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ANALYSIS OF RISK MANAGEMENT IN BUILDING WORKERS OF SMAN 5 BRAWIJAYA BUILDING KEDIRI

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Abstract

Construction projects are a job sector that has level risks and work accident , this is caused consequence low awareness to application Occupational Safety and Health (K3) and in accordance with the regulations applicable legislation. Often application of K3 to a construction project considered only as a cost expense , not as an investment to prevent happen work accidents but can give level loss of the construction project. Kediri is city biggest third in East Java province after Surabaya and Malang according to population . Kediri City is city the oldest in East Java. SMAN 5 Taruna Brawijaya Kediri, East Java was built with the aim of support teaching and learning activities. Results of the analysis it can be categorized Work accidents among construction workers at SMAN 5 Brawijaya Kediri : Indiscipline workforce , Do not have standardization of good and clear K3 implementation, Refuse recommendation use of personal safety equipment , No evaluation system regarding the implementation of work in implementing K3, and unclear division of tasks in formation organization so it is not clear how to implement it.

Keywords: *Work Accidents, Risk Breakdown Structure, Construction Projects*

1. INTRODUCTION

Indonesia is one of the developing countries with rapid growth and a relatively large population. The population in Indonesia is increasing in proportion to the development of community needs, both the needs of elementary schools, high schools, and universities. Inevitably, the increase in infrastructure development can be seen from the many construction projects that take place. Such as building, road, and bridge projects. As we know, construction projects are synonymous with work accidents.

Construction projects are a sector of work that has a level of risk and work accidents, this is due to low awareness of the importance of implementing Occupational Safety and Health (K3) that is good and in accordance with applicable laws and regulations(Wicaksono & Singgih, 2011). Often the application of OHS in a construction project is considered only as a cost burden, not as an investment to prevent work accidents but can provide a level of loss from the construction project itself.

Occupational Safety and Health (OSH) is a field related to the health, safety, and welfare of people who work in an institution or at a project site(Suma'mur, 2017). The purpose of implementing Occupational Safety and Health is to maintain the health and safety of the work environment, as well as protect coworkers, workers' families, consumers, and other people who may also be affected by work environment conditions(Habir & Mardianti, 2022). All organizations have an obligation to ensure that workers and others involved remain in a safe condition at all times. Occupational Safety

and Health (OSH) practices include prevention, sanctioning, and compensation, as well as healing injuries and care for workers, and providing health care, and sick leave(Pertama et al., 2022).

The success of a project is influenced by various factors, one of which is work accidents in construction projects, which of course hinder the performance and achievement of project goals. Therefore, procedures and implementation of occupational safety and health must be considered because the impact of work accidents that may arise can hamper the work being done in the construction project(SINAGA, 2021).

Construction work is a contributor to a fairly high accident rate. According to research by the United Nations agency for international labor, The International Labor Organization (ILO), which aims to encourage the presence of opportunities to obtain decent, productive work, freely, fairly, safely and with dignity. Stating that every year more than 1.2 million people die as a result of work accidents or work-related diseases and based on estimates there are 250 million work accidents and 160 million work-related diseases. One of the work sectors that experienced the highest number of work accidents occurred in the construction sector with a percentage reaching 31.9%. Meanwhile in Indonesia, data on work accidents according to the Employment Social Security Organizing Agency (BPJS) revealed that the number of work accidents in 2021 occurred as many as 234,270 cases. This number increased by 5.65% from 2020 of 221,740 cases.

In 2021, the three regions with the highest level of work accidents in Indonesia consist of several regions that do have large industrial areas in them, namely East Java Province, West Java Province and the West Sumatra region of Riau. From the various work accidents that occur, BPJS Ketenagakerjaan divides the consequences experienced by workers into several groups, namely; functional disability, partial disability, permanent total disability, death and recovery. Where based on data in 2021, workers who experienced functional disability were 3,804 cases, partial disability were 4,362 cases, permanent total disability were 28 cases, 6,552 cases died and 219 624 cases recovered. The number of work accidents in reality is certainly much greater than the data on work accidents originating from BPJS Ketenagakerjaan, this is because there are still many workers who are not included as participants in BPJS Ketenagakerjaan. In 2022, there were 36 million active BPJS Ketenagakerjaan participants out of a total of 131.06 million workers in Indonesia(Undang-Undang et al., 2003).

Based on The National Institute for Occupational Safety and Health (NIOSH), construction is one of the most dangerous jobs in the world, producing the most death rates among other sectors. In general, the process of building a construction project is an activity that contains many elements of danger(Adi & Kushartomo, 2023).

According to Indonesian Law No. 1 of 1970 on Occupational Safety, Law No. 3 of 1992 on Workers' Social Security (JAMSOSTEK), and Minister of Manpower Regulation No. Per.05/Men/1996 on Occupational Safety and Health Management System(Indonesia & Indonesia, 1970). But in reality, project implementers often ignore the requirements and regulations in Occupational Safety and Health(Rakyat, 2014). In addition, the existence of regulations regarding occupational safety and health is not matched by strict legal efforts and severe sanctions, occupational safety and health is the responsibility of all parties involved in construction projects(Steven & Waty, 2020).

Risk management aims to minimize adverse consequences that may arise through planning, identifying, analyzing, handling, and monitoring risks. In addition, risk management also aims to identify sources of risk and uncertainty, determine their effects, and determine appropriate responses. The purpose of risk management is not only to reduce risk. Risk management can be used by a decision maker in estimating risks to avoid risks that will occur during implementation in the field.

SMAN 5 Taruna Brawijaya East Java is located in a dormitory environment and nurtured by the Army and is one of the favorite schools in the city of Kediri. SMAN 5 Taruna Brawijaya East Java is not an entirely new school establishment. Rather, it is a transition of an existing school, SMAN 5 Kediri. The transition process was marked by the signing of a memorandum of understanding on the implementation of cooperation between the East Java Provincial Education Office and the Army, namely by the Chief of Staff of the Army (KASAD) Lieutenant General Andika Perkas, Governor of East Java Dra. Hj Khofifah Indar Parawansa, M.Si., and Pagdam V/Brawijaya Major General TNI R. Wisnoe Prasetja Boedi at the Grahadi State Building Surabaya on May 2, 2019.

The availability of adequate and sustainable educational facilities is an urgent need to support the implementation of national development. Education is one of the basic needs that is indispensable in improving the quality of human life and economic growth of a region. To support the objectives of the Development of SMAN 5 Taruna Brawijaya Kediri East Java (Dormitory and Dining Room) including the creation of a quality educational environment, a systematic step is needed to ensure the quantity and quality of construction built in accordance with predetermined standard criteria and planning documents that have been prepared.

SMAN 5 Taruna Brawijaya Kediri East Java (Dormitory and Dining Room) was built with the aim to support teaching and learning activities. To support the development of SMAN 5 Taruna Brawijaya Kediri East Java, supervision instruments are needed so that the output of the results of the implementation of the construction of educational facilities is expected to meet the requirements of technical specifications of infrastructure and facilities that cover the period of preparation for implementation, implementation, and post-implementation of development.

Based on this background and the need for educational infrastructure and risk management in the implementation of the construction of the SMAN 5 building, the construction of the SMAN 5 Brawijaya Kediri Building was carried out, the purpose of this study is to identify the risk factors that cause work accidents that exist in the Building Workers of SMAN 5 Brawijaya Kediri Building. As well as getting the ranking of risk factors causing work accidents that exist in the Building Workers of SMAN 5 Brawijaya Kediri.

2. RESEARCH METHODS

The location of this research is on Jl. Selomangleng No.2, Sukorame. The research location can be seen in Figure 3.3. which is located in Mojoroto District, Kediri City, East Java. The data to be collected and used in this research consists of 2 kinds, namely primary and secondary data. In this study, primary data were obtained from questionnaires, interview results and field surveys obtained from sources, namely building workers. In this study, the secondary data in question are technical documents

for building construction, project documents, and risk management which will produce risk outputs and responses to the implementation of building work. The data sources or respondents in this study are building workers who are directly affected by the project. From these qualifications, it is hoped that the data obtained can be trusted and accounted for. This research variable uses the equation formula (David Hillson, 2002):

Risk importance = frequency x impact

Where:

- Frequency is the probability of the risk occurring frequently.
- Impact is how much a risk affects the cost, quality, time of the project.

2.1. Ranking Risks Based on Risk Level

Risks are ranked based on the result of the multiplication between the frequency and impact scales, arranged from the largest to the smallest.

- Number of Risk Factors: z
- Value at frequency = a (0.1 - 0.9)
- Value on impact = b (0.05 - 0.8)
- Risk importance score = a x b = c
- The overall risk importance level is (Σ ci)/z

PMBOK (2013), the risk index is based on probability and impact. Each risk index reflects the level of risk, so based on the risk index, the risk level is determined. The risk level is divided into three, namely low risk, moderate risk and high risk.

- Probability is the chance of the risk occurring. Probability is based on statistical analysis or experience judgment. Probability can also be based on data on the frequency of such events in the past. Probability ratings are from very small to very large, or values of 0.1 to 0.9. A probability rating value of 0.1 means that it is unlikely to occur and a probability value of 0.9 means that it is very likely/often to occur.
- Impact is a negative effect on the achievement of goals or detrimental to the company. The size of the impact must be based on data or an approach to the losses incurred. Losses can be calculated on the basis of acquisition value, book value, market value or replacement value. Furthermore, the impact is converted into a scale value of 0.05 to 0.8. This impact rating will be different for each risk classification. An impact rating value of 0.05 means a very mild risk impact and an impact rating value of 0.8 means an extreme risk impact.

Risk identification is carried out by collecting data obtained through reference sources which are then validated using questionnaire and interview methods. Risk identification using questionnaire and interview methods serves to get input on risk factors that cause accidents to construction workers. Then all of these factors will be used in conducting risk analysis using the Risk Breakdown Structure (RBS) method. From the existing risk analysis, the risk response strategy will then be determined.

The risk factors causing work accidents in construction workers that will be validated using questionnaires and interviews are 20 (twenty) factors.

In the first stage, the risk will be analyzed using a qualitative analysis method where in this method the risk will be categorized based on its source using the Risk Breakdown Structure method. Categorizing risks based on the root of the problem or based on categories that are considered important can help increase the effectiveness of risk management. After the results of the questionnaire are obtained, the next step is to use the quantitative analysis method to compile the level of risk importance to find out which risks have the most potential to cause work accidents at the Building Workers of SMAN 5 Brawijaya Kediri.

In the research the author used questionnaire instruments and interviews. In this study, risks will be identified from the perceptions of building workers in the SMAN 5 Brawijaya Kediri Building project in East Java Province. From the identification of risks will be classified according to the category of risk factors that have been recorded, then risk analysis is carried out to obtain the level of risk and risk ranking. The next step is to determine the risk response of the risk level.

Interviews were conducted with respondents from all stakeholders that have been determined with a minimum number of 15 (fifteen) respondents with the following composition:

1. Building Worker 10 Respondents
2. Supervisory Consultant 5 Respondents

The questionnaire was conducted in three parts. The first was a questionnaire on risk identification. The second part is a questionnaire regarding the frequency of risk factors affecting the implementation of construction work with 5 (five) parameters namely: very small, small, medium, large, and very large. The third part is a questionnaire regarding the level of influence / impact of risk factors on the implementation of construction work with 5 (five) classifications, namely: very light, light, medium, heavy, extreme.

The questionnaire is used in the process of classification and weighting of risk levels. By using a minimum of 15 respondents, which are divided into 3 elements of respondents, each of which amounts to 10 people and 5 people, including Building Workers and Supervisory Consultants. This questionnaire will ask about the level of probability and impact of risk with a scale. There are 5 (five) scales of probability, including scale 1 with a score of 0.1, scale 2 with a score of 0.3, scale 3 with a score of 0.5, scale 4 with a score of 0.7, and scale 5 with a score of 0.9. For impact there are 5 (five) scales including scale 1 with a score of 0.05, scale 2 with a score of 0.1, scale 3 with a score of 0.2, scale 4 with a score of 0.4 and scale 5 with a score of 0.8.

Descriptive analysis will be conducted in this study to determine the level of risk that has the most potential to cause work accidents at the Building Workers of SMAN 5 Brawijaya Kediri. In this study, the risk factors analyzed will be taken 5 (five) largest rankings to discuss risk response strategies.

3. DATA ANALYSIS AND DISCUSSION

3.1. Assessment of Risk Factor Obstacle Levels in Project Implementation

The author takes questionnaire data through google forms and interviews. The following is an attachment to the questions listed on the google form. The frequency of

occurrence of risk-causing factors that have the potential to hinder the implementation of the construction work of the SMAN 5 Brawijaya Kediri Building based on the results of questionnaires that have been distributed, including:

Table 1. Assessment of the Level of Risk Factors in the Implementation of the Building Construction Project of SMAN 5 Brawijaya Kediri

No	Risk Factors	Category	Yes	No	Obstacle Level
1	Extreme weather	Environmental Factors	13	2	86,67%
2	Selection of raw materials that are not suitable and do not meet the standards	Environmental Factors	6	9	40,00%
3	Difficult location of material stacking	Environmental Factors	13	2	86,67%
4	Rainfall intensity	Environmental Factors	14	1	93,33%
5	Refusing to use personal protective equipment	Human Factors	14	1	93,33%
6	Irregular diet	Human Factors	10	5	66,67%
7	Ignoring work rules and safety standards applied at construction project sites	Human Factors	13	2	86,67%
8	Unskilled labor	Human Factors	13	2	86,67%
9	Labor shortage	Human Factors	13	2	86,67%
10	Labor indiscipline	Human Factors	15	0	100%
11	Lack of attention to place in the implementation of OHS	Management System Factors	13	2	86,67%
12	Does not have a good and clear standardization of OHS implementation	Management System Factors	12	3	80%
13	No system evaluation of work implementation in applying OHS	Management System Factors	12	3	80%
14	The division of tasks is not clear in the formation of the organization so that it is not clear in its implementation.	Management System Factors	14	1	93,33%
15	Equipment malfunction	Management System Factors	9	6	60%
16	Availability of equipment that is inadequate / as needed	Management System Factors	9	6	60%
17	Equipment productivity	Management System Factors	10	5	66,67%

18	Lack of operator skills in operating equipment	Management System Factors	13	2	86,67%
19	Improper equipment	Management System Factors	7	8	46,67%
20	Lack of communication	Management System Factors	15	0	100%

Source: Data from the distribution of questionnaires by researchers, 2023

According to the results of distributing questionnaires from 15 respondents out of 20 risk factors that hinder project implementation, there are 2 risk factors that can 100% hinder project implementation, namely aspects: labor indiscipline and lack of communication, out of 15 respondents fully assessed that both factors are obstacles to the implementation of building construction work. On the other hand, the factor "Selection of raw materials that are not suitable and do not meet the standards" is considered to have the lowest implementation inhibiting factor on **"Building Workers of SMAN 5 Brawijaya Kediri Building".**

3.2. Assessment of Frequency of Occurrence of Risk Factors Causing Work Accidents in Building Projects

Based on the results of the interview questionnaire and discussions carried out, the risk stakeholders agreed to determine the likelihood of each risk factor that will occur in project implementation by giving a value of 0.1 sample 0.9 with assumptions based on table 2.4 regarding the probability and impact matrix.

The results of the assessment of 15 respondents regarding the probability of each risk factor causing work accidents can be explained in table 3 as follows:

Table 3. Assessment of the Probability of Occurrence of Risk Factors Causing Work Accidents In Building Projects

No	Risk Factors	SK (1)	K (2)	S (3)	B (4)	SB (5)	Probability (a)
1	Extreme weather	4	5	2	3	1	0,393
2	Selection of raw materials that are not suitable and do not meet the standards	10	4	1	0	0	0,180
3	Difficult location of material stacking	9	3	3	0	0	0,220
4	Rainfall intensity	7	5	3	0	0	0,247
5	Refusing to use personal protective equipment	0	0	1	2	12	0,847
6	Irregular diet	9	4	2	0	0	0,207
7	Ignoring work rules and safety standards applied at construction project sites	0	0	10	4	1	0,580
8	Unskilled labor	0	0	9	5	1	0,593

9	Labor shortage	4	2	0	1	8	0,593
10	Labor indiscipline	0	0	0	1	14	0,887
11	Lack of attention to place in the implementation of OHS	0	6	4	5	0	0,487
12	Does not have a good and clear standardization of OHS implementation	0	0	1	1	13	0,860
13	No system evaluation of work implementation in applying OHS	0	1	0	2	12	0,833
14	The division of tasks is not clear in the formation of the organization so that it is not clear in its implementation.	0	0	2	3	10	0,807
15	Equipment malfunction	0	5	7	3	0	0,473
16	Availability of equipment that is inadequate / as needed	0	5	6	4	0	0,487
17	Equipment productivity	0	6	7	2	0	0,447
18	Lack of operator skills in operating equipment	0	3	8	4	0	0,513
19	Improper equipment	2	1	5	7	0	0,527
20	Lack of communication	0	3	8	4	0	0,513

Source: Author's Data, 2023

According to the results of distributing questionnaires from 15 respondents regarding the probability of risk factors causing work accidents in construction workers, the risk factor "Labor indiscipline" is considered to have the greatest probability of occurring, reaching 0.887. Conversely, the risk factor "Selection of raw materials that are not suitable and do not meet the standards" is considered to have the lowest probability of 0.180.

3.3. Impact Level Assessment of Risk Factors Causing Work Accidents in Building Projects

Based on the results of the interview questionnaire conducted, the risk stakeholders agreed to determine the possible impact of each aspect / risk factor in providing the risk of work accidents in building projects by giving a value of 0.05 to 0.8 with assumptions based on the probability and impact matrix.

The results of the assessment of 15 respondents regarding the impact of each risk factor can be explained in table 4 as follows:

Table 4. Assessment of The Impact of The Occurrence of Risk Factors Causing Work Accidents in Building Projects

No	Risk Factors	RS (1)	R (2)	S (3)	B (4)	E (5)	Impact (b)

1	Extreme weather	4	5	2	3	1	0,207
2	Selection of raw materials that are not suitable and do not meet the standards	10	4	1	0	0	0,073
3	Difficult location of material stacking	9	3	3	0	0	0,090
4	Rainfall intensity	7	5	3	0	0	0,097
5	Refusing to use personal protective equipment	0	0	1	2	12	0,707
6	Irregular diet	9	4	2	0	0	0,083
7	Ignoring work rules and safety standards applied at construction project sites	0	0	10	4	1	0,293
8	Unskilled labor	0	0	9	5	1	0,307
9	Labor shortage	4	2	0	1	8	0,480
10	Labor indiscipline	0	0	0	1	14	0,773
11	Lack of attention to place in the implementation of OHS	0	6	4	5	0	0,227
12	Does not have a good and clear standardization of OHS implementation	0	0	1	1	13	0,733
13	No system evaluation of work implementation in applying OHS	0	1	0	2	12	0,700
14	The division of tasks is not clear in the formation of the organization so that it is not clear in its implementation.	0	0	2	3	10	0,640
15	Equipment malfunction	0	5	7	3	0	0,207
16	Availability of equipment that is inadequate / as needed	0	5	6	4	0	0,220
17	Equipment productivity	0	6	7	2	0	0,187
18	Lack of operator skills in operating equipment	0	3	8	4	0	0,233
19	Improper equipment	2	1	5	7	0	0,267
20	Lack of communication	0	3	8	4	0	0,233

Source: Author's Data, 2023

Based on the assessment of 15 respondents regarding the impact of the occurrence of these risk factors in project implementation, it shows that the risk factor "Labor indiscipline" is considered to have the greatest risk impact that causes work accidents to occur in building construction projects, which reaches 0.773. Conversely, the risk factor "Selection of raw materials that are not suitable and do not meet the standards" is considered to have the lowest impact of 0.073.

3.4. Risk Breakdown Structure Analysis

RBS (Risk Breakdown Structure) analysis is calculated based on data regarding the probability of occurrence and impact of events assessed by previous respondents. The result of the multiplication of probability and impact will produce a risk importance level, which can be explained in the following table 5:

Table 5. RBS Analysis Results

No	Risk Factors	Probability	Impact	Risk Importance Level	Category
		(a)	(b)	(a x b) = (c)	
1	Extreme weather	0,393	0,207	0,081	Moderate
2	Selection of raw materials that are not suitable and do not meet the standards	0,180	0,073	0,013	Moderate
3	Difficult location of material stacking	0,220	0,090	0,020	Moderate
4	Rainfall intensity	0,247	0,097	0,024	Moderate
5	Refusing to use personal protective equipment	0,847	0,707	0,598	High
6	Irregular diet	0,207	0,083	0,017	Moderate
7	Ignoring work rules and safety standards applied at construction project sites	0,580	0,293	0,170	High
8	Unskilled labor	0,593	0,307	0,182	High
9	Labor shortage	0,593	0,480	0,285	High
10	Labor indiscipline	0,887	0,773	0,686	High
11	Lack of attention to place in the implementation of OHS	0,487	0,227	0,110	Moderate
12	Does not have a good and clear standardization of OHS implementation	0,860	0,733	0,631	High
13	No system evaluation of work implementation in applying OHS	0,833	0,700	0,583	High
14	The division of tasks is not clear in the formation of the organization so that it is not clear in its implementation.	0,807	0,640	0,516	High

15	Equipment malfunction	0,473	0,207	0,098	Moderate
16	Availability of equipment that is inadequate / as needed	0,487	0,220	0,107	Moderate
17	Equipment productivity	0,447	0,187	0,083	Moderate
18	Lack of operator skills in operating equipment	0,513	0,233	0,120	Moderate
19	Improper equipment	0,527	0,267	0,140	Moderate
20	Lack of communication	0,513	0,233	0,120	Moderate

Source: Author's Data, 2023

Based on the results of research from 15 respondents regarding the probability and impact of the occurrence of risk factors that cause occupational accidents to building workers in the implementation of Building Construction shows that the risk factor "Does not have a good and clear standardization of K3 implementation" has the greatest risk level that causes occupational accidents in the implementation of Building Construction SMAN 5 Brawijaya Kediri which reaches 0.686.(Sanjaya et al., 2012) Conversely, the risk factor "Selection of raw materials that are not suitable and do not meet the standards" is considered to have the lowest risk level of 0.013.

Of the 20 (twenty) risk factors taken 5 (five) risk factors with the greatest level of risk obtained as follows:

1. Labor indiscipline (0.686)
2. Not having a good and clear standardization of OHS implementation (0.631)
3. Rejecting the recommendation to use personal protective equipment (0.598)
4. There is no system evaluation of the implementation of work in applying OHS (0.583)
5. The division of tasks is not clear in the formation of the organization so that it is not clear in its implementation (0.516)

4. CONCLUSION

Based on the results of this study, the following conclusions can be drawn:

1. Based on the results of research and development of research concepts, it can be identified the risk category of occupational accidents in the Building Workers of SMAN 5 Brawijaya Kediri: Workers' indiscipline, Not having a good and clear standardization of OHS implementation, Rejecting the recommended use of personal protective equipment, The absence of a system evaluation of the implementation of work in applying OHS, and The division of tasks that are not clear in the formation of the organization so that it is not clear in its implementation.
2. From the results of the analysis using the Risk Breakdown Structure (RBS), it was found that the top 5 (five) ranking of risk factors for occupational accidents in building workers who have the highest risk include labor indiscipline, not having a good and clear standardization of OHS implementation, refusing

recommendations for the use of personal protective equipment, the absence of a system evaluation of the implementation of work in applying OHS, and unclear division of tasks in the formation of organizations so that it is not clear in its implementation.... For Low Risk, including the selection of raw materials that are not suitable and do not meet the standards and irregular diet.

ADVICE

1. Risk factors for occupational accidents in construction workers that are not included in the level of risk importance in the high category should receive attention by taking measures if the risk occurs so that they know the actions to be taken.
2. The results of this study are expected to be a guideline for identifying risks and taking mitigation actions for stakeholders who will carry out the process of implementing other building construction projects in the future.

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