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Ranking of human factors affecting contractors' risk attitudes in the Malaysian construction industry

Taofeeq.D. Moshood *, A.Q. Adeleke, Gusman Nawanir, Fatimah Mahmud

Faculty of Industrial Management, Universiti Malaysia Pahang, Pahang, Malaysia

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ABSTRACT

Project risk assessment is an operative tool for development and controlling cost, time, and attaining the technical performance of a construction project. Construction projects often face a lot of uncertainties, which place building and road construction projects at the risk of time overruns, cost as well as poor quality delivery. Therefore, project risk management is an essential part of the decision-making process in a construction company as it determines the success or failure of construction projects. This paper aims to determine the extent of construction risk management among the Malaysian construction companies and to rank the specific factors affecting contractors' risk attitudes among the Malaysian construction companies. Simple random under probability sampling techniques were used. A review of relevant literature and a questionnaire with a five-point Likert scale of (1) very low to (5) very high was adopted in gathering data regarding the extent of risk management and ranking of human factors affecting contractors' risk attitudes in the Malaysian construction companies. The sample size used for analysis is 146. This study also focused on the G7 contractors operating in the Malaysian construction industry. Findings revealed that construction risk management has not been highly implemented among the Malaysian construction companies and that the five leading factors affecting risk attitudes of contractors are as follows: work experience, physical health, educational background, professional competence, and emotional intelligence. The outcomes of this study can be used to inform decision-makers about strategies for risk management in handling contractors' risk attitudes, thus providing stakeholders with the necessary information for enhancing risk management performance in the construction industry.

1. Introduction

Construction risk management is the process of defining and analyzing risks and deciding on the appropriate course of action to minimize these risks while still achieving business goals. All the necessary steps about the construction risk management process should be included to deal with risks for the proper implementation of a project. Due to the nature of construction projects, construction risk management is very important in the process of erecting buildings (Liu et al., 2010).

In Malaysia, the construction industry is one of the biggest sectors that have significantly and rapidly contributed to the country's economic growth. Many construction projects in Malaysia in the process of initiating, planning, controlling, executing, and closing have experienced high risks. Besides, the risk level during the construction phase is recognized as a risk higher than that of the economic sector. Risk is frequently found in some of the processes involved in project management among construction companies (Taofeeq & Adeleke, 2019).

Construction risk management is primarily a decision to be made, rather than a predetermined outcome. The risk is present in every endeavour we stumble upon, and hence, the fate of any project or plan depends decisively on how we respond and cope with it. In general, risk management is a vital, an on-going, and an iterative process used to identify possible risks sources during different phases of projects under development (Boateng PAhiaga-Dagbui, Chen, A Aboagye-Nimo). Tserng et al. (Tserng et al., 2009) state that risk management must be carried out throughout the life cycle of the construction project from the initial stage until the commissioning of the project. The construction sector, perhaps more than others, is overloaded with risk because of the uncertainty involved in the process of erecting construction projects. Managing risks in construction projects has been recognized as a very important process for the achievement of a project's objectives in terms of time, cost, quality, safety, and environmental sustainability. The outcome of managing project risk can be evaluated through the following criteria: time, cost, quality, scope, resource, and activity (Radujkovi and Sjekavica, 2017).

* Corresponding author.
E-mail address: taofeeqmoshood@gmail.com (Taofeeq.D. Moshood).

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Therefore, many critical factors influence the effective management of risk in the construction of projects. There is unanimity among project and risk practitioners about the most significant factors affecting construction risk management, which is the "human factors." Human factors can be defined as a specific, group, and organizational factors that influence the achievement of project goals by indirectly shaping the behaviours of the project team members (Thevendran et al., 2004). Specific factors can be referred to as educational background, professional competence, physical health, emotional intelligence, and work experience (Taofeeq & Adeleke, 2019). Group factors can be referred to as leadership styles, communication methods, coordination, and empowerment, while organizational factors can be referred to as corporate policies, procedures, and senior management styles. Since the influence of each factor varies, this study, therefore, explains the importance of each factor. The understanding of human factors can help the contractors and project managers of the construction companies to utilize the available resources effectively (Taofeeq et al., 2020a). Therefore, for a successful implementation of risk management in the construction companies, more attention must be paid, and, at the same time, more efforts must be made towards overcoming or preventing factors affecting contractors' risk attitudes, especially human factors.

Although many scholars have emphasized the implementation of risk management, no study has been reported to evaluate the extent of risk management implementation, specifically on human factors with reference to contractors' risk attitudes in the Malaysian construction companies. Also, it is essential to know the level of adaptation to risk management. Therefore, the findings of the study would provide decision-makers with valuable managerial implications necessary for carrying out risk management. The current study aims to investigate the extent of construction risk management and to rank the factors affecting the contractors' risk attitudes in Malaysian construction companies. Descriptive statistics will be adopted in analyzing the quantitative data. The findings will contribute to the body of knowledge from the following two perspectives: (1) it will give insights into contractors' attitudes regarding the importance of risk management. (2) It will throw more light on the level of adoption of construction risk management among the construction companies in Malaysia.

2. Literature review

2.1. Risk

In the era of progressive globalization, it is difficult to avoid risk. As stated in the Project Management Institute PMI, (PMI, 2008), the risk is an uncertain condition that has a negative impact on the goal of a project. Risk is present everywhere (Perera et al., 2009), and the concept of risk varies according to individuals' viewpoints, attitudes, and experience. Engineers, designers, and contractors view risk from the technological perspective; lenders and developers tend to view it from the economic and financial aspect; health professionals, environmentalists, chemical engineers see the risk from the environmental perspective. Risk is, therefore, generally seen as an abstract concept whose measurement is challenging (Al-Shibly et al., 2013), (Hellstén, 2018).

Also, Risk has been understood in many ways, and the use of the word has changed over the years. The idea of risk usually relates to a threat or danger of some sort, but the risk can also connote opportunity or possibility. A common way of defining risk is as a function of its outcome and probability (Juvonen & Graham, 2014). In academic texts, the concept of risk may vary across different disciplines. A key component of risk is uncertainty; i.e., something with an uncertain outcome is risky.

Although dealing with "risk" is an age-old practice, the concept of "risk assessment and management" is relatively new, having been formally acknowledged and practiced for the last 20–30 years using this terminology. Through this time, the need for guidance to include a framework for risk evaluation and risk control became more evident as risk problems grew more complicated, and appropriate scientific knowledge became more comprehensive (Holton, 2004). Several international, national, and provincial/state organizations are increasingly implementing broad strategies to risk evaluation, risk management, and risk communication. Such methods are viewed as a tool to systematically evaluate, execute, and relate diverse and varying risk knowledge regarding human factors (Adeleke et al., 2020). The methods used, however, continue to vary considerably between, and even within, the various organizations that espouse their usage. It resulted in a loss of continuity in dealing with cross-cutting problems such as communication, enforcing standards for professional evaluation, and implementing strategies for risk management. These discrepancies produce inaccurate risk assessments, weaknesses in communication, and inadequate usage of tools intended to tackle human risk factors.

All organizations encounter the human error, the source of which can be attributed to their own conduct or to the environment in which they exist. By acknowledging risk and its uncertainty, organizations can anticipate and equip themselves to deal with the various albeit unpredictable situations (Adewale et al., 2016). Organizations are made up of the people within them, so the actions and conceptions of these individuals will have significance on how the organization considers risk. Personal views and the understanding of risk will change from one person to the next (Hellstén, 2018). The level of risk inherent in some ideas or endeavour might be fundamentally different if one were to ask an expert on the relevant field or a layman (Juvonen & Graham, 2014).

Therefore, there is a need to tackle the causes of risk and disaster in the construction industry in order to trigger long-lasting improvement. A review of the literature shows that several researchers have been enthusiastic about discovering the variables that influence construction risk management. Kartam and Bouz (Kartam & Bouz, 1998) performed an analysis among the construction companies in Kuwaiti. It was noted that the causes of accidents were attributed to workers' turnover and false acts, poor safety performance, insufficient cleaning, and unusable materials, destiny, poor maintenance of the tools, faulty supervision, and misplacement of items. Abdelhamid and Everett (Abdelhamid and Everett, 2000) published a more detailed study from the U.S by classifying the triggers into human and physical influences. Failure to wear personal protective equipment (PPE), horseplay, running equipment without authority, working at a dangerous speed, personal factor, lack of safety devices, repair of moving and energized machinery, hazardous place or posture, usage of faulty equipment or facilities, and other unsafe behaviour (Rejda, 2011). Although that was attributed to physical factors, dangerous conduct of person(s), disregard for established specified procedures, the incident is leading to defects, danger to garments or apparel, environmental threat, fire hazard, hazardous arrangement, hazardous method, housekeeping threat, insufficient personnel assignment, inadequate guard, public hazard, and other unhealthy circumstances are causes of risk.

Lubega et al. (Lubega et al., 2000), performed research in Uganda and discovered that the causes of accidents were primarily attributed to lack of knowledge of safety regulations, lack of implementation of safety regulations, insufficient understanding of health by people participating in construction projects, the participation of inexperienced personnel, non-vibrant professionalism, technical failure of construction machinery/equipment, physical and emotional stress.

Human error and unsafe conduct are also the causes of disasters that can lead to serious injury. Although the human error was a major cause of risky behaviours and injuries, earlier research did not offer much insight into the behavioural process that contributes to unsafe behaviours that this study aims to fill.

2.2. Construction risk management

The term risk management has been applied to business since the 1950s, but the use of the term itself was uncommon at that time. During the early era of construction risk management, corporations were mainly concerned with hazardous risks and insurance. The following decades

saw numerous developments in politics, regulation, and business trends in general, resulting in more efficient yet riskier operations (Hellstén, 2018). The need for a more refined understanding of risk and construction risk management grew, as shareholders and other stakeholders began to voice their concerns progressively (Kartam & Bouz, 1998). Over the years, construction risk management has been defined in many ways, and these have continued to evolve through more recent events such as the financial crisis (Kwon & Skipper, 2007). Though risk and risk management often have a negative connotation, risk management has more or less a positive implication, which is an integral part of any organization. Risk management can be used to identify, evaluate, and control opportunities (Hellstén, 2018).

Risk management is a function that applies to all types of operations. The value of successful risk management is higher in industries and organizations where the risk of harm, loss, or damage is or has the potential to be catastrophic (Hellstén, 2018). Such circumstances are often associated with high-risk industries (Juvonen & Graham, 2014). The construction industry is often described as a high-risk industry alongside aviation, manufacturing, and oil and gas production (Kartam & Bouz, 1998). Such organizations are characterized by high risk operating conditions where the outcomes have the potential to be catastrophic and fatal. The potential consequences require risk management is a core part of how they operate and their overall performance (Al-Shibly et al., 2013).

The assessment of the level of risk is potentially the most subjective aspect of the process requiring individuals to consider the likelihood of an event and also the potential consequences (Kartam & Bouz, 1998). While several tools often assist this decision-making process, there remains the potential for over-exaggeration both on occurrence and outcomes. A common oversight is for assessors to consider the risk before any controls are implemented. Unless the task or activity is new and innovative controls will be in place. It is the effectiveness and appropriateness of the controls that should be assessed and used to inform both likelihoods of occurrence and potential outcome (Al-Shibly et al., 2013). The use of adverse incident data provides a wealth of information on types of incidents occurring. Investigation of these incidents provides information as to why it happened and how to improve the system. However, this remains a reactive approach allowing harm, loss, or damage to the organization and staff to occur before action is taken. In the spirit of a system committed to improvement, the risk assessment process needs to be more proactive and comprehensive, embracing human and system failures, their independent robustness, and the interrelationships in risk management (Kartam & Bouz, 1998).

A risk treatment plan should follow the identification and assessment of risk in the construction industry. Such plans can be an indicator of the acceptance and tolerance of the identified risk. Plans should be systematic in their application and be time-limited with identified roles to complete the remedial work (Serpella et al., 2014). The ability to measure the effectiveness of the actions is essential not only as part of the monitoring and review mechanism but also as an assurance of the accuracy of risk identification and assessment (Qudus, 2016).

For implemented procedures to be effective, contractors and organizations have to target the root cause of the risk. The selection of risk management procedures should be focused on keeping risk at an acceptable level. Methods of managing risk usually fall into one of the following categories: avoidance, reduction, retention, transferring, and sharing. The selection of a suitable method will depend on the probability and outcome of risk (Serpella et al., 2014). Even after the implementation of risk management procedures, some residual risk may remain. Elements of monitoring and reporting are actually included in the previous steps as well, such as logging possible risks into a register. Many applications are available to make reporting more fluent, and Excel is a popular tool for this as well. Regardless of the tools used to monitor risk management, the important thing is to keep them up to date. If specific objectives have been defined, these can serve as the basis of the evaluation. Improvement should be a continuous element of risk management, and it should also happen according to the objectives of the risk management process. Risk management can be evaluated for an organization as a whole or some specific sector or operation (Lee et al., 2012).

Risk management is an essential part of construction projects, which aims at identifying the potential risks associated with a project and responding to those risks to reduce them to an acceptable extent (Serpella et al., 2014). Risk management is indeed a dynamic tool, which must be continuous as long as the project exists, and its operation is based on intuition and a high level of judgment. Also, effective construction risk management is a serious issue because it involves many construction risks, such as cost overrun, schedule slip, and poor quality performance (Lee et al., 2012).

Construction risk management can have internal and external drivers. Internal drivers are derived from an organization's own stance and decisions regarding risk management, such as strategy or vision. Internal drivers also include procedural guidelines as well as other policies. External drivers are referred to as risk management requirements that originate from outside the organization. These can include laws, agreements, and client demands. External drivers can form a complex framework, as the sources of these drivers are plentiful and can be quite different (Hellstén, 2018).

Due to the insufficiency of relevant information, many construction companies in Malaysia have not established their risk management departments (Hellstén, 2018). Nevertheless, there is a need for a proper risk management process for various types of risks. Furthermore, immense attention has been focused on the issues of risk factors affecting construction industries such as material, management, design, equipment, and labour risks, which in the long run have led to abandonment, delay, cost, and time overrun on the project (El-Sayegh, 2008). Thuyet et al. (Van Thuyet et al., 2007), also argue that in the construction companies, improper risk management is usually the cause of cost and time overruns on projects because of the project managers' competencies and contractors to manage the risk effectively (Hellstén, 2018). Fewer participants use the construction risk management method in Malaysia because of the lack of knowledge and awareness (Bamgbade et al., 2019). The track record regarding the prediction of risks in the project is also very poor, thereby having a negative result on the objectives of the projects. Construction risk management is supposed to involve proactive means of combating possible future risks rather than being reactive. It is very imperative to evaluate the main and common risks, which could bring about a negative effect on the goals of the construction project. Because the risk management concept is an unusual method in the construction industry in Malaysia, it is then necessary to create awareness of risk management in the sector (Hwang et al., 2014), (Taofeeq et al., 2020c), (Wang et al., 2016).

2.3. Contractors' risk attitudes

Simpson (Simpson-Housley, 2002) describes perception as a way of seeing or understanding, attitude as a way of thinking or behaving, and behaviour as a way of acting or functioning. These terms are interrelated but not identical. Weber et al. (Weber et al., 2002), explain that attitude is a situation in which people respond to a pattern of choice. For example, choosing the apparently hazardous option may actually have a different subjective impression on the relative risks of the opportunity. Besides, attitude is different from behaviour; it does not always accurately predict behaviour. Han et al., (Han, Diekmann, Ock) also identified the presence of some factors preventing the behavioural expression of contractors' attitudes. It was observed that differences in risk behaviours might be the result of differences in the way risk is perceived and defined, or differences in contractors' risk attitudes or different situational factors may be preventing the expression of contractors' attitudes (Dione, Ruwanpura, Hettiaratchi).

Many researchers have conducted research on various risk attitudes among administrations and personalities (Pennings & Smidts, 2000),

(Hillson & Murray-Webster, 2007). They have classified contractors' risk attitudes into three common categories in the construction industry: Risk-Averse, Risk-Taker, and Risk-Neutral.

The risk-averse contractor is a contractor who prefers lower returns with known risks rather than higher returns with unknown risk (Cha & Ellingwood, 2012). For example, contractors with risk-averse preferences are willing to take an amount of money smaller than the expected value of the huge amount in a contract (Cha & Ellingwood, 2012), (Kim & Reinschmidt, 2011). The risk-neutral contractor is a contractor who places himself in the middle of the risk spectrum, represented by the risk-seeker contractor at one end and risk-averse contractor at the other end. The risk-taker contractor is a contractor who risks everything to achieve or accept the greater potential for loss in decisions. In other words, a risk-taker contractor willingly tolerates uncertainty in order to achieve a goal (Shirodkar & Konara, 2017), (Taofeeq et al., 2020b). Furthermore, it is an individual who tends to behave in a way that can potentially cause physical harm or financial loss but might also present an opportunity for a rewarding outcome (Cha & Ellingwood, 2012), (Kim & Reinschmidt, 2011).

The critical effects of contractors' risk attitudes provide insights for management that have been using conventional approaches. It is also not easy to measure organizational risk attitude since an individual contractor's position in risk attitude is relative within the competitive domain (Wang & Yuan, 2011). Since risk is one of the most frequent terms used to describe the characteristics of the construction business, it is essential for contractors to be aware and to effectively deal with uncertainties inherent in the construction companies (Adeleke et al., 2016a). The most carefully planned project can run into trouble no matter how well it is being planned if the uncertainties are not envisaged early enough, as projects can always encounter unexpected problems. By the time risk occurs on a project, it will be too late to do anything about it. Ultimately, it will automatically result in delay, which, in turn, leads to an increase in the cost of the project.

Generally, most individuals and small groups confronted with potentially grave hazardous consequences are risk-averse in their attitudes. Corporations or government agencies with substantial resources tend to show a more risk-neutral attitude (Han, Diekmann, Ock). The importance of risk-aversion in the decision-making process has been recognized in the literature. Risk-averse decision-makers tend to overestimate possible losses and limit the state of probabilities, especially for low-probability events that are outside the realm of their experiences. They may resist the choosing of an alternative decision in which a traditional quantitative risk assessment (e.g., minimum expected cost analysis) is close to the ideal, and are likely to pay excessive premiums to reduce the risk, especially when personal injury is involved.

Apart from attitude, people's action is highly affected by their confidence in their capacity to perform (Mohd Zakir, 2012). This is due to how individuals viewed influence over the intended behaviour based on resource availability, competency, other people's encouragement, and prior experience with the conduct in question. Confidence can emerge if there is a perceived influence over the behaviour. Through this study, perceived control over actions is explained as the workers' awareness, skill, and willingness to control their behaviour, which has a more significant influence over attitudes. It is believed that workers with sufficient preparation, knowledge, skills, and experience are more motivated and able to demonstrate good dedication to performing their duties and in a position to behave in compliance with organizational safety requirements (Mohd Zakir, 2012). A professional employee presents the correct mindset required for high performance at work, competitiveness, and, most significantly, safety values.

Also, project team members' attitudes towards risk can be affected by their level of competence, where limited competence can lead to a risk-averse attitude and vice versa. Besides, individuals' risk perception is also affected by their level of competence since their estimation of their skill and competence can influence their risk attitude (Han, Diekmann, Ock). Moreover, individuals who feel uncertain and incompetent tend to overestimate risk, while those who perceive themselves as knowledgeable, experienced, and competent tend to underestimate it (Dikmen et al., 2007). Therefore, individuals confronting uncertain situations in which they have no prior knowledge or experience tend to perceive the situation as risky, thus leading to a more risk-averse response. In contrast, individuals adopt more risk-seeking attitudes when faced with a situation where they have proven skills such as extraversion, agreeableness, and conscientiousness (Abd Karim et al., 2012, pp. 347–350).

2.4. Human factors affecting Contractor's risk attitudes

2.4.1. Emotional intelligence

Hillson & Murray-Webster (Hillson et al., 2007) define emotions as a term referring to all those extrinsic feelings that are thought of or stated. Emotional intelligence, however, can be defined as the ability to observe, express, and manage emotions within oneself and in a relationship with others. Emotional intelligence can consist of two sets of competencies: personal and social. Personal competencies include self-awareness, confidence, self-regulation, conscientiousness, and motivation, while social competencies consist of empathy and social skills (Hofstede & Consequences, 2001). Therefore, project professionals must develop their emotional intelligence since it has a straight influence on the effectiveness of risk control (Taofeeq et al., 2020b).

Goleman (Goleman, 1990) strongly asserts that emotional intelligence is a precondition for successful contractors. Numerous explanations of why individuals with great emotional intelligence could easily adapt to different situations have been asserted. First, contractors who understand and can easily manage their emotions by displaying self-discipline can serve as role models for other workers, thus enhancing workers' belief in and respect for such contractors (Taofeeq et al., 2020a). This could be reliable with the spirit of the idealized effect. Because such contractors are keen on understanding others' emotions, they would be placed in a position where workers could easily understand what is expected of them, thus being a source of motivation. Third, because of the contractors' selflessness and empathy, they can understand workers' needs, interact accordingly with them, and manage relationships positively (Mayer et al., 2004).

2.4.2. Educational background

Educational background is linked to a contractor's knowledge. It is recognized as a vital factor affecting contractors' risk attitudes. It has been found that educational background has been ignored by contractors when compared to the other factors in Malaysia construction companies. Naik et al., (Naik, Radhika) confirmed that the educational background of contractors has been vital to the effectiveness and successful completion of construction projects. The excellence of administrative employees allocated to a contract reflects deeply on the total competence of a contractor's hard work. Also, it has been established that contractors who have higher qualifications (degrees) and who are also members of a professional body, such as the chartered institute of building and institution of civil engineers, perform effectively well while supervising projects on the construction sites (Taofeeq et al., 2020c).

Moreover, younger contractors show a significantly better performance in the construction site because, in addition to their academic qualifications, they are more likely to adapt to changes and have greater ambition for promotion than the older contractors. Onuka et al. (Onuka, 2017, pp. 3–24), claim that lack of manpower training and re-training program in construction firms often results in a lack of skill, lack of productivity, and ineffectiveness. Therefore without a training policy provided by contractors, these problems will continue to exist. In this study, it is recommended that educational background be viewed as necessary elements that can assist in bringing improvement to the construction companies through the upgrading of workers' and contractors' knowledge (Taofeeq et al., 2020c).

2.4.3. Professional competencies

Professional competence comprises ability (to do a task economically), adequacy (to provide good service to the client), and capability (ability to undertake the commission). Indifference or neglect is the want of good care, and the oversight of such responsibility for the interests of others as the law of dereliction may require (Mhetre et al., 2016). Professional competencies involve business processes and value chains that are essential to a firm's ability to compete in its market. Members of every profession require occupational competencies to perform their roles. Managers in every occupation/profession do, however, require managerial competencies, which include individual behaviours, such as goal setting, action management, and leadership skills, in addition to organizational skills, such as HRM and performance, to operate effectively (Taofeeq et al., 2020b). Also, other critical managerial competencies required are cognitive, affective, and conceptual skills, relationships, and learning competencies, together with different abilities such as self-knowledge, self-understanding, self-management, and self-learning (Taofeeq et al., 2020a).

The attitudes of project team members towards risk can be affected by their level of competence, while limited competence can lead to a risk-averse attitude and vice versa. Besides, individuals' risk perception is also affected by their level of competence since their estimation of their skill and competence can influence their risk attitude (Hillson & Murray-Webster, 2007). Moreover, individuals who feel uncertain and incompetent tend to overestimate risk, while those who perceive themselves as knowledgeable, experienced, and competent tend to underestimate it. Therefore, individuals confronting uncertain situations of which they have no prior knowledge or experience tend to perceive the situation as risky, thus leading to a more risk-averse response. In contrast, individuals adopt more risk-seeking attitudes when faced with a situation where they have proven skills such as extraversion, agreeableness, and conscientiousness (Hofstede & Consequences, 2001).

2.4.4. Work experience

Work experience in construction companies always affects both the practical and organizational abilities of contractors. It is also accepted as the main standard for prequalification in any organization. Mohammed et al. (Noor, 2011), acknowledge that the proprietors and consultants graded unskilled engineers amongst the top three causes of construction delay in Malaysia. Correspondingly, SambasIvan, and Soon (Sambasivan and Soon, 2007) conclude that insufficient work experience of contractors is the third most prevalent cause of delay in Malaysian construction projects.

Work experience is a pressure that partly affects contractors' risk attitudes in the Malaysian construction companies. Experience comprises the ability to demonstrate effective observation, which has been gained through contribution and exposure to different issues in the process of working on various construction sites (Taofeeq et al., 2019). A contractor with substantial experience in the construction industry can gain status as an expert. This designates that contractors with rich experience in construction and engineering practices in the society would improve their potentials for better management of risk in the construction companies.

2.4.5. Physical health and safety

The World Health Organization's (WHO) definition of health is a state of complete physical, mental, and social well-being. At the same time, the health of the worker is supposed to be free from any physical health disease. Psychological and social activity is related to working conditions, working practices, and the working environment (Alinaitwe, 2010). Also, the safety of a worker is defined by the Occupational Safety and Health Administration (OSHA) as the protection of the workers from accidents, injuries, and threats from the occupational workplace, unsafe environment, etc. In the context of civil engineering, safety is defined as the means of preserving the health of those who build, operate, maintain, and demolish engineering works and of others affected by those works (Ghazali et al., 2014).

The guidelines were issued by the Department of Occupational Safety and Health (DOSH). The purpose of these guidelines is to guide employers on how work practices can be carried out on every activity in the construction to prevent any form of accident. These guidelines can be used as a standard reference for developers, contractors, engineers, architects, designers, and health officers to control contractors' risk attitudes in the construction companies (Ghazali et al., 2014). Contractors with a strong health condition will be able to complete projects successfully, and it will also help contractors to be able to identify and address the potential risk problems. The good health condition of contractors will facilitate contractors' ability to evaluate projects better (Taofeeq et al., 2020a).

2.5. The role of government policy as moderator

The policy is the guiding principle that is used to establish organizational regulations, and it is a course of action that leads or influences decisions. Also, it is used as a guide for making judgments by following an assigned event within the structure of goals, objectives, and management philosophies as defined by the senior management. Government policy is described as the program of action whose aim is to change a definite state of affairs. The government uses policies as the starting point for them to execute a course of action and to contribute a real-life change (Rahim et al., 2003), which is paramount to maintaining a safe working environment in the construction business. Rules and regulations are defined as the statement and standard or procedure of a general pertinence adopted by an organization board that addresses certain issues related to types of construction risk management to be used, process, and steps involve before project execution and safety of employees (Adeleke et al., 2019). This study also suggests government policy as a moderator on the relationship between human factors and contractors' risk attitudes because Gibb (Gibb, 2011) and Niu (Niu, 2010) have found that those organizations that follow government rules and regulations effectively are less likely to be affected with construction risk. Additionally, Bamgbade et al. (Bamgbade et al., 2017), noted that government policy is important issues to be considered in understanding the accomplishment of an organization because they tend to reduce the levels of risk occurrence on the construction projects and make risk management more effective. Also, in line with the study of Nuruddin et al., (Nuruddin, Bakar, Jaafar), which stated that government regulations or policies are parts of key factors contributing to the growth of Malaysian construction companies.

Adeleke et al. (Adeleke et al., 2019), discovered that government policy (rules and regulations) plays an essential role in moderating the relationship between organizational factors and risk management. Government policy was used as a moderator in this study because it has been used as an independent variable in the study of Ismail (Ismail, 2001) in the Malaysian context and by Iroegbu (Iroegbu, Kalu, Chima) in Nigeria. However, Ismail (Ismail, 2001) revealed that in Malaysia context, rules and regulations on housing has a positive relationship with construction risk management. This finding suggests that there must be a replacement for the traditional building practices by an Industrialized Building System (IBS), which in the long run might save labour, cost, a period of construction as well as ensuring quality and durability as cited by (Alaghbari et al., 2007). The study of Iroegbu (Iroegbu, Kalu, Chima) also revealed that government rules and regulations positively influenced construction projects in Nigeria, such as the importation of construction materials and taxes (Taofeeq et al., 2020b).

Therefore, government policy is, however, statically significant for individuals with high obedience to rules and regulations than for individuals with low compliance to rules and regulations because when government policy (rules and regulations) is high in construction companies, contractor risk attitude is low. When government policy and contractor risk attitudes are both high, human factors and contractors' risk attitudes are significantly negatively correlated. That is to say, at a high level of government policy in construction companies, there is a

more significant positive effect of the human factor affecting contractors' risk attitude with the help of government policy to regulate and to control the behaviour and attitudes of contractors in construction companies. Therefore, Human errors are a significant contributor to accidents in the construction industry. They constitute up to 90%, while the remaining 10% represent technical mistakes due to uncontrollable conditions. Most time in the construction business, health and safety regulations are enforced to reduce accidents, and large contractors need the proof of minimum safety training for workers and managers (Adeleke et al., 2016b), (Bamgbade et al., 2017).

3. Conceptual Framework

This study considers the work experience, physical health, educational background, professional competence, and emotional intelligence as human factors with government policy (rules and regulations) as the moderator, and that might influence contractor's risk attitudes among construction companies in Malaysia, as depicted in Fig. 1.

4. Methodology

The targeted population for this study is made up of individuals within the construction companies, such as experienced architects, engineers, contractors, project managers, and the team members in the various construction companies in Malaysia. The unit of analysis for this study are the construction companies in Malaysia. Simple random under probability sampling methodology was used. A booklet comprising a structured questionnaire was posted to the various construction companies in Malaysia. Statistical Package for Social Science (SPSS) version 21.0 for Microsoft Windows was used to analyze the collected data. The demographic profile of the companies and respondents were analyzed using descriptive statistics. This study also focused on the G7 contractors operating in the Malaysian construction industry that specializes in building, bridge, and road construction projects. To achieve the research objectives, a systematic review was performed to provide evidence for the synthesis. In starting a systematic review, the research questions need to be addressed unambiguously, and specified order in step 1, the framing of questions for a review search keywords is required to meet the requirements of the study. To assure the search range of the review, plural forms of search keywords are advisable. In step 2, the selection of data sources, comprehensive and extensive search from the relevant database, and journals are required (Khan et al., 2003). Therefore, to capture many relevant citations and journals, the appropriate domain of study need to be identified and selected.

Moreover, in step 3, the performance of a preliminary search involves the use of search keywords within the defined specific domain of titles, keywords, and abstracts, and then selected from the journal databases. Lu & Liu (Lu and Liu, 2014) and Khan et al. (Khan et al., 2003), suggested that at this stage, a confined parameter search should be employed to ensure consistency. Moreover, step 4 involves assessing the quality of studies to ensure academic rigour. This implies that the articles acquired for analysis and synthesis should be subjected to a set of qualities for proper assessment. The qualities of these articles from the preliminary search need to be filtered. Understandably, the preliminary search conducted in step 3 would yield a broad spectrum of themes and mainstreams of articles.

Hence, a visual inspection of the article content is essential. Furthermore, step 5 involves summarizing the evidence. Here a detailed review will be conducted to analyze and synthesize the remaining filtered articles, focusing on the articles which are only related to topics of interest. This calls for the extraction of articles that are aligned with the research scope and background. Typically, the data are summarized and synthesized in the form of tabulation by study characteristics, quality, and effects of study. The statistical method may appropriately use, as supported by Khan et al., (Khan et al., 2003).

4. 1. Scale of the questionnaire

The major instrument adopted in gathering the primary data for this study is a questionnaire (Ahmad et al., 2014), (Adeleke et al., 2017). The adopted five-point Likert scale, which ranged from (1) very low to (5) very high, was intended to elicit the participants' responses regarding the influence of the factors (Kulatunga et al., 2006b), (Nawanir et al., 2020). Respondents were asked to respond to the questionnaire items by indicating their level of agreement using a five-point Likert scale. The five-point scale was used because it allows respondents to freely make a suitable choice, which is not restricted by only two or three options.

Data were collected from experienced architects, engineers, contractors, project managers, and team members who worked in the various construction companies in Malaysia. Printed copies of the questionnaire were dispatched through their postal addresses. The copies of the questionnaire were accompanied by a letter requesting the consent of the targeted audience, stating the benefit of the study, and asking for an endorsement from the main supervisor. Addressed and stamped envelopes were also attached to the sent copies of the questionnaire to make it easy for the potential respondents to return the completed questionnaire. After four weeks, the sent copies of the questionnaire were followed up via posts, emails, and calls to those respondents who did not respond.

4. 2. Response rate

A total of 160 copies of the questionnaires were randomly distributed

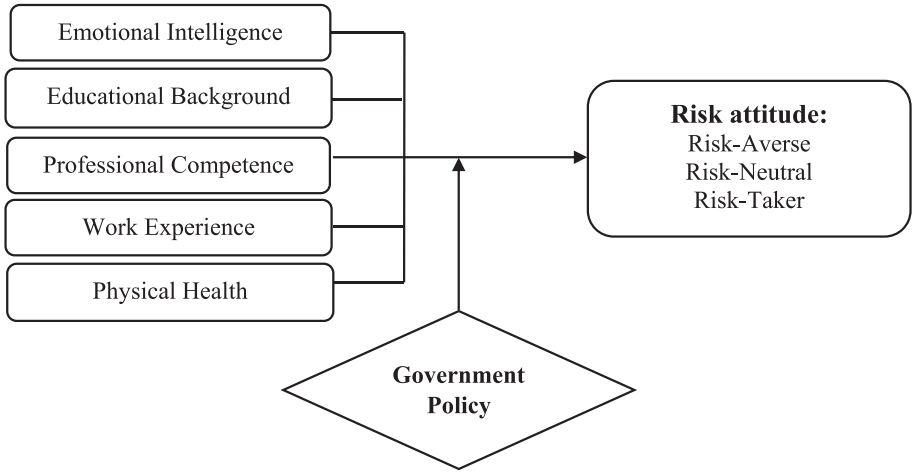

Fig. 1. Conceptual framework.

to the various construction companies in Kuantan Malaysia. Out of the distributed 160 copies of the questionnaire, 154 copies of the questionnaire were filled and returned, making it a 96.25% response rate. Conversely, eight copies of the questionnaire were found to be unusable due to missing data. Thus, 146 copies of the questionnaire were used for the data analysis, making it 94.81%. A response rate of 94.81% was considered adequate for the analysis in this study because Sekaran & Rani (Sekaran & Rani, 2010) suggested that a response rate of 30% is sufficient for surveys, as shown in Table 1.

5. Findings

5. 1. Demographic distribution of the respondents

The demographic profile of respondents is made up of the following: position, gender, age, years of experience, qualification, specialization of the company, and the location of the company (Dikmen et al., 2007). Among the respondents, 33 were (22.6%) females, and 113 (77.4%) were males. The sample was spread out among all age groups, ages between 16 and 30 were 40 (27.7%), ages between 31 and 45 were 53 (36.3%), ages between 46 and 60 were 35 (24%), and age 60 and above were 18 (12.3%) respondents.

The total number of G7-contractors that responded was 146 (100%). Regarding the qualification, the majority (88 in number - 60.3%) of the respondents had a master's degree, followed by respondents having Ph.D., 41 (28.1%). Finally, 17 (11.6%) respondents had a bachelor's degree. As regards the level of experience of the respondents, most of the respondents had a moderate experience. A total of 53 (36.3%) respondents had experienced between 4 and 6 years, followed by 41 (28.1%) having 7–9 years, 28 had above ten years job experience (19.2%), and 24 had less than three years (16.4%) work experience. Regarding job specialization and companies' location, more than half of the respondents, 105 (71.9%), specialized in a building project, followed by 27 (18.5%) respondents who specialized in on-road projects. Only 14 (9.6%) respondents specialized in bridge construction. The location of all the 146 respondents (100%) was Kuantan.

5. 2 Reliability test

There are various types of reliability tests, "convergent validity, discriminant validity, and indicator reliability." However, the most adopted method by the researchers is the "internal consistency reliability test" (Ismail, 2001), (Joost & Pennings, 2012). It is adopted in order to evaluate the magnitude to which items of a specific construct congregate together and are autonomously capable of measuring the actual construct. At the same time, the items are correlated with each other. The internal consistency reliability test of Cronbach's alpha coefficient (Tavakol & Dennick, 2011), (Litwin, Fink), was adopted. SPSS 20 was used to analyze the internal consistency of the measurement tools to evaluate the Cronbach's alpha coefficient. Sekaran (Sekaran, 2006) reported that if a value is above 0.60, it is a better internal consistency. The descriptive statistics of the measurement instrument and the outcomes of the reliability analysis are presented in Tables 2 and 3, which demonstrate that all the Cronbach's alpha coefficient values were above 0.60, ranging from 0.712 to 0.914, thus indicating good internal consistencies

Table 1
Summary of the response rate of questionnaires.

Items	No of questionnaire	Percentage
Total copies of the questionnaire distributed	160	100%
Unreturned copies of questionnaires	6	3.75%
Completed copies of questionnaires received	154	96.25%
Unusable copies of questionnaires	8	5.19%
Usable copies of questionnaires from received one	146	94.81%

Table 2
Descriptive statistics of measurement instrument.

Construct	Items Code	Items	Mean	Std. Deviation
EDUCATIONAL BACKGROUND	**EB1**	In our company, contractors with a high level of education tend to be more rational and careful.	3.744	0.923
	EB2	In our company, contractors with a little level of education tend to be more fearless and unwary.	3.765	0.865
	EB3	In our company, attitudes toward risks within the decision-making process may vary significantly.	3.812	0.910
	EB4	In our company, the contractors' educational background depends on their risk attitude.	3.644	0.893
	EB5	In our company, different backgrounds across professional knowledge of contractors will reflect in their risk attitude.	3.738	0.833
	EB6	In our company, the scope of knowledge will influence contractors directly on their attitude.	3.704	0.881
	EB7	In our company, the contractor has a high reputation and credibility in the marketplace.	3.738	0.895
WORK EXPERIENCES	**WE1**	In our company, contractors' experience and their qualifications influence the attitude of contractors.	3.389	1.131
	WE2	In our company, working experience on the previous project does not affect our contractors.	3.543	1.055
	WE3	In our company, the lack of working experience leads to poor relations and disagreements with a partner.	3.543	0.982
	WE4	In our company, the lack of teamwork of contractors leads to poor performance on the field.	3.657	0.921
	WE5	In our company, improper project Planning and budgeting are caused by a lack of working experiences of contractors.	3.738	0.903
	WE6	A low level of working experience affects contractors in our company.	3.637	0.967
	WE7	Experience affects the effectiveness of coordination in our company.	3.812	0.888
EMOTIONAL INTELLIGENCE	**EI1**	In our company, our contractors are flexible and willing to adapt to new conditions.	3.778	0.845
	EI2	In our company, our contractors are ready to share their feelings with others.	3.852	0.808
	EI3	In our company, our contractors are capable of	3.879	0.787

(*continued on next page*)

Table 2 (*continued*)

Construct	Items Code	Items	Mean	Std. Deviation
		influencing other people's feelings.		
	EI4	In our company, our contractors are capable of controlling their emotions.	3.758	0.776
	EI5	In our company, our contractors are capable of withstanding pressure and regulating stress.	3.838	0.789
	EI6	In our company, contractors are cheerful and satisfied with their lives.	3.852	0.825
	EI7	In our company, contractors are capable of taking someone else's perspective.	3.583	0.901
PROFESSIONAL COMPETENCE	**PC1**	Contractors develop orientation programs for new workers in our company.	3.671	0.833
	PC2	Limited operational resources affect the contractor's performance in our company.	3.691	0.876
	PC3	In our company, desire can inspire people's active actions toward particular objectives.	3.812	0.841
	PC4	In our company, contractors use research findings in the further development of worker's care.	3.765	0.833
	PC5	In our company, the contractor's duties are distributed based on skill level.	3.899	0.786
	PC6	In our company, our contractors can recognize the college's needs for support and helps.	3.946	0.714
	PC7	In our company, contractors are coordinating worker's overall care.	3.791	0.674
PHYSICAL HEALTH	**PH1**	In our company, we are all aware of the current health and safety legislation that governs our activities.	4.013	0.830
	PH2	In our company, there is someone responsible for health and safety matters.	3.953	0.791
	PH3	Insurance is provided for all employees in our company.	3.852	0.816
	PH4	In our company, there is a health and safety manual and procedure.	3.906	0.756
	PH5	In our company, there are goals and objectives with occupational health in the workplace.	3.899	0.819
	PH6	Physical health is a prequalification criterion for all workers in our company.	3.885	0.826
	PH7	In our company, contractors and workers are physically fit.	3.791	0.728
GOVERNMENT POLICY	**RR1**	The government introduces a regulation that promotes physical health in our company.	3.899	0.803
	RR2	In our company, we obtain permission from government policy.	3.798	0.854
	RR3	In our company, we wait for the approval of the government before we can recruit new workers.	3.932	0.785
	RR4	In our company, we obtain a permit from the government to carry out the project.	3.979	0.881
	RR5	Government rules and regulations improve the quality of workers in our company.	3.926	0.771
	RR6	Our company enforces constitutional law relating to the recruitment of a new worker.	3.845	0.759
	RR7	Our company is committed to complying with government legislation and regulation.	3.865	0.802
CONTRACTORS RISK ATTITUDE	**CRA1**	The level of experience of contractors in a similar type of project makes contractors risk-averse in our company.	3.838	0.805
	CRA2	Project size affects the contractor's in our company to be risk-averse.	3.798	0.770
	CRA3	The late issuing of approval documents affect contractors in our company to be risk-averse.	4.100	0.760
	CRA4	Safety bonus payments influence contractors' risk attitude in our company to be risk-taker.	4.000	0.771
	CRA5	The potential for gaining similar future experience in the same project influences contractors' risk attitudes in our company to be risk-taker.	3.906	0.799
	CRA6	The attitude of the client towards the contractors about timelines of payment influences contractors' risk attitudes to be risk-taker in our company.	3.953	0.756
	CRA7	The existence of a local agent that helps the contractors with the project influence contractors' risk attitude to be risk-neutral in our company.	3.912	0.787
	CRA8	The risk of fluctuation in materials prices makes the contractor risk-neutral in our company.	3.979	0.800
	CRA9	Unfavourable of physical condition that may adversely affect productivity at the site make the contractor risk-neutral in our company.	3.919	0.757

Table 3
Summary of reliability results.

Items	Dimensions	No. of Items	Cronbach's Alpha
Factors affecting risk attitudes.	Education background	7	0.914
	Working experience	7	0.840
	Emotional intelligence	7	0.724
	Professional competence	7	0.768
	Physical health	7	0.828
Contractor risk attitudes	Risk-averse	3	0.865
	Risk-neutral	3	0.732
	Risk-taker	3	0.712
Government policy	Rules and regulations	7	0.715

(Henseler et al., 2016), (Hair et al., 2011). Therefore, it was concluded that the measurement tools were usable, consistent, and reliable for collecting data.

5. 3. Result and discussion

The present study was carried out with these two objectives: to determine the extent of construction risk management and to rank the individual factors affecting the contractors' risk attitudes among the Malaysian construction companies. This study attempts to answer these research questions: What is the extent of construction risk management among Malaysian construction management? What are the leading factors affecting the contractors' risk attitudes among the construction companies operating in Kuantan Malaysia?

The first objective of this research is to determine the extent of construction risk management among Malaysian construction companies. The intention is to investigate the degree and the angles from which the risk factors have been affecting the Malaysian construction companies from attaining effective construction risk management. Adeleke et al., (2018), interpretation of the Likert scale was used to interpret the 5-point Likert scale in ascending order (in the questionnaire) as follows: 1 = very low (1.0–1.49); 2 = low (1.5–2.49); 3 = medium (2.5–3.49); 4 = high = (3.5–4.49); 5 = very high (4.5–5.00). Finally, the extent of construction risk management among Malaysian construction companies was ascertained by examining the observed range, which matched the mean score of construction companies' risk in the SPSS descriptive statistics result. For example, a mean score of 1.0–1.49 signifies that the extent of risk management within the construction companies is very low. Table 4 shows the extent of construction risk management in Malaysian construction companies.

Table 4 presents the frequency and percentage scores for management risk among the construction companies in Malaysia. The score with the highest frequency (53) and percentage (36.3%) was at a medium level.

In this study, the extent of construction risk management among Malaysian construction companies was achieved through a descriptive analysis of how construction risk management has been effective within the companies. The score with the highest frequency (53) and percentage (36.3%) was medium. The result showed that the mean score of the extent of construction risk management was 2.75, with a standard deviation of 0.590. The extent of the construction risk management means score (2.75) was within the "medium" category. This suggests that risk management is not highly implemented or given serious attention within the Malaysian construction companies, thus causing possible negative effects on most of their projects.

The second objective of this study was to rank the factors affecting contractors' risk attitudes in Malaysian construction companies. Table 5 shows the ranking of specific factors affecting contractors' risk attitudes among the construction companies in Malaysia.

The mean and standard deviation of each factor is derived from the total sample to determine the level of importance. If two or more factors happen to have the same mean value, the one with the lower standard deviation is considered more valuable. To analyze the factors with relatively high mean values, which indicate higher impacts in decision making, a measure was set in this study for the identification of those critical factors. The factors with mean values that were greater than the average value of all mean values were classified as critical factors affecting contractors' risk attitudes. The ranking results of these factors are shown below.

Work experience was ranked as the first critical factor affecting contractors' risk attitudes with this mean value: 3.64, and Std: 0.56. It is well understood that the conceptual phase of a new construction project is the riskiest because decisions such as project cost, quality, time, safety, and environment made in this phase tend to have significant impacts on obtaining the project objectives. It is also the phase at which the greatest degree of uncertainty about the future is encountered since the nature of complexity, dynamics, and uncertainty of construction projects prevent projects from being implemented in the real world as they were planned in the feasibility studies. This, in turn, indicates that contractors would encounter various uncertainties and risks during project implementation. Hence, those contractors with richer work experience would be more familiar with and more skilful at addressing the potential risks that might block the successful implementation of projects (Onuka, 2017, pp. 3–24; Shirodkar & Konara, 2017; Naik, Radhika; Naik, Radhika). It is thus perceived as an important factor influencing contractors' risk attitudes in the Kuantan, Malaysia construction companies.

The physical health factor was ranked as the second critical factor affecting contractors' risk attitudes with this mean value: 3.60, and Std: 0.68. Contractors with a strong health condition will be able to complete projects successfully, and it will also help contractors to behave more actively to identify and address the potential risk problems. Furthermore, the good health condition of contractors will increase the possibility of contractors to evaluate the situation of any encountered project better. Therefore, strong health condition will help the contractor in decision making and the ability to make better judgment are helpful for a contractor to deal with risk issues in the construction companies. The level of the risk is based on the probability of its occurrence, the possible severity of the risk, such as the population that may be affected, and the health effects.

Educational background was ranked third place with the mean value of 3.51 and Std: 0.55, among other important factors. Educational background is related to a contractor's knowledge. It is recognized as an important factor affecting contractors' risk attitudes; contractors highly

Table 4
The extent of Construction Management Risk.

Management Risk				
		Frequency (N)	Percentage (%)	Mean
1.0–1.49	Very Low	11	7.5	
1.5–2.49	Low	15	10.3	
2.5–3.49	Medium	53	36.3	2.75
3.5–4.49	High	40	27.4	
4.5–5.00	Very High	27	18.5	

Table 5
Ranking of human factors affecting contractors' risk attitudes among the Kuantan, Malaysia construction industry.

Factors	Mean	Standard Deviation	Ranking
1. Work Experience	3.64	0.56	1
2. Physical Health	3.60	0.68	2
3. Educational Background	3.51	0.55	3
4. Professional Competence	3.44	0.58	4
5. Emotional Intelligence	2.92	0.76	5

stressed educational background compared to the other four specific factors in the Kuantan Malaysia construction companies with a significant mean value of 3.51 and Std: 0.55. all respondents have higher or master's degrees, and some of them with bachelor degrees and Ph.D. degrees as well. This may be the reason why the educational background has a relatively high significant factor for influencing contractors' risk attitudes in the Kuantan Malaysia construction companies.

Professional competence was ranked fourth place with the mean value of 3.44 and Std: 0.58, among other important factors. This finding is in line with the findings of Ward, Chapman, Curtis, & Abrahamson (Ward et al., 1991), who discovered that a prerequisite for high-quality project risk management is the ability to have access to required information relating to the handling of risk concerning a specific project. The character of professional contractors signifies a planned, skilful, strong-minded, and operative manner, as well as facets like dutifulness, carefulness, level-headedness, and neatness. Besides, professional contractors tend to exhibit a low level of fear regarding risk management behaviour than other contractors. Thus, professional contractors are probable to be careful and balanced in risky circumstances and to make suitable decisions in dangerous circumstances.

Also, if contractors have adequate and accurate information when making decisions against risks, they are probably going to be willing to be risk bearers, as they are confident and competent in making good trade-offs between risks and benefits. Otherwise, they cannot have the right perception of project risks or a clear understanding of the consequential risks to them. Therefore, taking a risk without adequate understanding and competence about the risk may lead to unwillingness in bearing and managing the risk. Also, there is limited literature inability to address this issue further; this study recognizes that it is a limitation and suggests further research to explore this issue.

The emotional intelligence factor is ranked as the fifth critical factor affecting contractors' risk attitudes with this mean value: 2.92 and Std: 0.76. Emotion can greatly influence contractors' attitudes toward risks because each individual possesses a unique conception of principles that influence the contractors' thoughts, feelings, and actions. It is the unique characteristics of morals that make contractors' risk attitudes manifest differently. For instance, contractors might tend to take risks if extra economic benefits could be obtained by successfully addressing the risk problems. Still, those who are more conservative might tend to pursue the successful accomplishment of the project's goals. Therefore emotional intelligence is the ability to observe, express, and manage emotions within oneself and in a relationship with others, thus making it one of the specific factors affecting risk attitudes.

Emotions can either assist project team members in managing project risks, or it can be a burden. Furthermore, all risk processes can be affected by the emotional intelligence of the project stakeholders at both individual and group levels. Therefore, project professionals must develop their emotional intelligence since it has a direct impact on the effectiveness of risk management.

6. Research implications

Although the identified human factors affecting risk attitudes in this study is easy to control during the recruitment of new workers, project managers are encouraged to consider the findings of this study to address risk attitudes in the delivery of construction projects. Our research also provides contractors, project managers, team members, and clients with some strategies to know how to deal with risk attitudes and construction risk management in the construction companies. Moreover, this study has contributed to identifying gaps in terms of knowledge production and utilization to ensure optimal implementation of risk management based on scientific evidence. The outcomes of this study can be used to inform decision-makers about strategies to be adopted for risk management and in handling contractors' risk attitudes. Furthermore, it also provides a blueprint for future studies to explore additional factors pertaining to the contractors' risk attitudes in different projects of the construction companies in Malaysia.

Besides, there is also a need for the development of policies that encourage and support project issuance. Policymakers should, therefore, develop initiatives that can motivate contractors and project managers to adhere to the effective performance of contractors to attract the client's patronage. Policymakers might as well consider organizational control theory in order to mitigate the occurrence of risk during the project.

Therefore, the availability of risk knowledge will prove to be valuable information for planning and risk information in the future. The errors made in the past projects could be avoided by good risk management processing. The failure of most projects is usually associated with poor construction risk management. Therefore, it is advisable to have a construction risk assessment as an essential process in every active information system development. To have better and effective risk management, an organization should consider risk identification as the first stage of risk management since it cultivates the footing of the next steps, which are analysis, response, and monitoring of construction risk management.

Also, good risk management is a very crucial practice of project management since it is linked to all the management areas in a project. However, it is very difficult and not easy to foresee the risks, but at times we can manage to handle them and even cope with them. Construction risk management helps to overcome a range of obstacles that may be encountered in a project, and it helps save time and money to be used on a project. It also gives an overview of what can go right or wrong along the process of construction project management.

7. Research limitation

Our study focused on individual factors affecting contractors' risk attitudes in the construction companies in Kuantan, Pahang, Malaysia. Therefore, these dimensions of the factors affecting risk attitudes can be used in another aspect of construction projects, such as management factors, economic factors, and technical factors. Further research might investigate other grades within the Malaysian construction industry apart from Grade 7 contractors to know if there is a similarity in the results because studies have shown that other grades of contractors (especially the small and medium scale) are also contributing immensely to the aversion in the industry.

8. Conclusions

This study's theoretical framework has also contributed to the field of risk management by investigating the influence of the human factor affecting contractors' risk attitude. Likewise, through the theoretical contributions, a piece of new evidence has been introduced by this study to nurture the idea about risk management in the construction industry in Malaysia, and the findings from the present study offer some essential practical implications to the contractors and the construction industry. In conclusion, the current research has contributed valuable practical, methodological, and theoretical ramifications to the developing body of knowledge in the domain of industry, particularly project management. The conclusion and limitations of the research lead to the direction of future investigation. First and foremost, future research can achieve by strengthening the framework further, and studies can go deep and research activity or specific activities of the human factors affecting contractors' risk attitudes in detail. Moreover, it would be precious for the organization to recognize the influence of government policy on the competitive advantage of construction companies. Lastly, utilizing quantitative data to support qualitative data can also bring another perspective.

CRediT authorship contribution statement

TaofeeqD. Moshood: Information-gathering, Writing - original draft, and Data analyzes (40%). **A.Q. Adeleke:** Designing a research model

(25%). **Gusman Nawanir:** Methodology. **Fatimah Mahmud:** Supervision, (10%), All authors have contributed a particular percentage to this study.

Declaration of competing interest

I have no conflict of interest to report.

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