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Mediating Effect of Safety Knowledge on The Relationship between Safety Competency and Safety Attitude among Oil and Gas On-Shore Contractor Workers in Bintulu, Sarawak

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Abstract
Construction site accidents have been found to be mainly caused by workers unsafe behaviors, largely due to nonchalant attitude towards safety hazards. Workers often tend to underestimate safety risks on construction site, which limits their ability to identify hazardous situations. A growing number of studies indicate frameworks of research on safety knowledge articulate the skills, knowledge, and abilities for a skilled worker in the modern world. However, there exist a scarcity of the factors of workplace safety and health from most of the current study frameworks to prepare for the future workforce. Currently, an onshore oil and gas activity in Bintulu, which is in Sarawak warrant a deeper study on the contractor worker's Safety Competencies to better understand of other factors that may influence it. Worker's competency working in this industry needs to be strengthened as part of the element in Health, Safety and Environment Management System (HSEMS) requirement to ensure sustainable and safe operation of the plant as it contributes to HSE performance of the organization. The objectives of this study involve assessing contractor's Safety competency and Safety attitude working in the oil and gas industry in Sarawak and analyzing the mediator effect of Safety Knowledge. A survey has been conducted to assess 450 contractor worker's HSE competency. A self-administered with Likert scale questionnaire was used to collect the data. The survey results shows that education level, experience and competency played key important roles in ensuring safe execution of the work and support the hypothesis that knowledge do influence the competency as mediating

factor. Based on the findings, further studies will provide the organization a better understanding of safety knowledge and to strategize their Induction Program in ensuring that their future workforce are competent technically as well as their safety attitude prior entering the industry.
Keywords: Competency, Contract Workers, Oil and Gas Industry, Assessment Tool, On-Shore, Sarawak.

Introduction

One of the riskiest and most hazardous industries, the oil and gas sector is vital to Malaysia's economy. Bintulu, which is in the Tropics and is one of the active sites involved in this activity, is in that region. Major incidents involving this industry occur frequently all around the world, for instance, gas leaks, explosions, and tank fires. Numerous ordinary tasks performed in maintaining and running the facilities result in deadly and non-fatal injuries on a regular basis. Examples Working at a height, heavy lifting, using equipment that is highly charged, working in an area where there is a high concentration of hydrogen sulfide, handling dangerous chemicals, exposure to radioactive material, etc. Specific abilities and skills are needed by individuals before they enter the oil and gas sectors and do the job safely due to the complexity of the technology, hazards, and risk exposure. The events frequently have numerous complicated causes, one of which is the level of staff expertise (Bhusari et al., 2020).

Bintulu is a larger coastal town in the district of Sarawak, Malaysia. Bintulu located on the Kemena River, on the island of Borneo in the central part the district and 200 kilometers southwest of Miri. Before the form of Malaysia in 1963, the Bintulu town was settled in 1862 by James Brooke, a British soldier and adventure. According to Bintulu Development Authority (2023), Bintulu is also known as the “Energy Town of Sarawak”. The Bintulu latitude and longitude coordinates are 3.194335, 113.095322 which is located at Malaysia country in the towns. In 1997 December 21, there was an explosion and fire occurred at a gas-to-liquids (GTL) plant in Bintulu, Sarawak. In Bintulu, Malaysia, a significant explosion took place in an air separation unit (ASU). The Shell Middle Distillate Synthesis (MDS) Plant received oxygen from the air ASU (Van Hardeveld, 2001). The explosion severely damaged the nearby facilities in addition to destroying the ASU's main components.

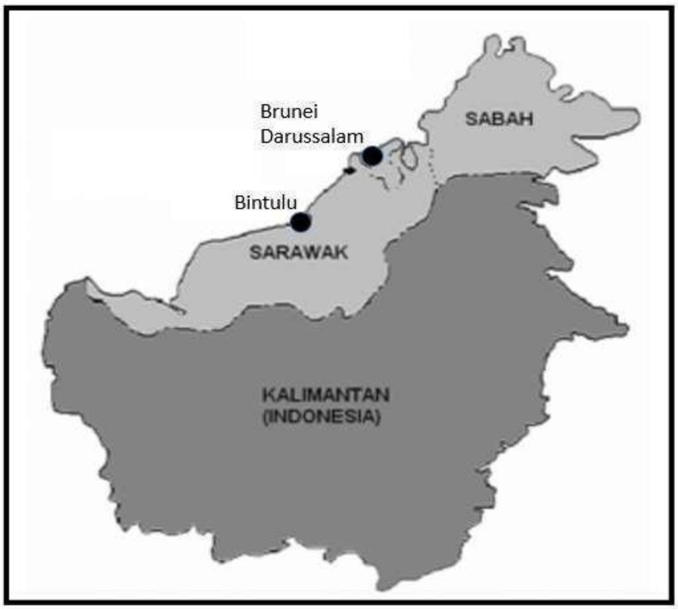

Figure 1 Borneo Map

The competence of contract workers is affected by several factors. One of them is the subcontracting approach that a big international oil and gas company has implemented in its overseas business. After 30 years of publishing, corporations started outsourcing their downsizing procedures. Cost savings was the top priority in these processes. As a result, riskier activities were outsourced to contractors rather than being transferred to risk management technology.

Contrarily, numerous reports claimed that local content problems such as a lack of skilled workers and professionals, insufficient infrastructure, and power and so forth. They were to blame for oil and gas project failures. Adolescents are likely to be inexperienced and unfamiliar with many of the tasks asked of them because they are new employees. Young workers might anticipate switching jobs and employers frequently during their working careers because of the changing nature and structure of the workplace. These changes will raise the possibility of coming across fresh or novel risks or hazards, highlighting the significance of continuing to use theoretical knowledge in occupational safety and health (Schulte et al., 2005).

Additionally, the majority of Borneo or Tropics oil and gas facilities are classified as Major Hazard Installations (MHI) by DOSH regulations, which mandates that they have effective HSEMS that aid organizations in ensuring the facility's safe operation as seen in Figure 2. One of the essential components or pillars that must exist to guarantee that employees have the necessary education, training, and experience to operate in the oil and gas industry is competency and training. Safety training revealed as a major predictor of safety knowledge, work-related injuries, and workplace accidents (Liu et al., 2020). As a result, the purpose of this study is to ascertain the mediator effect (age and working experience) between Safety Belief, Safety Knowledge, and the capacity to recognize hazards among contractor workers in the Borneo or Tropics oil and gas business which translate into their Safety Behavior.

Figure 2 On-shore Plant Facility at Bintulu Sarawak
Source: PETRONAS LNG Complex

Human Development Theories

This issue was identified in the inquiry reports for major accidents like (Alpha, 1988; Valdez, 1989; Horizon, 2010). After every significant accident, new, more stringent laws are adopted, risk-reduction strategies are implemented, and extra safeguards are put in place to prevent future occurrences (Gupta et al., 2005; Decola, 2009). Numerous studies have found that people are primarily to blame for the incident's occurrence (Vredenburgh, 2002; Mullen, 2004).

Understanding human development theories and looking into elements that can be used to enhance workforce performance are necessary to address this. Human development throughout the course of a lifetime can be explained in various ways. Development is 1) multidimensional, 2) multidirectional, 3) Plastic, 4) Influenced by multiple contexts, and 5) Multidisciplinary (Baltes & Carstensen, 2003; Baltes et al., 1998; Baltes, 1997). Human development researcher offers many theoretical explanations for the changes that occur over the lifetime. As for this research, focused are pointed to Social Learning Theory. Overcoming workforce-related difficulties in the on-shore oil and gas sector will assure solid human resource management, foster an influential talent culture, and result in a more robust business (Kanason, 2018). The demand for qualified workers rises as the case industry expands since the human resource market has become more competitive (Gallardo-Gallardo et al., 2013). Numerous studies have demonstrated that individuals are the primary cause of the issues (Vredenburgh, 2002; Mullen, 2004). Organizational variables also influence the setting that contributes to at-risk work behaviour and human mistake, in addition to humans being recognised as a contributing element (Gordon, 1998; Papazoglou and Aneziris, 1999).

Behaviorist Theory

Miller and Prentice claims that a common criticism of behaviourist theory is its neglect of internal influences on development and behaviour and overemphasis on the visible (Miller & Prentice, 2016). Albert Bandura Born (1925) supported the idea that mind and emotion play a part in growth in addition to the physical and social settings. The social learning hypothesis proposed by Bandura contends that people actively receive information, think, and experience emotion, and that these processes have an impact on their behaviour. He also emphasizes how our thoughts and emotions are influenced by our physical and social environments, which in turn affects how we behave. By considering the of our activities, we can gain knowledge. The idea of reciprocal determinatism, which holds that people and their environment interact and influence one another, is another one of Bandura's contributions to the subject of lifelong human development, which has served as a reference for this research (Bandura, 2011; Bandura, 2012). Bandura believed that humans actively shape their own development as opposed to being passively shaped by their social and physical environments, in opposition to behaviourist theorists. The social and physical environments they are in are subject to human influence. Development is specifically the outcome of interactions between an individual's traits, behaviours, and physical and social environments.

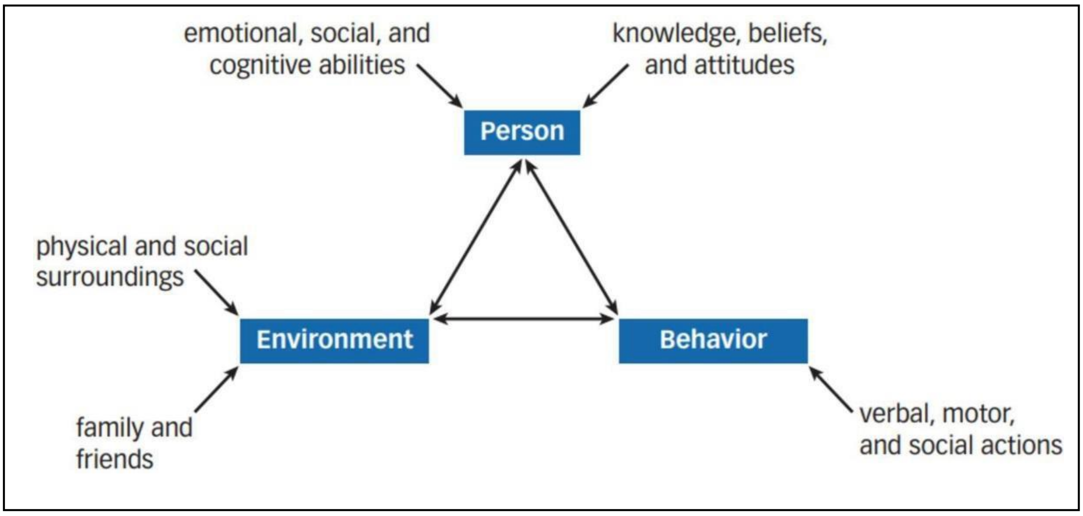

Figure 3 Bandura’s model of Reciprocal Determinism

Ability to identify Hazard (Environment)

More than 42% of construction injuries. They are the result of insufficient hazard detection and assessment (Haslam et al., 2005). Employees who lack safety expertise are at risk because they do not know how to properly approach their work. When employees lack enough safety knowledge, their workload pressure dramatically rises, and their risk of harm rises in comparison to those who do (Neal et al., 2000). People who don't have enough safety knowledge may not be able to recognize safety concerns or have a good understanding of safety procedures. As a result, they are unable to act in a safe manner when it is necessary. Inadequate safety information may cause employees to act in risky ways at work. According to Ajzen et al (2011), knowledge is a requirement for safe behavior. Knowledge is regarded in safety as being vital to many occupations and enables workers to complete the work safely. Many occupations, including crane operators, electricians, and others, call for a certificate of practice, especially for jobs that have a particular set of operational, technical, and safety criteria. According to Christian et al research safety behavior is positively impacted by safety knowledge along the full cause chain of safety accidents (Christian et al., 2009).

Research by Abu Bakar, Albert and their team highlight that hazard recognition capability of workers also has been identified as a fundamental requirement for addressing the health and safety challenges encountered on construction sites (Abubakar et al., 2020; Albert et al., 2014). Construction site accidents have been found to be mainly caused by workers unsafe behaviors, largely due to nonchalant attitude towards safety hazards (Fang & Wu, 2013; Feng, 2015). Workers often tend to underestimate safety risks on construction site, which limits their ability to identify hazardous situations (Pandit et al., 2019). The concept of Hazard recognition as the ability of managers and workers to sense, analyze, and extract physical or mental stimuli that indicates the existence of a hazardous situation in a complex and dynamic scenario of construction environments (Pandit et al., 2019; Chen et al., 2014). These hazardous situations often when not recognized and managed lead to unsavory safety incidences and fatalities in construction.

Haro & Kleiner claim that if hazards are not appropriately identified and reported, the safety management program may not be working as intended. As a result, from a behavioural perspective with training implications, the procedure calls for both acquired skills and knowledge (Haro & Kleiner, 2008). Effective safety management should be viewed as requiring the ability to recognise and evaluate hazards (Cooke and Lingard, 2011; Behm and Schneller, 2013). Numerous construction risks are not acknowledged, appreciated, or properly addressed before workers are exposed, according to research. For instance, Haslam et al (2005) discovered that workers' inadequate safety knowledge and hazard recognition abilities account for 42% of construction-related injuries. Workers are unable to change their behaviour to prevent hazard exposure when hazardous construction work scenarios are not effectively detected or conveyed. Through brainstorming-style sessions, Albert and Hallowel discovered that most workplace dangers are identified by employees based on their experience and operational knowledge (Albert & Hallowell, 2013; Wang & Boukamp, 2011). Rozenfeld cited job hazard analysis (JHA) as an illustration of one of the more sophisticated ways. JHA typically entails analyzing the project scope, defining construction tasks, identifying potential hazards pertinent to the stated task, assessing risk, and creating a safe work plan (Rozenfeld et al., 2010). Although this approach is useful, it has a number of drawbacks, including the following: (1) hazards imposed by adjacent tasks are overlooked Rozenfeld et al (2010); (2) workers frequently lack the ability to predict how tasks will be performed in the planning phase Borys (2012); and (3) workers are not fully competent or experienced enough to recognize the potential hazards. Combinations of strategies from routine inspections to behavioural safety programs in high-risk industries, have been used in practice to alleviate some of these limitations. The majority of dynamic safety hazard recognition techniques, however, continue to work under the presumption that employees are able to forecast and recognize risks on their own. Finally, due to the difference between tasks as they are conceived and accomplished, the cognitive demands of predicting dangers are quite high and frequently ineffective (Borys, 2012). The communication that is essential to ensuring crew level hazard awareness is not always facilitated by present approaches that may help with hazard recognition. Identification of undesired events that may cause a risk, study of the risk that may arise from this unpleasant event, and typically evaluation of the extent, magnitude, and likelihood of adverse impacts. It is generally acknowledged in the business world that the numerous risk assessment methods significantly enhance the security of intricate processes and machinery (Zhang et al.. 2022).

In order to develop context-based strategies for enhancing the safety performance of the construction industry, Abubakar et al (2020) classified the key factors influencing construction workers' ability to recognise hazards into four distinct taxonomies (personal, organisational, social, and project). His study found a substantial relationship between workers' personal characteristics and their capacity to recognise hazards. However, this study builds on the findings of Abubakar et al (2020) by offering insight into the dynamics of workers' safety attitudes, which is an antecedent of personal factors, influencing safety behaviour and workers' ability to recognise hazards according to ISO 10003. It is noteworthy that pointed out the complexity of the issue of worker attitudes and their relationship to safety performance in the construction business (Choudhry et al., 2008).

Workers Behaviour (Behaviour)

According to safety regulations established by their organizations, safety behaviour involves workers upholding the established working procedures, fully utilizing personal protective equipment while at work, and assisting in the creation of a safe environment that is directly beneficial to people (Griffin and Neal, 2000). Neal and Griffin (2000) discovered that safety performance is influenced by the safety atmosphere. To go further, risk perception, management, safety rules, and procedures all have an impact on how construction workers feel about safety. The way that management, safety rules, and procedures are perceived by employees affects how they feel about safety.

Additionally, Laurent and his team discovered that additional elements, such as safety motivation and knowledge, were strongly associated with safe conduct and required further discussion (Laurent et al., 2020). However, a study by Al-Zyoud et al (2019) revealed that chemical engineering students at the German Jordanian University in Jordan had only average understanding of safety symbols and risks in the lab. This demonstrated that there was a dearth of understanding among students about laboratory safety and that the university needed to implement more safety-training and awareness initiatives. The relationship between safety participation and safety participation could also shed light on the relationship between safety knowledge and safety behaviour. Stable emotional states are required for participation in safety-related activities, disseminating safety information, and assisting coworkers with technical safety issues (Mirza et al., 2019).

The literature on safety is highly ambiguous and changeable when it comes to attitude, behaviour, and terminology. According to Sawacha (1993), the definition frequently depends on the discourse context and the observables chosen as the foundation for inference. Sartain et al (1974) defined attitude as the propensity of an individual to react favorably or unfavorably towards an object or a person, despite the notion of attitude being perceived as an abstraction or a hypothetical construct rather than an actual principle. According to Katz (1960), attitude refers to a person's propensity to view a symbol, object, or aspect of the world favorably or unfavorable. The notion of safety attitude might then be viewed as broad and multifaceted, with a strong foundation in disciplines like management science, psychology, and safety science. Additionally, because behaviour is a clear expression of attitudes and beliefs, workers' social and psychological dynamics may have a significant impact on how they behave in regard to safety on construction sites (Choudhry, 2014). Lingard and Turner (2017) discovered that factors affecting the individual have an impact on how readily employees adopt healthy behaviours. This support by previous study whether the worker is cognizant of the risk to their own health (Bhandari et al. 2018). The safety attitudes of construction workers can have an impact on safety incidents and dangerous behaviours, as demonstrated by (Leung et al., 2010). Workplace mishaps are more frequently caused by employees who are unable to recognise a dangerous situation. More than 42% of injuries in the construction industry, according to Haslam and Sacks studies, are the result of insufficient hazard assessment and evaluation (Haslam et al., 2005) . Zhou and Ding (2017) noted that workers frequently found themselves in risky situations as a result of their ignorance or incapacity to act responsibly. Although their lack of information and experience may be related to their ignorance, their attitude toward safety may be what drives their risky behaviour.

When people act in an unsafe manner while performing work-related tasks, they are breaking safety regulations or protocols. Numerous studies and statistics demonstrate that workers' risky behaviour is a primary factor in workplace accidents (Salminen et al., 1998; Neal & Griffin, 2006; Jiang et al., 2010). Previous studied have number of variables that affect safety behaviour and results as such safety motivation and climate (Panuwatwanich et al., 2017). Numerous research looked at the influence of organizational level safety atmosphere on safety behaviour and outcomes. Based on the information given, it is conceivable that a worker's attitude toward safety will have a commensurate impact on their behaviour about safety and their capacity to identify risks on the job site. This presumption is supported by the psychological theory underpinning planned behaviour theory, which establishes a relationship between individual beliefs and subsequent behaviour. According to Ajzen & Fishbein (1975), a person's beliefs and attitudes toward a particular phenomenon correlate with their propensity to behave either favorably or adversely. According to Pandit et al (2019), workers who have a casual attitude toward safety risk frequently engage in risk-taking behaviour and normalize deviations from safe work practices. For instance, Perlman et al (2014) noticed that workers who frequently utilize ladders as part of their profession become less aware of the risk of falls even in situations when the possibility of a fall was acknowledged as a relevant hazard. This is also typical of those who work in other specific job trades (Choudhry & Fang, 2007). The level of workplace safety, improved safety procedures, and a lower accident rate are all associated with a positive relationship between safety climate and safe work behaviour. Safety climate is also thought to be connected to self-reports of compliance with safety procedures and involvement in safety-related activities at work, as well as a predictor of injury severity and injury frequency. Therefore, it can be stated that creating a safe environment will encourage the abolition of risky behaviours and circumstances, which will ultimately result in accident avoidance and safety enhancement.

Safety Knowledge (Person)

Safety knowledge is defined as comprehension of acquired hazard and safety controls through safety training (Goswami et al., 2011). Safety knowledge had a relationship with safety behavior, including safety compliance and safety participation (Christian et al., 2009; Keiser & Payne, 2019). This is because safety knowledge increases awareness, vigilance and makes people more responsive and alert while conducting their tasks. Previous study by Gressgård (2014) on employees of petroleum, oil, and gas industries indicated that safety compliance was influenced by safety knowledge. Another study explained that Knowledge refers to the ability and determinant of individuals to act safely through the learning process, such as participating in safety training. As for the impact, safety knowledge obtained through safety training had a critical impact on safety commitment among students in responding to act safely in the laboratory. This research was able to support the research conducted by Al-Zyoud et al (2019) that mild safety behavior among students surfaced due to a lack of safety knowledge and limited safety training. Also, the findings of this study confirmed the research conducted by Goswami et al (2011) that safety knowledge is an understanding of the hazards and safety regulations reinforce through safety training.

Safety knowledge and safety motivation are proposed to influence safety behavior through safety commitment. Safety commitment is defined as the degree to prevent risky activities, obey procedures, and trust the effectiveness of safety initiatives of the organization (Stackhouse & Turner, 2019). Safety commitment among students becomes a critical element in reducing accident rates in the laboratory (Salazar- Escoboza et al., 2020). Research conducted by Mostafa and Moments (2014) on student safety knowledge, attitudes, and behaviors in the laboratory concluded that 71.40% of students reported using safety equipment, and 61.20% reported using safety equipment while performing hazardous experiment. Tsuji et al (2016) found that safety knowledge enhanced students' commitment to safety, particularly in chemical safety. This situation was owed to the safety knowledge that provided students' details on proper handling and disposing of chemicals. Also stated that the laboratory safety program at the university enhanced student commitment and safety knowledge (Marendaz et al., 2011; Pedersen and Kines, 2011). Jeknavorian (2016), found that students were committed to monitoring laboratory accidents that could occur.

Yu (2013) identifies three types of safety knowledge: operational skills, knowledge to identify potential hazards, and knowledge to make timely resolution when employees identify these hazards. Safety knowledge is a big concern of construction management researchers (Oehling & Barry, 2019). Dragano et al (2015) reported that approximately 10% of more than 20,000 frontline employees thought that their safety knowledge was insufficient. Unrecognized hazards that remain unmanaged can potentially result in catastrophic and unexpected injuries (Namian et al., 2016). Safety knowledge, which is important for ensuring jobs safely executed, is the knowledge and skills that employees must have in dealing with various safety situations at work (Zhou et al., 2017). Occupiers operate on the premise that providing safety knowledge decreases the likelihood of on-the-job injuries (Hofmann et al., 1995). Prior studies examined the relationship between safety knowledge and outcomes (Neal and Griffin, 2006; Dong et al., 2011; Chen et al., 2012; Shin et al., 2012). Westaby and Lee (2005) found an unexpected association between safety knowledge and injury, and a recent study found that safety knowledge does not necessarily lead to behavior that promotes safety (Manning, 2018). These findings imply that in some circumstances, an employee's safety knowledge may not be transferred automatically to safety outcomes. However, in construction management research, the role at individual-level factors and their mechanisms still yet to be assessed. Little is known about how safety knowledge leads to safety behavior and how personal factors interact to facilitate safety outcomes (Kao et al., 2019). Scholars called for studies on individual factors (Cooper and Sutherland, 1987) and mediators (Fugas et al., 2012) in safety research.

According to Yu, Physiological perceived control (PPC) referring as ability to perceive the degree of difficulty in performing expected behaviors and controlling work safely. In the absence of a sense of control, an individual is unable to manage work properly with conscious awareness and physical strength. For example, in the long-distance passenger transport industry, fatigue driving (falling asleep for as little as 1 or 2 s) leads to losing control of the vehicle. From this discussion, Yu argues that perceived control is a key factor affecting the relationship between safety knowledge and outcomes. This factor could explain to some degree the phenomenon that people with the same level of safety knowledge might exhibit different levels of safety behavior (Yu, 2013). Drawing on existing literature makes it realistic to assume that safety knowledge influences safety outcomes through behavior. PPC moderates the relationship between safety knowledge and behavior because an individual with low levels of perceived control exhibits less expected safety behavior. The combination of the mediating role of safety behavior and the moderating role of perceived control produces an integrated model. In this study, Yu advances this line of research by examining the roles of safety knowledge, PPC, and safety behavior in influencing safety outcomes. Moreover, the safety belief among the employee belief may encourage employees to perceive the seriousness of an issue that their organization will attempt to address and feel empowered to solve it, thereby increasing their work performance (Lee, 2022).

According to Christian, he pays attention to how individual level factors act as mediating and moderating factor that together affect the process of safety knowledge and outcomes. This focus is an important step in understanding the situation under which safety knowledge influences safety behavior and, in turn, creates safety outcomes. This research may also encourage future researchers to address other boundary conditions at the individual and organizational or working environmental levels on safety behavior in the construction industry (Christian et al., 2009). This study also generates knowledge that safety managers could use to reduce or eliminate situations that weaken the PPC of construction workers or to create conditions that enhance their PPC. Finally, according to Mimiaga et al (2009), the key extension of the theory of planned behavior (TPB) (Ajzen, 1991) is the concept of perceived behavioral control, defined as an individual's perception of the ease or difficulty in performing the behavior. However, some argument exists in the literature about the nature of perceived control and the clarity of this concept (Mimiaga et al., 2009). TPB measures the need to reflect the specificity of the desired behaviors in context. In the area of construction safety, Mimiaga focus less on the efficacy aspect of perceived control (best captured in the safety knowledge construct) and more on the perceived physiological ability to perform desired safety behavior. This focus provides a more specific application of the concept of perceived control in the construction industry.

Furthermore, safety knowledge can increase students' intentions to improve safety behavior in the laboratory. If students did not have proper safety knowledge, they have less intention of experimenting in the laboratory safely, and then they cannot change their behavior towards safety. Consequently, the combination of safety knowledge and safety commitment will enable students to engage in activities safely during experiments in the laboratory. Notably, young people frequently enter the labor force lacking even the most basic workplace safety and health knowledge and skills needed to be cognizant of the safety and health challenges and hazards they may face. The inverse relationship between age and non-fatal work injuries is a consistent association found in occupational safety and health research (Breslin & Smith, 2013; Laflamme & Menckel, 1995; Salminen, 2004). Adolescent sensation seeking—the desire to pursue novel and intense experiences and sensations—and adolescent risk taking, especially when in the company of other young people, are commonly observed phenomena among developing youth (Spear, 2000; Steinberg, 2005, 2011). Moreover, when adolescents experience an absence of negative consequences when they engage in risky behavior, feelings of invulnerability may increase (Reyna& Farley, 2006). Lack of job-related knowledge, skills, and training; and lack of job control also contribute to heightened risk among younger workers, who might be less likely to recognize hazards, less likely to speak up regarding safety issues (Polzer, et al., 2007; Tucker & Turner, 2013; Zakocs et al., 1998), and less aware of their legal rights as workers (NIOSH, 2003).

In general, workers that working in oil and gas industry is highly equipped with high education and experience employees but lack of knowledge of the issues pretending to hazard associated with the work. They only know how to carry out their work without knowing the potential hazards associated to their work that can cause injury. PETRONAS has developed technical standard to assist contractor in identifying competency requirement to engage worker in their activity as shown in Figure 4.

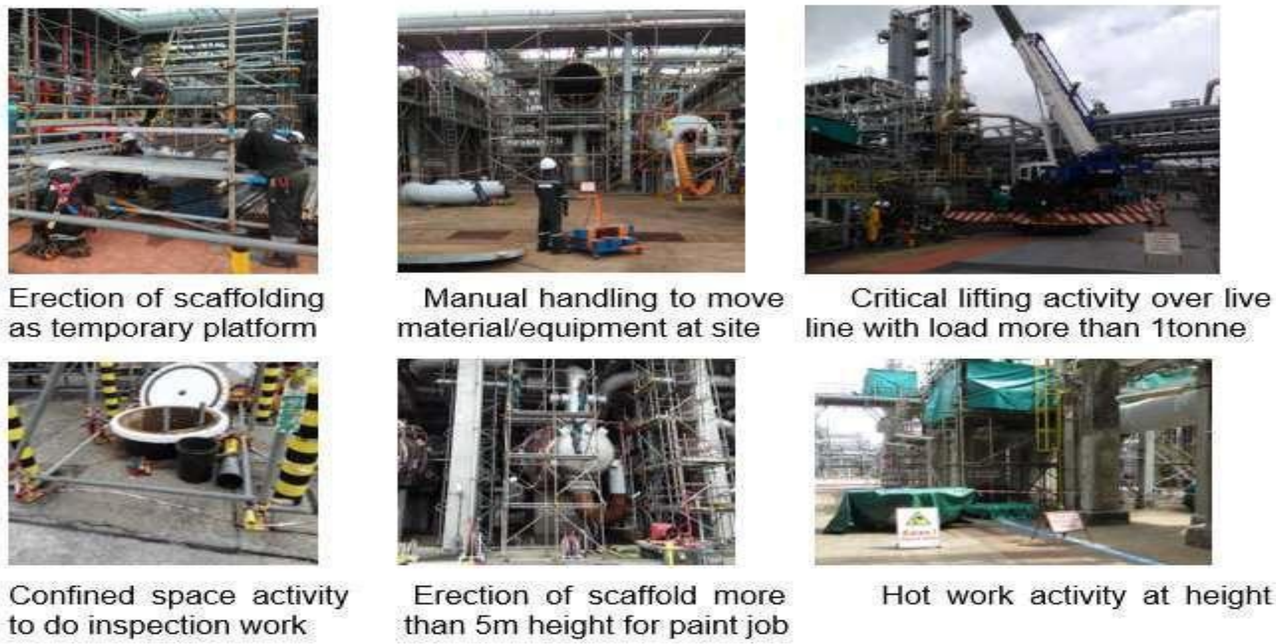

Figure 4 Worker activity in Oil and Gas Industry

Figure 4 Worker activity in Oil and Gas Industry for these studies, research framework being design to facilitate the analysis are as pe figure 6 below:

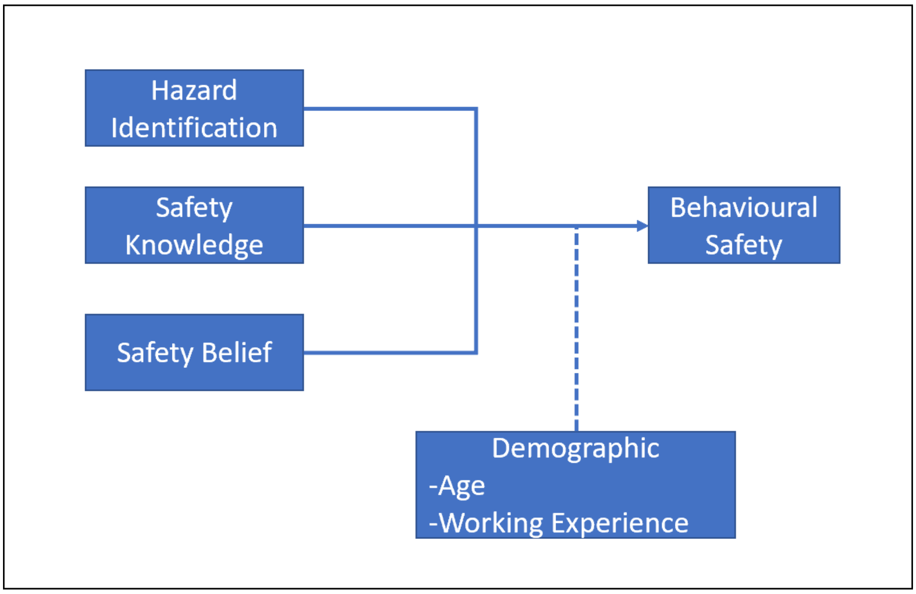

Figure 6 Research Framework

Data Collection

Following from the method selected above, survey instrument has been developed in collaboration with subject matter experts from various disciplines. samples have been collected to confirm reliability of the questionnaire. From reliability statistics test conducted, alpha coefficient for the 4 sets of questions found to be respectively 0.833, 0.76, 0.831 and 0.94. This concludes that the items have relatively high internal consistency. (Note that a reliability coefficient of 0.7 or higher is considered "acceptable" in most social science research situations.)

Table 1
Reliability Test Summary from all 4 sets questions

Case Processing Summary (Safety Behaviour)

		N	%
Cases	Valid	450	100
	Excluded	0	0
	Total	450	100

Reliability (Safety Behaviour)

Chronbach's alpha	Chronbach's alpha based on	N of items
0.833	0.837	20

Case Processing Summary (Safety Belief)

		N	%
Cases	Valid	450	100
	Excluded	0	0
	Total	450	100

Reliability (Safety Belief)

Chronbach's alpha	Chronbach's alpha based on	N of items
0.76	0.78	20

Case Processing Summary (Safety Knowledge)

		N	%
Cases	Valid	450	100
	Excluded	0	0
	Total	450	100

Reliability (Safety Knowledge)

Chronbach's alpha	Chronbach's alpha based on	N of items
0.831	0.89	32

Case Processing Summary (Hazard Identification)

		N	%
Cases	Valid	450	100
	Excluded	0	0
	Total	450	100

Reliability (Hazard Identification)

Chronbach's alpha	Chronbach's alpha based on	N of items
0.94	0.939	21

Frequency analysis also has been conducted where “Hazard Identification” surfaced an interesting finding where about 25% of population falls under Low categories which summarized as per Table 2 below.

Table 2
Summary of Frequency Analysis

No	Variables	Low	Medium	High
1	Safety Behaviour	59	305	86
2	Safety Knowledge	56	311	83
3	Hazard Identification	111	261	78
4	Safety Belief	64	266	120

Range classification above was determined using formula

Range	Level
X < [4.1 - 1(SD)]	Low
[4.1 - 1(SD)] < X < [4.1 + 1(SD)]	Medium
[4.1 + 1(SD)] < X	High

* SD = Standard Deviation

Further analysis on 25% data recorded for Hazard Identification from test concluded. Three interesting findings

1. Respondent’s educational level are between SPM/SPMV and Diploma Level.

1. The findings are in line with other studies by Salminen (2004); Breslin & Smith (2007), which showed that younger age groups are more likely to experience workplace accidents.
2. Young persons are more likely to have occupational accidents due to inexperience, limited job tenure, and the type of industrial setting (Bena et al., 2013; Breslin et al., 2007).
3. According to earlier research, students' knowledge and awareness of occupational safety are frequently lacking in the upper secondary level of school (Salminen & Palukka, 2007; Andersson et al., 2015).

2. Their working experience are between 0~5years and 6~10 years.
   1. These results are consistent with Mullen's studies from 2004, which found that people might engage in risky behaviour at work if the perceived benefits outweigh the risks (risk of being injured).
   2.Prior research has demonstrated that peer workers have an impact on young employees' risk-taking orientation at work (Westaby & Lowe, 2005).
   3. According to Breslin et al (2007) research, young workers can consider accidents to be "part of the job." The locus of control idea describes how much a person believes they have influence over how things turn out in the settings they encounter.
   4. Research has also shown that management engagement and dedication are essential components in establishing success in workplace safety performance (Langford et al., 2000; Sawacha et al., 1999; Tam et al., 2004).
   5. Youth may lack the knowledge and experience necessary to react to risky working conditions (Kincl et al., 2016). For instance, Mullen (2004) discovered that young employees may decide not to utilise safety equipment or may choose to operate dangerously to avoid receiving jeers from their coworkers. In turn, Tucker and Turner (2013) explain how young employees' unwillingness to take action to address safety issues can be connected to an underlying fear of being fired, their status as newcomers, and their emotions of helplessness.

3. The distribution between Permanent and Contract Worker are equal.

Numerous reports claimed that local content problems—such as a high proportion of imported raw materials, a lack of qualified professionals and labour with the necessary technical skills, poor infrastructure and power, etc.—were to blame for oil and gas project failures. These changes will increase the likelihood of coming across fresh or novel risks or hazards, highlighting the significance of continuing to use theoretical knowledge in occupational safety and health (Schulte et al., 2005). These three findings will be analyzed further upon full scale data collection in the later stage.

Confidence Interval

Data will be collected through distribution of survey to a group of workers. Data collection through survey/questionnaire is seldom done with entire populations but rather with samples drawn from a population. Even though we work with samples, our goal is to describe and draw inferences regarding the underlying population. It is possible to use a sample statistic and estimates of error in the sample to get a fair idea of the population parameter, not as a single value, but as a range of values. This range is the confidence interval (CI) which is estimated based on a desired confidence level.

Formulas for calculating CIs take the general form:
CI = Point estimate ± Margin of error Point estimate ± Critical value (z) × Standard error of point estimate

$$p \pm z\ value \times \sqrt{\left[p \frac{(1-p)}{n} \right]}$$

The CI of a statistic may be regarded as a range of values, calculated from sample observations, that is likely to contain the true population value with some degree of uncertainty. Although the CI provides an estimate of the unknown population parameter, the interval computed from a particular sample does not necessarily include the true value of the parameter. Therefore, CIs are constructed at a confidence level, say 95%, selected by the user. This implies that were the estimation process to be repeated over and over with random samples from the same population, then 95% of the calculated intervals would be expected to contain the true value. Calculation of the CI of a sample statistic takes the general form: CI = Point estimate ± Margin of error, where the margin of error is given by the product of a critical value (z) derived from the standard normal curve and the standard error of point estimate.

The factors influencing the width of the CI include the desired confidence level, the sample size and the variability in the sample. Although the 95% CI is most often used, a CI can be calculated for any level of confidence. A 99% CI will be wider than 95% CI for the same sample.

Table 3 indicates how required sample size for population surveys varies with acceptable margin of error and confidence level.

Table 3
Sample size required for surveys

Estimated population size	Margin of error					
	Confidence level 95%			Confidence level 99%		
	5%	2.5%	1%	5%	2.5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1,000	278	606	906	399	727	943
10,000	370	1332	4899	622	2098	6239
100,000	383	1513	8762	659	2585	14227
500,000	384	1532	9423	663	2640	16055
1,000,000	384	1534	9512	663	2647	16317

Sample size is larger for a lower margin of error or higher level of confidence. Once the estimated population size is very large (>100,000), the sample size is not changing much.

Discussion

The construct of safety behaviour shows that the result for reliability was 0.83 this show that the employee in the plantation was aware of the safety behaviour. The value of the

Cronbach's alpha show that majority of the employee in the plantation aware of their own risk for the health safety as state by the (Bhandari et al., 2018). Furthermore, from the result shown that the employees' willingness to adopt healthy habits is influenced by elements that are specific to each individual (Lingard & Turner's, 2017). Subsequent, for the construct of safety knowledge show that the value of Cronbach's alpha is 0.831, this led to the employee have practice very well for the knowledge of safety in the workplace. the findings of this study have proven that previous studies done by Koa et al (2019) coincides with the researcher's current study value. The safety knowledge has led to how this personal factor interacts with individual colleagues in ensuring safety knowledge is very important to every employee by sharing knowledge related to safety knowledge in addition to putting it into practice.

For the construct of safety belief, the value was 0.76. As state by Lee (2022), trust or will encourage employees to follow the safety practices that have been set by the organization, encourage in good safety behavior and also be able to foster employee safety. Therefore, directly this belief has been influenced by safety and safety motivation which has been suggested by (Stackhouse & Turner, 2019). Hazard identification show highest value among all the construct which is 0.94. All the workers aware about the hazard identification in their workplace. The workers aware to recognize the hazard in the workplace as there have been training from the beginning this has support the previous study which is that numerous risk assessment methods significantly enhance the security of intricate processes and machinery (Zhang, 2022).

Conclusion

Following successful initial outcome from this data collection which tested to 450 contractor workers, detail analysis to be conducted on mediator factor (age and working experience) against 3 variables that has been discussed above.

Outcome from this can be used for future research in developing assessment tool for contractor workers in onshore oil and gas industry in Borneo or Tropics. Understanding the relationship between Safety Knowledge to Safety Behaviour will help the industry to charter the strategy in shaping the contractor behavior towards Safety, which as a result will reduce number of incidences, improving their HSE performance and translated into good productivity.

References

Abubakar, M., Ibrahim Y. M., Bala, K., & Ibrahim, A. D. (2020) Identifying the Factors Influencing Hazard Recognition Capability of Construction Workers.

Albert, A., Hallowell, M. R., and Kleiner, B. M. (2014) Enhancing Construction Hazard Recognition and Communication with Energy-Based Cognitive Mnemonics and Safety Meeting Maturity Model: Multiple Baseline Study.

Al-Zyoud, W., Qunies, A. M., Walters, A. U. C., & Jalsa, N. K. (2019) Perceptions of Chemical Safety in Laboratories.

Ajzen, I., & Fishbein, M. (1975) A Bayesian Analysis of Attribution Processes.

Andersson, M., Gunnarsson, K., & Rosen, G. (2015) Safety and health at work

Bandura A. (2011) A social cognitive perspective of positive psychology

Bandura A. (2012) On the Functional Properties of Perceived Self-Efficacy Revisited

Behm M., & Schneller A. (2013) Application of the Loughborough Construction Accident Causation model: a framework for organizational learning

Bena, A., Giraudo, M., Leombruni, R., & Costa, G., (2013) Job tenure and work injuries: a multivariate analysis of the relation with previous experience and differences by age.

Bhandari, G., Atreya, K., Yang, X., Fan, L., & Geissen, V. (2018). Factors affecting pesticide safety behaviour: The perceptions of Nepalese farmers and retailers. *Science of the total environment*, *631*, 1560-1571.

Bintulu Development Authority. (2023). History: Bintulu in General. Bintulu Development Authority website. Retrived: https://www.bda.gov.my/page-0-92-75-History.html

Bory D. (2011) The role of safe work method statements in the Australian construction industry

Breslin, F. C., Day, D., Tompa, E., Irvin, E., Bhattacharyya, S., Clarke, J., & Wang, A. (2007a). Non-agricultural work injuries among youth: A systematic review. American Journal of Preventive Medicine, 32(2), 151–162. http://dx.doi.org/10.1016/j.amepre.2006.10.007.

Breslin, F. C., & Smith, P. M. (2013). Risk factors for nonfatal work injury for young workers: A review of two relevant literatures. In C. W. Runyan, J. Lewko, K. Rauscher,D. Castillo, & S. Brandspigel (Eds.), Health and safety of young workers: Proceedings of a U.S. and Canadian series of symposia. DHHS (NIOSH) Publication No. 2013–144. (pp. 80–104). Cincinnati, OH: US Department of Health and Human Services.

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Chen, A., Golparvar-Fard, M., & Kleiner, B. (2014) Saves: A Augmented virtuality strategy for training construction hazard recognition.

Choudhry, R. M. (2014) Behavior-based safety on construction sites: A case study.

Christian, M. S., Bradley, J. C., Wallace, J. C., & Burke, M. J. (2009). Workplace Safety: A Meta-Analysis of the Roles of Person and Situation Factors

Cooke, T., & Lingard, H. (2011) A retrospective analysis of work-related deaths in the Australian construction industry.

Cooper, C. L., and Sutherland, V. J. (1987). "Job stress, mental health, and accidents among offshore workers in the oil and gas extraction indus tries." J. Occup. Med. 29 (2): 119–125.

Culture. (1991). S. Culture Safety series no. 75 INSAG-4, international nuclear safety advisory group International Atomic Energy Agency, Vienna (1991)

Russo, D. (2016). Competency Measurement Model.

DeCola, E. (2009). A review of double hull tanker oil spill prevention considerations

Donald, P., Dingsdag, H. C., Biggs & Vaughn, L. S. (2008). Understanding And Defining OH&S Competency for Construction Site Positions: Worker Perceptions.

Gallardo-Gallardo, E., Dries, N., Gonz_alez-Cruz, T. F. (2013). What is the meaning of 'talent' in the world of work? Hum. Resour. Manag. Rev. 23 (4), 290-300.

Fang, D., & Wu, H. (2013). Development of a Safety Culture Interaction (SCI) model for construction projects

Feng, Z. (2015) An Empirical Study of Employees' Safety Perceptions of Site Hazard/Accident Scenes.

Lee, Y. (2022). How dialogic internal communication fosters employees' safety behavior during the COVID-19 pandemic. *Public relations review*, *48*(1), 102156.

Reyna, V. F., & Farley, F. (2006). Risk and rationality in adolescent decision making: Implications for theory, practice, and public policy. *Psychological science in the public interest*, *7*(1), 1-44.

Stackhouse, M., & Turner, N. (2019). How do organizational practices relate to perceived system safety effectiveness? Perceptions of safety climate and co-worker commitment to safety as workplace safety signals. *Journal of safety research*, *70*, 59-69.

Salazar-Escoboza, M. A., Laborin-Alvarez, J. F., Alvarez-Chavez, C. R., Noriega-Orozco, L., & Borbon-Morales, C. (2020). Safety climate perceived by users of academic laboratories in higher education institutes. *Safety science*, *121*, 93-99.

Schulte, P. A., Stephenson, C. M., Okun, A. H., Palassis, J., & Biddle, E. (2005). Integrating occupational safety and health information into vocational and technical education and other workforce preparation programs. *American Journal of Public Health*, *95*(3), 404-411.

Van Hardeveld, R. M., Groeneveld, M. J., Lehman, J. Y., & Bull, D. C. (2001). Investigation of an air separation unit explosion. *Journal of Loss Prevention in the Process Industries*, *14*(3), 167-180.

Westaby, J. D., & Lowe, J. K. (2005). Risk-taking orientation and injury among youth workers: examining the social influence of supervisors, coworkers, and parents. *Journal of Applied Psychology*, *90*(5), 1027.

Zhang, L., Wang, J., Wang, Y., Sun, H., & Zhao, X. (2022). Automatic construction site hazard identification integrating construction scene graphs with BERT based domain knowledge. *Automation in Construction*, *142*, 104535.