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Analysis of the Effect of JSA, Hirarc and Unsafe Action on the Occupation of Work Accidents on Forklift Operations in a Light Steel Company – East Java

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Abstract:- Work in the industrial world has a high risk of potential hazards, and one type of lift and transport aircraft that is widely used in the industrial world is forklifts, where almost all companies use forklifts at work which are operated by forklift operators. Factors that cause work accidents include humans, equipment, hazards, and the environment. And the biggest cause of work accidents is the human factor. One way or method of risk assessment is Job Safety Analysis (JSA), and the Hazard Identification Risk Assessment and Risk Control (HIRARC) method can be used to identify potential hazards.

This study aims to analyze the effect of the application of JSA, HIRARC, and Unsafe Action on the prevention of work accidents in the operation of forklifts for light steel companies in East Java. This research method is non-probability sampling, especially purposive sampling and questionnaires

Keywords:- *Forklift, Job Safety Analysis, Hazard Identification Risk Assessment and Risk Control, Unsafe Action, Work accident.*

I. INTRODUCTION

There are three factors that can cause work accidents, namely human factors, equipment factors, and also factors from the work environment itself. In overcoming and controlling the risk of work accidents, it is necessary to apply the importance of knowing the unsafe behavior of workers. In this sustainable development, the most valuable asset for any country is its human resources.

To carry out processes in business, part of daily production of course cannot be separated from equipment and machines that are at risk of high work accidents (unsafe conditions). According to the results of interviews that have been carried out with the company, of course there are risks that arise. Based on the results of previous studies, there are personal factors that play a role from workers regarding unsafe actions. When workers are not satisfied with their work, it will increase work accidents. However, this statement has been questioned in recent years. Although the personality, attitudes of workers andthe characteristics of each worker will affect the occurrence of work accidents, in terms of causality, it is certainly still difficult to be certain.

The following is data on work accidents related to forklift operations. The data was obtained from the company where the research data was taken. The results are as follows:

No	Incident Communication	Years	Categorization	
			Unsafe Action	Unsafe Condition
1	Forklift bumper touches coil rim/material	2016	yes	
2	Forklift tires lift when lifting spandek optima machine	2017	yes	
3	The forklift does not activate the hand brake while parking in the forklift parking area	2018	yes	
4	Fork forklift hit warehouse coil gate rail F1	2019	yes	
5	Folder machine rolls over when moved by forklift	2022	yes	
6	The upper gate rail is hit by the forklift mast when the operator is lifting the scrap	2022	yes	

Table 1: Unsafe action data

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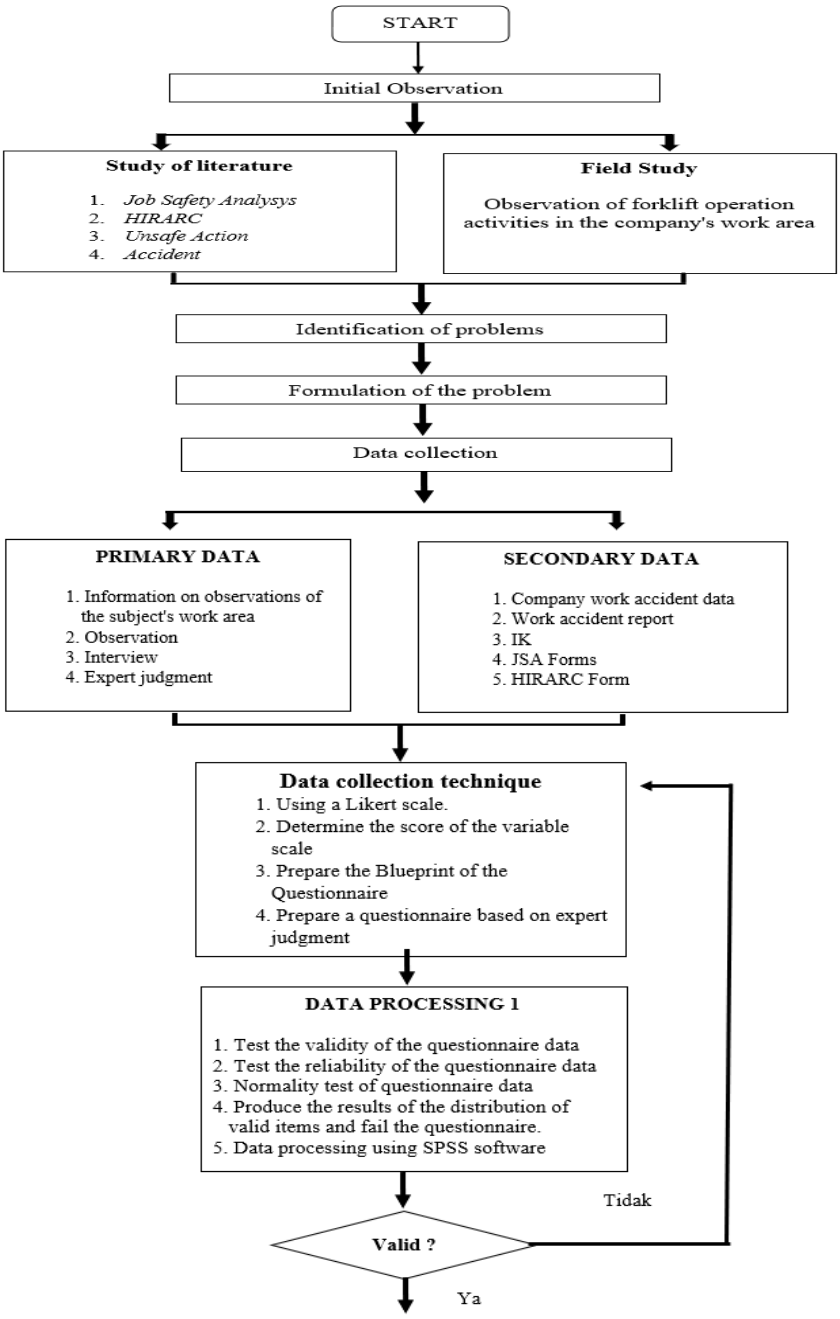
A work accident is an event that is clearly unwanted and often unforeseen which can cause loss of time, property or property as well as loss of life that occurs in an industrial work process or related to it. A work accident can only occur if there are various contributing factors simultaneously in a workplace or production process. Several studies indicate that a work accident cannot occur by itself, but occurs by one or several factors causing the accident at once in one incident.

Based on the research that has been done previously, there are some differences with the current research. The difference lies in the respondents, the research location, the combination of research variables, namely JSA, HIRARC and Unsafe Action which will be used to reduce the risk of work accidents in forklift operations.

II. METHOD

The research methodology is a description of the stages that will be passed in the process of solving the problem formulation in this study. The research methodology in this study is described in the form of a flowchart as follows:



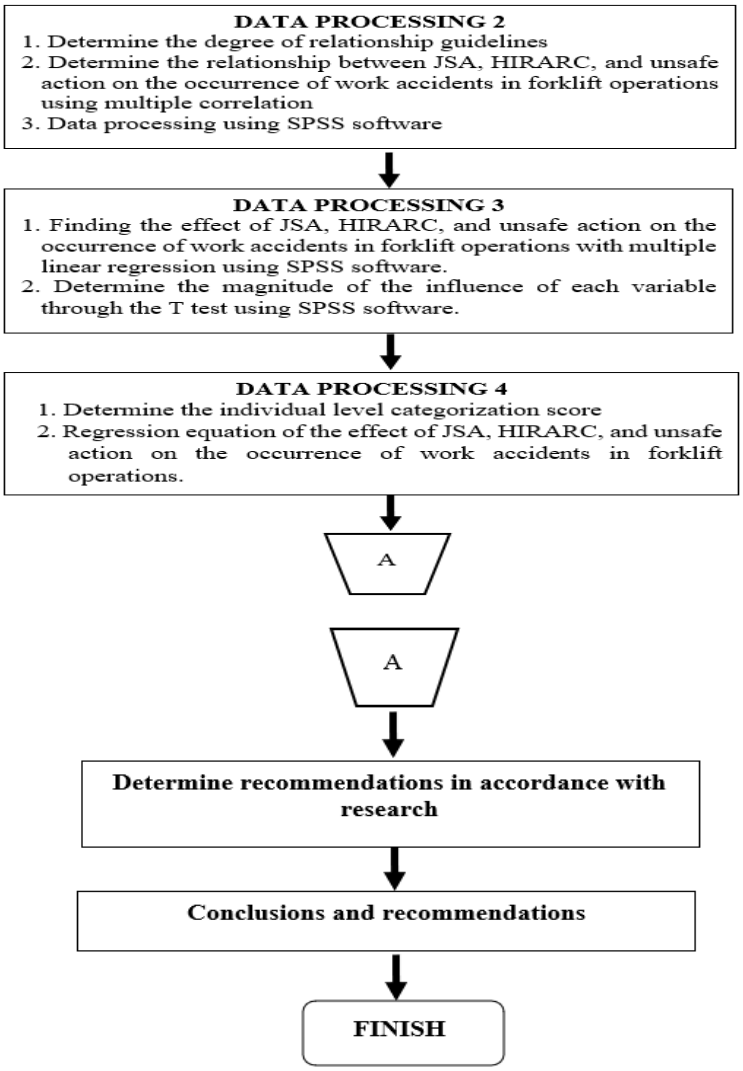


Fig. 1: Research Methodology Flowchart

If you have processed the data using SPSS software, the results will be able to be seen and categorized by looking at the table in the first problem formulation in the study to find a relationship, then there is also a basis for making decisions on multiple correlations as follows:

a. If the value of Sig, F Change <0.05 then the relationship has a significant relationship.
b. If the value of Sig, F Change > 0.05 then there is no significant relationship.

Pearson Correlation Score	Relationship Level
0.00-0.199	Very low
0.20-0.399	Low
0.40-0.599	Medium
0.60-0.799	Strong
0.80-1.00	Very Strong

Table 2: Guidelines for Relationship Degrees

Including to determine the effect of each variable, the T test is used to see more specific results. The value of tcount is used to partially test the effect of JSA, HIRARC, and Unsafe Action on the dependent variable. The error rate used as a reference in this study is 5%. This test was carried out by looking at the significance column for each independent variable with a significant level of 0.05. Decision making is as follows:

1. If Sig. > 0.05 then Ho is accepted
2. If Sig. < 0.05 then Ho is rejected, Hi is accepted

The hypothesis that is built is as follows:

1. Ho = regression coefficient is not significant
2. Hi = significant regression coefficient

III. RESULTS AND DISCUSSION

Validity test was conducted to test each item in the variables used in this study. The following is the item validity of each research variable instrument:

A. Validity of Job Safety Analysys (JSA) scale

The JSA scale item has a total of 25 statements that were tested on 100 respondents. The results of the validity test carried out on the JSA scale in the first round produced 25 valid items so that the second round and so on were no longer needed.

B. Hazard Identification Risk Assessment and Risk Control (HIRARC) scale validity

The item scale has 25 statement items that are tested on 100 respondents. The results of the validity test on the HIRARC scale in the first round resulted in 25 valid items or no items dropped at all.

C. Unsafe Action scale validity

The statement items in the questionnaire used on the work accident variable were obtained and modified from the FATIH EREL research. The items that have been tested resulted in 2 rounds of the process. In the first round found 6 items fall. The items dropped include items 13, 14, 16, 17, 18 and 20. Meanwhile, in the second round, all items have been declared valid.

D. Work Accident scale validity

The statement items on the questionnaire used on the work accident variable were also obtained and modified from the FATIH EREL study. In this variable using 17 statement items and then processed using SPSS resulting in 1 item being dropped in the first round. Items that fall in the first round are only item number 10. In the second round, all statement items are declared valid.

Reliability testing in this study used the Cronbach alpha method, where in this study the researcher used SPSS to test the reliability of the instrument. An instrument is said to be reliable if the Cronbach alpha value is more than 0.6 and close to 1.

The following is the reliability of each research variable:

E. Job Safety Analysis (JSA) Scale

Based on the results of the reliability test on the JSA scale in table 3 below, it was found that Cronbach's alpha was 0.904 with a total of 25 valid items. This value is greater than 0.6 and close to 1.00, so it can be concluded that the items on the JSA scale are reliable.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,904	,930	25

Table 3: JSA Reliability Results

F. HIRARC Scale

Based on the results of the reliability test on the HIRARC scale in the table below, it was found that the Cronbach alpha 0.926 with a total of 25 valid items. This value is greater than 0.6 and close to 1.00, so it can be concluded that the items on the HIRARC scale are also reliable.

Case Processing Summary

		N	%
Cases	Valid	100	100,0
	Excluded[a]	0	,0
	Total	100	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,926	25

Table 4: HIRARC . Reliability Results

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G. Unsafe Action Scale

Case Processing Summary

		N	%
Cases	Valid	100	100,0
	Excluded[a]	0	,0
	Total	100	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,851	14

Table 5: Unsafe Action Reliability Results

The results above are the results of the second round of the process using SPSS. This scale has 20 items submitted in the questionnaire and found 4 items dropped and 16 items were valid in the first round. In the second round it was stated that the 16 items were valid and the results of the Cronbach Alpha value of 0.851 were greater than 0.6 and approached the number 1.00 so it can be said that the items in the Unsafe Action scale were reliable.

H. Work Accident Scale

Case Processing Summary

		N	%
Cases	Valid	100	100,0
	Excluded[a]	0	,0
	Total	100	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,807	16

Table 6: Work Accident Reliability Results

The table above is also the result of SPSS processing in the second round. In the first round with 17 items, 1 item was found to be rejected and then in the second process the remaining 16 items were declared valid with a Cronbach Alpha value of 0.807 which is more than 0.6 and close to the value of 1.00, it can be said that the items on the work accident scale are reliable.

The normality test of the data was also carried out with the aim of seeing whether the distribution of the data on the research variables was normally distributed. The normality test in this study was using One Sample Kolmogorov-Smirnov and the results can be seen in the table below:

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		100
Normal Parameters[a,b]	Mean	0E-7
	Std. Deviation	4,33294480
Most Extreme Differences	Absolute	,131
	Positive	,131
	Negative	-,118
Kolmogorov-Smirnov Z		1,309
Asymp. Sig. (2-tailed)		,065

a. Test distribution is Normal.
b. Calculated from data.

Table 7: Data Normality Test Results

Based on the results of the normality test above, it can be seen that if the significance value is > 0.05, then the residual value is normally distributed and vice versa. The results from the table above show a significance value of 0.065 > 0.05 meaning that the data is normally distributed. This is reinforced by the information written below the table that says "Test Distribution is Normal".

Linearity Test Data is used to determine whether the variables of this study have a linear relationship or not significantly. Its significance can be seen in the following table:

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Unstandardized Residual * Unstandardized Predicted Value	Between Groups	(Combined)	1850,667	88	21,030	28,917	,000
		Linearity	,000	1	,000	,000	1,000
		Deviation from Linearity	1850,667	87	21,272	29,249	,000
	Within Groups		8,000	11	,727		
	Total		1858,667	99			

Table 8: Data Linearity Test Results

The basis for decision making on the linearity test in multiple regression is 2, namely if the value of Sig, Linearity > 0.05, then it is concluded that there is a linear relationship between the independent variable and the dependent variable. On the other hand, if the value of Sig, Linearity < 0.05, it can be concluded that there is no linear relationship between the independent and dependent variables. From the table above, we can all know that the value of Sig, linearity is 1,000, which indicates greater than 0.05. This means that there is a linear relationship between the independent variable and the dependent variable in this study.

Here are the results of the multiple correlation process using SPSS:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,767[a]	,588	,575	4,40013	,588	45,667	3	96	,000

a. Predictors: (Constant), UNSAFE ACTION, JSA, HIRARC

Table 9: Multiple Correlation Test Results

From the table above, it can be seen that the value of Sig, F Change is 0.000 indicating that the value is smaller than 0.05 so it can be concluded that the JSA, HIRARC and Unsafe Action variables have a significant relationship to work accidents simultaneously. The R value (correlation coefficient) is 0.767 so it can be concluded that the level of the relationship between JSA, HIRARC and Unsafe Action on work accidents simultaneously has a strong relationship.

Furthermore, the F test is used to simultaneously test the effect of the independent variables on the dependent variable. This test is carried out by comparing the

significance of the value of Fcount>Ftable, then the formulated model is correct. If the value of Fcount>Ftable, it can be interpreted that the regression model is correct, meaning that it affects together, by looking at the value of Ftable = f(k;n-k), F=(3;100-3), Ftable = (3;97) = 2.70 with an error rate of 5%. The F test performed can be seen in the table below:

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2652,493	3	884,164	45,667	,000[b]
	Residual	1858,667	96	19,361		
	Total	4511,160	99			

a. Dependent Variable: ACCIDENT

b. Predictors: (Constant), UNSAFE ACTION, JSA, HIRARC

Table 10: F Test Results

Based on the test results above, it can be seen that the Fcount value of 45,667 with the value of Ftable is 2.70 so that the value of Fcount > Ftable or 45,667 > 2.70 with a significance level of 0.000 < 0.005, it can be concluded that the variables JSA, HIRARC, Unsafe Action simultaneously have a significant effect on the occurrence of accidents. working on forklift operations at a light steel company in East Java.

The coefficient of determination (R2) essentially measures how far the model's ability to explain variations in the dependent variable is. The value of the coefficient of determination is zero and one. A low R2 value means that the ability of the independent variables in explaining the variation of the dependent variable is very limited. A value close to one means that the independent variables provide almost all the information needed to predict the variation of the dependent variable. Based on the R2 test conducted using SPSS, it can be seen in the table below:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,767[a]	,588	,575	4,400	,588	45,667	3	96	,000

a. Predictors: (Constant), UNSAFE ACTION, JSA, HIRARC

b. Dependent Variable: ACCIDENT

Table 11: Coefficient of Determination Test Results

Based on the table above, it can be seen that the value of the coefficient of determination is found in the Adjusted R Square value of 0.575. This means that the ability of the independent variable to explain the dependent variable is 57.5%, the remaining 42.5% is explained by other variables not discussed in this study.

IV. CONCLUSION

Based on the results of data processing and analysis that has been done, it can be concluded as follows:

- Variables JSA, HIRARC and Unsafe Action have a significant relationship with reducing the number of accidents in forklift operations in the company where this research takes place. This is reinforced by the results of data processing which shows that the R value (correlation coefficient) is 0.767 which means that the level of relationship between JSA, HIRARC and unsafe action is strong.
- The results of the analysis of the effect of JSA, HIRARC and unsafe action show different values..
  - The effect of JSA on reducing work accidents on forklift operations is positive. The value of tcount = 7.388 is greater than ttable = 1.98498 which states that JSA has a positive and significant effect on preventing work accidents in forklift operations.
  - The effect of HIRARC on reducing work accidents on forklift operations is positive. The value of tcount = 1.032 is smaller than ttable = 1.98498 which states that HIRARC has a positive but not significant effect on preventing work accidents in forklift operations.
  - The effect of unsafe action on the occurrence of work accidents in forklift operations is positive. The value of tcount = 4.690 is greater than ttable = 1.98498 which states that unsafe action has a significant effect on the occurrence of work accidents in forklift operations.
- Multiple Linear Regression which was carried out from the data processing of this research resulted in the following equation:

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4$$

Then the value of the research data is entered as follows:

$$Y = 13{,}107 + 0.288X_1 + 0.039X_2 + 0.266X_3$$

Based on the above equation, it can be concluded that the constant value of this research is 13.107, which means that when there is no change in the application of one of the variables, the prevention value for the number of work accidents in forklift operations can be at 13.107 units. If only one variable is used, the effect value will change.

- If the JSA variable is increased by 1% in its application, the work accident prevention rate will increase by 0.288 units.

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- If the HIRARC variable is increased by 1% in its application, the work accident prevention rate will increase by 0.039 units
- If the unsafe actiom variable is increased by 1% in its application, the work accident prevention rate will increase by 0.266 units.
- Recommendations that can be given based on the analysis in this study include:
- The application of the JSA and HIRARC methods is very influential in reducing the number of work accidents in the field of forklift operations in this company. So that the data on work accidents in the section studied in this company is relatively low.
- Being able to recognize and analyze any unsafe action can also reduce the number of work accidents in the field of forklift operation in this company.
- Conduct a review of HIRARC. This is because this study shows that the JSA method and unsafe action control have a higher influence than HIRARC.
- Schedule a review on work accident prevention methods and audits / field observations on forklift operating activities on a regular basis to maximize the risk reduction of work accidents that will occur.
- As is the principle of the research company which reads "Employee involvement is very important". In making JSA, HIRARC and controlling unsafe action, everyone involved in a work process must participate in expressing their thoughts in the process of preparing other work methods and instructions. This makes everyone from the main actors, supervisors to managers understand clearly the contents of JSA, HIRARC etc. thoroughly. So that when applied in the field it will be easier to implement.

V. SUGGESTION

Suggestions that can be given to research and the company are as follows:

- Companies are expected to be more stringent in terms of conducting reviews on the HIRARC method. From the information obtained, it is stated that the review is carried out every 6 months. To get better results, it is hoped that the review will be carried out according to schedule by involving all people involved in work that requires HIRARC, JSA and handling unsafe actions. This is believed to increase the value of the functioning of HIRARC in reducing the number of work accidents in the company.
- In future research, the variables in this study can be used on different subjects. The results obtained today are because the company where the research has a good work safety system. So the number of work accidents obtained is relatively low.

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