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## ANALYSIS OF RISK MANAGEMENT IN BUILDING WORKERS AT SMAN 5 BRAWIJAYA 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

### INTRODUCTION

Indonesia is a developing country with rapid growth and a relatively large population.(Ananta & Pungut, 1992) The population in Indonesia is increasing in proportion to the development of community needs, including the needs of elementary schools, high schools and universities. We can see the inevitable increase in infrastructure development from the many ongoing construction projects. Such as building, road and bridge projects. As we know, construction projects are synonymous with work accidents.(Latupeirissa et al., 2021)

Construction projects are a work sector that has a level of risk and work accidents, this is caused by low awareness of its importance implement Occupational Safety and Health (K3) good and in accordance with applicable laws and regulations. Often implementing K3 on a construction project is considered only as a cost burden, not as an investment to prevent work accidents, but it can provides the level of losses from the construction project itself.

Occupational Safety and Health (K3) is a field related to the health, safety and welfare of people who work in an

institution or at a project site (Gultom, 2021). The aim of implementing Occupational Safety and Health is to maintain the health and safety of the work environment, as well as protect co-workers, workers' families, consumers and other people who may also be affected by work environment conditions (Abd Latib et al., 2016). All organizations have an obligation to ensure that workers and other people involved remain safe at all times. (Sandra et al., 2021) Occupational Safety and Health (K3) practices include prevention, sanctions and compensation, as well as wound healing and care for workers, as well as providing health care and sick leave.

The success of a project is influenced by various factors, one of which is work accidents on construction projects which of course hinder performance and achievement of project targets. 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 carried out in the construction project.

Construction work is a fairly high contributor to accident rates (Hu et al., 2011). According to research by the United Nations agency for international labor, The International Labor Organization (ILO), which aims to encourage opportunities to obtain work that is decent, productive, free, fair, safe and dignified. States that every year more than 1.2 million people die as a result of work accidents or due to work-related diseases and based on estimates there are 250 million work accidents and 160 million work-related illnesses. (Hämäläinen et al., 2009) One of the work sectors with the highest number of work accidents occurs in the construction sector with a percentage reaching 31.9%.

Meanwhile in Indonesia, data on work accidents according to the Social Security Administering Agency (BPJS) for Employment revealed that the number of work accidents in 2021 occurred as many as 234,270 cases. This number increased 5.65% from 2020 of 221,740 cases.

In 2021, the three regions with the highest work accident rates in Indonesia consist of several regions that have quite large industrial areas, namely East Java Province, West Java Province and the West Sumatra Riau region. From the various work accidents that occur, BPJS Employment 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, 3,804 cases of workers experienced functional disability, 4,362 cases of partial disability, 28 cases of permanent total disability, 6,552 cases of death and 219,624 cases of recovery. In reality, the number of work accidents is confirmed to be much greater than the work accident data from BPJS Employment, this is because there are still many workers who are not included as participants in BPJS Employment. In 2022, there will be 36 million active BPJS Employment participants out of a total of 131.06 million workers in Indonesia.

According to The National Institute for Occupational Safety and Health (NIOSH), construction is one of the most dangerous jobs in the world, resulting in the highest death rate of any sector (Tolera, 2016). In general, the construction project development process is an activity that contains many elements of danger.

According to Republic of Indonesia Law no. 1 of 1970 concerning Work Safety, Law no. 3 of 1992 concerning *Social Security for Workers* (JAMSOSTEK), and Minister of

Manpower Regulation no (Tambunan & Purwoko, 2002). Per.05/Men/1996 concerning Occupational Safety and Health Management Systems. However, in reality, project implementers often ignore the requirements and regulations in Occupational Safety and Health (Aji et al., 2019). In addition, the existence of regulations regarding occupational safety and health is not balanced by strict legal measures and heavy sanctions, occupational safety and health is the responsibility of all parties involved in a construction project.

Risk management aims to minimize bad consequences that may arise through planning, identifying, analyzing, handling and monitoring risks. Apart from that, risk management also aims to identify sources of risk and uncertainty, determine their impact, and determine appropriate responses. The goal of risk management is not just to reduce risk. Risk management can be used by a decision maker to estimate risks to avoid risks that will occur during implementation in the field (Dey, 2012).

SMAN 5 Taruna Brawijaya East Java is in a dormitory environment and is looked after by the Indonesian Army and is one of the favorite schools in the city of Kediri (Suwandi & Fitri, 2023). SMAN 5 Taruna Brawijaya East Java is not a completely new school establishment. Rather, it is a transition from an existing school, namely from SMAN 5 Kediri. The school transition process was marked by the signing of a memorandum of agreement on the implementation of cooperation between the East Java Provincial Education Service and the Army (Sebastian et al., 2018), namely by the Chief of Army Staff (KASAD) Lt. Gen. Andika Perkasa, the Governor of East Java Dra. Hj. Khofifah Indar Parawansa, M.Si., and Pagdam V/Brawijaya Major

General TNI R. Wisnoe Prasetja Boedi in the courtyard of 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 (Adams, 2002). Education is one of the basic needs that is very necessary in improving the quality of human life and the economic growth of a region. To support the development objectives of SMAN 5 Taruna Brawijaya, Kediri, East Java (dormitory and dining room), including the creation of a quality educational environment, systematic steps are 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 of supporting teaching and learning activities. To support the development of SMAN 5 Taruna Brawijaya, Kediri, East Java, supervision instruments are needed so that the output from the implementation of the construction of educational facilities is expected to meet the technical specification requirements for infrastructure and facilities covering the preparation, implementation and post-implementation periods of development (Naumann et al., 2011).

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 author is interested in taking a thesis topic related to risk management with the title ""Analysis of Risk Management for Construction Workers

at SMAN 5 Brawijaya Kediri". The aim of this research is :

Identify the risk factors that cause work accidents that exist Construction workers at SMAN 5 Brawijaya Kediri.

Get ranking Existing risk factors for work accidents Construction workers at SMAN 5 Brawijaya Kediri.

## RESEARCH METHODS

### Data collection

The data that will be collected and used in this research consists of 2 types, namely primary and secondary data. Primary data is data obtained directly from original sources. In this research, primary data was obtained from questionnaires, interview results and field surveys obtained from sources, namely construction workers. (Wu et al., 2018) Secondary data is data obtained from the results of data collection carried out by other parties which has been published, including reference books and journals related to the study topic. In this research, the secondary data referred to are technical building construction documents, project documents, and risk management which will produce risk outputs and responses to the implementation of building construction work (Cooper et al., 2005).

The data sources or respondents in this research are construction workers who are directly affected by the project (Alzahrani & Emsley, 2013). From these qualifications, it is hoped that the data obtained can be trusted and accounted for.

### Research variable

This research variable uses an equation formula (David Hillson, 2002);

$$\text{Risk importance} = \text{frequency} \times \text{impact} \quad (2.1)$$

Where:

- Frequency is the probability that the risk occurs frequently
- Impact is how much influence a risk has on the cost, quality and time of the project

### Sort risks by risk level

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

Number of Risk Factors: z

Value at frequency = a (0.1 – 0.9)

Value on impact = b (0.05 – 0.8)

Risk importance level value =  $axb = c$

The overall level of risk importance is  $(\sum ci)/z$

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

**Probability** is the opportunity /probability of the risk occurring. Probability is based on statistical analysis or experience judgment (Aven et al., 2013). Probability can also be based on data on the frequency of these events in the past. The Probability Rating ranges from very small to very large, or a value of 0.1 to 0.9. A probability rating value of 0.1 means it is unlikely to happen and a probability value of 0.9 means it is very likely/often happens.

**Impactis** a negative impact on achieving targets or is detrimental to the company. The size of the impact must be based on data or an approach to the losses incurred (Ibn-Mohammed et al., 2021). Losses can be calculated on the basis of acquisition value, book value, market value or replacement value (Barth, 1994). Next,

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 light risk impact and an impact rating value of 0.8 means an extreme risk impact.

**Table 1. Risk Importance Level**

PROBABILITY SCALE	IMPACT SCALE				
	1 (0.05)	2 (0.1)	3 (0.2)	4 (0.4)	5 (0.8)
5 (0.9)	m	m	Q	Q	Q
4 (0.7)	R	m	m	Q	Q
3 (0.5)	R	m	m	Q	Q
2 (0.3)	R	R	m	m	Q
1 (0.1)	R	R	R	R	m

Source: PMBOK Fifth Edition (2013)

Information :

T = High Risk

M = Moderate Risk

R = Low Risk

**Risk Identification**

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

The risk factors that cause work accidents in construction workers that will be validated using questionnaire and interview methods are 20 (twenty) factors.

**Research Instrument**

In the research the author used questionnaires and interviews (Interview) instruments. In this research, risks will be identified from the perceptions of construction workers in the SMAN 5 Brawijaya Kediri Building project in East Java Province. From the risk identification, it will be classified according to the risk factor categories that have been recorded, then risk analysis will be carried out to obtain the risk level and risk ranking. The next step is determining the risk response from the risk level. For more clarity, the research framework can be seen as follows:

**Analysis and Discussion**

Descriptive analysis will be carried out in this research to determine the level of risk that has the greatest potential to cause work accidents among building workers at SMAN 5 Brawijaya Kediri. In this research, the 5 (five) largest risk factors analyzed will be taken to discuss risk response strategies.

**RESULTS AND DISCUSSION**

**Risk Level Measurement**

The level of risk is measured using subjective probability which is carried out by respondents who have professional experience by someone who is an expert in the related case and based on various information and experience about the condition. In this research, the author used a minimum of 15 respondents, who were divided into 2 respondent elements, each consisting of 10 and 5 people, including construction workers and supervisory consultants. The way to obtain this is done through a questionnaire technique using Google Form and interviews. Then it is

separated into two variables used to measure risk, namely the frequency of possible risks and the impact of risks.

**Assessment of the Level of Risk Factor Obstacles in Project Implementation**

The author took questionnaire data via Google Form and interviews. The following is an attachment to the questions

listed on the Google form. Frequency of occurrence of risk factors that have the potential to hinder the implementation of construction workSMAN 5 Brawijaya Kediri buildingbased on the results of questionnaires that have been distributed, including;

**Table 2. Assessment of the Level of Risk Factors in Development Project Implementation SMAN 5 Brawijaya Kediri building**

	Risk Factors	Category	Yes	No	Barrier Level
1	Extreme weather	Environmental factor	13	2	86.67%
2	Selection of raw materials that are inappropriate and do not meet standards	Environmental factor	6	9	40.00%
3	Difficult location of material accumulation	Environmental factor	13	2	86.67%
4	Rainfall intensity	Environmental factor	14	1	93.33%
5	Refuse the recommendation to use personal protective equipment	Human Factors	14	1	93.33%
6	Irregular eating patterns	Human Factors	10	5	66.67%
7	Ignoring work rules and work safety standards applied at construction project sites	Human Factors	13	2	86.67%
8	Unskilled labor	Human Factors	13	2	86.67%
9	Shortage of workforce	Human Factors	13	2	86.67%
10	Labor indiscipline	Human Factors	15	0	100%
11	Lack of attention to place in the implementation of K3	Management System Factors	13	2	86.67%
12	There is no good and clear standardization of K3 implementation	Management System Factors	12	3	80%
13	There is no system evaluation of work implementation in implementing K3	Management System Factors	12	3	80%
14	Unclear division of tasks in the formation of the organization so that its implementation is unclear	Management System Factors	14	1	93.33%

**Table 3. Assessment of the Level of Risk Factors in Development Project Implementation SMAN 5 Brawijaya Kediri Building (continued)**

	Risk Factors	Category	Yes	No	Barrier Level
15	Equipment damage	Management System Factors	9	6	60%
16	Availability of equipment is inadequate/as needed	Management System Factors	9	6	60%
17	Equipment productivity	Management System Factors	10	5	66.67%
18	Insufficient operator ability to operate 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 for obstacles to project implementation, there are 2 risk factors that can 100% hinder project implementation, namely aspects: workforce indiscipline and lack of communication. Of the 15 respondents, they fully assess that these two factors are obstacles to implementation of construction workbuilding. On the other hand, the factor "Selection of raw materials that are inappropriate and do not meet standards" is considered to have the lowest implementation inhibiting factor in "Building Workers at SMAN 5 Brawijaya Kediri".

**Assessment of the Occurrence Frequency Level 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 probability of each risk factor occurring 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 15 respondents' assessment regarding the probability of each risk factor causing work accidents can be explained in table 4.3 as follows:

**Table 4. Assessment of the probability of occurrence of risk factors causing work accidents on building construction projects**

	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 inappropriate and do not meet standards	10	4	1	0	0	0.180
3	Difficult location of material accumulation	9	3	3	0	0	0.220
4	Rainfall intensity	7	5	3	0	0	0.247
5	Refuse the recommendation to use personal protective equipment	0	0	1	2	12	0.847
6	Irregular eating patterns	9	4	2	0	0	0.207
7	Ignoring work rules and work 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	Shortage of workforce	4	2		1	8	0.593
10	Labor indiscipline	0	0	0	1	14	0.887
11	Lack of attention to place in the implementation of K3	0	6	4	5	0	0.487
12	There is no good and clear standardization of K3 implementation	0	0	1	1	13	0.860
13	There is no system evaluation of work implementation in implementing K3	0	1	0	2	12	0.833
14	Unclear division of tasks in the formation of the organization so that its implementation is unclear	0	0	2	3	10	0.807
15	Equipment damage	0	5	7	3	0	0.473
16	Availability of equipment is inadequate/as needed	0	5	6	4	0	0.487
17	Equipment productivity	0	6	7	2	0	0.447
18	Insufficient operator ability to operate equipment	0	3	8	4	0	0.513

19	Improper equipment						
20	Lack of communication	0	3	8	4	0	0.513

Source: Author's Data Processing, 2023

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

**Assessment of the Level of Impact on Risk Factors Causing Work Accidents in Building Projects**

Based on the results of the interview questionnaire conducted, the risk stakeholders agreed to determine the magnitude of the possible impact of each aspect/risk factor in providing the risk of work accidents in building construction projects by giving a value of 0.05 to 0.8 with assumptions based on table 2.4 regarding the matrix. probability and impact.

**Table 5. Assessment of the impact of risk factors causing work accidents on building construction projects**

	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 inappropriate and do not meet standards	10	4	1	0	0	0.073
3	Difficult location of material accumulation	9	3	3	0	0	0.090
4	Rainfall intensity	7	5	3	0	0	0.097
5	Refuse the recommendation to use personal protective equipment	0	0	1	2	12	0.707
6	Irregular eating patterns	9	4	2	0	0	0.083
7	Ignoring work rules and work 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	Shortage of workforce	4	2		1	8	0.480

10	Labor indiscipline	0	0	0	1	14	0.773
11	Lack of attention to place in the implementation of K3	0	6	4	5	0	0.227
12	There is no good and clear standardization of K3 implementation	0	0	1	1	13	0.733
13	There is no system evaluation of work implementation in implementing K3	0	1	0	2	12	0.700
14	Unclear division of tasks in the formation of the organization so that its implementation is unclear	0	0	2	3	10	0.640
15	Equipment damage	0	5	7	3	0	0.207
16	Availability of equipment is inadequate/as needed	0	5	6	4	0	0.220
17	Equipment productivity	0	6	7	2	0	0.187
18	Insufficient operator ability to operate 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 Processing, 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 factors "Labor indiscipline" assessed as having the greatest risk impact causing work accidents to occur in building construction projects, reaching 0.773. On the other hand, risk factors "Selection of raw materials that are inappropriate and do not meet standards" assessed to have the lowest impact, namely 0.073.

#### **Analysis Risk Breakdown Structure**

RBS (Risk Breakdown Structure) analysis is calculated based on data regarding the probability of events and the impact of events assessed by previous respondents. The multiplication result of probability and impact will produce a risk importance level (importance level) which can be explained in table 6 below:

**Table 6. RBS Analysis Results**

	Risk Factors	Probability	Impact	Risk Importance Level	Category
		(a)	(b)	(axb) = (c)	
1	Extreme weather	0.393	0.207	0.081	Moderate
2	Selection of raw materials that are inappropriate and do not meet standards	0.180	0.073	0.013	Moderate
3	Difficult location of material accumulation	0.220	0.090	0.020	Moderate
4	Rainfall intensity	0.247	0.097	0.024	Moderate
5	Refuse the recommendation to use personal protective equipment	0.847	0.707	0.598	Tall
6	Irregular eating patterns	0.207	0.083	0.017	Moderate
7	Ignoring work rules and work safety standards applied at construction project sites	0.580	0.293	0.170	Tall
8	Unskilled labor	0.593	0.307	0.182	Tall
9	Shortage of workforce	0.593	0.480	0.285	Tall
10	Labor indiscipline	0.887	0.773	0.686	Tall
11	Lack of attention to place in the implementation of K3	0.487	0.227	0.110	Moderate
12	There is no good and clear standardization of K3 implementation	0.860	0.733	0.631	Tall
13	There is no system evaluation of work implementation in implementing K3	0.833	0.700	0.583	Tall
14	Unclear division of tasks in the formation of the organization so	0.807	0.640	0.516	Tall

	that its implementation is unclear				
15	Equipment damage	0.473	0.207	0.098	Moderate
16	Availability of equipment is inadequate/as needed	0.487	0.220	0.107	Moderate
17	Equipment productivity	0.447	0.187	0.083	Moderate
18	Insufficient operator ability to operate 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 Processing, 2023

Based on the results of research from 15 respondents regarding the probability and impact of the occurrence of risk factors that cause work accidents among construction workers in the implementation of building construction, it shows that the risk factor "Not having good and clear standardization of K3 implementation" has the greatest level of risk that causes work accidents in implementation. Construction of the SMAN 5 Brawijaya Kediri Building reached 0.686. On the other hand, risk factors Selection of raw materials that are inappropriate and do not meet standards is considered to have the lowest level of risk, namely 0.013.

Of the 20 (twenty) risk factors, 5 (five) risk factors were taken with the highest risk levels obtained as follows:

1. Labor indiscipline (0.686)
2. Does not have good and clear K3 implementation standards (0.631)
3. Refuse the recommendation to use personal protective equipment (0.598)

4. There is no system evaluation of work implementation in implementing K3 (0.583)
5. Unclear division of tasks in the formation of the organization so that its implementation is unclear (0.516)

## CONCLUSION

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

1. Based on the results of research and development of research concepts, it shows that risk categories can be identified work accident On Construction workers at SMAN 5 Brawijaya Kediri : Labor indiscipline, not having good and clear standards for implementing K3, refusing recommendations for the use of personal protective equipment, no evaluation system for work implementation in implementing K3, and unclear division of tasks in the

formation of the organization so that implementation is not clear.

2. From The results of the analysis using the Risk Breakdown Structure (RBS) obtained 5 (five) major risk factor rankings work accident On Building Construction Workers Those with the highest risk include: Labor indiscipline, not having good and clear standards for implementing K3, refusing recommendations for the use of personal protective equipment, no evaluation system for work implementation in implementing K3, and unclear division of tasks in the formation of the organization so that implementation is not clear.. Low risks include selecting raw materials that are inappropriate and do not meet standards and irregular eating patterns.

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