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# Analysis of Causes of Human Errors in Construction Projects

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## Abstract:

The number of infrastructure developments in Indonesia certainly has a good impact on the pace of the nation's economy. However, in recent years, there have been a series of work accidents that have fatal consequences for workers. The purpose of this study was to identify the dominant factors causing human errors in construction projects. Collecting primary data was done by distributing questionnaires to respondents. Perception assessment uses a Likert scale. Respondents were small qualified contractors. After getting the data, validity and reliability tests will be carried out, analysis of research data using descriptive statistical methods. The number of samples was calculated using the slovin formula. Based on the results of the study, the mean value for each risk factor for human error in construction projects, of the 30 risk factors for human error, there were 5 highest factors, namely the factor of incomplete use of PPE (X21), workers who do not have competency certificates (X1), noise level excessive (X20), low safety factor (X11), and poor work standards (X2).

*Keywords* **—Safety management, human error, project workers, construction projects, accidents**
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## I. INTRODUCTION

Construction projects have types of activities that are interconnected with each other and have project resources, in projects often two types of resources are used, namely natural resources and human resources. Human resources (HR) are things that are vulnerable to the risk of human errors so proper handling is needed for this problem. To avoid project losses and delays, contractors need to manage human resources effectively and efficiently to achieve organizational goals (Mathis & Jackson, 2006).The tight competition in Aceh province makes construction service companies have to be more detailed in utilizing project resources, especially labor, untrained workers can cause accidents. To avoid delays and losses, contractors need to minimize accidents based on human errors in the project (Rauzana, 2016; Rauzana & Dharma, 2022). A work accident is an unexpected and unexpected event in which there is no intentional element (Dauly, 2011). Accidents do not always cause injuries, but can also cause damage to project materials and existing equipment.

One of the risks that often occurs in projects is the risk of human errors (Aidil et al., 2021; Rauzana & Dharma, 2021). Failure to complete a job that results in accidents, damage to objects and equipment is a human error (Dhillon, B, 2007). Which means the risk of human errors affecting the progress/continuation of a project in terms of effectiveness and performance. Accidents often occur due to weak response in the event of an accident, inadequate training and supervision, management only determines one-way communication, poor work procedures, and failure to use personal protective equipment/safety properly (Williams et al., 2018). Therefore, it is necessary to study the steps to identify risk factors for human errors. So that companies can minimize the things that affect accidents based on human errors, the occurrence of human errors is caused by work standards that are often underestimated by workers, too confident in a job, and too high personal ego (Rachmawati et al., 2022). The phenomenon of human error accidents in construction projects in Banda Aceh is "A work accident on the Sibanceh Toll Road, a subcontractor worker dies" (Ekonomi.Bisnis.com, 2020). The purpose of this study was to identify the dominant factors causing human errors in construction projects. Having no experience at work, not recognizing the characteristics of the work area, and having poor work techniques are the causes of human errors (Shappell & Wiegmann, 2009).

## II. MATERIALS AND METHODS

This study uses quantitative methods, quantitative methods were used to obtain scores or values generated from the questionnaire. The results will then be processed through SPSS software. This research was conducted in Banda Aceh City. Respondents in this study were contractor companies with K1, K2, and K3 qualifications.

### 2.1 Research Data

In this study, the types of data sources used were primary data and secondary data. Primary data in this study were obtained by distributing questionnaires to respondents to provide the necessary information. Questionnaires were distributed to 64 contractor companies with K1, K2, and K3 qualifications in Banda Aceh. The distribution of the questionnaire was done by meeting the respondents directly.Secondary data was obtained indirectly from documents related to the object of research, namely the name of the contractor company. Respondents in this study were small qualified contractor companies. The number of respondents who were sampled amounted to 64 of the 167 population of contractor companies, the data was obtained from the office of the National Construction Implementing Association.

$$n = \frac{N}{1+(Nxe^2)} = \frac{167}{1+167x0{,}1^2} = 64$$

Where :
n = number of samples
N = Total population
e = 10% error value

The questionnaire in this study used a Likert scale. The Likert scale is a scale that can be used to measure attitudes, opinions, and perceptions of a person or group of people about a symptom or phenomenon of education (Djaali, 2008). This scale is very commonly used, especially in research in the form of surveys. The response category on the Likert scale has levels but the distance between categories cannot be considered the same, so the Likert scale is an ordinal scale class (Jamieson, 2004). On the other hand, some researchers consider that the Likert scale is an interval measurement scale. The Likert scale can produce an interval measurement scale (J & Rocco, 2007).

### 2.2 Simple Random Sampling

Simple random sampling is a way to obtain a sample by giving equal opportunities to every member of a population (Arieska & Herdiani. N, 2018). The simple random sampling method is very easy to use because it only involves one random selection and requires little information about the population. To perform simple random sampling there are several steps as follows:

1. Determine the target population.
2. Calculate the number of respondents/samples needed.
3. Do a random selection of respondents. By distributing questionnaire surveys to respondents and waiting until the responses received reach the targeted number of respondents.

  

4. Collect data obtained from respondents and perform analysis.

### 2.3 Data Processing

After getting data from the questionnaires that have been distributed, the next step was to test the validity and reliability for data processing. Data analysis is an effort to systematically search and organize notes from observations, interviews, and others to increase researchers' understanding of the case under study and present them as findings (Noeng, 1998). Meanwhile, to improve this understanding, the analysis needs to be continued by trying to find meaning. This opinion states that data analysis is related to activities in systematically arranging findings in the field, efforts to obtain field data, and presenting what has been found.

### 2.4 Descriptive statistics

Descriptive statistics are statistics used to analyze data by explaining existing data. This analysis aims to describe the data in the variables seen from the mean, minimum, maximum and standard deviation values (Ghozali, 2011). Numerical values such as finding the mean, median, mode, percentile, decile and quartile will later be needed to carry out this descriptive statistical analysis.

## III. RESULTS AND DISCUSSION

In this study to test the validity by taking the value of r table = 0.2423. The following is the calculation of the validity test in Table 1.

TABLE 1
VALIDITY TEST

| Item | R-count value | R-table value |
|---|---|---|
| X1 | 0,269 | 0,2423 |
| X2 | 0,364 | 0,2423 |
| X3 | 0,448 | 0,2423 |
| X4 | 0,379 | 0,2423 |
| X5 | 0,273 | 0,2423 |
| X6 | 0,587 | 0,2423 |
| X7 | 0,269 | 0,2423 |
| X8 | 0,381 | 0,2423 |
| X9 | 0,583 | 0,2423 |
| X10 | 0,458 | 0,2423 |
| X11 | 0,313 | 0,2423 |
| X12 | 0,452 | 0,2423 |
| X13 | 0,451 | 0,2423 |
| X14 | 0,501 | 0,2423 |
| X15 | 0,443 | 0,2423 |
| X16 | 0,582 | 0,2423 |
| X17 | 0,416 | 0,2423 |
| X18 | 0,340 | 0,2423 |
| X19 | 0,305 | 0,2423 |
| X20 | 0,391 | 0,2423 |
| X21 | 0,597 | 0,2423 |
| X22 | 0,355 | 0,2423 |
| X23 | 0,254 | 0,2423 |
| X24 | 0,332 | 0,2423 |
| X25 | 0,331 | 0,2423 |
| X26 | 0,603 | 0,2423 |
| X27 | 0,642 | 0,2423 |
| X28 | 0,669 | 0,2423 |
| X29 | 0,485 | 0,2423 |
| X30 | 0,357 | 0,2423 |

Table 1 shows that all variables have an R-count value that exceeds the R-table value, which was > 0.2423. So, the questionnaire in this study was feasible (valid) to be used and distributed to respondents.

The reliability test explains how consistent the data has been obtained, in other words, this test confirms that the instruments used in this study can be trusted in order to achieve the objectives. The reliability test in this study used the Cronbach Alpha method, the results of the reliability test for all criteria obtained a value of > 0.60.

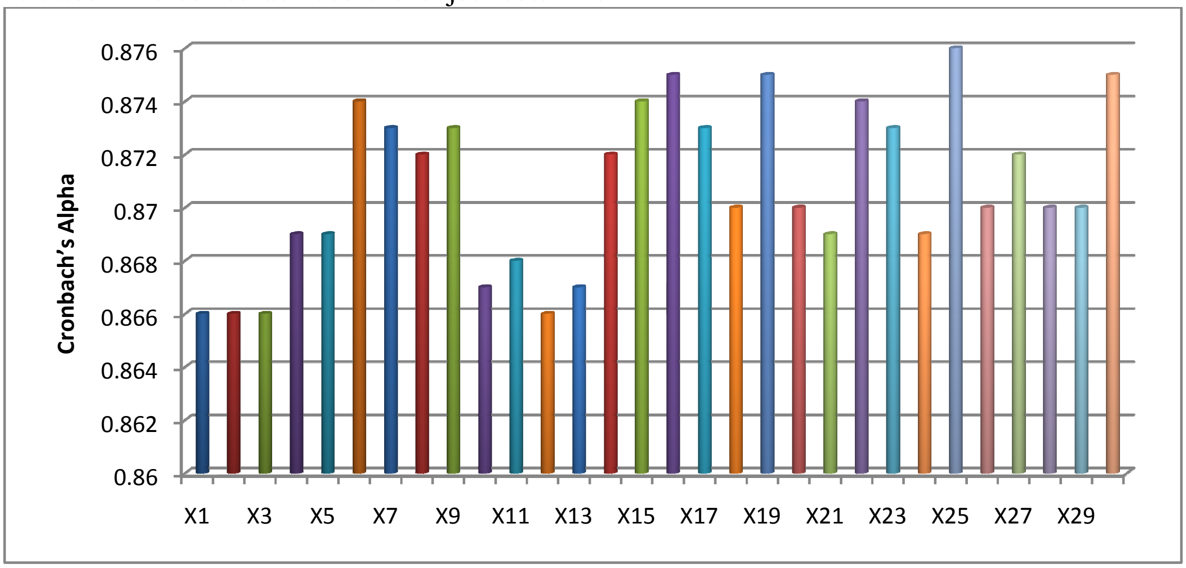


Fig. 1. Reliability Test Results

Fig.1 shows that 30 variables have Cronbach's Alpha values greater than 0.60. So, the questionnaire in this study was reliable.

### 3.1 Dominant Human Error Factors

The main data in the study is in part B of the questionnaire. The purpose of this research was to find information about the level of influence of the dominant human error risk factor on construction projects.

TABLE 2
THE INFLUENCE OF HUMAN ERROR RISK FACTORS ON CONSTRUCTION PROJECTS

| Item | *Human Error* | Total | Mean | Standard deviation | Rank |
|---|---|---|---|---|---|
| X21 | Incomplete using PPE | 64 | 3.44 | 1.08 | 1 |
| X1 | The workforce does not have a competency certificate | 64 | 3.23 | 1.21 | 2 |
| X20 | Excessive noise level | 64 | 3.20 | 1.22 | 3 |
| X11 | Low Safety | 64 | 3.19 | 1.17 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| X2 | Work standards are often underestimated | 64 | 3.17 | 1.15 | 5 |
| X12 | Often do not attend daily briefings | 64 | 3.08 | 1.20 | 6 |
| X27 | Personal ego is too high | 64 | 2.91 | 1.20 | 7 |
| X26 | No work experience | 64 | 2.89 | 1.10 | 8 |
| X5 | Inadequate training and supervision | 64 | 2.88 | 0.98 | 9 |
| X22 | Lack of education and training | 64 | 2.86 | 1.14 | 10 |
| X24 | Too confident in a job | 64 | 2.77 | 1.16 | 11 |
| X23 | Ignorance, negligence and carelessness | 64 | 2.67 | 1.17 | 12 |
| X3 | No pre-check | 64 | 2.56 | 1.19 | 13 |
| X14 | Failure to use protective equipment | 64 | 2.56 | 0.97 | 14 |
| X15 | Not following the rules during training | 64 | 2.53 | 1.07 | 15 |
| X18 | Uncontrolled workers in the field | 64 | 2.52 | 0.99 | 16 |
| X10 | Poor work procedures | 64 | 2.50 | 1.07 | 17 |
| X28 | Does not recognize the characteristics of the work area | 64 | 2.50 | 1.14 | 18 |
| X6 | Management only establishes one-way communication | 64 | 2.45 | 1.21 | 19 |
| X13 | Poor work facility layout design | 64 | 2.45 | 1.27 | 20 |
| X19 | Poor lighting | 64 | 2.45 | 1.08 | 21 |
| X30 | Poor work technique | 64 | 2.36 | 0.88 | 22 |
| X17 | Trust/dependence on others | 64 | 2.31 | 0.77 | 23 |
| X8 | Only use one-way communication in the field | 64 | 2.30 | 1.05 | 24 |
| X29 | Lack of ability to communicate | 64 | 2.30 | 0.97 | 25 |
| X9 | Completely unknown situation | 64 | 2.20 | 0.91 | 26 |
| X7 | The choice of construction method does not take into account the risk aspect | 64 | 2.16 | 0.84 | 27 |
| X4 | Weak response in case of work accident | 64 | 2.14 | 1.07 | 28 |
| X25 | Workers are stressed or have personal problems | 64 | 2.06 | 1.17 | 29 |

| | | | | | |
|---|---|---|---|---|---|
| X16 | Work procedures are not clear | 64 | 1.73 | 0.76 | 30 |

Based on Table 2, it was obtained the mean value for each risk factor for human error in construction projects, of the 30 risk factors for human error there were 5 highest factors, namely the factor of using incomplete PPE (X21), workers who did not have competency certificates (X1), excessive noise level (X20), low safety factor (X11), and underestimated work standard (X2). The dominant factor can be explained as follows:

1. The factor using incomplete PPE has a mean value of 3.44. Not using PPE can cause accidents(Suak et al., 2018). Many workers are reluctant to use PPE completely because it can make their appearance not optimal, not look good, and underestimate safety at work. Work safety equipment is equipment used by construction workers to protect themselves from unwanted things, such as accidents at work. Work safety equipment can be in the form of head protection (project helmets), foot protectors (project shoes), hand protection, respiratory protection, hearing protection, eye protection, safety vests, and safety harnesses.

2. The labor factor does not have a competency certificate, which has a mean value of 3.23. Competency certificates are very important for the workforce, to ensure that the workforce has gone through learning, training, and work experience (Sudalma, 2021).

3. The excessive noise level factor has a mean value of 3.20. Noise levels that exceed the threshold value can encourage hearing loss and the risk of damage to the ears, both temporary and permanent after exposure for a certain period of time, without the use of adequate protective equipment (Williams et al., 2018). Noise factor in the workplace can cause other potential risks such as stress disorders, accelerated pulse, increased blood pressure, emotional stability, communication disorders and decreased work motivation.

4. The low safety factor has a mean value of 3.19. Safety is very necessary in construction project development activities. Low safety can cause work accidents. In project implementation, the work environment is one of the important factors in human resource management in the company, therefore the work environment needs to be considered (Rachmawati et al., 2022). Construction projects are activities with the possibility of uncertain and unstable risks, especially the risk of human error. The possibility of human error in construction projects can result in losses and failure of construction project development activities.

5. The work standard factor is often underestimated having a mean value of 3.17. Work standards are the minimum behavior or results that are expected to be achieved by the entire workforce. Workers who do not follow work standards can cause errors in carrying out work methods, poor quality, and can cause damage and accidents (Rachmawati et al., 2022).

## IV. CONCLUSION

Based on the results of the study, the mean value for each risk factor for human error in construction projects, of the 30 risk factors for human error, there are 5 highest factors, namely the factor of incomplete use of PPE (X21), workers who do not have competency certificates (X1), noise level excessive (X20), low safety factor (X11), and poor work standards (X2).

  

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