Risk Management and K3 Study in Construction Projects (Empirical Study: Construction Projects in South Kalimantan)

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Abstract. This study aims to assess the implementation of risk management and Occupational Safety and Health (OHS) practices in construction projects in South Kalimantan. An empirical approach was employed, with data collected from ongoing construction activities in the region. The study utilized multiple data collection methods, including surveys, interviews, and direct field observations, to obtain a comprehensive understanding of current practices. The findings indicate that, although most construction projects have established formal risk management procedures, their practical implementation remains limited and inconsistent. Key challenges include insufficient training for project personnel, weak communication among stakeholders, and uncertainties in project planning processes. These factors collectively hinder the effectiveness of risk management and reduce the ability to anticipate and mitigate potential project risks. Furthermore, the study highlights that OHS practices, while regulated, are not optimally implemented across many projects. Limited awareness of workplace hazards, inadequate training, and weak enforcement of safety regulations contribute to ongoing safety concerns. To address these issues, this study recommends strengthening capacity through targeted training programs, improving coordination and communication among project stakeholders, adopting technological tools to support risk identification and monitoring, and reinforcing compliance with OHS standards. These measures are expected to enhance both project safety and overall construction performance.

Keywords: Risk Management, OHS, Construction Projects, South Kalimantan, Empirical Study.

1 Introduction

Risk management and Occupational Safety and Health (OSH/K3) are critical components in the successful execution of construction projects. Given the inherent complexity of construction activities, effective risk management and OSH practices play a central role in ensuring project continuity, as well as safeguarding the safety and well-being of workers on site. This study aims to explore and analyze the implementation of risk management and OSH within construction projects conducted in South Kalimantan through an empirical approach.

In high-risk industries such as construction, the integration of Health, Safety, and Environment (HSE) principles is essential for systematically identifying, assessing, and

ICWSDGs 2024, September 09-10, Banjarmasin, Indonesia

DOI 10.4108/eai.9-9-2024.2359069

mitigating potential hazards. HSE analysis provides a structured framework for managing risks associated with occupational safety, worker health, and environmental impacts. It is particularly relevant in sectors involving complex operations, hazardous materials, and dynamic working conditions, where the likelihood of accidents and environmental damage is significantly higher [1].

By examining current practices in South Kalimantan, this study seeks to provide a clearer understanding of how risk management and OSH are applied in real project settings, as well as to identify areas requiring improvement to enhance safety performance and project effectiveness.

The concept of risk has been defined in various ways; however, from a scientific perspective, risk is generally understood as the potential for adverse outcomes arising from a particular action or condition. In the context of construction projects, the implementation of Occupational Safety and Health (OSH/K3) management systems is mandatory, as it forms an integral part of project planning and control processes. Effective OSH practices are essential not only to protect workers from accidents and occupational diseases but also to minimize both direct and indirect losses faced by organizations. Workplace incidents can lead to financial losses, project delays, and reputational damage, thereby affecting overall organizational performance [2].

In general, risk is defined as a function of probability and consequences, often expressed as: *Risk = f (probability, consequence)*. Probability refers to the likelihood of an event occurring, while consequences represent the severity of its impact. In some cases, frequency is incorporated into probability, reflecting how often an event may occur based on past experience [4], [5]. Risk management, therefore, involves a systematic process of identifying, analyzing, and controlling risks to ensure the safety of workers, the public, and the environment [6].

In construction and infrastructure projects, particularly those involving public-private partnerships (PPP), risk-based performance assessment frameworks are increasingly applied to integrate risk management with project evaluation, thereby improving project outcomes and sustainability [3]. Risk assessment typically considers both the likelihood of an incident and its potential consequences, often evaluated using tools such as a risk matrix, which supports informed decision-making in project management.

Table 1. Risk Level Matrix

5= Very Likely	**5 M**	**10 H**	**15 H**	**20 L**	**25 L**
4= Likely	4 L	8 M	12 H	16 L	20 L
3= Possible	3 L	6 M	9 H	12 H	15 H
2= Unlikely	2 L	4 L	6 M	8 M	10 H
1= Very Unlikely	1 N	2 L	3 L	4 L	5 M
Frequency Probability	1= None	2= First Aid	3= Media Handling	4= Disability	5= Death
	Impact (severity)				

Risk Level Description:

- Negligible (N), with a Risk Value of 1
- Low (L), with a Risk Value of 2 – 4
- Moderate (M), with a Risk Value of 5 – 8
- High (H), with a Risk Value of 9 – 15
- Extreme (E), with a Risk Value of 16 – 25

Building construction encompasses a series of interrelated activities carried out across multiple stages at the project site. These stages typically include planning, site preparation, structural development, material installation, finishing, and post-construction evaluation. The planning stage involves designing the building, selecting the site, determining dimensions, and performing structural calculations. This is followed by the preparation stage, which includes land clearing, leveling, and site readiness. The structural development stage focuses on constructing key components such as foundations, walls, and roofing systems in accordance with the approved design. Subsequently, the material installation stage involves the integration of essential building elements, including doors, windows, electrical systems, and sanitation facilities. The finishing stage enhances the building's final appearance through painting, flooring, and interior and exterior detailing. Finally, testing and maintenance are conducted to ensure structural safety, functionality, and long-term performance. These stages require effective coordination among architects, engineers, contractors, and construction workers [8].

South Kalimantan was selected as the study area due to its diverse and significant construction activities. Using an empirical approach, this study examines risk management practices and the implementation of Occupational Safety and Health (OSH/K3) policies within ongoing projects in the region [9].

Risk evaluation plays a crucial role in determining whether a risk is acceptable or requires further mitigation. This assessment depends on several factors, including existing control measures, available resources, regulatory standards, emergency preparedness, and historical accident data. Even when risks are deemed acceptable, continuous monitoring remains essential to ensure safety and compliance [10].

2 Methodology

Data collection methods include survey, interview, and observation directly in the field. Research results show that management risks in the project construction in South Kalimantan are still own room for improved.

Methodology that can used for study management risk and K3 on projects construction in South Kalimantan can involving a series step as following:

a. Step 1: Determining the Scope of the Study
   1. Identification projects relevant construction in South Kalimantan.
   2. Determine the risk parameters to be reviewed, including risk construction and K3 risks.
b. Step 2: Identification Risk
   1. Use method like SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) for identify factors risk.
   2. Do interview with the expert's industry construction and K3 for get more insight deep.
   3. Do survey or observation field for identify possible risks happen in a way specific in projects construction in South Kalimantan.
c. Step 3: Analysis Risk
   1. Use method analysis like FMEA analysis (Failure Mode and Effects Analysis) or HAZOP (Hazard and Operability) analysis for evaluate identified risks.
   2. Give scale priority for risks the based-on probability occurrence and impact.
d. Step 4: Developing Management Strategy Risk

1. Identify mitigation strategies for reduce or remove identified risks.
2. Set actions prevention and appropriate response for every risk.
3. Determine not quite enough answer and schedule implementation for each mitigation strategy.

e. Step 5: Implementation and Evaluation
1. Implement management strategies the risks that have been developed in environment project the actual construction.
2. Do monitoring continuously to implementation of management strategy risk and identification change conditions that require adjustment.
3. Evaluation effectiveness of management strategy risk in a way periodically and do repair if required.

f. Step 6: Reporting and Dissemination
1. Serve findings and recommendations from study management risk and K3 in report end.
2. Share results study to stakeholder's interest project construction in South Kalimantan, including parties related, regulators, and the community general If required.

g. Step 7: Compilation Recommendation
1. Based on findings and analysis, compilation recommendation for repair system management risks and K3 in projects construction in South Kalimantan.
2. Prioritize recommendation based on potential impact and level urgency its implementation.

h. Step 8: Implementation Recommendation
1. Submit recommendation to authorized party or party related for implemented in practice management risks and K3 in projects construction in South Kalimantan.
2. Do act carry on to implementation recommendations and make sure that changes needed has done.

Methodology This will allow for comprehensive and fact-based study proof to management risk and K3 on projects construction in South Kalimantan. With Thus, it can increase efficiency, safety and sustainability projects construction in the area.

3 Results and Discussion

The data in this study were collected using a survey method administered to respondents selected based on the relevance of their roles to the research objectives [11]. Primary data collection was conducted through the distribution of structured questionnaires, which served as the main research instrument [12]. The questionnaires were completed by construction workers actively involved in ongoing projects [13]. The study focused on multi-story commercial building (shop-house) construction projects as the primary research object [14]. A total of 25 completed questionnaires were obtained and analyzed.

The collected data were intended to identify risks associated with work performed at height and to determine relevant criteria and sub-criteria based on risk levels, particularly those with a high likelihood of causing occupational accidents [15–37].

Respondents were characterized based on several demographic and professional attributes, including age, job position or department within the project, years of experience in the construction sector, and educational background. These variables were considered essential for providing a comprehensive understanding of respondents' perspectives and for ensuring the reliability of the risk assessment analysis. The detailed profile of the 25 respondents is presented in the following section.

Table 2. Age Worker

No	Age (Year)	Frequency	Persentage (%)
1	< 20	4	16
2	21-25	3	12
3	26-30	2	8
4	31-35	6	24
5	36-40	3	12
6	41-45	3	12
7	46-50	2	8
8	>51	2	8
Total		25	100

Source: Research Results

From the table above can see that workers who are in the group age ≤ 20 years is as many as 4 people or 16%, for workers in the group age 21 – 25 years is as many as 3 people or 12%, for workers in the group age 26 – 30 years is as many as 2 people or 8%, for workers in the group age 31 – 35 years is as many as 6 people or 24%, for workers in the group age 36 – 40 years is as many as 3 people or 12%, for workers in the group age 41 – 45 years is as many as 3 people or 12% , , For workers in the group age 46 – 50 years is as many as 2 people or 8%, and for workers in the group age ≥ 51 years is as many as 2 people or 8%.

Table 3. Workers' Education Level

No	Education Level	Frequency	Persentage (%)
1	Elementary School	1	4
2	Junior High School	13	52
3	Senior High School	11	44
Total	25	100	

Source: Research Results

From the table above can see that workers who have a level only 1 person or 4% has elementary school education, while the workers who have junior high school education are the most numerous namely 13 people or 52%, and the rest workers who have level high school education is as many as 11 people or 44%.

Table 4. Experience Work Construction

No	Work Experience	Frequency	Persentage (%)
1	<5	7	28
2	6-10	3	12
3	11-15	7	28
4	16-20	3	12
5	21-25	2	8
6	26-30	2	8
7	31-35	0	0

8	36-40	1	4
	Total	25	100

Source: Research Results

Based on the table above There is as many as 7 people or 28% have experience work ≤ 5 years , 3 people or 12% who have experience work 6 – 10 years, 7 people or 28% who have experience work 11 – 15 years, 3 people or 12% who have experience work 16 – 20 years , 2 people or 8% who own experience work 21 – 25 years and 26 – 30 years, meanwhile for 31 – 35 years no there is , and 1 person or 4% for experience Work as many as ≥ 36 years.

Table 5. Labor Force Status

No	Labor Force Status	Frequency	Persentage (%)
1	Foreman	1	4
2	Worker	15	60
3	Assistant Worker	9	36
	Total	25	100

Source: Research Results

Based on the table above as much as 1 person or 4% is foreman, as many as 15 people or 60% are craftsmen, and as many as 9 people or 36% are servant craftsman .

Risk level for each criterion determined with formula:
Risk Level = Frequency x Impact

Table 6. Risk Rating and Risk Level of the Main Criteria For Occupational Safety

No	Main Criteria For Occupational Safety	Respondent 1		Risk rating	Risk level
		Frequency	Impact		
1	Worker's fall	1	1	1	N
2	Falling objects	1	1	1	N
3	Electric shock	1	1	1	N
4	Occurrence of fire	1	1	1	N
5	Exposure to hazardous materials or radiation	1	1	1	N

Source: Research Results

After questionnaire processed, then The Risk Rating and Risk Level are obtained from each criterion and sub- criteria displayed. in tables – tables following:

Table 7. Risk Rating and Risk Level of the Main Sub- Criteria of Accidents Work

No	Main Sub- Criteria of Accidents Work	Frequency			Number of Respondents	Persentage (%)	
		N	L	M		L	M
1	Worker's fall	12	13	0	25	25	0
2	Falling objects	15	10	0	25	40	0
3	Electric shock	25	0	0	25	0	0
4	Occurrence of fire	25	0	0	25	0	0
5	Exposure to hazardous	25	0	0	25	0	0

	materials or radiation

Source: Research Results

Table 8. Risk Rating and Risk Level of the Main Sub- Criteria Causes Accident Work

No	Main Sub- Criteria Causes Accident Work	Frequency			Number of Respondents	Persentage (%)	
		N	L	M		L	M
1	Environmental factors	18	7	0	25	28	0
2	Human factors	9	14	2	25	56	8
3	Construction factors	22	3	0	25	12	0
4	Material and equipment factors	23	2	0	25	8	0
5	Hazard factors	25	0	0	25	0	0

Source: Research Results

Table 9. Risk Rating and Risk Level of Main Criteria Causes Accident Work

No	Main Criteria Causes Accident Work	Frequency			Number of Respondents	Persentage (%)	
1	Environmental factors	N	L	M		L	M
	a. Lack of lighting	25	3	0	25	12	0
	b. Disruptions in the form of gas, vapor, dust, fog	25	0	0	25	0	0
	c. Rain, wind, storm, flood, lightning, earthquake	25	5	0	25	20	0
	d. Occurrence of woker congestion	25	0	0	25	0	0
2	Human Error	Frequency			Number of	Persentage (%)	
		N	L	M	Respondents	L	M
	a. The workforce is less expirienced	14	11	0	25	44	0
	b. The lack of coordination/communication between the workers and between workers and their supervisors	19	6	0	25	24	0
	c. Insufficient guidance from management to the workers regarding workplace safety	22	3	0	25	12	0
	d. Failure to use personal protective equipment (helmets, goggles, masks, ear protection, body harness, gloves, safety shoes)	9	14	2	25	56	8
	e. Weak management oversight of workers who do not wear personal protective equipment (APD)	19	6	0	25	24	0
	f. Workers engaging in inappropriate actions while working (smoking, drinking alcohol, being intoxicated)	22	3	0	25	12	0
3	Construction Factors	Frequency			Number of	Persentage (%)	

		N	L	M	respondents	L	M
	a. Uneven, slippery, and oily floor surfaces	13	12	0	25	48	0
4	Material and Equipment Factors	Frequency			Number of respondents	Persentage (%)	
		N	L	M		L	M
	a. Damaged equipment	25	0	0	25	0	0
	b. Safety signs are incomplete or not in place	15	9	0	25	36	0
	c. Insufficient availability of personal protective equipment (APD) in both quality and quantity	22	3	0	25	12	0
5	Hazard Factors	Frequency			Number of respondents	Persentage (%)	
		N	L	M		L	M
	a. Improper placement of equipment that can pose a potential hazard	24	1	0	25	4	0

Source: Research Results

Calculation table on got from amount choose in each column shared with total respondents in a way overall furthermore results distribution times with 100%. Example calculation in the Main Accident Criteria Table Selected work as following:
Column 1: 13 respondents = 13.25 x 100% = 52%
Column 2: 10 respondents = 10 25 x 100% = 40%
Column 3: 0 respondents = 0.25 x 100% = 0%
Column 4: 0 respondents = 0.25 x 100% = 0%

Risk management and occupational safety and health (K3) are critical aspects of construction project management. Effective risk management helps project stakeholders identify, assess, and control potential uncertainties, while proper implementation of K3 standards reduces workplace accidents and protects workers. The following points are commonly addressed in the results and discussion section of a study on risk management and K3 in construction projects:

a. Risk Identification. The study may identify various risks that can occur during the implementation of a construction project. These risks may include occupational accidents, project delays, cost overruns, financial problems, equipment failure, environmental impacts, material shortages, and coordination problems among project stakeholders.
b. Risk Analysis. The discussion should examine the likelihood and potential impact of each identified risk. Risk analysis enables researchers and project managers to determine which risks require immediate attention and which risks can be managed through routine monitoring and control measures.
c. Risk Management Strategies. The study may propose appropriate strategies for mitigating, transferring, avoiding, or controlling construction project risks. These strategies may include purchasing insurance, improving safety procedures, conducting regular inspections, providing worker training, selecting competent contractors, preparing contingency plans, and strengthening communication among project stakeholders.

d. Implementation of Occupational Safety and Health Standards. The discussion may evaluate the implementation of occupational safety and health standards within the construction project. This evaluation may cover the availability of personal protective equipment, safety training, hazard communication, emergency procedures, workplace supervision, incident reporting, and compliance with applicable occupational safety regulations.
e. Impact on Project Performance. The study may examine how risk management and K3 implementation affect overall project performance. Relevant performance indicators may include project cost, completion time, work quality, accident rates, worker productivity, and stakeholder satisfaction. Effective risk management and strong safety practices are generally expected to reduce disruptions and improve project outcomes.
f. Recommendations. Based on the empirical findings, the study should provide practical recommendations for improving risk management and K3 implementation in future construction projects. The recommendations should be directly linked to the identified problems, supported by the research results, and applicable to contractors, project managers, workers, and other relevant stakeholders.

4 Conclusions

Based on the data processing and analysis conducted in this study, several key conclusions can be drawn. First, the results of the risk assessment, derived from the multiplication of risk frequency and impact, indicate that the highest accident risk category is worker falls, with a Risk Level classified as Low (52%). Similarly, the highest sub-criterion identified is falls from ladders, also with a Low Risk Level of 52%. Furthermore, the primary contributing factor to workplace accidents is identified as the human factor, accounting for 56% at a Low Risk Level. The most dominant sub-factor within this category is the failure to use Personal Protective Equipment (PPE) .

Field observations and literature analysis suggest that effective risk control measures should prioritize routine OSH inspections, strict supervision of PPE compliance, and the provision of adequate safety signage within construction sites.

Second, this study highlights several fundamental principles in risk management and OSH implementation. These include the importance of systematic risk identification, risk evaluation based on probability and impact, and the implementation of appropriate mitigation strategies. In addition, effective communication, continuous training, and regular monitoring are essential to ensure the effectiveness of safety practices. Strong commitment from all stakeholders—including management, workers, and regulatory bodies—is also critical.

Overall, the findings confirm that risk management and OSH are integral components of construction project management and must be consistently integrated into planning, implementation, and evaluation processes to ensure project safety and sustainability.

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