Minimizing Work Risks in Indonesia: A Case Study Analysis of Hazard Identification, Risk Assessment, and Risk Control Implementation

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Abstract. Workplace safety must be a primary priority in order to prevent work-related accidents that might result in disability or death. Promoting workplace safety is a crucial component of labor protection since it can lead to improved employee relations and management. Construction and industrial industries, which rely on heavy machinery or outside labor, are especially vulnerable to safety and health concerns that can lead to accidents. This case study and literature review investigates the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) theory as a systematic method for promoting workplace safety. HIRARC seeks to identify potential hazards within an organization and control associated risks in order to prevent accidents. The study reveals numerous factors that contribute to occupational accidents and the potential harm they can inflict. The study specifically addresses worker attitudes toward the usage of personal protective equipment (PPE) and high-temperature production environments as accident risk factors. The study recommends that organizations prioritize instilling work discipline in their employees, with an emphasis on the correct use of PPE to prevent accidents and promote workplace safety.

1 Introduction

Along with the rapid development of technology, the manufacturing process is required to meet the desired standards and quality both in terms of quality and safety. In addition, in facing the era of industrialization and the era of globalization as well as the free market, occupational health and safety is one of the prerequisites set out in economic relations between countries that must be met by all countries [1].

The acceleration of infrastructure development carried out by the government is a development of the era of industrialization which is global in nature and has very rapid development, such as the construction industry which provides construction services and has a significant role in current development. Work in the construction industry sector is a dangerous job and has a fairly high risk of work accidents. If a work accident occurs, it will cause various losses, both material losses, loss of life, and disruption of the production process.

Based on graphic data on work accidents in Indonesia for the last five (5) years, quoted from the website for the General K3 Expert Training, the Social Security Administration for Manpower (BPJS) noted that in 2017 the number of reported work accidents reached 123,041 cases, while throughout 2018 reached 173,105 cases with Work Accident Insurance (JKK) claims amounting to Rp 1.2 trillion. For 2019, there were 114,000 cases, and an increase of 55.2% cases to 177,000 cases in 2020. Then, from January to September 2021, there were 82,000 cases of work accidents and 179 cases of work-related illnesses, 65 percent of which were caused by Covid-19 [2].

According to data released by the Indonesian Ministry of Manpower in 2020 [3], 57.5% of the total 126.51 million working population in Indonesia, have a low level of education. This condition affects the workers' low awareness of the importance of OHS (Occupational Health and Safety) culture. At the same time, the employer is also at risk of having to bear large costs if a work accident occurs in the workplace.

The purpose of implementing the Occupational Health and Safety Management System (SMK3) is to reduce or prevent accidents that result in injury or material loss; therefore Occupational Safety and Health (K3) experts seek to study the phenomenon of accidents, their causal factors, and effective ways to prevent them. Efforts to prevent accidents in Indonesia are still facing various obstacles, one of which is the traditional mindset that considers accidents as disasters so that people are resigned.

To prevent accidents, it is important to identify potential risks. The HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method is commonly used for this purpose. This approach involves effective planning, including experience and assessment steps, and the establishment of control measures based on collected data. By implementing the
HIRARC method, companies can develop a comprehensive model for managing occupational safety and health (OSH). This method guides the implementation of safety measures within the company, enabling it to address management issues and solve problems independently.

2 Literature Review

2.1 Hazard Identification, Risk Assessment and Risk Control (HIRARC)

HIRARC (Hazard Identification and Risk Assessment Risk Control. The HIRARC method is Hazard Identification, Risk Assessment and determining its control (Risk Control). This whole process is also known as risk management. HIRARC is an important element in the occupational safety and health management system that is directly related to hazard prevention and control efforts.

According to Ramli [4], HIRARC is a process that has occurred Controlling hazards that can occur in routine and non-routine activities in the company then conducts a risk assessment of these hazards and creates a hazard control program in order to minimize the level of risk to a higher level with the aim of preventing accidents.

1. Hazard Identification
   According to [4] "Hazard identification is a systematic effort to find out the existence of hazards in occupational activities". Every workplace that tries to take risks from each event and then weighs the conditions in determining risk are as follows:
   a) Normal Operating Conditions (N): Daily work and according to procedures
   b) Abnormal Operating Conditions (A): Work outside of procedures
   c) Emergency Conditions (E): Situations that are difficult to control

2. Risk Assessment
   According to Ramli [4] Risk assessment is an attempt to calculate a risk and determine whether the risk is acceptable or not. Risk is used to determine the level of assessment of the likelihood of occurrence (probability) and the severity that can be caused (severity). The qualitative method according to the AS/NZS 4360 standard, the probability or probability is given a range between a risk that rarely occurs to a risk that can occur at any time. For severity or severity, it is categorized between events that do not cause injury or only minor losses which are the most severe if they can cause fatal events (death) or major damage to company assets.

3. Risk Control Risk control is carried out on all hazards found in the hazard process and considers risks to find priorities and how to control them. Furthermore, in controlling the control must consider the control control starting from elimination, substitution, technical control, administrative and PPE.

2.2 Occupational Health and Safety Management System

According to Regulation of the Minister of Manpower No. 05 released in 1996, "The OHS Management System" is part of the overall management system which includes organizational structure, planning, responsibilities, implementation, procedures, processes, and resources needed for development, application, study, assessment, and maintenance of occupational safety and health policies in controlling risks related to work activities in order to create a safe, efficient and productive workplace”.

2.3 Occupational Health and Safety (K3)

According to Suryati Darmiatun and Tasrial [5] the definition of K3 procedures includes preventing deviations from previously set K3 activities and objectives. According to Syafrial and Arriansyah [6] there are things that must be considered in making OSH procedures in organizations:

1. Organizational Commitment in implementing OHS management
2. Focus/type, complexity of organizational structure and size,
4. Implementation of procedures (easy to operate by the user); and
5. Measurability and able to evaluate the results of the implementation of the procedure.

3 Methodology

This study utilized a systematic literature review to collect the necessary data. According to Xiao and Watson [7], a systematic literature review (SLR) is a technique that involves determining, identifying, and critically evaluating the selected sources in order to provide an explanation for the formulated question. Therefore, a well-planned search strategy is required for the specified question.

This study’s systematic literature review was conducted using the Google Scholar database (https://scholar.google.com/). Google Scholar is an excellent choice for finding scientific sources due to its comprehensive coverage of journals, conference papers, theses, and books. Its user-friendly interface simplifies the search process, allowing researchers to efficiently locate sources on a specific topic. Being a free online resource, it provides open access to scholarly literature, ensuring universal accessibility. Additionally, the integration of citation metrics and the ability to access various publication formats make it a convenient and time-efficient tool for researchers.

When the keyword "HIRARC" was entered, 2,670 results were displayed. The website displayed 1,820 results after the second keyword "Indonesia" was entered, narrowing the search results further. The search was then limited to the keyword "industry," yielding 510 results. From the 510 records, research conducted more than ten years ago and by the same company are
excluded. As a result, the author selected only five sources to analyze five distinct companies that offer distinct products and services.

4 Analysis and Discussion

The method used in this paper is a literature review that discusses HIRARC related to case studies on five (5) companies. Here are the companies that have been analyzed regarding HIRARC:

4.1 Implementation of HIRARC at PT. Hutama Karya (Persero) Tbk.

PT. Hutama Karya Persero is an Indonesian state-owned company engaged in the construction service industry. Based on the results of the analysis in research journals that discuss the implementation of HIRARC at PT. Hutama Karya (Persero) Tbk., it is concluded that PT. Hutama Karya needs to take action to evaluate the risk of work accidents in the process of construction and formwork brackets from piles because there are 7 risks of work accidents that are classified as high and must be repaired in 1 months ahead, as well as 3 risks of work accidents that are classified as medium and must be repaired within the next 1 year. PT. Hutama Karya needs to take administrative actions such as workers who do not wear complete PPE according to K3 regulations, they will be given penalty which will make workers aware of the behavior of workers not to repeat the same mistakes or other violations. Meanwhile, for workers who obey K3 regulations in using PPE every day, complete in the field at work, they are given rewards which will increase awareness and concern for the use of PPE and workers can be motivated not to take unsafe actions and unsafe conditions[8].

4.2 Application of HIRARC on CV. Jati Jepara Furniture

CV. Jati Jepara Furniture is a business engaged in the production of furniture. Based on the results and discussions in research journals that discuss HIRARC on CV. Jati Jepara Furniture, it can be concluded that the dangers contained in CV. Jati Jepara Furniture are in the form of the highest scores in the assessment process, namely 4 & 5 such as dust and sawdust that interfere with breathing and finishing sprays that interfere with smell and fall from the second floor (2) as well as machine noise that disturbs hearing, has such a high value because the long-term effects will affect the health of workers and are sustainable over time. The medium level is with values ranging from 3 & 2. Included in the medium level are the hands hit by the planner machine, the fingers hit by the spindle, the sanding machine conveyor, and the hands hit by the cutter. Then the lowest level with a value of 1 is that the hand is exposed to the cutter and the hand is exposed to glue when packing [9].

4.3 Application of HIRARC at PT. Glory Industrial Semarang II

PT. Glory Industrial Semarang II is a manufacturing company for the American and European markets. Implementation of HIRARC (Hazard Identification Risk Assessment and Risk Control) in the Production process of PT. Glory Industrial Semarang II. Has implemented 88 applications of HIRARC (Hazard Identification Risk Assessment and Risk Control) of the 97 applications that have been written in the HIRARC (Hazard Identification Risk Assessment and Risk Control) document, the Warehouse process contained 26 of 29 applications, the cutting process contained 25 of 29 applications, the process of Sewing there are 18 out of 19 applications, Ironing or rubbing process there are 7 out of 8 applications, and Finishing process there are 12 out of 13 applications, and in practice workers do not comply with the use of PPE, the company does not provide PPE, such as footwear with insulating materials with standards or regulations that applicable, namely in OSHA standards explaining that footwear is made of aluminum, steel, fiber or plastic, and can protect feet against industrial heat, stab wounds, and electrical hazards in the workplace and there are still production equipment that does not comply with standards or regulations applicable, such as a damaged pallet is not immediately replaced. Based on the data that has been obtained in this study, damaged pallets should not be used, specifications for pallets used for racking must include pallet quality and inspection of all storage equipment must be carried out systematically on a regular basis and usually carried out from ground level, where most of the damage tends to occur. unless there is an indication of a problem that needs investigation Recommendations that can be given to further researchers are to conduct a preliminary study so as to find more accurate data for research, to be able to add secondary data that researchers cannot obtain at this time, and also to adapt the research to standards and regulations legislation so that research results are better [10].

4.4 Application of HIRARC at PT. Cahaya Murni Andalas Permai

PT. Cahaya Murni Andalas Permai is a company engaged in the furniture sector with the Bigland Springbed trademark. PT. CMAP is a subsidiary of PT. Cahaya Buana Group which has not yet received the ISO 14001 certificate as its parent company. As a large company, PT. CMAP must be able to implement an occupational health and safety management system (SMK3) to minimize the risk of work accidents and increase company productivity. To demonstrate commitment related to OHS, in 2012 the management of PT. CMAP began to document detailed data on every work accident that occurred, such as inhalation of toxic gas, slashing with a cutting knife, and falling on equipment while working. As many as 10 cases of work accidents occurred in 2014 in the company. (3) From the results of the analysis, it can be seen how the countermeasures that can be applied to PT. CMAP so
that the number of accidents in the factory area is expected to be reduced and achieve zero accidents. The work accident control effort that has been carried out by this company is to provide first aid kits and safety-first signs.

The results of the identification of hazards in the production area of PT. CMAP indicates that inhalation of hazardous materials (particulate foam) is frequent and moderate. In general, the results of the work accident risk analysis at PT. CMAP is in the low category. However, there are still 2 of the 9 sub-divisions of the following production processes that are important to note, namely Foam Cutting and Finishing. Several risk controls that can be applied to PT CMAP include engineering: administrative controls and personal protective equipment. Regarding further research, it is better to design an appropriate K3 culture to be applied to PT. CMAP.

The results of the average risk assessment show that the production area at PT. CMAP is still at a low risk level with 2 moderate accidents, namely equipment scratches and inhalation of harmful gases. In addition, the production area at PT. CMAP is still at a low risk level in addition to 2 moderate sub-divisions. The level of risk in each type of work accident and production sub-division. Risk control aims to reduce and even prevent work accidents to zero accidents. Based on the results of the risk evaluation, several risk controls can be applied at PT. CMAP. For engineering controls, providing protective equipment. Regarding further research, it is better to design an appropriate K3 culture to be applied to PT. CMAP.

In the HIRARC method, the level of risk is categorized into high, medium, and low levels, and appropriate control measures were recommended to address the identified risks.

### 4.5 Application of HIRARC at PT. PAL Indonesia

PT. Pal Indonesia is a company engaged in shipping construction. Based on the results of research and discussion, it can be concluded as follows: The results of hazard identification using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method on the work of the fuel pipe installation system have 7 aspects with 10 potential hazards, when the diesel generator system work there are 4 aspects with 7 potential hazards, and the work of the mooring system has 4 aspects with 7 potential hazards. The results of the risk assessment using the Hazard Identification, Risk Assessment and Risk Control (HIRARC) method on the activity of the fuel pipe installation system against the danger of leaking fuel storage tanks obtained a value of 16 and oil storage tank leaks, gas leaks in the network, compressed air leaks in pipelines obtained a value of 12. When the activity of the diesel generator system against the danger of spilled goods/oil/fuel obtained a value of 16 and the danger of electric current, scuffed cables obtained a value of 12. Also, the activities of the mooring system against the dangers of heavy objects, rigging, operator error obtained a value 12 and the danger when the ship docks or exits the dock is obtained a value of 9 [12].

### 5 Conclusion

The HIRARC method is a systematic approach to occupational safety that can be tailored to the specific needs of each company. It is designed to identify potential hazards and risks, assess the likelihood and severity of those risks, and then take steps to control or mitigate them. The HIRARC method is particularly useful in identifying problems related to work safety.

In the HIRARC method, the level of risk is categorized based on a traffic light system, with the red zone indicating high risk, the yellow zone indicating medium risk, and the green zone indicating low risk. The approach to risk control and mitigation is then adjusted according to the risk level. For example, in the red zone, the focus is on hazard elimination, while in the yellow zone, the focus is on implementing safeguards and in the green zone, the focus is on using personal protective equipment (PPE).

A study conducted by [13] in the construction industry in Malaysia found that the HIRARC method was effective in identifying and controlling workplace hazards. Similarly, a study by [14] in the oil and gas industry in Malaysia found that the HIRARC method was useful in identifying potential hazards and risks associated with offshore drilling operations. The five case studies, although they are from different industries, share some similarities in terms of the application of HIRARC. All companies have identified potential hazards in their workplaces and have taken actions to reduce or eliminate the risks associated with those hazards. The risks were categorized into high, medium, and low levels, and appropriate control measures were recommended to address the identified risks.
Another similarity between these case studies is the importance of conducting regular risk assessments. In these cases, conducting regular risk assessments was recommended to identify and address potential hazards in the workplace.

Furthermore, these studies emphasize the importance of creating a safer work environment for workers. This is achieved through implementing appropriate control measures, providing personal protective equipment, and conducting training to raise awareness and promote safe working practices.

While the correct use of PPE is a standard procedure for workplace safety, additional recommendations can enhance it. Engineering controls modify the environment to minimize hazards, while administrative controls focus on work practices and policies. Hazard elimination/substitution removes or replaces hazards, and regular maintenance and inspections identify issues. However, these recommendations have limitations. Engineering controls can be costly, administrative controls depend on human compliance, hazard elimination/substitution may not always be feasible, and maintenance/inspections may not cover all hazards. Combining multiple measures, including PPE, is the most effective approach for workplace safety.

References


