

# **Risk Analysis In The Rigging And Lifting Process Using The HIRARC Method In The Indonesian Production Platform Module Erection Area**

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## **Abstract**

PT. McDermott Indonesia is a company engaged in offshore construction services. Workplace accidents in the offshore construction industry are often due to poor weather conditions, inadequate work locations, equipment failures, and incompetent employees. The aim of this study is to determine the risk level in the rigging and lifting process using the HIRARC method as an effort to achieve zero accidents in the Production Platform Module Erection Area. This research uses a descriptive qualitative approach. The research subjects consist of 5 informants: a rigging superintendent, an HSE specialist, a rigger, a crane operator, and a mechanic foreman, assisted by interview guidelines and a risk matrix. The results of the study indicate that there are 21 potential hazards across 4 work stages and 10 work processes, categorized into 6 low risk, 8 medium risk, 13 high risk, and 4 extreme risk. Risk control is carried out in accordance with HSE procedures and the lifting plan, and it is recommended to consistently use PPE. In conclusion, the risk analysis in the rigging and lifting process has been conducted according to procedures, but updates to the TRA are necessary to reduce increasing risks. It is recommended to enhance employee awareness and discipline regarding the importance of implementing HSE measures.

**Keywords: Risk Rating, HIRARC, Rigging and Lifting, TRA**

## **1. Introduction**

Employees at the company are familiar with Occupational Safety and Health (OSH), where employees play a crucial role in enhancing the success of projects within the company. It is a crucial element in the assessment of remuneration schemes, promoting ethical conduct and employees welfare (E. Beck-Krala, 2016). By implementing Occupational Safety and Health (OSH), the company can prevent and control potential workplace accident risks.

However, according to data from the BPJS Ketenagakerjaan, the number of workplace accidents in Indonesia over the past six years, from 123,040 cases in 2017, has continued to increase annually, reaching 265,334 cases in 2022 (Pratiwi, 2023). This high number of workplace accidents each year

indicates that the implementation of Occupational Safety and Health (OSH) in Indonesia is becoming increasingly prioritized. Workplace accidents will not occur if employees collectively work to prevent and control potential accident risks in the workplace. Sources of workplace accidents include environmental influences and human factors, where employee negligence can lead to accident (Novita, 2021).

The construction industry is the largest contributor to workplace accident cases each year, accounting for 32% of the total workplace accident cases in Indonesia (Mayandari & Inayah, 2023). Therefore, according to the Construction Services Law, Article 70, Paragraph 1, every construction worker employed in the field of Construction Services must have a work competency certification to prevent potential workplace accident risks.

One of the companies engaged in construction is PT. McDermott Indonesia, renowned as an offshore fabrication construction industry specializing in engineering, fabrication, offshore installation, material procurement, and project management. The Marjan Saudi Aramco project is one of its contract, encompassing the design, procurement, fabrication, and installation for pre-commissioning of the TP-10 tie-in platform, six gas lift topside modules and associated pipeline and subsea cables (Breakbulk Events, 2019).

During its construction, employees frequently handle various equipment and work processes that increase the risk of workplace accidents. The rigging process, particularly loading and unloading, presents a high risk of occupational accidents due to various hazards such as falling, being struck by materials, and being squeezed (Pasaribu, 2020). These risks are further exacerbated by using lifting equipment, which can lead to injury and health problems (Douwes, 2021). Therefore, preventive measures are necessary by analyzing potential hazards and risks and taking accurate actions in risk control during the rigging process at Production Platform Module Erection Area. Based on workplace accident data in the rigging process at the Production Platform Module Erection Area of PT. McDermott Indonesia from 2022 to 2024, there was one property damage case in March 2022, four near-miss cases (two of which occurred in November and December 2023), and two workplace incident cases, one of which occurred in January 2024. Accident investigation data and interview results indicate that these accidents occurred due to employees' lack of discipline in implementing hazard identification procedures and lifting procedures, directly impacting employees with various potential hazards.

To prevent the risk of work accidents PT. McDermott Indonesia utilizes Task Risk Assessment (TRA) to pinpoint dangers and evaluate their likelihood during work procedures, with the goal of minimizing workplace incidents and managing risks. Even though TRA is proficient in concentrating on particular duties and offering thorough examinations, its scope is

restricted and it heavily depends on precise data. In general, TRA is efficient for managing certain risks but needs extra steps to adequately handle overall workplace risks.

According to OHSAS 18001:2007, it is important to reduce the risk of workplace accidents by using risk assessment and risk management (Boariu & Armean, 2020). This allows the company to determine the risk levels in work processes and identify appropriate control measures based on these risk levels.

Therefore, to minimize the potential for workplace accidents, it is necessary to implement risk analysis using the HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method to identify potential hazards and risks in each work process, thereby reducing, protecting against, and eliminating risks (zero accidents).

## **2. Theoretical Review**

### **A. Occupational Safety and Health (OSH)**

OSH is a practical effort to ensure safety and improve employee health by preventing work-related accidents and diseases, as well as controlling workplace hazards (Meirinawati & Prabawati, 2017). Supporting worker health is one of the Millennium Development Goals, and occupational safety and health is a multidisciplinary discipline that includes identifying, preventing, and controlling workplace hazards (Salvador & Think, 2016).

### **B. Rigging and Lifting**

Rigging is the process of transporting and moving materials in the fabrication area using heavy transport equipment such as forklifts, cranes, and supporting equipment like hooks, slings, wire ropes, shackles, sockets, and chains, while lifting is the process of hoisting equipment, loads, or materials using lifting devices (Hutari, 2022). Rigging typically includes binding, securing, and preparing the weight for the loads, while lifting the load against gravity is known as lifting. (Mishra, et al., 2022).

### **C. Risk Management**

Risk management is a system that supports and enhances the quality of a company by identifying and controlling risk levels in the workplace. Risk

management consists of a series of actions to list out all possible risks, evaluate their influences, and reduce or avoid losses (Y. Hayashi, 2020)

**D. HIRARC (Hazard Identification, Risk Assessment, and Risk Control)**

HIRARC is the activity of risk identification in all situations, conducting risk assessments by categorizing the levels of risk hazards, and implementing risk control measures aimed at managing and minimizing the hazard levels and the occurrence of accidents in the workplace (Fitri Damayanti & Mahbubah, 2021).

**E. Hazard Identification**

According to Fitri Damayanti & Mahbubah (2021), this stage involves examining each area and identifying potential hazards or risks in every work activity, as well as the work systems that could lead to accidents. The company's considerations for determining risks or hazards are as follows (Urrohmah & Riandadari, 2019):

- a. Abnormal operating conditions (A): Work outside standard procedures.
- b. Normal operating conditions (N): Routine work and procedures.
- a. Emergency conditions (E): Situations that are difficult to control.

**F. Risk Assessment**

According to Hutari, Tri (2022), risk assessment is a set of rules used to control and ensure that worker health and safety are not affected by risks in the workplace. There are two assessments: Likelihood and Severity. Likelihood identifies the probability of a workplace accident occurring, while Severity assesses the level of severity of the consequences of such an accident. The values of likelihood and severity are used to determine the assessed risk level.

Risk rating is a value indicating whether the risk level is low, medium, high, or extreme. Low (L) with risk value 2-4, Moderate (M) with risk value 5-8, High (H) with risk value 9-15, and Extreme (E) with risk value 16-20.

Tabel 2. 1 Levels of Likelihood

Level	Description	Explanation
5	<i>Almost Certain</i>	There is ≥ 1 occurrence per shift

4	<i>Unlikely</i>	There is ≥ 1 occurrence per day
3	<i>Possible</i>	There is ≥ 1 occurrence per week
2	<i>Unlikely</i>	There is ≥ 1 occurrence per month
1	<i>Rare</i>	There is ≥ 1 occurrence per year or longer

(Source: AS/NZS 4360:2004)

Tabel 2. 2 Levels of Severity

Level	Description	Explanation
1	<i>Insignification</i>	No injury, minimal financial loss
2	<i>Minor</i>	Minor injury, minimal financial loss
3	<i>Moderate</i>	Moderate injury, requires medical treatment, moderate financial loss
4	<i>Major</i>	Serious injury ≥ 1 person, significant financial loss, disrupts production process
5	<i>Cotastrophic</i>	Fatality ≥ 1 person, very significant financial loss, extensive impact, results in complete halt of all activities

(Source: AS/NZS 4360:2004)

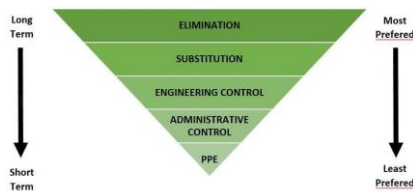
Tabel 2. 3 Risk Rating

Frequency of Risk	Impact of Risk				
	1	2	3	4	5
5	H	H	E	E	E
4	M	H	E	E	E
3	L	M	H	E	E
2	L	L	M	H	E
1	L	L	M	H	H

(Source: AS/NZS 4360:2004)

**G. Risk Control**

Risk control is a useful procedure for identifying and managing all potential risks or hazards that occur in the workplace (Indragiri & Yuttya, 2018). The first step in risk control is to determine the priority scale, making it easier to select risk control measures, also known as the hierarchy of controls (Wibowo, 2016). There are 5 stages in the Hierarchy of Risk Control namely elimination, substitution, engineering control, administrative control, and PPE (Dhaifullah, 2022).



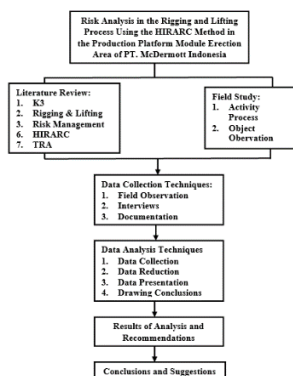
Gambar 2. 1 Hierarchy of Risk Control  
(Source: AS/NZS 4360:2004)

### H. Task Risk Assessment (TRA)

Task risk assessment (TRA) is a hazard identification activity to find out how much potential hazard occurs during the work process as a way to reduce work accidents and control these hazards (Sobah & Maulitana, 2019). According to Sobah & Maulitana (2019) 6 steps in making a Task Risk Assessment (TRA):

1. Determine the type of work to be analysed.
2. Identify the activities, materials, equipment, or work procedures used.
3. Analyse the potential hazards of each job task and their consequences.
4. Determine the risk level for each task.
5. Determine the safeguards required.
6. Determine the residual risk

### I. Framework of Thinking



Gambar 2. 2 Framework of Thinking

## 3. Research Method

The method used by the researcher is a qualitative descriptive approach. By using qualitative descriptive research, the researcher can provide an objective and factual explanation or description of an event regarding

the potential risks and risk analysis in the rigging and lifting process at the Production Platform Module Erection Area of PT. McDermott Indonesia.

### A. Time, Location, and Research Object

- The researcher began the study from July 2023 to July 2024.
- The research was located at the Production Platform Module Erection Area of PT. McDermott Indonesia.
- The object studied in this research is Occupational Safety and Health (OSH) in the rigging and lifting process at the Production Platform Module Erection Area of PT. McDermott Indonesia

### B. Informants / Research Subjects

Purposive sampling is the informant selection technique in this research, where the researcher determines the identity of informants according to the research objectives (Lenaini, 2021). There are three types of informants in this research, as follows (Socrates, 2013).

- Main informants: Rigging Superintendent, Rigger, and Crane Operator.
- Key informant: HSE Specialist.
- Supporting informant: Mechanic Foreman.

### C. Data Collection Techniques

- Field Observation.

Observation of operational activities related to potential hazards in the rigging and lifting process at the Production Platform Module Erection Area of PT. McDermott Indonesia.

- Interviews.

The researcher interviewed with parties related to the research problem using interview guidelines.

- Documentation.

The documents in this research can include images, recordings, and minutes that have covered activities throughout the research process.

### D. Data Analysis Techniques

The data analysis technique in this research uses the Miles and Huberman Model, which is an interactive data analysis process that continues consistently until saturation is reached (Sugiyono, 2013). The stages in

data analysis based on the Miles and Huberman Model are as follows:

- Data Collection.

Primary data sources are recorded from interview responses of informants and observed actions of employees in the field. Meanwhile, secondary data sources are recorded from books, scientific journals, personal documents, and official documents (Rijali, 2019).

- Data Reduction.

According to Rijali (2019), data reduction is carried out by summarizing data, strict data selection, and categorizing it into broader patterns.

- Data Presentation.

In qualitative research, data presentation can be in the form of narrative texts. Besides narrative texts, data presentation in qualitative research can also be in matrices, graphs, and charts.

- Drawing Conclusions.

Various conclusions should be approached openly, and skeptically. Even though unclear, they will become more detailed over time.

#### 4. Results & Discussion

There are 3 steps in processing data collection in the rigging and lifting process at the Production Platform Module Erection Area of PT. McDermott Indonesia, using the HIRARC method (Hazard Identification, Risk Assessment, and Risk Control) and gap analysis between PT McDermott Indonesia's Task Risk Assessment (TRA) method and the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method.

##### A. Hazard Identification Results

To identify a number of work stages that have the potential to cause hazards and workplace accidents in the rigging and lifting process at the Production Platform Module Erection Area, to achieve zero accidents. Data were collected through direct observation and interviews with relevant employees.

Tabel 4. 1 Hazard Identification Results

No	Work Process	Hazard Identification	Risk	Condition (N/A/E)
1	Preparation Stage 1) Conducting Lifting Plan, Toolbox Talk,	Overload exceeding SWL	Property Damage, Personnel Injured	A

2	Load Transportation Stage	and Filling out HIT and TRA	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E
		2) Inspecting Rigging Equipment	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E
			Chain Block & Sling Breakage	Personnel Injured, Crushed by Load	E
		3) Setting Up The Crane	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E
			Overload exceeding SWL	Property Damage, Personnel Injured	A
			Uneven/Soft Ground	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N
			Crane Stability Failure	Crane Tipping/Overturning	E
		4) Sterilizing the Work Area	Falling load outside the safety exclusion zone	Property Damage, Personnel Injured	E
			Uneven/Soft Ground	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N
		5) Transporting Load from Workshop by Forklift/Truck Operator	Forklift/truck malfunction	Personnel Injured, Crushed by Load	A
			Load Rolling Off Truck	Hitting Personnel, Personnel Injured, Crushed by Load	E
			Heavy Traffic	Hitting Personnel, Personnel Injured	A
6) Forklift/truck operator placing the load in the Production Platform Erection Area	Blindspot		Hitting Personnel, Personnel Injured	N	
	Load Falling in the Wrong Spot		Property Damage, Personnel Injured	A	
3	Lifting Stage	7) Crane operator rechecking load suitability based on Safe Working Load (SWL)	Uneven/Soft Ground	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N
			Crane Stability Failure	Crane Tipping/Overturning	E
		8) Rigger securing the load	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E
			Securing Material at Height	Pinched, Personnel Falling	N
			Load Falling from Height	Property Damage, Personnel Injured, Crushed by Load	E
			Chain Block & Sling Breakage	Personnel Injured, Crushed by Load	E
		9) Signalman directing the crane operator during the lifting process	Blindspot	Hitting Personnel, Personnel Injured	N
			Load shifting unexpectedly	Hitting Personnel, Personnel Injured, Property Damage	A
			Head room problems	Property Damage	N
			Loss of radio communication	Personnel Confusion	N
Loss of	Hitting Personnel	A			

4	Load Lowering Stage	10) Crane releasing rigging equipment	control		
			Adverse weather	Property Damage	A
			Blindspot	Hitting Personnel, Personnel Injured	N
			Falling load outside the safety exclusion zone	Property Damage, Personnel Injured	E
			Falling from height	Personnel Injured	E
Pinch Point	Personnel Injured	N			

(Source: has been processed by researchers, 2024)

Based on the results of interviews from informants and the hazard identification table above, the researchers found 4 work stages with 10 work processes and 21 potential hazards. Among the 21 potential hazards found, there are 10 Normal working conditions (N), 8 Abnormal working conditions (A), and 13 emergency working conditions (E) in the rigging and lifting process at the Production Platform Module Erection Area of PT McDermott Indonesia.

### B. Risk Assessment Results

Risk assessment is conducted by determining the level of likelihood and severity using the risk rating matrix based on AS/NZS 4360:2004. Risk rating indicates the level of risk as low, medium, high, or extreme. The risks present in the rigging and lifting process at the Production Platform Module Erection Area mostly have significant impacts, which can result in fatalities and require immediate action (Estri Kartika, et al., 2022).

Tabel 4. 2 Risk Assessment Results

No	Work Process	Hazard Identification	Risk	Condition (N/A/E)	Likelihood	Severity	Risk Rating
1	1) Conducting Lifting Plan, Toolbox Talk, and Filling out HIT and TRA	Overload exceeding SWL	Property Damage, Personnel Injured	A	3	4	8
		Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E	3	4	12
	2) Inspecting Rigging Equipment	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E	3	4	12
		Chain Block & Sling Breakage	Personnel Injured, Crushed by Load	E	2	4	8
		Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E	3	4	12
	3) Setting Up The Crane	Overload exceeding SWL	Property Damage, Personnel Injured	A	2	4	8
		Crane Tipping/Overturning	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N	1	3	3
		Uneven/Soft Ground	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N	1	3	3

2	Load Transportation Stage	4) Sterilizing the Work Area	Crane Stability Failure	Crane Tipping/Overturning	E	3	4	12	
			Falling load outside the safety exclusion zone	Property Damage, Personnel Injured	E	2	4	8	
			Uneven/Soft Ground	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N	1	3	3	
			Forklift/truck malfunction	Personnel Injured, Crushed by Load	E	2	3	2	6
			Load Rolling Off Truck	Hitting Personnel, Personnel Injured, Crushed by Load	E	4	4	16	
3	Lifting Stage	5) Transporting Load from Workshop by Forklift/Truck Operator	Heavy Traffic	Hitting Personnel, Personnel Injured	A	2	4	8	
			Blindspot	Hitting Personnel, Personnel Injured	N	3	4	12	
			Load Falling in the Wrong Spot	Property Damage, Personnel Injured	A	1	4	4	
			Crane operator rechecking load suitability based on Safe Working Load (SWL)	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	E	3	1	3	3
			Crane Stability Failure	Crane Tipping/Overturning	E	3	4	12	
3	Lifting Stage	6) Forklift/truck operator placing the load in the Production Platform Erection Area	Failure in Rigging and Lifting Gear	Property Damage, Personnel Injured, Crushed by Load	E	3	4	12	
			Securing Material at Height	Pinched, Personnel Falling	N	2	4	8	
			Load Falling from Height	Property Damage, Personnel Injured, Crushed by Load	E	4	5	20	
			Chain Block & Sling Breakage	Personnel Injured, Crushed by Load	E	2	4	8	
			7) Crane operator rechecking load suitability based on Safe Working Load (SWL)	Blindspot	Hitting Personnel, Personnel Injured	N	3	4	12
				Load shifting unexpectedly	Hitting Personnel, Personnel Injured, Property Damage	A	4	4	16
				Head room problems	Property Damage	N	2	2	4
4	Load Lowering Stage	8) Rigger securing the load	Loss of radio communication	Personnel Confusion	N	1	2	2	
			Loss of control	Hitting Personnel	A	2	2	4	
			Adverse weather	Property Damage	A	2	3	6	
			Blindspot	Hitting Personnel, Personnel Injured	E	4	3	4	12
			Falling load outside the safety exclusion zone	Property Damage, Personnel Injured	E	3	4	12	
4	Load Lowering Stage	9) Signalman directing the crane operator during the lifting process	Falling from height	Personnel Injured	E	4	5	20	
			Pinch	Personnel	N	2	4	8	
			Crane releasing rigging equipment	Crane Tipping/Overturning, Tripping, Falling Load, Slipping	N	1	3	3	





**D. Gap Analysis Between PT McDermott Indonesia's Task Risk Assessment (TRA) Method and the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) Method**

Tabel 4. 4 Gap Analysis Between PT McDermott Indonesia's Task Risk Assessment (TRA) Method and the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) Method.

Method	Task Risk Assessment (TRA) Method at PT. McDermott Indonesia	Hazard Identification, Risk Assessment, and Risk Control (HIRARC) Method
Work Process	There are 6 work processes	There are 10 work processes
Hazard Potential	There are 16 hazard potentials	There are 21 hazard potentials
Risk Control	No hierarchy of risk control	Hierarchy of Risk Control
Adoption of Computerized System	Has not yet implemented a computerized system	HIRARC already has applications and software that assist in the process of hazard identification, risk assessment, and risk control.
Stakeholder Involvement	Limited to feedback on task-related risks.	Broader, involving stakeholders for feedback, hazard identification, and risk control plans.
Risk Control Effectiveness	Risk control can be limited to specific tasks.	Risk control is designed to address systemic risks and provide more comprehensive solutions.
Approach	TRA is more reactive, conducted before certain tasks.	HIRARC is more proactive, involving preventive measures that cover the entire process and work environment.
Comprehensiveness	TRA does not always consider all aspects of hazards and risks present in the work environment.	HIRARC provides a more comprehensive assessment of all potential hazards and risks.

(Source: has been processed by researchers, 2024)

HIRARC provides a broader, more systematic and comprehensive approach to risk management than the TRA at PT. McDermott Indonesia. HIRARC covers 10 work processes, identifies 21 potential hazards and

uses a systematic hierarchy of risk control. It supports digital implementation, such as e-HIRARC, which improves efficiency and accuracy. HIRARC also incorporates broader stakeholder feedback and is designed to address systemic risks with comprehensive solutions. In contrast, the TRA involves 6 work processes, identifies 16 potential hazards, lacks a risk control hierarchy, has not implemented a computerised system and has limited stakeholder involvement and a reactive approach.

**5. Conclusions & Suggestions**

**A. Conclusions**

Based on the research of rigging process at the Production Platform Module Erection Area of PT. McDermott Indonesia, it can be concluded that there are 21 potential hazards identified in the rigging process, including exceeding the Safe Working Load (S WL), failure of rigging and lifting gear, broken chain blocks and slings, uneven or soft ground, objects falling outside the safety exclusion zone, damaged forklifts/trucks, loads rolling off forklifts/trucks, congested traffic, blind spots, loads falling at wrong points, crane instability or tipping, material being hoisted at height, loads falling from height, unexpected shifting of loads, headroom problems, loss of radio communication, loss of control, unfavorable weather conditions, being struck by loads, pinch points, and being hit by loads.

Based on the risk assessment, risks in the rigging process were categorized as low (e.g., tripping, slipping, confusion among personnel, job delays, and property damage), medium (e.g., property damage, personnel injury, loads falling, falling, and pinching), high (e.g., being struck by loads, crane tipping, hitting personnel, severe injuries, being hit by loads, and falling from forklifts), and extreme (e.g., falling from height, being struck by loads, and fatalities).

Risk control measures include ensuring that crane operators are certified, inspecting and certifying all slings and lifting gear, ensuring proper load weight and crane positioning, placing wooden dunnage under crane outriggers for soft/muddy ground, and using

appropriate safety gloves and full-body harnesses when handling rigging equipment.

Overall, HIRARC provides a more systematic, comprehensive and proactive approach to risk management than the TRA, supported by computerised systems and wider stakeholder involvement.

### **B. Suggestions**

Based on the results of the research and analysis conducted on the rigging process at the Production Platform Module Erection Area of PT. McDermott Indonesia, the following recommendations can be provided for the company are increase supervision to ensure employees always use Personal Protective Equipment (PPE) properly, implement measures to prevent loss of life, assets, and business continuity in extreme-risk situations, enhance supervision and provide short-term solutions to reduce hazards and risks in high-risk situations, monitor and improve every activity to ensure that risk control measures are implemented according to procedures based on priority.

While for the future research, it is recommended to use another method to protect and prevent financial losses and asset damage for the company, such as the Failure Mode and Effect Analysis (FMEA) method, to ensure more comprehensive results a detailed questionnaire can be included, and it is suggested to use FGD (*Focus Group Discussion*) to gather detailed insights from various stakeholders, including supervisors, rigging crew members, and safety officers.

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