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Analysis of factor Affecting the Implemation of Construction Occupational Safety and Health in Multi-Story Building in Palu City

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ABSTRAK
Construction projects require a large amount of human labor to complete, and the physical state of workers and open work areas such as the climate, weather, and environment have a significant impact on every aspect of construction work activities. As a result, work accidents are common when construction projects are being implemented. One strategy for reducing workplace accidents is the implementation of occupational safety and health (OHS). Factor analysis is used in this study's data processing along with quantitative and descriptive qualitative methodologies. OHS procedures and implementation factors, OHS regulations, occupational safety and health factors, and occupational safety and health factors are the four factors that influence occupational safety and health.
.Word Keywords: Project Construction, Deployment, Factors, Occupational Safety and Health.

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I. INTRODUCTION

Indonesia is one of the developing countries where a lot of development is being carried out. Some construction projects in Indonesia occur in big cities, one of which is Palu City. In addition to paying attention to timeliness, quality, and cost, construction companies also need to pay attention to occupational safety and health in the project. The implementation of a construction project uses a lot of human labor and in every construction work activity is greatly influenced by the physical conditions of workers and open work areas, such as climate, environment, and weather. Weather conditions significantly affect many construction projects carried out at work sites with open environments [1]. Therefore, the implementation of construction projects is very prone to occupational accidents. Numerous OHS risks can be avoided or reduced by putting in place an occupational health and safety management system (OHSMS), according to occupational health and safety research. In response to business demands for occupational risk management, national and international organizations and institutions have developed a variety of OHS models and guidelines [2] [3]. The OHSAS (Occupational Health and Safety Assessment Series) 18001 standard is the most widely used OHSMS to evaluate health and safety management procedures [4]. According to PUPR Regulation No. 10 of 2021 concerning Guidelines for Construction Safety Management Systems, construction safety is defined as all engineering activities to support construction work in realizing the fulfillment of security, safety, health, and sustainability standards that ensure construction engineering safety, labor safety and health, public safety, and the environment. The goal of this study is to identify the variables that may have an impact on the implementation of occupational safety and health in Palu City's multi-story buildings as well as the variables that are crucial in determining that implementation.

II. LITERATURE REVIEW

Some concepts and literature reviews related to and supporting the object of research are as follows:

2.1 Construction Project

A project's overall development typically happens in phases, each of which calls for a different set of specialized services. From the beginning of planning a project to its completion, the work is usually Financial institutions, governmental organizations, engineers, architects, lawyers, insurance and guarantee companies, contractors, manufacturers and material suppliers, and building merchants are just a few of the industries that mustprovide input. It goes through several sequential and distinct stages [5] .

The development of a construction project involves many parties, various processes, stages and different stages of work as well as a lot of input from both government and private parties, with the main objective that the project can be completed successfully [6]. Progress monitoring is a crucial component of construction project management, serving as the cornerstone for effective administration and decision-making. Additionally, increasing workplace safety is crucial. [7]

2.2 OCCUPATIONAL SAFETY AND HEALTH

Occupational health and safety is an area that requires improvement in construction despite advances in the technological implementation of robust occupational health and safety management systems [8].

Over time, occupational health and safety (OHS) management tends to concentrate on particular areas, such as practices and policies, social dynamics and individual traits, events and incidents related to injuries and accidents,management control, and industrial relations [9]

There are particular difficulties with occupational safety and health on construction sites [10]. Despite the difficulties, accidents can be decreased by well-designed and well-funded safety programs and procedures put in place by businesses. However, most businesses only devote a small amount of resources to safety management, so contractors must make thoughtful selections from the options available. Consequently, optimizing construction sitesafety performance is a direct result of good safety procedures [11].

2.3 Setting up the control system for occupational safety and health

Employers include worker representatives, occupational safety experts, occupational safety and health working committees, and other relevant parties in the OHS plan. Due to the significance of implementing Occupational Health and Safety (OHS), every company has an obligation to emphasize to all employees—especially those in key positions like supervisors and managers in every department—that they understand Indonesian government regulations. Some provisions on who is required to implement OHS include: Businesses that employ at least one hundred people as laborers, Businesses that pose a significant risk or danger. The goals of the internal audit conducted by OHS are:

a. To ascertain whether the OHS management system being implemented has followed established procedures andcomplies with standards and requirements.

b. To determine whether the OHS management system has been performing at all ranges in line with its intendeduse.

c. Make sure the organization's OHS management system is capable of handling all OHS concerns in order toprevent misinformed, sporadic, or virtual OHS [12].

2.4 Occupational Health and Safety (OHS) Standard Equipment on Construction Projects

The effects of workplace exposures, activities, and materials on health and safety are least known to small- scale industrial workers [13]. It is evident that these workers still lack information, understanding, and knowledge about how to use personal protective equipment (PPE), and that small-scale industries use very little PPE. [13] [14]. Low levels of education can also result in people not using personal protective measures because they are unaware of their significance [14]. Although personal protective equipment (PPE) is usually used as a last resort for workplace hazard control and in situations where managerial and technical control measures are already in place,

PPE has proven to be the most practical protection measure for workers in small-scale industries where conventionalhazard control measures and programs are still difficult to implement [13] [15].

Employees who are not wearing personal protective equipment (PPE) may be subjected to a range of risks and hazards that could be harmful to their health. PPE is particularly beneficial in lowering workplace accidents and injuries that result in severe pain for individuals as well as monetary losses due to missed work, heavy fines, healthand insurance claims, and absenteeism [14].

In the construction field, there are several pieces of equipment used to protect a person from accidents or hazards that might occur in the construction process. This equipment must be used by someone working in a construction environment. However, not many who realize how important these tools are to use. Safety and occupational health are two crucial issues. As a result, personal protective equipment (PPE) must be provided for all projects implemented by implementers. Conditions Any piece of gear that an employee is intended to wear or carry while at work to protect them from potential hazards to their health or safety is known as personal protective equipment, or PPE. PPE includes things like safety footwear, knee caps, hard hats, respirators, gloves, goggles, and safety harnesses. When it is necessary to improve processes or reduce health risks, personal protective equipment (PPE) can be a useful tool in safeguarding the health of employees[16].

2.5 Definition of Factor Analysis

Idea of "dimensionality reduction," or the reduction of quantifiable and observable variables to a smaller number of unobservable variables with the same variance, forms the basis of factor analysis [17]. These unobservable variables are essentially imaginary constructs used to represent variables since they cannot be measured directly [18].

When a researcher wishes to identify several factors that influence variables and analyze variables, they employ exploratory factor analysis (EFA) [19].

Finding the fewest common factors that will adequately explain the correlations is the aim of the essential hypothesis of exploratory factor analysis (EFA), which holds that there are common factors present in the data set.[20].

2.6 Factor analysis requirements

The data must contain both univariate and multivariant nomality in order to perform factor analysis [21]. It's crucial that the determinants be based on the idea that factors and variables have a linear relationship in order to calculate correlations. Additionally, there must not be any univariate or multivariate outliers [22]. Depending on the research design, an item needs to have at least three variables in order to be eligible for a factor analysis [23].

A minimum of 300 participants is the recommended sample size, and each of the variables undergoing factor analysis should have five to ten observations [18]. If the ratio of respondents to variables is at least 10:1, the factoris considered stable and can be cross-validated with a ratio of 30:1.

EFA typically performs better with larger sample sizes since they will lower data errors. A smaller size (n > 150) is adequate if there are some high factor loading scores (> 0.80) in the data set. The amount that a variable contributes to a factor is indicated by its factor loading. The factor loading score shows that the variable more adequately accounts for the factor's dimensions[24]. Additionally, a lower correlation value indicates a very weak relationship between the variables, so the correlation r should be 0.30 or higher [23].

2.7 Factor Analysis Process

Basic process of factor analysis includes the following:

1. Determining what variables will be analyzed, the variables selected are variables that are relevant to the research being conducted and must be based on previous studies, theories and the researcher's own opinion. Calculating the correlation matrix using the Bartlett test of spericity method and measuring the MSA (Measure of Sampling). In factor analysis, the desired result is the correlation between variables. If the correlation between variables is small, then most likely the variables are located on different factors [25]. Correlation matrix, which is formed from the data obtained from the research results. The relatively high correlation between variables X1, X2, Xn is expected to correlate with the same set of indicators. if the calculated *Bartlett* value> *Bartlett* table, or sign < 5% Alpha, It shows that the variables under analysis have a strong correlation with one another, and the processcan go on.
2. Sampling adequacy measured (MSA)

By comparing the observed sample correlation coefficient with the partial correlation coefficient, the Kaiser Meyer Olkin index—also known as the Kaiser Meyyer (KMO) index—is used in SPSS to assess the accuracy of factor analysis. When the (KMO MSA) value falls between 0.5 and 1.0, the analysis is suitable and can proceed. In SPSS, the anti-image correlation matrix's diagonals show the sampling adequacy measure for every variable. The variable ought to be taken out of consideration if its MSA size is small. KMO Examination The matrix's inter-variable criteria [25]

3. Factor Extraction

The common factor model is a theoretical model that serves as the foundation for factor analysis. According to this model, correlation patterns between the unique and common underlying factors that influence observed measures must be identified. Although there are many different extraction techniques available, we will quickly go over a few popular ones that are available in SPSS. Analyzing the highest probability of sampling the observed correlation matrix is the goal of maximum likelihood[23]. Maximum Likelihood is used to estimate a population's factor load and is more helpful in confirmatory factor analysis. The principle axis factor method is predicated on the notion that all variables are members of the first group, and that the residual matrix is computed upon factor extraction. After then, the factors are removed one at a time until the correlation matrix's variance is sufficiently large to be explained [18].

4. Determining the Number of Factors

While extracting too few factors could remove important common variance, extracting too many factors could introduce unwanted error variance. So, when determining how many factors to extract, it is crucial to select the criteria that best fit your research. The number of factors to retain is determined using the scree test, also called the scree plot, and eigenvalues. One criterion that can be used to determine how many factors to retain is the

Kaiser criterion, which is a rule.This criterion states that all factors with eigenvalues larger than one ought to be retained [26]. An additional criterion is predicated on the Jolliffe criterion, which suggests holding onto factors greater than 0.70 [27]. Some claim that using both criteria could lead to an overestimation of the number of factors that are extracted [28] [22].

5. Factor rotation

By increasing the number of high loadings on each variable and decreasing the number of factors that each variable loads, rotation seeks to produce an optimal, simple structure. [29].

Factor extraction results are useless if they are not rotated because rotation helps facilitate scientific interpretation and analysis. In factor analysis, there are two kinds of rotations oblique and orthogonal. The orthogonal rotation includes the varimax, quartimax, and equamax components[30]. Without rotation, factor extraction results are meaningless since it makes scientific interpretation and analysis easier. In factor analysis, there are two kinds of rotations: orthogonal and oblique. The components varimax, quartimax, and equamax are included in the orthogonal rotation.

III. RESEARCH METHODS

This section starts from the background of factors affecting occupational safety and health. gathering both secondary and primary data. Reliability testing is done to ensure consistent measurement results, and validity testing is done to assess the degree of measurement accuracy. In order to identify the dominant and influencing factors in this study, factor analysis was done [31].

III.1 Techniques for gathering and retrieving data

This research was conducted in several building construction projects in Palu City, Post-disaster Central Sulawesi High Court Office Building Construction Project, Witel Telkom Palu Building Construction Project, Post- Disaster State Administrative Court Office Building Construction Project, RRI Palu Building Construction/Rehabilitation Project, Mutiara Sis Aljufri Multipurpose Building Construction Project with a research period of 1 month. The authors selected samples using saturated sampling techniques because the population in this study is relatively small and nonprobability sampling was employed, specifically using the census technique.In this study, three methods of gathering data were employed: documentation, questionnaires, and observation.

III.2 Data analysis technique

The next stage in this study's process is data analysis; the data collected during the data collection stage is still raw data. The analysis phase of research is crucial. This is due to the fact that the data can be given a meaning that helps with research problem solving. The factor analysis method was used to analyze the data in this study.

IV. RESULTS AND DISCUSSION

A total of 65 respondents, who were involved in the construction of multi-story buildings in Palu City in 2023 as research objects, were included in this study as commit maker officials, consultants, and contractors.

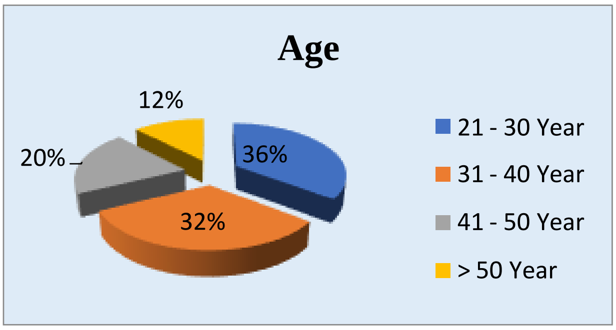

Figure 1. Age-related percentage diagram of responders

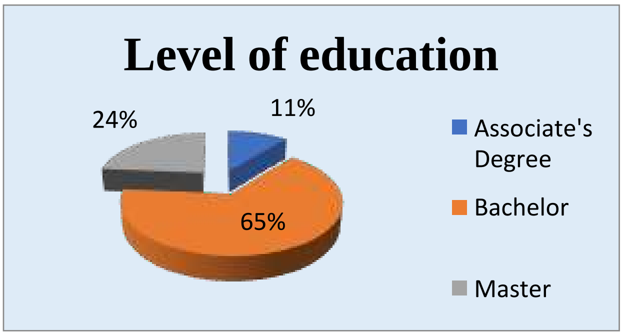

Figure 2: Education level percentage diagram

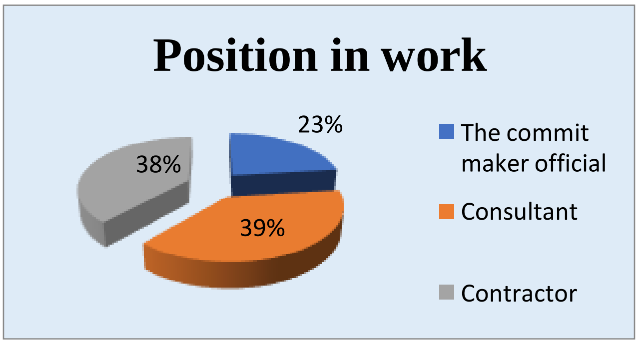

Figure 3: Diagram of a job position

IV.1 Validity Test

Testing the validity of a questionnaire is necessary to determine whether or not each variable is valid. This is made possible by correlating the total variable score of the questionnaire with the score of each indicator item. The instrument is deemed valid if the value of rcount is greater than or equal to the value of rtable otherwise, it isdeemed invalid.

$$r = \frac{N(\Sigma XY) - (\Sigma X \Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

r = Correlation coefficient
N = Number of samples (respondents)X = Question score
Y = Total score
Researchers used a 95% confidence level or a level of significance (α) = 0.05 to test the responses of up to65 respondents, and the results were obtained in a rtable of 0.2404.

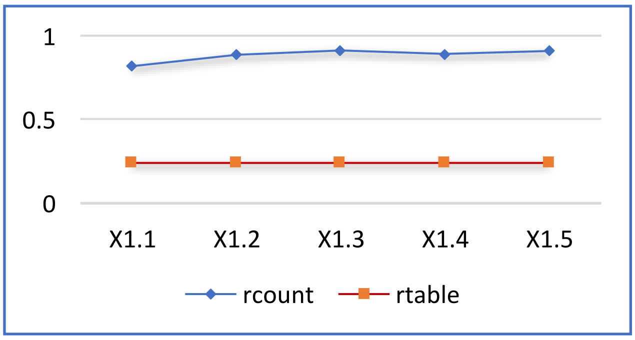

Figure 4. Validity test results curve of work safety factor($_{X1}$)

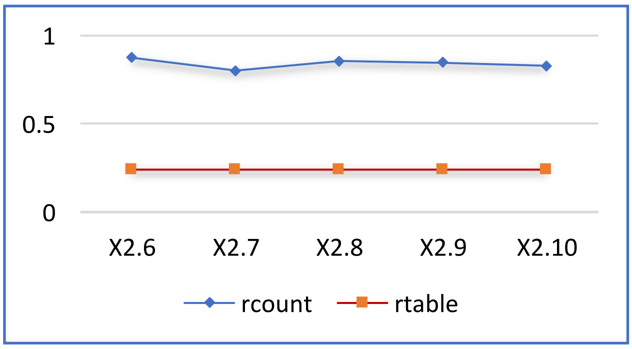

Figure 5. Validity test results curve for occupational health factor (X2)

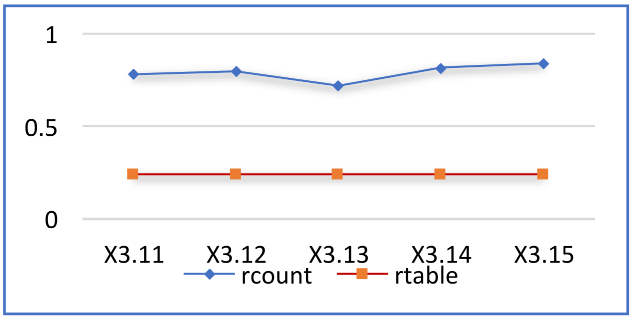

Figure 6. The validity test results curve of the rules and procedures factor (x3)

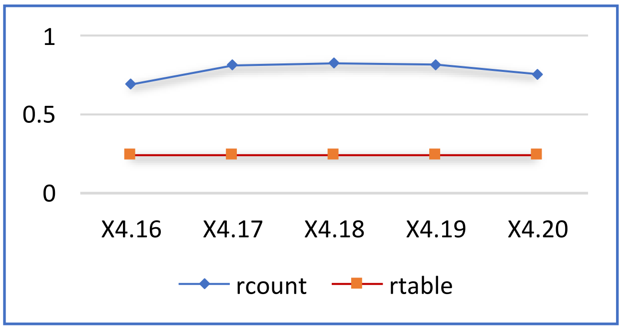

Figure 7. Validity test results curve of commitment factors and top *management* (x4)

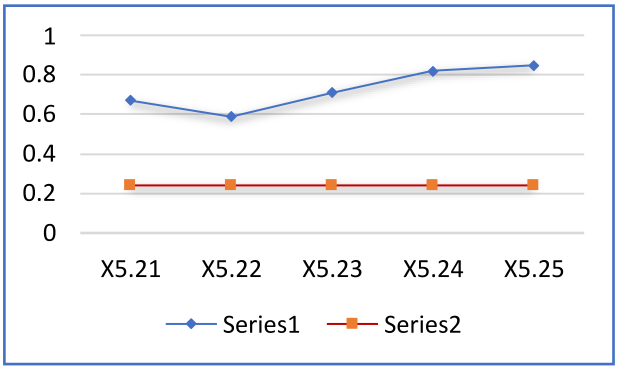

Figure 8. Human factor validity test result curve (x5)

All of the statements can be included in the research questionnaire because, as can be seen from the curve above, all of the rcount values are greater than the rtable value.

IV.2 Reliability test

Reliability tests are used in research to assess a questionnaire's consistency. If the Cronbach's Alpha value is more than 0.60, the variable is considered reliable; if it is less than 0.60, the variable is considered unreliable.

Table 1. Results of the reliability test

Variables	***Cronbach's Alpha***	Description
Work safety factor (x_1)	0,932	Reliabel
Occupational health factors (x_2)	0,896	Reliabel
Regulatory and procedural factors (X3)	0,855	Reliabel
Commitment and top factors *mangement* (x_4)	0,834	Reliabel
Human factor (X5)	0,721	Reliabel

Table 1 demonstrates the reliability of each variable by displaying all values obtained with Cronbach's Alpha valuesgreater than 0.60.

IV.3 Test Keiser Meyer Olkin (KMO) testing as well as Bartlett's test

The Keiser Meyer Olkin (KMO) test and Bartlett's test are used to determine whether a variable is viable for factor analysis. If the KMO test results indicate a KMO value > 0.50 to 1.0 and significant Bartlet's <0.05, the study's data can be factor analyzed [32].

Table 2. KMO and Bartlett's test results

KMO and Bartlett's test results		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		*0.868*
Bartlett's Test of Sphericity	*Approx. Chi-Square*	*1590.88*
	df	*300*
	Sig.	*0,000*

The results of the KMO and Bartlett's Test are shown in Table 2 above. The Bartlett's Test of Sphericity value has a significant magnitude of 0.000, and the KMO calculation yields a value of 0.868. Because the Bartlett's significant is less than 0.05 and the KMO value is greater than 0.5, the indicator can be further examined and predicted.

IV.4 MSA (Measure of Sampling Adequacy) Test

Anti-Image Matrices are helpful for understanding and identifying which variables are appropriate for factor analysis. Another technique for evaluating the suitability of factor analysis and the intercorrelation between variables is the MSA (Measure of Sampling Adequacy) test. If the Anti-Image Matrices' diagonal value in this investigation produced an MSA of at least 0.50, the indicator may be the subject of more investigation.

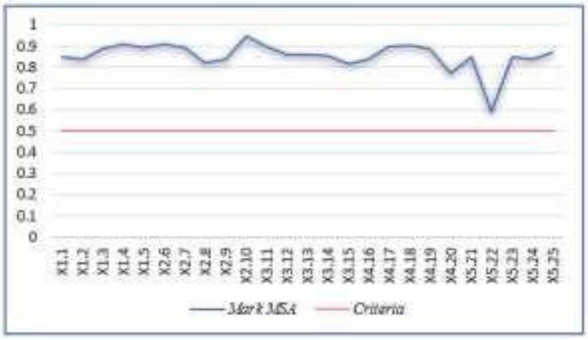

Figure 9. Curve of MSA test results

Since it is known that every indicator under study has a value greater than 0.5, the analysis's findings can proceed to the next phase of factor analysis.

IV.5 Estimasi Communality

Communalities are defined as the percentage of an item's variance, or the origin variable, that can be accounted for by the primary factor. The value of the communality itself must be greater than 0.5. Every variable's extraction value from the communalities analysis is more than 0.50.

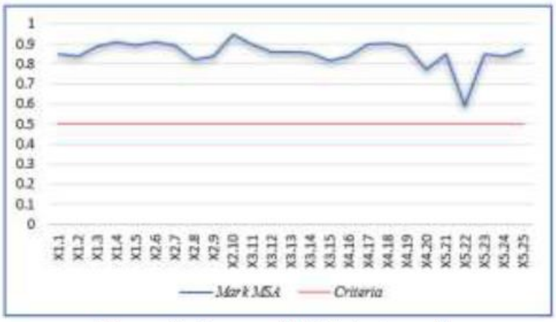

Figure 9. Curve of MSA test results

IV.6 Factor Extraction

Finding out how many factors are used to present the data and how much each factor contributes to the research phenomenon is the aim of factor extraction. To construct the factors, only those elements that meet the eigen value>1 requirement will be used. To find the total number of factors formed from the extraction results, the eigenvalue arrangement is always sorted from largest to smallest.

Table 3: Results of Factor Extraction

Total Variance Explained

Component	*Initial Eigenvalues*			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	13.687	54.750	54.750	13.687	54.750	54.750	7.071	28.285	28.285
2	1.886	7.542	62.292	1.886	7.542	62.292	5.169	20.676	48.962
3	1.395	5.580	67.872	1.395	5.580	67.872	3.786	15.145	64.107
4	1.265	5.060	72.932	1.265	5.060	72.932	2.206	8.825	72.932
5	0.934	3.738	76.670						
6	0.865	3.461	80.131						
7	0.766	3.064	83.195						
8	0.636	2.545	85.740						
9	0.536	2.144	87.884						
10	0.485	1.941	89.825						
11	0.396	1.582	91.407						
12	0.360	1.439	92.846						
13	0.322	1.287	94.133						
14	0.269	1.075	95.208						
15	0.224	0.896	96.105						
16	0.197	0.787	96.891						
17	0.148	0.592	97.483						
18	0.130	0.521	98.004						
19	0.112	0.447	98.451						
20	0.092	0.368	98.818						
21	0.087	0.347	99.166						
22	0.081	0.323	99.489						
23	0.052	0.210	99.698						
24	0.045	0.181	99.879						
25	0.030	0.121	100.000						

The value of each variable under analysis is displayed in the above table. Out of the 25 factors under analysis, 4 sub-factors were formed, and each of the 4 factors has an eigenvalue greater than 1. Component 1 has an eigenvalue of 13.687> 1 with a factor eigenvalue of 1. The eigenvalues of Component 2 are 1.886> 1 with a variance of 7.542%, Component 3 is 1.395> 1 with a variance of 5.580%, and Component 4 is 1.265> 1 with a variance of 5.060%. The variance of Component 2 is 54.750%. The effect of the four subfactors can be ascertained by adding the variance values as follows, which, using the eigenvalue as a basis, displays the proportional significance of each factor in estimating the variance of the 25 subfactors studied:

$$54{,}750\% + 7{,}542\% + 5{,}580\% + 5{,}060 = 72{,}932$$

Since the cumulative variance value of 72.932% already exceeds 60% of the required cumulative variance, it can be continued in the next analysis. In addition to the table above, the factor extraction of this study can also be seen in the following Scree Plot. The percentage of variance that can be accounted for by the four factors demonstrates the 72.932% impact that occupational safety and health has. Other factors that are not included in the study's set of indicators impact the remaining 27.068%.

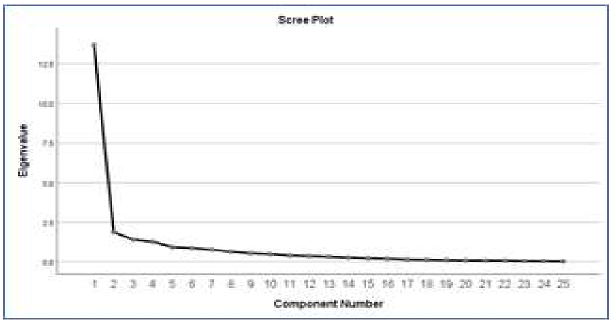

Figure 11. Curve of Scree Plot

An illustration of the number of factors that will form (Initial Eigenvalues>1.00) can be seen in the ScreePlot image. Values greater than one for four component points indicate the formation of four new factors.

IV.7 Components of the matrix and rotation

Finding some of each section's most noticeable components is the next stage. Even with the extraction results, finding the dominant indicator or sub-factor by looking at the highest value of each factor remains difficult. Because of this, rotating the factors is required to more clearly identify the factors that enter the four factors that are formed.

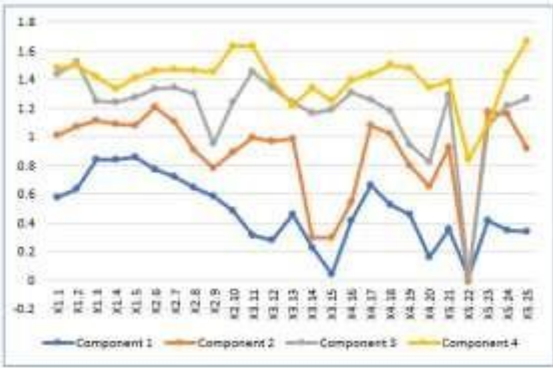

Figure 11. Rotation curve of the component matrix

Demonstrates that all variables have loading factor values greater than 0.3, indicating that all factors examined have an impact on the Construction Occupational Safety and Health in Multi-Story Buildings in Palu City analysis when compared to other factors.

IV.8 Dominant Risk Factors

1. Occupational safety and health factors

Work safety factor, is a factor formed from several sub- factors from the results of factor analysis, this factor has the highest *variance* value of 54.750%, which means that this factor is the factor that has the greatest or most dominant influence compared to other factors.

This factor has 13 sub-factors, namely availability, availability of personal protective equipment, completeness of personal protective equipment, condition of personal protective equipment, placement of warning signs, work accident benefits, occupational health insurance, available first aid equipment (medicines for first aid in the event of an accident), available space for rest for workers, available kitchen for workers to prepare food and drinks, breafing about health, the company provides OHS equipment, there is supervision of OHS for workers, the company gives top priority to OHS issues. For the variable that has the highest loading factor value, namely work accident benefits, which corresponds to a loanding factor value of 0.856. "Work Accident Allowance" usually refers to the protection or reimbursement provided to workers if they have a work accident or injury during the course of their job duties. occupational safety and health (OHS) factors are very important in reducing the risk of work accidents and maintaining worker health. So by paying attention to these factors and implementing a good OHS top management commitment, companies can reduce the risk of work accidents, improve safety, and provide better protection to workers through the provision of work accident benefits if needed.

2. Procedures and implementation factors

The OHS procedures and implementation factor is a factor formed from several sub-factors. From the results of factor analysis, this factor has a *variance* value of 7.542%. This factor has 7 sub-factors, namely OHS rules and procedures are very necessary, OHS procedures are easy to apply consistently, OHS rules and procedures are easy to understand, level of knowledge of OHS, level of awareness of the importance of OHS, level of discipline in using PPE and compliance with OHS instructions, directions and signs. For the variable that has the highest factor loading value, namely the level of discipline in accordance with the factor loading value of 0.808. To create a safe and healthy work environment, one must consider the "level of discipline" with regard to occupational safety and health (OHS) practices and procedures. Factors that influence the level of discipline in the context of OHS involve understanding, commitment, supervision and consequences. Thus, in short, discipline in the application of OHS procedures is the result of a safety culture that is instilled. throughout the organization, as well as ongoing efforts toeducate, motivate, and monitor worker behavior.

3. OHS regulatory factors

The OHS Regulation factor is a factor formed from several sub-factors From the results of factor analysis, this factor has a *variance* value of 5.580%. This factor has 3 sub-factors, namely OHS regulations OHS Law Regulations Must be understood, changes to OHS regulations and procedures are socialized, the company provides OHS training to workers. For variables that have the highest loading factor value, changes to OHS regulations and procedures are socialized, which corresponds to a factor loading value of 0.899. changes to the occupational safety and health (OHS) *Standard Operating Procedure* (SOP) can be influenced by various factors, including changes in applicable OHS regulations. OHS regulations are often issued by government authorities or regulatory agencies to ensure that organizations and companies comply with certain safety standards.

4. Human factors

The PPE application sanction factor is a factor formed from several sub-factors from the results of factor analysis, this factor has a *variance* value of 5.060%. This factor has 2 sub-factors, namely dismissing workers who endanger and the absence of sanctions against workers. According to the loading factor value of 0.829, the variable with the highest factor loading value is the absence of worker sanctions. It is crucial to use personal protective equipment (PPE) in the workplace to safeguard employees' health and safety. If no sanctions are applied against workers who do not comply or do not use PPE properly, this can pose a serious risk to worker welfare and the integrity of the work safety program.

V. CONCLUSIONS

Drawing from the research findings that have been methodically examined in the preceding chapters, the following conclusions can be drawn: Four factors impact the application of construction occupational safety and health in multi-story buildings in Palu City. These four factors are: OHS regulatory factors;2) OHS procedures and application;3) OHS factors related to occupational safety and health; and4) human factors. According to the results of the factor analysis test, the total amount of influence produced by all of these factors was 72.932%, with other factors having a non-significant influence on the remaining 27.068%. The occupational safety and health factor in OHS procedures, which has the highest Variance value of 54.750%, is found to be the factor most influencing the safety and health of construction work on high-rise buildings in the city of Palu.

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