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Research Article

Analysis of Human Factors that Influence Contractors' Risk Management Attitudes in Sumatra Island in Construction Projects

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ARTICLE INFO**ABSTRACT****Keywords:**

Contractor's risk attitude, Risk management. Human factor

Project risk assessment serves as an effective tool for overseeing cost, and time, and achieving technical performance in construction projects. The construction industry frequently contends with various uncertainties, which can lead to potential risks such as delays, cost overruns, and compromised quality in building and road construction ventures. Consequently, adept project risk management becomes crucial in the decision-making process of construction companies, ultimately determining project success or failure. This paper aims to assess the prioritize the specific factors influencing contractors' risk attitudes in these companies. The study employed simple random sampling under probability techniques. Data collection involved a thorough review of pertinent literature and the use of a questionnaire employing a five-point Likert scale ranging from (1) very low/very disagree to (5) very high/very agree. The sample size used for analysis was 47 companies, with a particular focus on the Sumatra construction companies. This study was analyzed using Statistical Package for Social Science (SPSS) version 23.0 for Microsoft Windows and a reliability test with Cronbach's alpha. The finding of this study is primary factors influencing contractors' risk attitudes are as follows: educational background, physical health, emotional intelligence, work experience, and professional competence, The results of this research can provide decision-makers with valuable insights into strategies for effectively managing contractors' risk attitudes, thus furnishing stakeholders with the requisite knowledge to enhance risk management performance within the Sumatera construction companies.

1. Introduction

The construction project is unique and built only once. From pre-construction until post construction, the risk factor in construction project is very high and various that come from many sources especially in project team [1]. Risk Management is the directional organization activity and coordinated to control risk on project, Risk Management includes the process risk management planning (identification risk), analysis risk (qualitative and quantitative risk), generating response strategy, and controlling or

monitoring the risk during the process construction [2], [3]. Risk management should handle all stages in construction from the initial stage until the commissioning project.

The concept of risk is varieties depending on the viewpoints, experiences, and attitudes contractors, engineers, or architects. Managing risk projects is an important process to create value, to protect value, and to achieve company targets. The proprietor of risk or risk owner is the people or entity that have accountability and authority to manage risk, accountability is the responsibility that can't be delegated to others. Therefore, the risk owner has responsibility to manage risk to achieve goals [4].

In the process of risk management, risk owners should design a plan of implementation risk management for direction for risk management. The one of important thing is about human resource and profile organization. Human resources affect the effective management of construction risk. The human factors related to knowledge, skill and attitude. In traditional definition human factors is the study of the interaction between machine and man. The other authors use the human factor as the combination of interaction between individual, organization, and project team which influence the behavior people and the climate at work that can increase or decrease productivity [5]. Individual factors include skills, capability, knowledge, motivation, cultural and emotional intelligence. project team factors are communication, coordination, supervision, management, and organizational factors include policies and standards, system, and procedure. These human factors can affect a construction project therefore managing human factors is necessary for the project process. In the other research, the factors affecting risk management from contractors are human related factors, working capital, project related factor, and environmental [6].

In this research, the specific factor will be used to analysis contractor' risk attitude in the project construction Sumatera, the specific factors can be referred to educational background, emotional intelligence, work experience, professional competency, and physical health. The findings of the study would provide the company with a way to prepare risk management and allocate human resources refer to strategic risk management company. This research study aims to analysis the factors affecting risk attitudes from contractor in Indonesia construction project. The analysis will be adopted based on qualitative data analysis.

2. Literature Study

Contractor risk attitude refers to the perception, approach, or mindset that contractors have towards risks associated with their projects or engagements. It encompasses their willingness to take on various types of risks. Contractor risk attitude can build their strategies for managing and mitigating those risks, and their overall tolerance for uncertainty in their work [7]. Individual characteristics can be considered as factors affecting risk attitude called big five theory personality by McCrae and Costa analyzing between work behaviors and personality [8]. The big five theories contain five-dimension framework, these dimensions are openness to experience, conscientiousness, extraversion, agreeableness, neuroticism, or emotional stability. In this research, the human factors affecting contractor's risk attitude will be analyzed in 5 dimensions specifically in educational background, emotional intelligence, experience, competency, and physical health.

2.1 Educational background

The effect of educational background on contractor's risk can be significant and can influence how they approach and manage risk in their projects. Investments in improving professional skill through training and education programs ensure that contractors have necessary skills to be more safely operate in risk [9]. Many ways educational background can impact contractor risk attitude such as knowledge and expertise, contractor with higher level of education in relevant fields have a deeper understanding of

industry best practice, regulations, and technical aspect that can contribute to make better decision making and good execution. The other education contractor can influence risk attitude is cultivate problem solving abilities and critical thinking when encounter challenges or unexpected situations on project. Critical thinking same with metacognition, ability to think about thinking process [10].

2.2 Openness to experience

This dimension reflects a person's openness to new information, ideas, and experiences, the workers with openness to experience more likely to engage in risky attitude in their environment [7]. Interestingly [11] investigate the connection between working memory, intellect and openness and discovered that intellect showed a correlation both working memory accuracy and brain activity. However, openness did not display a similar correlation and the brain regions involved in the relationship between working memory and intellect as a neutral basis for intellectual capability.

2.3 Emotional Intelligence

Emotional intelligence is defined as the ability to understand people in a social context. Because teamwork inherently involves social interactions, emotions are fundamental to the effectiveness of a team and influence the behavioral results of the team. As a result, emotional intelligence is vital for productive and efficient team collaboration, likewise acknowledging and handling emotions is important for both individuals and workgroups [12]. Emotional intelligence and work teams play an integral role which include skills such as self-control, confidence, empathy, creativity, and intuition to increase ability to adapt in unexpected situations.

2.4 Professional competency

Competencies have definitions into the cognitive, the behaviorist, and the generic where all of them can be gain through development and training [13]. Professional competence includes the capacity to efficiently carry out tasks, the proficiency to deliver quality services to the client and the capability to take an assignment. [14] declared that two phase process to develop competency framework, built environment professionals and refining, developing, and validating the competency framework. A competency framework was established with three levels: first, fundamental competencies relevant to all professionals involved in mass displacement; second, competencies that apply across the entire built environment industry; and third, competencies specific to a subgroup of professionals within the built environment sector. Contractors who possess a high degree of professional competence have the requisite expertise, skills, and knowledge pertaining to construction practices, regulations, and technical aspects.

2.5 Physical Health

The World Health Organization (WHO) characterizes health as a condition encompassing full physical, mental, and social well-being. Simultaneously, a worker's health is expected to be devoid of any physical ailments. The psychological and social aspects are interconnected with factors like work conditions, practices, and the overall work environment. Additionally, Occupational Safety and Health Administration (OSHA) defines worker safety as safeguarding employees against accidents, injuries, and potential hazards within the workplace, ensuring a secure working environment, and so forth [15], The Occupational Safety and Health Act can be defined as a piece of legislation that serves as the legal framework for ensuring the safety, health, and well-being of all contractor employees. Furthermore, it is designed not only to safeguard individuals within the workforce but also to shield others from potential safety and health hazards associated with activities carried out by individuals in the workplace [16].

Contractors who are in good health are more likely to successfully complete projects. Additionally, their robust health enables them to recognize and manage potential risks effectively. Optimal health condition further enhances contractors' capacity to assess projects with greater accuracy.

In this research, factors such as educational background, openness to experience, emotional intelligence, professional competency, and physical health are examined as human factors. These factors may have an impact on the risk perspectives of contractors within the construction industry in Indonesia.

3. Research Method

The study targets individuals employed in construction companies, including experienced professionals such as architects, engineers, contractors, project managers, and team members across various construction firms in Indonesia. The research employed a simple random sampling approach within a probability sampling methodology. A structured questionnaire was compiled into a booklet and distributed to diverse construction companies in Indonesia. Data collected was analyzed using Statistical Package for Social Science (SPSS) version 23.0 for Microsoft Windows. The demographic characteristics of both the companies and respondents were examined through descriptive statistics.

This study specifically concentrated on contractors that specialize in building, road, and bridge construction projects within the Indonesia construction industry. In pursuit of the research objectives, a systematic review was conducted to furnish comprehensive evidence. The initial step in commencing a systematic review involves articulating the research questions distinctly, followed by a specified sequence for framing the questions to facilitate an effective review search. This necessitates the inclusion of appropriate search keywords to align with the study's requirements. In the subsequent step, the selection of data sources mandates a thorough and wide-ranging exploration of pertinent databases and journals. Therefore, it is imperative to identify and designate the pertinent domain of study to encompass a broad spectrum of relevant citations and journals.

The prime data in this study is gathered through questionnaire with a five-point Likert scale, ranging from 1 (very low) to 5 (very high). The data is collected by Google Form from experienced engineers, project managers, contractors, and team member who worked in construction project in Indonesia. After one month the questionnaires were distributed, the questionnaires were followed up via emails, messages to that respondent who did not respond.

4. Results And Discussion

4.1 Response Rate and Distribution of The Respondent

The total questionnaire is 48 from 48 companies in Sumatra with the purposive sampling in random companies Sumatra. the criteria respondent is minimum one year experience and work in project construction Indonesia. Among the respondent, we found 62% males and 38% females, most of the respondents are bachelor's degree (74%), master's degree (13%), and diploma's degree (13%). The result of descriptive statistics represents with the mean and standard deviation by SPSS 23. The mean provides a measure of central tendency that gives general idea of the representative or typical response by respondents. The standard deviations measure the spread of responses or dispersion around the mean. A lower standard deviation indicates that responses are closely around the mean. Moreover, standard deviation helps understanding the degree to which responses from the average. In some cases, standard deviation is used to reliability of the responses. The descriptive statistic of the measurement instrument showed below.

Table 1. The descriptive statistics of the measurement instrument

Code	Item	Mean	Standard Deviation
Educational Background			
BP1	Contractors with higher education tend to be more rational and cautious	4.11	0.759
BP2	Contractors with lower education levels tend to be more fearful and less vigilant.	3.040	1.062
BP3	In our company, the attitude towards risk in the decision-making process varies depending on the level of risk	3.810	0.825
BP4	The educational background of the contractor influences their risk attitude	3.740	0.706
BP5	Differences in professional knowledge background among contractors will reflect in their risk attitudes.	3.810	0.900
BP6	The scope of knowledge will impact the contractors in terms of their risk attitudes.	3.980	0.794
BP7	Contractors in our company have a high reputation and credibility in the global market.	3.850	0.807
Emotional Intelligence			
EI1	Contractor are flexible and willing to adapt to new conditions	3.940	0.763
EI2	The contractor able to share their condition or feeling to others	3.360	0.965
EI3	The contractor able to influence the feeling of those around them	3.150	0.908
EI4	The contractor able to control their own emotions	3.380	0.874
EI5	The contractor able to work with under pressure and manage stress	3.640	0.845
EI6	The contractor has a spirited and very comfortable with their lives	3.600	0.825
EI7	The contractor has the ability to understand the perspective of others	3.300	0.805
Working Experience			
PK1	In our company, the experience and qualifications of contractor influence their risk attitude.	3.910	0.717
PK2	In our company, the work experiences do not affect to risk attitude of contractor	2.430	1.211
PK3	In our company, a lack of experience can affect to poor relations and disputes with partner	3.280	0.926
PK4	In our company, lacks cooperation among contractor leads to poor performance in the site	3.570	0.927
PK5	In our company, inappropriate in planning and budgeting are caused by lack of work experience among contractors	3.020	0.989
PK6	The low level of work experience can affect risk attitude of contractor	3.300	0.998
PK7	The experiences affect the coordination effectiveness in our company	3.640	0.764
Professional Competency			
KP1	In our company, the contractor develops orientation programs to new employees	3.170	1.110
KP2	Limited operational resources affect the performance of contractor in our company	3.300	0.976
KP3	In our company, the desire's contractor can motivate them to achieve their goals	3.400	0.798

KP4	In our company, the contractor use research findings for employee development	3.130	0.947
KP5	In our company, tasks for contractor are assigned based on their level of capability	3.450	0.951
KP6	In our company, our contractors can recognize the needs of colleagues to support and assist each other.	3.340	0.891
KP7	IN our company, contractors can coordinate well in their work environment	3.620	0.768
Physical Health			
KF1	In our company, we are all very aware of maintaining health and following the mandated safety regulations while working.	3.530	1.018
KF2	In our company, there is someone responsible for health and safety issues.	3.470	1.213
KF3	The company provides insurance for all employees	3.450	1.194
KF4	In our company, there are steps and a safety manual provided.	3.300	1.140
KF5	Our company has goals and objectives related to occupational health in the field.	3.530	1.018
KF6	Physical health is a prerequisite for all employees in our company.	3.640	1.072
KF7	In our company, all contractors and workers are physically fit.	3.620	0.874

4.2 Reliability Test

The reliability test represents the consistency of the score from the instrument. There are several types of reliability tests, including Test – Retest reliability, Parallel form’s reliability, Inter-Rater reliability, and indicator reliability [17]. Nevertheless, the most commonly utilized method among researchers is the "internal consistency reliability test," as noted by [18]. This method assesses the extent to which items within a specific construct cluster together and independently measure the actual construct while also being correlated with each other. The internal consistency reliability test employed Cronbach's alpha coefficient, as recommended by [19]. [18]. To evaluate the Cronbach's alpha coefficient, SPSS 23 was utilized, a value above 0.60 indicates good internal consistency. The descriptive statistics of the measurement instrument and the results of the reliability analysis are presented in the table below. These tables illustrate that all Cronbach's alpha coefficient values exceeded 0.60, ranging from 0.712 to 0.914, indicating strong internal consistencies.

Table 2. Summary of reliability result

Item	Cronbach's Alpha
Educational Background	0.782
Emotional Intelligence	0.711
Working Experience	0.841
Professional Competency	0.677
Physical Health	0.690

Hence, it was determined that the assessment instruments were suitable, dependable, and consistent for gathering information. The objective of this study is analyzing the human factors affecting contractor’s risk attitude in Sumatra construction companies. The result of analyzing is ranking of specific factor are shown below.

Table 3 . The ranking of human factor that affected risk attitude contractor in Sumatra Construction Project

Item	Mean	Std.	Ranking
Educational Background	3.763	0.836	1
Physical Health	3.506	1.076	2
Emotional Intelligence	3.481	0.855	3
Working Experience	3.307	0.933	4
Professional Competency	3.344	0.920	5

The mean and standard deviation for each factor is calculated from the entire sample to assess their significance. In this study, a criterion was established to pinpoint the critical factors, focusing on those with higher mean values that signify greater impact on decision-making. Factors with mean values surpassing the overall average were categorized as critical in influencing contractors' risk attitudes.

The educational background was ranked in the first place with the mean 3.763 and standard deviation 0.836, educational background related to level of education, knowledge of contractor, and the scope of professional knowledge from contractor. Some of respondents have bachelor's degrees and master's degrees well, this may be one of the reasons that the educational background has a highly significant factor influencing contractor's risk attitude in Sumatra construction companies. In other study, Based on Table 4, BP1 – Contractor with higher education to be more rational and cautions have 43% scale High and 34% very high that it means the educational background has a significant influence on employee performance because the education create a learning process to develop their potential, abilities, self-control, intelligence, personality, and skills needed by themselves and others [20]. Moreover BP4 – the educational background of the contractor influences their risk attitude have 51% agreed/high scale that it means good knowledge and expertise may have a deeper understanding of industry best practices, regulations, and technical aspects which can enable them to make more informed decisions regarding risk assessment and management. In other hand, Education equips individuals with problem-solving and critical thinking skills. Contractors with a strong educational background may be better at analyzing complex situations, identifying potential risks, and devising effective strategies to mitigate the and more likely to be aware of and understand these regulations, reducing the likelihood of non-compliance and associated risks. In summary, based on the result from Table 4, education background can influence a contractor's risk attitude by equipping them with the knowledge, skills, and mindset needed to proactively manage risks in construction projects. However, it's important to note that while education can be a contributing factor, other factors like experience, company culture, and individual personality also play a role in shaping a contractor's risk attitude.

Table 4 . The extent of educational background factor that affected risk attitude contractor in Sumatra Construction Project

Code	Educational Background (%)						
	BP1	BP2	BP3	BP4	BP5	BP6	BP7
Very High	34	11	19	13	23	28	26
High	43	19	49	51	40	45	34
Medium	23	40	23	32	32	26	38
Low	0	23	6	2	2	2	0
Very Low	0	4	0	0	2	0	0

The second rank affected risk attitude contractor is physical health with mean 3.506 and standard deviation is 1.076. It can be denied that strong health condition is able to complete their work and reduce the risk of illness. Many construction task will handle manually, one of most studies [21] said that physical fatigue impacted awareness diminishes and worker safety as it lack of to process hazard

information. Physical fatigue leads to a depletion of energy and decreased effectiveness when engaging in prolonged physical activities. Hence, it is crucial for a company to proactively prevent fatigue, and doing so necessitates the capability to promptly identify it as it occurs. Physical fatigue affected to strong or weak physical health employee, physical fatigue has been recognized as one of the ten major risks faced by construction workers, with a high likelihood of leading to accidents [21]. Additionally, contractors in good health are more likely to assess project situations effectively. Consequently, their robust health contributes to informed decision-making and improved judgment, enabling them to address risk-related challenges within construction companies. The level of risk is determined by factors such as the probability of occurrence, potential severity, and the health impact on affected populations. The result of physical factors described the table 4 below, the average result states that in construction Sumatra company aware to maintaining health and regulations while working, but 11% Company stated Low and 9% very low scale to provide insurance for all employees.

Table 5. The extent of physical health factor that affected risk attitude contractor in Sumatra Construction Project

Code	Physical Health (%)						
	KP1	KP2	KP3	KP4	KP5	KP6	KP7
Very High	19	23	21	15	17	23	15
High	32	30	30	32	38	34	40
Medium	32	23	30	28	28	30	38
Low	13	17	11	19	15	9	4
Very Low	2	6	9	4	2	4	2

The third rank affected risk attitude contractor is Emotional intelligence with mean 3.481 and standard deviation is 0.855. Emotional intelligence can a contractor's risk attitude in construction project, contractor with high emotional intelligence is better to manage stress so they enable to make more rational decisions when faced with risky situations. Contractors who are emotionally intelligent consider the emotional impact of decision on themselves and their college and partner. Based on table 6, item EI1 - Contractor are flexible and willing to adapt to new conditions have 55% high respond and 21% Very High respond that it's mean emotional intelligence fosters adaptability and flexibility which can reduce risks associated with unforeseen challenges. The other item EI2 represent that the contractor's dominant to 11% very high and 34% high scale respond and 40% medium or able to share their condition to others that it's mean emotional intelligence is needed to get strong communication skills for conveying risk and mitigation strategies to project teams and other stakeholder. The result of EI3 – EI7 factor can be seen in the table 6 below

Table 6. The extent of emotional intelligence factor that affected risk attitude contractor in Sumatra Construction Project

Code	Emotional Intelligence (%)						
	EI1	EI2	EI3	EI4	EI5	EI6	EI7
Very High	21	11	6	11	15	15	9
High	55	34	26	32	43	36	26
Medium	19	40	49	43	34	43	53
Low	3	11	15	11	7	5	10
Very Low	1	4	4	4	2	1	3

The fourth rank affected risk attitude contractor is working experience with mean 3.307 and standard deviation is 0.933. Even though work experience is absolutely significant factor [18] but in the Sumatra companies this factor is not get one position affected risk attitude because working experience should

combine with other factors to manage risks effectively. From the result in table 7, Factor PK1 – the experience and qualifications of contractor influence their risk attitude was 21% very high and 49% high or agreed. In PK5 - inappropriate in planning and budgeting are caused by lack of work experience among contractors have 23% low and 6% very low / very disagreed, it's mean has the other factor caused lack or affected risk in project. The other factor described in table 7 below.

Table 7. The extent of working experience factor that affected risk attitude contractor in Sumatra Construction Project

Working Experience (%)							
Code	PK1	PK2	PK3	PK4	PK5	PK6	PK7
Very High	21	4	9	15	4	6	13
High	49	19	30	40	30	45	43
Medium	28	17	43	32	32	23	40
Low	0	30	11	9	23	19	4
Very Low	0	26	4	2	6	4	0

Professional competency was ranked fifth place with the mean value of 3.344 and standard deviation of 0.920 among other important factors. Contractors with strong professional competency enable them executed project and evaluate potential risks accurately. The result from table 8, 45% companies develop orientation programs to new employees and Factor KP4- the contractor use research findings for employee development has 21% low scale and 4% very low that it's means professionals with high competency levels should be more likely to engage in ongoing learning and professional development. This means they should stay updated with the latest industry trends, technologies, and risk management strategies, allowing them to adapt to changing circumstances. The other results professional factor described below.

Table 8 . The extent of Professional competency factor that affected risk attitude contractor in Sumatra Construction Project

Professional Competency (%)							
Code	KP1	KP2	KP3	KP4	KP5	KP6	KP7
Very High	9	6	9	4	13	11	13
High	34	40	34	34	36	30	40
Medium	34	36	47	34	34	40	43
Low	13	11	11	21	13	17	4
Very Low	9	6	0	4	2	0	0

5. Conclusion

This study's theoretical framework has made a substantial contribution to the field of risk management by examining how human factors influence contractors' risk attitudes. Additionally, the theoretical insights provided by this study have introduced new evidence that enriches our understanding of risk management in the Sumatra construction company. The findings of this study have crucial practical implications for contractors and the construction sector. Overall, this research has offered valuable practical, methodological, and theoretical insights to the expanding body of knowledge in the field, particularly in project management. The conclusions and limitations of this research point towards directions for future investigations. Firstly, future research could enhance the framework further by delving deeper into specific activities related to human factors that influence contractors' risk attitudes such as management factor, economic factors, environmental factors, and others. Furthermore, it would be valuable for organizations to acknowledge the impact of government policies on the competitive

advantage of construction companies. Finally, integrating quantitative data to support qualitative findings can provide an additional perspective.

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