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Operational Risk Management of Loading and Unloading Operations in Container Terminal Service Company

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Abstract

Container shipping is one of the important areas in the global logistics industry, where containerisation or the use of containers is used as a container that serves to transport goods. It plays an important role in facilitating international trade, providing reliable and efficient shipping routes for a wide range of goods, from consumer products to industrial raw materials. With the continuous development of technology and infrastructure, container shipping must continue to improve in terms of speed, capacity and efficiency. Meanwhile, in loading and unloading activities, employees play a big role. Employees are valuable assets for the company, and maintaining their health and safety conditions is key to maintaining productivity and operational efficiency. This study aims to identify hazards and potential risks in loading and unloading operations at container terminal service company, and implement risk controls to minimise hazard identified in order to improve the occupational safety and health of workers. HIRARC method is an approach that can be used to identify potential hazards. Implementation of good OHS practices will protect employees from the risk of occupational injury, also reduces costs associated with work accidents. Risk control can be used as an improvement step. The risk of injury can be minimised by identifying potential hazards and adopting appropriate preventive measures, thus creating a safer and healthier working environment for all workers. By implementing OHS, employees can avoid the risk of accidents also increase productivity.

Keywords
Risk Management, HIRARC, Hazard Identification, Risk Control, Container Terminal Service

1. Introduction
Indonesia is the largest archipelago located in Southeast Asia, crossing two continents, Asia and Australia, and two oceans, the Indian Ocean and the Pacific Ocean. Indonesia has a strategic geographical position, which makes it a very important maritime country as it is located at the centre of logistics activities, one of which is container shipping. Container terminals are places where containers are loaded onto and discharged from containerships and key nodes in the sea transportation network (Lu and Yang, 2010). Facilitation of current patterns of global production and trade are widely recognised (Bonacich and Wilson, 2008). Container shipping is one of the important areas in the global logistics industry, where containerisation or the use of containers is used as a container that serves to transport goods. Shipping goods using containers helps transport goods around the world efficiently and safely. The process begins with the collection of goods at the port of origin, and then the packing of the goods to be shipped into containers. With the continuous development of technology and infrastructure, container shipping must continue to improve in terms of speed, capacity and efficiency, which plays an important role in maintaining global connectivity and international economic growth.

Container loading and unloading activities are complex and risky. Apart from the risk of damage to the goods transported in the container, there is also the potential for harm to workers. Conventional wisdom suggests that arrangements for the safety and health of those who remain in employment are generally improved in comparison

with past conditions. Yet, reliable evidence of the effects of work on the occupational safety and health (OSH) of these workers is scarce (Walters and Wadsworth, 2020). Employees are a valuable asset to a company, and maintaining their health and safety is key to maintaining productivity and operational efficiency. By implementing good OHS practices, companies not only protect employees from the risk of occupational injury or illness, but also reduce potential downtime and costs associated with workplace accidents. Awareness of OHS also reflects the company's commitment to social and environmental responsibility.

There are many factors that cause work accidents, making it mandatory for companies to conduct analyses and evaluations to reduce or eliminate work accidents in the future. Therefore, risk analysis is needed to identify, evaluate, and control the factors that cause risks that affect employee safety and health.

1.1 Objectives

This study aims to identify hazards and potential risks in loading and unloading operations at container terminal service company, and implement strategies to improve the occupational safety and health of workers.

2. Literature Review

2.1 Risk

Risk can be define as a concept that encompasses the probability or likelihood of an adverse event occurring and the negative impacts that can arise from that event. Risk can arise in many different areas of life. In general, risk involves the assessment of potential losses or consequences that may arise if an adverse event occurs. Risk is the likelihood that someone will be harmed by a hazard. It is important to identify, assess and manage potential hazards in the workplace to ensure a safe and healthy working environment for all workers, by taking appropriate action to reduce the likelihood of such events occurring or minimise their negative impact.

Risk-taking is often an integral part of the decision-making process at various levels of organisations and in everyday life, with the aim of achieving certain goals or benefits by considering the balance between potential benefits and losses. Therefore, a good understanding of risk and the ability to manage risk effectively are important skills for individuals, businesses and society as a whole (Al-Shanini et al., 2014).

2.2 Risk Management

Risk management is the coordination of activities to direct and control an organisation with respect to risk (ISO 31000**:** 2018). Risk management is a systematic and structured process to identify, assess, and manage the risks faced by an organisation or entity. The purpose of risk management is to minimise the possibility of loss or negative impact due to risks that may arise, and increase the chances of achieving the desired goals. In general, risk management can be defined as the decisions that must be taken to manage risk in the sense that the risk is recognised, assessed, and measured (Tepe and Kaya, 2020). The risk management approach involves identifying the different types of risks that may be faced, such as operational, financial or reputational risks, and then assessing the impact and likelihood of these risks occurring.

Effective risk management can not only reduce losses, costs and waste of social resources, but also improve an organisation's operational performance, competitive value and reputation. Risk management is at the heart of the OHS management system. According to the international risk management standard (ISO 31000**:**2009), to ensure the effectiveness of risk management, organisations should measure risk management performance based on some appropriate indicators. Based on performance monitoring, it can be determined how risk management policies and plans should be improved (Amir-Heidari et al., 2017).

2.3 Hazard

Hazards can be defined as conditions or factors that have the potential to cause accidents or harm to workers. Hazards refers to those features (either physical or psychosocial or in combination) of the workplace that have the potential to lead to harm or unwanted consequences (Agwu, 2012). Hazards can come from a variety of sources, including chemicals, machinery and equipment, environmental conditions, and unsafe work practices. Effective identification and management of hazards is an integral part of efforts to create a safe and healthy working environment for workers.

2.4 Health and Safety Environment

Health, safety and environment (HSE) is an essential aspect of organizational management, encompassing the principles, policies and practices that ensure the well-being of individuals, protect the environment and promote sustainable operations. According to experts from a variety of fields, HSE involves the systematic identification, assessment and management of risks associated with workplace activities and environmental impacts. It integrates health, safety and environmental considerations into all aspects of business operations, from planning and design to implementation and monitoring. The main objective of the HSE is to prevent accidents, injuries and illnesses to employees, contractors and the public, while minimizing negative environmental impacts such as pollution and resource depletion. HSE management systems typically include relevant legal and regulatory compliance frameworks, risk assessment methods, emergency preparedness and response plans, training and awareness programs as well as improvement initiatives. By prioritizing HSE, organizations can create safer working environments, reduce operational disruption, enhance their reputation and contribute to the overall well-being of society.

2.5 HIRARC

Hazard Identification, Risk Assessment, and Risk Control (HIRARC) is a structured method recognized by occupational health and safety management experts to manage risks in the workplace effectively. A risk assessment is then conducted to assess the likelihood and severity of potential harm associated with each identified hazard. Risk assessment provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards (Saravana and Senthi, 2023). This assessment includes consideration of factors such as frequency of exposure, potential consequences, and number of people affected. Throughout the process, experts emphasize the importance of continuous review and updates to adapt to changes in the workplace, emerging hazards, and advances in risk management practices.

The HIRARC model consists of a comprehensive series of phases for hazard identification, risk assessment and determination of control measures for the implementation of HSE in logistics activities. HIRARC involves three stages as shown in Figure 1 (Shaleh and Leman, 2016). An important element of risk assessment is the identification of existing hazards, evaluating the likelihood or chance of their occurrence and recommending relevant controls (Saedi et al., 2022). Reducing risk will led to reducing in accidents at workplaces (Shaleh and Leman, 2016). By adhering to HIRARC principles, organizations can proactively protect employee health and safety, comply with regulatory requirements, and foster a workplace safety culture.

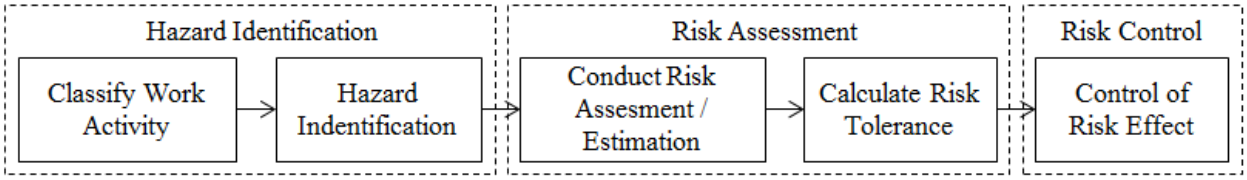

Figure 1. Three steps of HIRARC assessment processes

3. Methodology

In this study, HIRARC is used to conduct risk assessment includes the likelihood and severity of potential harm associated with each identified hazard. This assessment includes consideration of factors such as frequency of exposure and potential consequences. Throughout the process, the writers emphasize the importance of continuous review and updates to adapt to workplace changes, emerging hazards and advances in risk management practices. Then, risk control measures are implemented to either eliminate or mitigate identified risks. Research flowchart is shown at Figure 2.

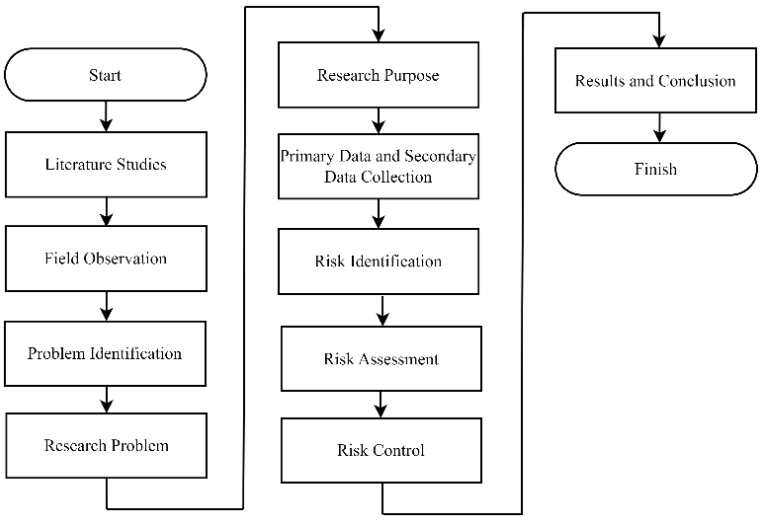

Figure 2. Research Flowchart

4. Results and Discussion

4.1 Problem Situation and Descriptions

Container terminals are facilities used to load containers from sea freight ships, which are an integral part of the global distribution chain. Container loading and unloading activities involves a series of complex and well-coordinated processes to ensure efficient and smooth management of containers entering and leaving the port. The operation of lifting and transport equipment such as ship cranes for container loading and unloading activities has a very high potential for work accidents. These potential hazards can cause work accidents that cause economic and non-economic losses to the company and workers. Analysis and evaluation in container terminal service is carried out to identify hazard, evaluate risk, and control risk factors that can affect worker safety and health.

4.2 Work Process for Container Loading and Unloading

Container loading and unloading is an important part of the global supply chain and is carried out at ports, cargo terminals or other distribution facilities. This process requires special equipment such as cranes, forklifts, or cranes, as well as personnel trained in safe and efficient loading and unloading operations. The analysis and evaluation that occurs will discuss the following two processes: stevedoring and cargodoring

1. Stevedoring
   Stevedoring is the process of loading and unloading cargo, including containers, from ships or onto ships at ports. This process involves the use of special equipment such as cranes, forklifts and other tools and is carried out by workers called stevedores. The process begins with docking the ship and preparing the necessary equipment and personnel. The dockworkers then work to lift the containers from the ship's deck using a crane and then move them carefully and efficiently to the dock or shipping truck. Likewise, when loading containers onto a ship, port workers must ensure reasonable arrangements so that the containers can be positioned stably and safely throughout the sea journey. Apart from that, the handling process also includes arranging container storage space at the port, grouping containers based on their destination or type of goods they contain, as well as providing appropriate labels to facilitate identification and handling.
2. Cargodoring
   Cargodoring is the process of arranging and maintaining goods in containers before and after transportation by ship, which includes arranging goods in containers, packaging them safely and efficiently, installing appropriate labels and identification marks, as well as arranging the documents required for shipping goods. The cargodoring process ensures the safety and efficiency of goods delivery, as well as to protect goods from damage during sea travel. Damage may occur during the sea transportation process which may be caused by vibration, shock or extreme marine weather conditions. This process involves careful planning and coordination between various related parties in the logistics supply chain.

4.3 HSE Evaluation using HIRARC

The risk management process is measured using the HIRARC method to identify hazards and assess risks at each stage of the loading and unloading process, in accordance with the AS/NZS 2004 standards, especially Australian Standards/New Zealand. HSE evaluation using the HIRARC approach includes three points, namely risk identification, risk assessment and risk control to ensure worker safety and welfare.

1. Stevedoring

   Stevedoring is the process of loading and unloading cargo from the ship's hold to the dock using a crane, from a ship or to a ship at the port. HSE evaluation of the stevedoring process. Based on the evaluation results in shown in Table 1, it can be seen that the stevedoring process has 5 potential dangers, namely low back pain, fatigue, dehydration, serious injury, and even fatality (death).

Table 1. Stevedoring Process Evaluation

No.	Activity	Hazard	Risk	Risk Assessment		Severity	Risk Control
				Frequency	Consequency		
1.	The operator operates the crane	Hit by container	Serious injury; fatality (died)	3	5	High	Operators are required to focus and be careful when working
		Less ergonomic sitting position	Low back pain	2	2	Low	Operators are advised to adjust the seat and stretch to reduce muscle tension
2.	Tally does reporting/recording	Less ergonomic sitting position	Fatigue; dehydration	2	3	Moderate	Use PPE such as safety helmets to avoid the heat of the sun
		Exposure to sunlight for a long time	Fatigue	5	2	Moderate	Stretch legs after finishing work
3.	Foreman manages the process of loading and unloading containers	Ergonomics: Standing too long	Fatigue; dehydration	2	3	Moderate	Use PPE such as safety helmets to avoid the heat of the sun
4.	Stevedores install sling cranes on containers	Exposure to sunlight for a long time	Fatigue; dehydration	5	2	Moderate	Stretch legs after finishing work
		Ergonomics: Standing too long	Muscle and joint injuries	1	2	Moderate	Muscle stretching after some time of work
		Ergonomics: Repetitive work positions	Serious injury; fatality (died)	3	4	High	Operators use safety equipment such as safety ropes, harnesses and railings
5.	Stevedores remove the crane sling on the container	Falling from a height	Serious injury (disability)	3	4	High	Use complete PPE such as safety helmets, gloves and safety shoes when working
		Pinched; abrasions due to friction; bruised	Serious injury; fatality (died)	3	4	High	PPE must be used when working
6.	Stevedores climbed the stairs	Falling from a height	Serious injury; fatality (died)	3	4	High	Operators use safety equipment such as safety ropes, harnesses and railings
7.	Stevedores directs the container	Falling from a height	Serious injury; fatality (died)	3	5	High	Safety training, application of safety standards and briefing before work
8.	Stevedores arranges the location of containers on the transport truck	Hit by container	Serious injury (disability)	3	4	High	Use PPE such as safety helmets to avoid the heat of the sun
9.	Foreman organizes loading and unloading activities	Pinched; bruises	Fatigue; dehydration	2	3	Moderate	Use PPE such as safety helmets to avoid the heat of the sun

2. **Cargodoring**

   Cargodoring is a term that refers to the process of organizing and implementing cargo loading and unloading activities at the port. This process involves coordination between various parties, including cargo owners, ship operators, and port officials to ensure cargo can be moved efficiently and safely. Next, the cargo arranged in containers or other cargo units will be unloaded from the ship using these tools. The loading and unloading process is then carried out carefully and efficiently, using heavy equipment such as a forklift to lift the cargo from the container and load it onto a truck or storage warehouse. Once completed, empty containers or containing cargo that has been processed can be loaded back onto the ship to be sent to the next destination. Based on the evaluation results in shown in Table 2, it can be seen that the cargodoring process has 3 potential dangers, namely low back pain, fatigue, damage to the container, serious injury, and even fatality (death).

Table 2. Cargodoring Process Evaluation

No.	Activity	Hazard	Risk	Risk Assessment		Severity	Risk Control
				Frequency	Consequency		
1.	Head truck operators carry containers from the dock to the stacking yard	Less ergonomic sitting position	Low back pain	2	2	Low	Stretch and adjust to a comfortable sitting position
		Collisions caused by careless driving	Serious injury; fatality (died)	3	5	High	Be careful when driving and drive at a steady speed
2.	Crane operator sits in the operator's seat	Less ergonomic sitting position	Low back pain	2	2	Low	Stretch and adjust to a comfortable sitting position
3.	Forklift operator or reach staker stacks the containers from the truck into the field	Inappropriate placement of containers	Containers damage	2	4	Moderate	Careful when arranging the container layout
		Hit by container	Serious injury; fatality (died)	3	5	High	Safety training, application of safety standards and briefing before work

5. Conclusion

Based on the results of the analysis and evaluation, the author provides a contribution in the form of recommendations for HSE risk control as an improvement step. It enables container terminal operators to systematically identify potential hazards present in their operations, ranging from manual handling of cargo to machinery operation and chemical exposure. By pinpointing these hazards, terminal operators can proactively mitigate risks before they escalate into accidents or incidents that could harm personnel, damage equipment, or impact the environment.

Implementing recommendations as risk control has the impact of increasing employee safety and health. The risk of injury can be minimized by identifying potential hazards and adopting appropriate preventive measures, thereby creating a safer and healthier work environment for all workers. Apart from that, work productivity will also increase. Proper risk control can also increase productivity in the workplace. By reducing the likelihood of accidents and incidents, operators can focus on work activities without the distraction and fear of potential dangers, which can improve efficiency and overall performance in the workplace. Ultimately, the purpose of HIRARC in container terminal services is to foster a safe working environment, protect personnel, safeguard assets, and minimize the environmental footprint of operations.

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Biographies

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