as special trade contractors. Specialty trade contractors are not responsible for the structure as a whole, apart from fitting their jobs in with the other trades. They still get orders from general contractors, architects, or landowners for their jobs. The bulk of their jobs entails maintenance work. During the construction phase of the Malaysian construction industry, all contractors must register with the Construction Industry Development Board (CIDB) (Awang, & Iranmanesh, 2017). Owing to the high demand for building construction relative to other forms of construction, the number of contractors registering for building construction is the largest (Figure 3). In Malaysia in 2006, Fig. 3 depicted the number of contractor registrations by group 2017.

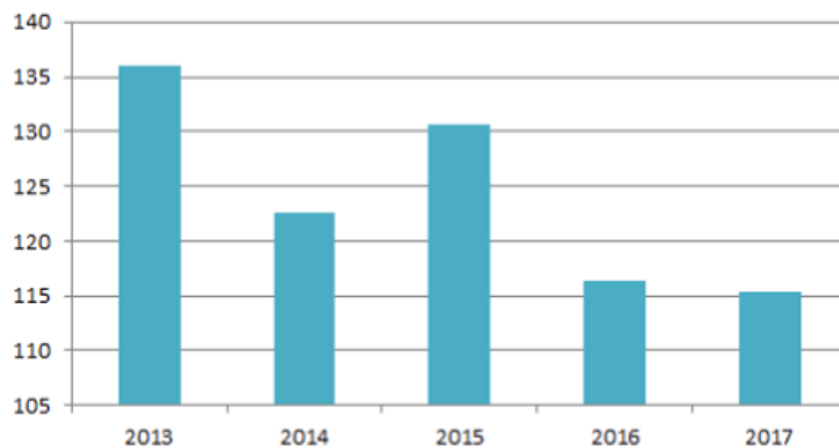


Fig. 3 - Contractors registration by category
(Source: CIDB Construction Quarterly Statistical Bulletin, Third Quarter 2017)

According to a 2009 article published by The Malaysian German Chamber of Commerce, the strong output of residential projects during the first six months of 2008 was attributed to the rapid introduction of the government's low and medium housing programmes, which grew by 3.5 percent (January-June 2007: 0.9 percent) (Ikau et al., 2016). Syarikat Perumahan Negara Berhad, for example, is building 36,000 affordable housing units. Aside from that, the extension of this project category was aided by the liberalisation of the Foreign Investment Committee's ruling on foreign property acquisitions and the promotion of Malaysia My Second Home (MM2H) (Wong, 2019). As a result, it represented a high percentage of high-end condominium construction activities, primarily concentrated in Selangor and Kuala Lumpur (Wong, 2019).

7. Discussion

According to the literature reviewed above, some researchers claim that construction safety is essential to the growth of the construction industry because if there is no safety, many employees will be adversely affected. Subsequently, the sector may collapse due to a lack of manpower. However, some researchers believe that providing workers with training could reduce the risk of an accident and improve the construction industry's performance in Malaysia. As a result, it is proposed that providing training and basic equipment to the Malaysian construction industry would undoubtedly reduce accidents and improve safety results.

8. Conclusion

This paper looked at the literature on construction safety in the Malaysian construction industry. The paper focuses on reviewing the literature on construction safety and efficiency, construction safety performance in the industry, construction safety performance in developing countries, safety management, safety programme, safety policy, safety expense, and safety training. The paper shows that proper construction safety practices would improve the overall performance of the Malaysian construction industry. It is suggested that growing research and development, training, and the availability of adequate construction materials will undoubtedly improve the Malaysian construction industry's safety and efficiency.

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