Preferences For Controlling Occupational Health and Safety Risk In The Building Projects

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Abstract Building projects have the complexity and massive frequency of procurement that can trigger work accidents. Although different efforts have been made, there are still work injuries, one of which is caused by employees who are uncomfortable with the control measures being taken. The aim of this analysis is to find alternatives or solutions in controlling OHS regulation. In order to assess the degree of risk, risk analysis was performed by multiplying the probability value with the concequence. Risk management was performed by referring to the hierarchy of OHS risk control based on OHSAS 18001. Questionnaires were administered using the method of purposeful sampling to assess the choice of field workers and OHS officers for OHS risk management. 168 hazards were described in this study, 24 hazards (14.2%) were classified as low risk, 94 hazards (55.95%) as moderate risk, 49 hazards (29.17%) as high risk, and 1 hazard (0.6%) as very high risk. From the point of view of the OHS officer, the preference for OHS risk control in the very high-risk category was the administrative method, the personal protective equipment (PPE) method in the high-risk category, and the engineering controls were liable for the moderate and low risks. In the meanwhile, from the point of view of the field workers, the control preference in the very high risk category was by administrative method, by the personal protective equipment (PPE) method in the high and moderate risks, and by the engineering controls in the low risk category.

Keywords: building projects, occupational safety and health risk, risk control preference.

I. Introduction

In line with infrastructure needs, both in terms of quantity and technology used, the speed of growth in the construction world has increased. These are obviously the hazards and threats that can cause accident at work. The construction sector , namely 32%, ranks top for employment. BPJS Ketenagakerjaan recorded 147.000 accidents in 2018 and 33.05% decline in 2019 recorded 77,295 accidents [1]. Although it has decreased, the number of accidents is still relatively high. To overcome this, the government has established a regulation contained in pasal 4 ayat 1 of regulation No. 05/PRT/M/2014 of Minister of Public Works [2], requiring all construction service providers to implement occupational health and safety (OHS).

Even though various regulations have been established and implemented, work accidents still occur because risk control measures are not maximally implemented in the field. This is triggered by several factors. One of which is workers who are uncomfortable with the control measures taken so that workers become less obedient to the established regulations. Implementation of occupational safety and health systems interaction between leaders and workers should be kept in mind. Comprehension in occupational safety and health prevention and promotion programs is at risk of workers becoming rejected and jobs becoming hazardous [3].

Therefore, a study was conducted to determine preferences or options for OHS risk control from the perspective of the OHS officer and from the perspective of field workers so that controls can be applied effectively and efficiently. The building project was chosen to be the object of research because the construction process is usually at depth and height, in which there are many work items and massive frequency of procurement, so the building project is one of the projects that have high risk.

II. Literature Review

A. Occupational Health and Safety (OHS)

Occupational health and safety (OHS) is a multidisciplinary science that is applied in an effort to maintain and improve the safety conditions of the work environment, protection of workers from accidents or

occupational diseases, prevention of losses caused by work accidents, and all production sources can be utilized or used safely and efficiently [4]. The objectives of occupational health and safety (OHS) are mentioned below.

1. Protect every workforce for their rights and safety in doing work and improving their performance
2. Ensure the safety of other people in the work environment
3. Company assets can be maintained and used safely and efficiently.

B. Occupational Health and Safety Management System

The Occupational Health and Safety Management System (OHSMS) is part of a management system that involves the organisation, planning, implementation responsibilities, procedures and resources needed for implementation, achievement, development, assessment, and maintenance of OHS in order to monitor risks relevant to job activities in order to establish a healthty and efficient workplace. The benefits of implementing OHSMS are listed below [5].

1. The company can find out the weaknesses of the operational system so that it can prevent accidents, incidents, operational disruptions, and other losses.
2. Know the company's OHS performance clearly.
3. Meet the laws and regulations on OHS.
4. To improve skills, knowledge, and workers' awareness of the importance of OHS.
5. Increase productivity in the workplace.

C. Obstacles in Implementing OHS

In its application in the workfield, the OHS program certainly encountered obstacles so that the efforts made could not run optimally. According to Dharmayanti *et al.* [6], some of the obstacles to implementing OHS on contractors in Bali are as follows:

1. Limited fund allocation for OHS activities.
2. The company's leadership only pursues production targets and cost savings, thus ignore the risks posed.
3. Weak supervision of the implementation of OHS.
4. Lack of knowledge about OHS.
5. Less strict sanctions from the company.
6. Force work overtime or work late at night.
7. Low awareness of workers about the importance of OHS. The low awareness of workers about OHS can be seen from workers who are less disciplined in using PPE.

Although PPE is the last step in risk control, using PPE is a must for all workforce in the field. The reasons for workers are lazy to use PPE are meentione below [7].

1. Feel uncomfortable, difficult, and are considered to interfere the activities.
2. Low awareness of the importance of safety equipment.
3. Not disciplined in using PPE, so it must be continuously monitored.

According to Machfudiyanto [8] to implement a work accident control policy, a good safety culture requires national safety standards, company policies and procedures. The safety procedures and policies implemented by the contractor must be simple to understand and not difficult to apply to building projects, specific fines must be enforced where safety rules and procedures are followed and periodic adjustments must be taken out in accordance with the building project conditions. Clear safety procedures and guidelines promote a healthy culture of safety.

III. RESEARCH METHOD

This research was conducted on a 3 to 5 storey building construction project with reinforced concrete structures. The stages of work reviewed are preparatory work and structural work. The locations of this research are in Bali.

The risk analysis in this study was carried out with a qualitative risk analysis based on AS / NZS 4360: 2004 [9]. Level of risk is obtained from the multiplication of the value, likelihood namely the frequency/ probability of occurrence of a hazard with the value of consequence, namely the consequences/ impacts of the hazard.

Primary data were obtained from interviews, observations, and questionnaires. The distribution of questionnaires was carried out using the purposive sampling method, in which the questionnaire can only be answered by people who meet certain criteria to be taken into consideration for the research results. Meanwhile, secondary data were obtained from previous research, job data, accident data, OHS organizational structure, and other literature related to this study.

Respondents in this study were OHS officers (safety officers) and field workers on predetermined projects. The questionnaire was distributed to 89 respondents, they were 5 OHS officers and 84 field workers. Respondents were divided into 14 questionnaire sheets based on their assignment / job or position in each project. Analysis of the questionnaire data in this study was carried out using descriptive statistical analysis.

IV. RESULTS AND DISCUSSION

A. Job Safety Analysis

The safety analysis work or *job safety analysis* (JSA) is a method used to identify hazards or risks that occur in the workplace based on aspects that affect each step or phase of work [10]. The aim of JSA is to identify and evaluate all the risk elements associated with the mission so that steps to remove and monitor the hazards can be implemented [11]. The steps in carrying out a job safety analysis are stated below [12].

1. Determine the work to be analyzed
2. Describe job steps or procedures
3. Conduct hazard identification at each step
4. Determine control measures or measures

B. Hazards Identification

Hazards identification is an effort made to identify the hazards that appear in a project. At this stage, all possible hazards in the work environment are collected and identified. Hazard identification is carried out with the consideration of the OHS officer by giving a value based on the situation and conditions of each project concerned. Increasing the variety of hazards makes it necessary to identify hazards and to control occupational safety and health risks. This programs can protect employees and reduce of organizational expenses [13]. There is an urgent need to develop methods for identifying and assessing OHS risks, further improve conditions to increase productivity. This issue is of economic importance as accidents can cause excessive cost, such as damage to products and equipment, time-consuming investigations, training costs, etc.

In this study, 168 hazards were identified at 12 stages of work and 47 work activities. The results of this identification were obtained based on data from previous research, job data, observation, and *brainstorming* with OHS officers in the field. This hazard identification data then used for risk assessment and questionnaire preparation materials.

C. Qualitative Risk Analysis

According to AS/NZS 4360, 2004, qualitative analysis is a step used to assess the magnitude of the potential consequences that arise and the likelihood of these consequences. In analyzing risk qualitatively, there are several methods that can be used, namely:

1. Compile *a checklist* risk based on previous events or experiences.
2. Conduct interviews with people who are experienced and competent in their fields.
3. Brainstorming or discussion with the team on the project.

After the hazards that exist at each stage of work are identified, then a risk analysis is carried out by multiplying the *likelihood* value by the value consequence of each hazard. The value used is the mode value for each hazard identification which represents or can represent the answers of the OHS officers in each project.

To determine the qualitative risk, multiplication of the likelihood value and the value consequence carried of each identified hazard is out in order to obtain a risk level in the range 1-25. To make it easier to determine the level of risk, a qualitative risk matrix is used which can be seen in Table I. Meanwhile, for the level of risk based on AS/NZS 4360, 2004 can be seen in Table II.

TABLE I
QUALITATIVE RISK MATRIX

Frequency of Risk	Consequences Risk				
	1	2	3	4	5
5	MR	HR	VHR	VHR	VHR
4	MR	HR	HR	VHR	VHR
3	LR	MR	HR	VHR	VHR
2	LR	LR	MR	HR	VHR
1	LR	LR	MR	HR	HR

TABLE II
LEVEL OF RISK

Very High Risk 15-25	Risk cannot be accepted, activities are stopped until certain circumstances
High Risk 8-12	Risk is not expected, activities are stopped, if it is continued, immediate treatment is needed
Moderate Risk 4-6	Risk is acceptable, action is needed to reduce risk
Low Risk 1-3	Risk can be ignored, continued control is not required

The results of the risk analysis in this study can be seen in Table III.

TABLE III
OHS RISK ANALYSIS

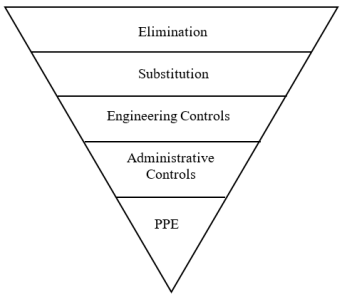
Level Risk	Lots	Percentage (%)
Very High	1	0.60
High	49	29.17
Moderate	94	55.95
Low	24	14.29
Total	168	100.00

Table III shows that there are 24 hazards (14.2 %) classified as low risk, 94 hazards (55.95%) classified as moderate risk, 49 hazards (29.17%) classified as high risk, and 1 hazard (0.6%) classified as very high risk.

D. Risk Control

According to OHSAS 18001 [14], the hierarchy of risk control is a priority in determining and implementing OHS risk control measures. Risk control can be done by sequencing the consideration of the actions given to a risk until the risk is reduced or at a safe point. The hierarchy of OHS risk control according to OHSAS 18001 can be seen in Figure 1.

Fig. 1. Hierarchy of Risk Control According to OHSAS 18001



The hazard control hierarchy is primarily a priority in the choice and application of OHS-related hazards control, including:

1. Elimination
   Elimination is a technique of approach or risk control that is a priority because this method is the most effective way. This technique is done by eliminating the source of the hazard so that the potential risk can be eliminated.
2. Substitution
   Substitution is a risk control technique in the second hierarchy which is carried out by replacing dangerous procedures with the safest procedures. This technique can also be done by replacing dangerous tools or materials with tools or materials with a lower risk level.
3. Engineering Controls
   This method is carried out by improving the design, adding safety equipment or providing security to technical tools / sources that are a source of danger.
4. Administrative controls
   This approach is carried out by establishing a structure of administrative tasks aimed at minimizing the risk of employees being vulnerable to potential hazards at the workplace.
5. Personal protection equipment (PPE)
   PPE is a risk control method that is the last choice because it is temporary and is used for the short term. This method is used only to reduce the impact of a risk and not to eliminate or prevent an accident from happening.

Providing risk control measures is carried out by interviewing and *brainstorming the* OHS officers or based on references from previous research. Each identified hazard will be given 5 (five) risk control measures, namely elimination, substitution, engineering controls, administrative control, and personal protective equipment (PPE). This control measure takes the form of efforts made to prevent accidents and reduce the level of risk according to the situation and conditions in each project.

From 168 identified hazards, 840 control measures were obtained. The results of these risk control measures are then used as a reference for the preparation of the questionnaire.

E. Validity and Reliability Test

Before analyzing the questionnaire data, the validity and reliability tests were carried out for all the questions on the distributed questionnaire. The validation test is performed by comparing the value r_{count} with the value r_{table}. Based on the distribution of the value r_{table} with a significance level of 5% for 14 respondents, the value r_{table} is 0.532. The requirement for a question item to be declared valid is if $r_{count} > r_{table,}$ so that in this validity test, all items/ question items are declared valid. The reliability test was carried out using the method *Cronbach Alpha* where the value *Cronbach Alpha* (α) is at least 0.6 so that the question is declared reliable. Based on the outcome of the analysis, the value of the reliability coefficient of all question items was 0.993 than 0.6 so that the questionnaire was declared reliable.

F. Risk Control Preferences

Analysis of OHS risk control preferences is carried out to find alternative solutions that can develop a risk management procedure so that it can be implemented safely, effectively, and efficiently. The selected control measures chosen are based on the situation and conditions in the field, the respondent's work experience, the procedures that have been established and implemented, and the respondent's personal condition.

The results of the respondent's answers to the OHS risk control preferences were tabulated into tables and analysis was carried out. To determine control preferences, the mode value of each hazard identification number is used based on the answer selected by the respondent. A recapitulation of risk control preferences from the point of view of OHS officers and field workers can be seen in Figure 2 and Figure 3.

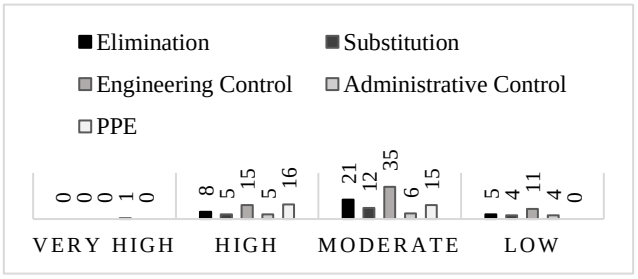


Fig. 2. Preferences of Risk Control from the Viewpoint of an OHS Officer

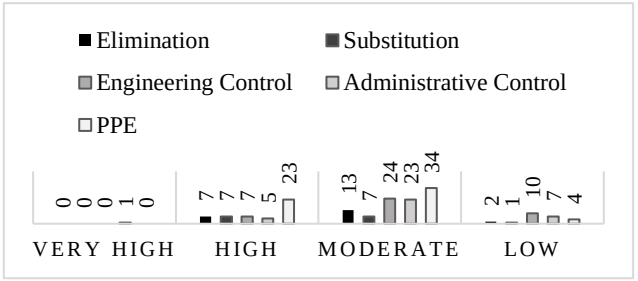


Fig. 3. Preferences of Risk Control from the viewpoint of Field Worker

Knowing the risk evaluation, it is important to set Objectives, targets, and management programs (OTPs) to reduce the risk of occupational accidents and occupational diseases. OTP can also be referred to as a corporate

objectives that has to be reviewed on a periodic basis to assess the efficacy of hazard control. OTP is also equipped with time of implementation, the person in charge, and media monitoring [15].

V. CONCLUSION

From the risk analysis of 168 hazards identified in 47 work activities, there are 24 hazards (14.2%) classified as low risk, 94 hazards (55.95%) classified as moderate risk, 49 hazards (29.17%) classified as high risk, and 1 hazard (0.6%) classified as very high risk.

The preference for OHS risk control from the viewpoint of the OHS officer in the very high risk category is to use administrative methods. In the high risk category, the control preference is to use the personal protective equipment (PPE) method. In the medium and low risk categories, the control preference is engineering controls.

The preference for OHS risk control from the viewpoint of field worker in the very high risk category is to use administrative methods. In the high and medium risk categories, the control preference is the personal protective equipment (PPE) method. In the low risk category, the control preference is engineering controls. Often this happens when workers have put on personal protective equipment, they feel they are safe from accident. This condition requires direct supervision.

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