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Analysis of Factors Influencing And Strategies for Improving the Performance of Skilled Workforce in Housing Construction in Palu City

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Abstract: The success of housing construction projects is greatly influenced by the performance of skilled labor in achieving time, cost, and quality targets. The post-disaster conditions in Palu City require effective workforce management to optimally support housing development. This study aims to identify the factors affecting the performance of skilled labor and to formulate strategies for improving performance in housing construction projects in Palu City. The research uses a quantitative approach with descriptive and associative methods. Data were obtained through a Likert-scale questionnaire administered to 75 respondents on type 36 and type 45 housing construction projects. Data analysis includes validity and reliability tests, descriptive statistics, factor analysis using Principal Component Analysis (PCA) with Varimax rotation, and SWOT analysis. The factor analysis results showed a Cronbach's Alpha value of 0.975, a KMO of 0.807, and Bartlett's Test with significance p < 0.001. From 35 indicators, four main factors were formed explaining 82.126% of the total variance, namely (1) Labor Productivity Support Factor at 53.113%, (2) Project Resources and Operational Readiness at 13.478%, (3) Compliance with Work, Quality, and Project HSE Standards at 10.966%, and (4) Work Discipline and Equipment Availability at 4.569%. The descriptive analysis results showed that individual factors and managerial factors received high to very high ratings of 82.7%, while the work environment factor was 78.7%. This indicates that these three factors are perceived to have a positive influence on the performance of skilled labor. The main strategy is periodic skills training since 96% of workers have never attended training, followed by realistic scheduling, a safe and comfortable work environment, effective communication, and performance-based incentives.

Keywords: *Skilled Workforce, Performance, Factor Analysis, PCA, SWOT, Housing Construction, Palu City.*

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I. INTRODUCTION

A construction project is a temporary activity that utilizes limited resources to achieve specific objectives within a set timeframe, budget, and quality standards. The success of a construction project is determined by its ability to meet the time, cost, and quality standards as stipulated in the work contract. Delays and deviations in work quality can result in losses for both the owner and the contractor and may potentially trigger conflicts during project execution.

According to [5], the most dominant factor influencing project performance is the group of internal factors, because the material management factor and subsequently the work environment factor are part of the internal factor group, where each of these factors has the most determining variables, namely delays in material delivery from suppliers and site congestion.

Factors that influence worker performance on the quality of building construction work are Motivation, Skills, Discipline, Education, Experience, Wages, Age, Environment, and Competence. By paying attention to and managing these factors, it is expected that construction projects can proceed more efficiently and produce high-quality results [2].

Human resources are a key element in the success of construction projects. The selection of labor that is appropriate and in accordance with project needs is crucial for achieving work targets. Inaccuracies in human resource management can affect all stages of construction projects,

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ranging from decreased productivity to failure in achieving work quality [9].

Housing is a collection of residential units (houses) within a specific environment, equipped with supporting infrastructure (roads, clean water, electricity, drainage) and aimed at meeting the community's residential needs in a proper and sustainable manner. Housing is not only seen as a physical structure but also as part of the social system and regional development.

In an effort to analyze the factors influencing the improvement of worker performance, researchers need to consider various factors that can affect the enhancement of worker performance. Therefore, the author is interested in conducting a study entitled "Analysis of Factors Affecting and Strategies for Improving the Performance of Skilled Labor in Housing Construction in the City of Palu".

II. METHOD

This research, which focuses on analyzing the factors influencing the performance of skilled labor in residential construction and strategies for its improvement, can be categorized as a quantitative, qualitative, or mixed-methods study. A quantitative approach is employed to analyze the relationships between variables that affect labor performance such as competence, experience, motivation, education level, wage systems, and working conditions. Quantitative data can be gathered through questionnaires or surveys distributed to skilled workers and subsequently analyzed using statistical factor analysis to determine which variables exert the most dominant influence on performance [10]. Furthermore, a qualitative approach is also relevant for exploring performance-improvement strategies in greater depth. Through interviews, group discussions, or case studies of specific residential projects, researchers can gain insight into the experiences, perceptions, and challenges encountered by both the workforce and field management. The findings from this qualitative analysis are then used to formulate appropriate strategies for enhancing productivity and work quality [6].

The variables examined in this study consist of independent variables factors influencing performance, such as competence, work experience, education and training, motivation, wage systems, working conditions, and leadership style while the dependent variable is the performance of skilled labor, measured in terms of productivity, quality of output, speed, and work discipline. The study aims to identify the dominant factors affecting performance and provide strategic recommendations for improvement, such as implementing continuous training programs, offering fair incentives, enhancing project management, and improving workplace safety and comfort. Consequently, this research offers not only an academic contribution but also practical benefits for the residential construction industry [8].

The sampling technique employed in this study is purposive sampling a method in which individuals or groups are deliberately selected based on specific criteria relevant to the research objectives. The study population is distributed across three locations. Given that the population size at each location is relatively limited, the sample size for each site was determined using purposive sampling. This approach ensures an equal number of respondents 25 individuals at each location, resulting in a total sample size of 75 respondents. The research was conducted at the X, Y, and Z housing projects in Palu City.

Given the heterogeneous backgrounds and educational levels of the skilled workers (craftsmen) in the field, data collection was conducted using a structured questionnaire (guided questionnaire) administered through interviews. The researcher, accompanied by a supervisor, met with the respondents in person (face-to-face), read out each question using accessible, easy-to-understand language, and recorded their responses in real time.

In the data analysis, several tests are conducted, such as:

➢ *Validity Test*

Validity testing is conducted using the SPSS program, with the following criteria:

- If the calculated r (r-calculated) ≥ the table r (r-table), then the items are considered valid.
- If the calculated r (r-calculated) ≤ the table r (r-table), then the items are considered invalid.
- The value of the calculated r (r-calculated) can be found in the "corrected item-total correlation" column.
- If the instrument is valid, then the interpretation criteria for its correlation index (r) are examined.

➢ *Reliability Test*

Reliability testing is conducted using the SPSS software to determine the Cronbach's alpha coefficient. The resulting Cronbach's alpha value is then used to assess whether the instrument can be considered reliable.

Table 1 Cronbach's Alpha Reliability Values

Cronbach's Alpha Value	Information
<0,500	Bad
0,600-0,790	Acceptable
Above 0,800-1	Good

➢ *Factor Analysis*

Factor analysis is used to simplify a large number of variables into a few key factors based on the correlations between the variables [3].

- *Extraction Method:*

Principal Component Analysis (PCA) is used to identify the primary factors that explain the greatest amount of variance.

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- *Factor Extraction Criteria*

✓ Using an eigenvalue ≥ 1.0 (Kaiser criterion) to determine the number of factors.
✓ A total variance explained of ≥ 60% is considered sufficiently good.

- *Factor Rotatio*

Varimax rotation is used to facilitate interpretation and clarify the factor structure.

- *Factor Loading+*

✓ Items with a loading ≥ 0.50 are considered strong.
✓ Items with a loading < 0.30 are typically eliminated.

➢ *Descriptive statistics*

This method is used to process data obtained from interviews, allowing the data to be depicted, described, or summarizedeither numerically or in the form of tables. To determine the percentage of respondents' answers based on a Likert scale, the following formula is used:

$$\% = \frac{\text{item score x number of respondents}}{\text{highest score} \times \text{number of respondents}} \text{x100}$$

➢ *SWOT Analysis*

This research aims to formulate a strategy; therefore, the results of the factor analysis can be followed up by:

- Identification of Internal & External Factors
- Preparation of the SWOT Matrix
- Development of SO, ST, WO, and WT Strategies

III. RESULT

A. Respondent Profile

The following table presents the characteristics of the respondents based on the questionnaire provided. The questions used to determine the respondents' profiles in this study include their company/organization, gender, job position, work experience, and the number of road projects they have handled.

Table 2 Corporate Entities

Number	Corporate Entity	Sample Population	Percentage
1.	PT. X	25	33,3%
2.	PT. Y	25	33,3%
3.	PT. Z	25	33,3%
Total		**75**	**100%**

Based on Table 2, it can be seen that there are 75 respondents in this study, drawn from three different companies. There are 25 respondents (33.3%) from PT. X , 25 respondents (33.3%) from PT. Y, and 25 respondents (33.3%) from PT. Z, all three companies are represented by an equal number and proportion of respondent specifically, 25 respondents each, accounting for 33.3% of the total sample. This indicates that the distribution of respondents across the companies is balanced, ensuring that each company contributes equally to the research data.

Table 3 Gender

Number	Gender	Amount	Percentage
1.	Man	75	100%
Total		**75**	**100%**

Based on Table 3, it can be seen that all respondents in this study are male a total of 75 individuals, representing 100% of the entire group of respondents. This indicates that all participants are male employees at the company where the study was conducted. Consequently, the demographic profile of the respondents in terms of gender is composed entirely of men, totaling 75 individuals (100%).

Table 4 Position

Number	Position	Amount	Percentage
1.	Supervisor	3	4%
2.	Foreman	3	4%
3.	Craftsman	69	92%
Total		**75**	**100%**

Based on Table 4, it can be seen that out of 75 respondents, the majority of respondents hold the position of worker, totaling 69 people or 92%. Furthermore, respondents holding the position of supervisor amounted to 3 people or 4%, while respondents with the position of foreman also totaled 3 people or 4%. Thus, the characteristics of respondents based on position in this study are dominated by workers. This condition indicates that most respondents are laborers directly involved in the execution of work in the field, so they are expected to provide relevant information regarding

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Table 5 Work Experience

Number	Work experience	Amount	Percentage
1.	< 3 year	3	4%
2.	3-5 year	66	88%
3.	> 5 year	6	8%
Total		**75**	**100%**

Based on Table 5, it can be seen that out of 75 respondents, the majority 66 individuals or 88% have 3–5 years of work experience. Furthermore, 6 respondents (8%) have more than 5 years of work experience, while 3 respondents (4%) have less than 3 years of work experience. Thus, in terms of work experience, the respondent profile is dominated by individuals with 3–5 years of experience.

Table 6 Projects Handled

Number	Projects handled	Amount	Percentage
1.	1-3 Proyek	75	100%
Total		**75**	**100%**

Based on Table 6, it can be seen that all 75 respondents in this study (100%) have handled between 1 and 3 projects. There are no respondents who have managed a number of projects outside of this range. This indicates that all respondents possess experience in handling projects within the 1–3 project range. Such a profile suggests that the respondents have practical experience in project execution, and they are therefore expected to be able to provide information that accurately reflects the conditions encountered in the field.

B. Data Testing

➢ *Validity Test*

The research instrument consists of assessments regarding factors that influence the performance of skilled labor in residential construction projects in Palu City including aspects such as competence, motivation, the work environment, and project management with the aim of supporting the formulation of strategies to enhance skilled labor performance. A Likert scale is employed for this purpose, and the scores for each variable are presented in the table. To determine the validity of the 43 questionnaire items administered to the respondents, a validity test was conducted using SPSS 22 software.

Table 7 Results of the Validity Test for Questionnaire Items

Variable item	Value			Conclusion
	r-calculated	>	r-table	
XI.1	0,758	>	0,227	Valid
XI.2	0,818	>	0,227	Valid
XI.3	0,642	>	0,227	Valid
XI.4	0,718	>	0,227	Valid
XI.5	0,829	>	0,227	Valid
X2.1	0,584	>	0,227	Valid
X2.2	0,697	>	0,227	Valid
X2.3	0,808	>	0,227	Valid
X2.4	0,737	>	0,227	Valid
X2.5	0,814	>	0,227	Valid
X3.1	0,724	>	0,227	Valid
X3.2	0,817	>	0,227	Valid
X3.3	0,837	>	0,227	Valid
X3.4	0,792	>	0,227	Valid
X3.5	0,749	>	0,227	Valid
X4.1	0,840	>	0,227	Valid
X4.2	0,748	>	0,227	Valid
X4.3	0,803	>	0,227	Valid
X4.4	0,694	>	0,227	Valid
X4.5	0,809	>	0,227	Valid
X5.1	0,862	>	0,227	Valid
X5.2	0,693	>	0,227	Valid
X5.3	0,786	>	0,227	Valid
X5.4	0,817	>	0,227	Valid

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X5.5	0,784	>	0,227	Valid
X6.1	0,668	>	0,227	Valid
X6.2	0,761	>	0,227	Valid
X6.3	0,741	>	0,227	Valid
X6.4	0,706	>	0,227	Valid
X6.5	0,725	>	0,227	Valid
X7.1	0,791	>	0,227	Valid
X7.2	0,728	>	0,227	Valid
X7.3	0,787	>	0,227	Valid
X7.4	0,707	>	0,227	Valid
X7.5	0,805	>	0,227	Valid
X8.1	0,940	>	0,227	Valid
X8.2	0,797	>	0,227	Valid
X8.3	0,907	>	0,227	Valid
X9.1	0,609	>	0,227	Valid
X9.2	0,586	>	0,227	Valid
X9.3	0,765	>	0,227	Valid
X9.4	0,705	>	0,227	Valid
X9.5	0,784	>	0,227	Valid

Based on Table 7, the validity test results for the 43 questions show that all items have a calculated r value higher than the table r (0.227), with r values ranging from 0.584 to 0.940. This proves that all the indicators used in this research questionnaire are valid and can accurately measure the intended construct, which is the factors that affect skilled workforce performance. The highest r value is on item X8.1, which is 0.940, indicating that this item has a very strong correlation with its total construct score, while the lowest is on item X2.1, which is 0.584, but still well above the table r value, so it is still considered valid. Therefore, all 43 questions can be used and are deemed valid. You can see that all items are declared valid because the calculated r > table r.

- *Reliability Test*

Reliability Test is used to find out whether the measuring tool used in this research is accurate and consistent. The instrument used in this study is said to be reliable if the Cronbach's alpha value is more than 0.6, and the testing is done using SPSS 22 software.

Table 8 Reliability Test Results

Realiability statistics	
Cronbach's Alpha	**N of Items**
,975	43

Based on the reliability test results, a Cronbach's Alpha value of 0.975 was obtained, which shows that the value is higher than the set minimum limit of 0.6. Therefore, it can be concluded that all the items in the questionnaire have a very high level of internal consistency and are considered reliable. This value also indicates that the research instrument has a very good level of reliability, making the questionnaire suitable to be used as a data collection tool in the study. As a result, the data obtained through the questionnaire is expected to provide consistent and trustworthy measurement result

Table 9 Item Question Validity Test Results

Variable item	**Value**			**conclusion**
	Cronbach's Alpha Value	>	**Rehabilitation Score**	
XI.1	0,974	>	0,6	Reliable
XI.2	0,974	>	0,6	Reliable
XI.3	0,975	>	0,6	Reliable
XI.4	0,975	>	0,6	Reliable
XI.5	0,974	>	0,6	Reliable
X2.1	0,975	>	0,6	Reliable
X2.2	0,975	>	0,6	Reliable
X2.3	0,974	>	0,6	Reliable
X2.4	0,974	>	0,6	Reliable
X2.5	0,974	>	0,6	Reliable
X3.1	0,975	>	0,6	Reliable
X3.2	0,974	>	0,6	Reliable
X3.3	0,974	>	0,6	Reliable

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X3.4	0,974	>	0,6	Reliable
X3.5	0,974	>	0,6	Reliable
X4.1	0,974	>	0,6	Reliable
X4.2	0,974	>	0,6	Reliable
X4.3	0,974	>	0,6	Reliable
X4.4	0,975	>	0,6	Reliable
X4.5	0,974	>	0,6	Reliable
X5.1	0,974	>	0,6	Reliable
X5.2	0,975	>	0,6	Reliable
X5.3	0,974	>	0,6	Reliable
X5.4	0,974	>	0,6	Reliable
X5.5	0,974	>	0,6	Reliable
X6.1	0,975	>	0,6	Reliable
X6.2	0,974	>	0,6	Reliable
X6.3	0,974	>	0,6	Reliable
X6.4	0,974	>	0,6	Reliable
X6.5	0,974	>	0,6	Reliable
X7.1	0,974	>	0,6	Reliable
X7.2	0,974	>	0,6	Reliable
X7.3	0,974	>	0,6	Reliable
X7.4	0,974	>	0,6	Reliable
X7.5	0,974	>	0,6	Reliable
X8.1	0,974	>	0,6	Reliable
X8.2	0,974	>	0,6	Reliable
X8.3	0,974	>	0,6	Reliable
X9.1	0,974	>	0,6	Reliable
X9.2	0,975	>	0,6	Reliable
X9.3	0,974	>	0,6	Reliable
X9.4	0.974	>	0,6	Reliable
X9.5	0,974	>	0,6	Reliable

Based on Table 9, the reliability test results show that the overall Cronbach's Alpha value is 0.975, far exceeding the threshold value of 0.6, which is the minimum requirement for an instrument to be considered reliable. This value falls into the category of very high reliability, meaning the research instrument has excellent internal consistency in measuring the variables studied. The reliability test results for each item also show good Alpha values. The consistency of these values strengthens the evidence that all the questions contribute steadily to forming the construct being measured, making this research instrument valid and trustworthy to use as a measurement tool in making strategic decisions related to improving workforce performance.

➢ *Factor Analysis*

The function of factor analysis is to simplify a large number of variables or indicators into a few main factors that represent the relationships between the variables. In other words, factor analysis is used to find the structure or dimensions underlying a set of indicators.

- *KMO (Kaiser-Meyer-Olkin) and Bartlett's Test*

According to [3], the KMO (Kaiser-Meyer-Olkin) test and Bartlett's test are tests used to determine the suitability of a variable before conducting factor analysis. These tests are important to ensure that the data used meet the requirements and can be further analyzed through factor analysis. Data can proceed to further testing if the KMO test results in a value > 0.5 and the Bartlett's significance value is < 0.05.

Table 10 Kaiser-Meyer-Olkin (KMO) Test Results

Test	Value	Criteria	Description
Kaiser-Meyer-Olkin (KMO)	0.807	≥ 0.50	Meet the requirements
Sig. (p-value)	< 0.001	< 0.05	Significant

Based on Table 4 the results of the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test obtained a KMO value of 0.807. This value is greater than the minimum required value of 0.50 and is even categorized as good according to Kaiser's criteria, thereby allowing the conclusion that the sample size and data used in this study have met the requirements for sampling adequacy for factor analysis.

Furthermore, the significance value was ($p < 0.001$). Since this significance value is less than 0.05, there is a significant correlation among the variables in this study. Based on these two test results, it can be concluded that the research data are valid and meet the requirements because the variables studied have a sufficiently strong correlation to form the underlying factors or constructs.

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- *Communalities Testing (Extraction)*

Communalities Testing (Extraction) is a test in factor analysis used to determine the proportion of variance of each variable that can be explained by the factors formed. The Extraction value indicates the ability of the formed factors to explain a variable. The higher the extraction value, the greater the variance of the variable that can be explained by the factor. In general, the criteria used are (Extraction ≥ 0.50, the variable is considered well explained by the formed factor). (Extraction < 0.50, the variable is less well explained by the formed factor and may be considered for exclusion from the analysis).

Table 11 Communalities Test Results (Extraction)

Variable item	Value			conclusion
	Extraction Result	>	Communalities Value (Extraction)	
XI.1	0,907	>	0,50	Valid
XI.2	0,934	>	0,50	Valid
XI.3	0,914	>	0,50	Valid
XI.4	0,952	>	0,50	Valid
XI.5	0,921	>	0,50	Valid
X2.1	0,917	>	0,50	Valid
X2.2	0,967	>	0,50	Valid
X2.3	0,979	>	0,50	Valid
X2.4	0,709	>	0,50	Valid
X2.5	0,821	>	0,50	Valid
X3.1	0,878	>	0,50	Valid
X3.2	0,928	>	0,50	Valid
X3.3	0,788	>	0,50	Valid
X3.4	0,686	>	0,50	Valid
X3.5	0,828	>	0,50	Valid
X4.1	0,891	>	0,50	Valid
X4.2	0,788	>	0,50	Valid
X4.3	0,728	>	0,50	Valid
X4.4	0,934	>	0,50	Valid
X4.5	0,929	>	0,50	Valid
X5.1	0,903	>	0,50	Valid
X5.2	0,980	>	0,50	Valid
X5.3	0,752	>	0,50	Valid
X5.4	0,790	>	0,50	Valid
X5.5	0,881	>	0,50	Valid
X6.1	0,952	>	0,50	Valid
X6.2	0,789	>	0,50	Valid
X6.3	0,717	>	0,50	Valid
X6.4	0,648	>	0,50	Valid
X6.5	0,712	>	0,50	Valid
X7.1	0,646	>	0,50	Valid
X7.2	0,753	>	0,50	Valid
X7.3	0,667	>	0,50	Valid
X7.4	0,597	>	0,50	Valid
X7.5	0,658	>	0,50	Valid

Based on table 11, Communalities present the extraction values from 35 items representing seven research variables (X1 to X7) resulting from extraction using the Principal Component Analysis (PCA) method. The communality value indicates the proportion of variance of each item that can be explained by the factors formed in the analysis. Based on the data processing results, all items have extraction values above the minimum threshold of 0.50, with the lowest value obtained for item X7.4 at 0.597 and the highest value for item X5.2 at 0.980. This indicates that all indicator items in this study can be well explained by the factors or components formed, so no items need to be eliminated. The high communality values for most items (above 0.70) suggest that these items have a strong association with the construct being measured, thereby supporting the construct validity of the research instrument used.

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- *Determining the Number of Factors*

In determining the number of factors to be taken in factor analysis, one of the criteria often used is the initial eigenvalue. Factors that are retained usually have an initial eigenvalue greater than 1. An initial eigenvalue greater than 1 indicates that the factor has more variance than a single individual variable.

In this study, there are 35 factors to be examined with the expectation of providing a cumulative variance percentage greater than 60%.

Table 12 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.590	53.113	53.113	18.590	53.113	53.113
2	4.717	13.478	66.591	4.717	13.478	66.591
3	3.838	10.966	77.558	3.838	10.966	77.558
4	1.599	4.569	82.126	1.599	4.569	82.126
5	.994	2.841	84.967			
6	.865	2.470	87.438			
7	.719	2.055	89.493			
8	.579	1.655	91.148			
9	.437	1.250	92.397			
10	.400	1.142	93.539			
11	.286	.817	94.357			
12	.277	.793	95.149			
13	.239	.684	95.833			
14	.209	.597	96.430			
15	.192	.548	96.978			
16	.161	.460	97.438			
17	.142	.405	97.843			
18	.116	.331	98.173			
19	.109	.311	98.484			
20	.083	.236	98.720			
21	.075	.216	98.936			
22	.062	.177	99.112			
23	.059	.168	99.281			
24	.053	.151	99.432			
25	.044	.127	99.559			
26	.037	.106	99.666			
27	.035	.101	99.766			
28	.029	.082	99.849			
29	.018	.051	99.899			
30	.014	.041	99.940			
31	.011	.031	99.972			
32	.006	.017	99.989			
33	.002	.007	99.996			
34	.001	.003	99.999			
35	.000	.001	100.000			

Based on Table 12, the Total Variance Explained shows the results of factor extraction from 35 research items using the Principal Component Analysis (PCA) method with the Kaiser criterion (eigenvalue > 1). Based on the analysis results, four components were formed with eigenvalues greater than 1, namely component 1 (18.590), component 2 (4.717), component 3 (3.838), and component 4 (1.599). These four components cumulatively explain 82.126% of the total data variance, which means that only about 17.874% of the variance cannot be explained by these four components. According to [3], setting the threshold at 60% is considered a good balance between reducing data size and retaining sufficient information from the original data. This cumulative variance value is classified as very good because it has exceeded the minimum threshold required in the study, which is 60%.

- *Determining Factor Rotation*

In factor analysis using the Principal Component Analysis (PCA) method, after the number of factors formed is obtained, factor rotation is a process to clarify and facilitate the interpretation of the formed factors by maximizing the relationship (loading) of variables to certain factors. One of the methods that is often used is Varimax.

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After rotation, the variables will be easier to group based on the highest factor loading value for each factor. The following is the Rotated Component Matrix of the 4 extracted components.

Table 13 Rotated Component Matrix

Component	Factor			
	1	2	3	4
XI.1		.864		
XI.2	.911			
XI.3				.889
XI.4			.929	
XI.5	.895			
X2.1				.917
X2.2			.937	
X2.3	.889			
X2.4		.771		
X2.5	.854			
X3.1			.894	
X3.2	.903			
X3.3		.808		
X3.4	.767			
X3.5		.867		
X4.1		.856		
X4.2	.842			
X4.3		.769		
X4.4			.931	
X4.5	.897			
X5.1		.862		
X5.2			.945	
X5.3	.781			
X5.4		.811		
X5.5	.888			
X6.1			.937	
X6.2	.822			
X6.3		.806		
X6.4	.778			
X6.5		.805		
X7.1	.750			
X7.2		.813		
X7.3	.777			
X7.4		.739		
X7.5	.780			

Based on Table 13, the results of the Rotated Component Matrix test present the Varimax rotation with Kaiser Normalization for the 35 research items. The rotation results indicate that all items have a loading factor value above 0.70, which is well above the minimum threshold value of 0.50 as required by [1]. This indicates that each item has a strong and clear correlation with the component it is grouped in, without exhibiting cross-loading symptoms on other components.

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Table 14 Factor Grouping

Number	Factor	Item	Loading
1	Factor 1	X1.2	0.911
2		X1.5	0.895
3		X2.3	0.889
4		X2.5	0.854
5		X3.2	0.903
6		X3.4	0.767
7		X4.2	0.842
8		X4.5	0.897
9		X5.3	0.781
10		X5.5	0.888
11		X6.2	0.822
12		X6.4	0.778
13		X7.1	0.750
14		X7.3	0.777
15		X7.5	0.780
1	Factor 2	X1.1	0.864
2		X2.4	0.771
3		X3.3	0.808
4		X3.5	0.867
5		X4.1	0.856
6		X4.3	0.769
7		X5.1	0.862
8		X5.4	0.811
9		X6.3	0.806
10		X6.5	0.805
11		X7.2	0.813
12		X7.4	0.739
1	Factor 3	X1.4	0.929
2		X2.2	0.937
3		X3.1	0.894
4		X4.4	0.931
5		X5.2	0.945
6		X6.1	0.937
1	Factor 4	X1.3	0.889
2		X2.1	0.917

Based on Table 14, the rotation results formed four components with the following item distribution: Factor 1 consists of 15 items (X1.2, X1.5, X2.3, X2.5, X3.2, X3.4, X4.2, X4.5, X5.3, X5.5, X6.2, X6.4, X7.1, X7.3, X7.5); Factor 2 consists of 12 items (X1.1, X2.4, X3.3, X3.5, X4.1, X4.3, X5.1, X5.4, X6.3, X6.5, X7.2, X7.4); Factor 3 consists of 6 items (X1.4, X2.2, X3.1, X4.4, X5.2, X6.1); and Factor 4 consists of 2 items (X1.3 and X2.1).

- *Determining the Factor Name*

Based on the results of factor grouping in Table 14, it is known that the factor analysis from this study produced 4 (four) new factors, which will be named by the researcher according to characteristics that correspond to these factors. The names of the new factors are as follows:

✓ *First New Factor*

The first new factor is a factor formed from 15 (fifteen) factors within it, namely X1.2 "the workforce has adequate work experience in the construction field," X1.5 "the workforce productivity is in accordance with the daily work targets," X2.3 "the equipment used is appropriate for the type of work being carried out," X2.5 "equipment maintenance is carried out regularly," X3.2 "the availability of materials on-site always meets the work requirements," X3.4 "material storage on-site is conducted properly and safely," X4.2 "the working methods applied are suitable for field conditions," X4.5 "the working methods used are able to improve work time efficiency," X5.3 "project expenditure is in accordance with the planned budget," X5.5 "project financial management supports the smooth execution of work on-site," X6.2 “Project monitoring systems are carried out routinely,” X6.4 “Decision-making by management is fairly quick,” X7.1 “The work equipment provided is adequate,” X7.3 “Weather often hinders work execution,” X7.5 “My work environment supports work productivity.” Based on these factors, the researcher names the first new factor as “Factor Supporting Workforce Productivity”.

✓ *Second New Factor*

The second new factor is a factor formed from 12 (twelve) factors within it, namely X1.1 “the workforce

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involved has skills appropriate to the type of work performed", X2.4 "equipment breakdowns rarely occur during the work process", X3.3 "material delivery at the site is conducted properly and safely", X3.5 "material damage during the work process is minimal", X4.1 "the work methods used have been clearly planned", X4.3 "work procedures (SOP) are easily understood by the workforce", X5.1 "project funds are available according to the needs of the work implementation", X5.4 "project cost control is carried out effectively", X6.3 "I feel that the work system in the project is quite organized", X6.5 "communication between workers and management runs smoothly", X7.2 "the project location is relatively easy to access", X7.4 "building materials are sufficiently available on site". Based on these factors, the researcher assigns the name of the second new factor as "Readiness of Project Resources and Operational Systems."

✓ *Third New Factor*

The third new factor is a factor formed from 6 (Six) factors within it, namely X1.4 'workers understand and implement occupational safety and health (OSH) procedures,' X2.2 'working equipment is in good condition and suitable for use,' X3.1 'the materials used have quality according to technical specifications,' X4.4 'workers perform work according to the established work methods,' X5.2 'project costs are paid on time,' X6.1 'supervisors provide clear and precise directions.' Based on these factors, the researcher named the third new factor ''Compliance with Work Standards, Quality, and Project Safety (OSH)''.

✓ *Fourth New Factor*

The fourth new factor is a factor formed from two factors within it, namely X1.3 "workers work disciplinarily according to the specified working hours" and X2.1 "the work equipment used is available according to job requirements." Based on these factors, the researcher named the fourth new factor "Work Discipline and Equipment Availability".

➢ *Descriptive Statistic*

Table 15 The Influence of Factors on Individual Performance

The Influence of Factors on Individual Performance			
Number	**Category**	**Amount**	**Percentage**
1	currently	13	17,3%
2	high	30	40%
3	very high	32	42,7%
Total		**75**	**100%**

Based on Table 15, the results of the frequency distribution regarding the Factor's effect on individual performance indicate that out of 75 respondents, 13 respondents (17.3%) provided ratings in the moderate category, 30 respondents (40.0%) provided ratings in the high category, while 32 respondents (42.7%) provided ratings in the very high category. These results show that the majority of respondents gave high to very high ratings for the indicator of the Factor's influence on individual performance. If the high and very high categories are combined, there are 62 respondents, or 82.7%, who provided positive ratings. This condition indicates that the indicator of the Factor's influence on individual performance, "how much individual factors affect your performance," has been well perceived by the majority of employees.

Table 16 The Influence of Factors on Environmental Performance

The Influence of Factors on Environmental Performance			
Number	**Category**	**c**	**Percentage**
1	currently	16	21,3%
2	high	29	38,7%
3	very high	30	40%
Total		**75**	**100%**

Based on Table 16, the results show that respondents' assessment of the influence of factors on environmental performance tends to be positive. This is evident from the number of respondents who gave high and very high ratings, totaling 59 respondents or 78.7% of all respondents. Thus, the majority of workers have given a good assessment of the aspects measured through the indicator 'Influence of factors on environmental performance,' regarding 'how much the workplace environmental factors affect your performance.' The very high category is the category with the largest percentage, namely 40.0% or 30 respondents. This indicates that the majority of respondents consider the conditions of the influence of factors on environmental performance to be running very well. Furthermore, 29 respondents (38.7%) are in the high category. If these two categories are combined, it appears that almost four out of five respondents gave a positive assessment of the indicator of the Influence of factors on environmental performance. Meanwhile, as many as 16 respondents (21.3%) gave a moderate assessment.

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Table 17 The Influence of Factors on Managerial Performance

The Influence of Factors on Managerial Performance			
Number	**Category**	**Category**	**Percentage**
1	currently	13	17,3%
2	high	28	37.3%
3	very high	34	45,3%
Total		**75**	**100%**

Based on Table 17, the results indicate that respondents' perceptions of the influence of factors on managerial performance tend to be very positive. This can be seen from the number of respondents in the high and very high categories, totaling 62 respondents or 82.7% of the 75 respondents. Thus, most employees give positive assessments of the aspect measured through the indicator of the influence of factors on managerial performance, "how much managerial factors affect your performance." The very high category has the largest proportion, at 45.3% or 34 respondents. This condition shows that nearly half of all respondents gave a very high assessment. Meanwhile, 28 respondents (37.3%) gave a high assessment. If these two categories are combined, 82.7% of respondents gave a high to very high assessment. These findings show that the influence of factors on managerial performance is an indicator that receives positive acceptance from the majority of workers. On the other hand, there are 13 respondents (17.3%) who gave a moderate assessment.

Based on the data processing results from 75 respondents, the assessment results for the five indicators of the 'Performance Improvement Strategy' were obtained. The assessment used a 1–5 Likert scale, with (1 meaning very no influence) and (5 meaning very influential).

Table 18 Performance Improvement Strategy

Number	Performance Improvement Strategy Indicators	Total Score	Average	Index (%)	Category
1	Periodic skills training	303	4,04	80,80	high
2	Performance-based incentive provision	302	4,03	80,53	high
3	A safe and comfortable work environment	308	4,11	82,13	very high
4	Good communication between workers and the foreman	307	4,09	81,87	very high
5	Realistic work schedule planning	309	4,12	82,40	very high
Total		**1.529**	**4,08**	**81,55**	**very high**

Based on Table 18, an overall average value of 4.08 was obtained with an index of 81.55%. This indicates that, in general, respondents consider performance enhancement strategies as a factor that has a very high influence on improving employee performance.

The indicator with the highest average score is realistic work schedule planning, which is 4.12. This indicates that time management and workload appropriate to the job conditions are very important aspects in supporting employee performance. Furthermore, the indicator of a safe and comfortable work environment received a score of 4.11, communication between workers and supervisors 4.09, periodic skills training 4.04, and performance-based incentives 4.03.

➢ *SWOT Analysis*

SWOT analysis is a strategic planning method used to identify and evaluate four main factors in an organization, company, product, or project, namely Strengths, Weaknesses, Opportunities, and Threats.

Based on the data processing results, the SWOT analysis of the "Performance Improvement Strategy" can be formulated as follows.

Table 19 SWOT Matrix for Performance Improvement Strategy

Internal Factors	Description
Strengths (S)	S1. Workers' perception of performance improvement strategies is considered very high, with an average of 4.08. S2. A realistic work schedule obtained the highest score of 4.12. S3. A safe and comfortable work environment received a score of 4.11. S4. Communication between workers and supervisors scored 4.09. S5. Workers responded positively to training and incentives.
Weaknesses (W)	W1.As many as 72 out of 75 respondents, or 96%, have never participated in training. W2.The implementation of employee competency development is still limited. W3.Opportunities to participate in training are not yet evenly distributed. W4.The evaluation of training effectiveness is not yet optimal because the number of training participants is very limited.
External Factors	**Description**

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Opportunities (O)	O1. Implementation of skills training on a regular basis. O2. Development of a performance-based incentive system. O3. Improvement of communication between workers and supervisors. O4. Preparation of a realistic work schedule. O5. Enhancement of safety and comfort in the work environment.
Threats (T)	T1. Workload and job pressure can cause stress. T2. An unsafe work environment can increase the risk of accidents. T3. Poor communication can lead to work errors. T4. The absence of a reward system can decrease motivation. T5. Limited skills can increase the risk of mistakes in work.

Table 20 SWOT Strategy Matrix

	Opportunities (O)	**Threats (T)**
Strengths (S)	**Strategi SO** 1. Utilizing the high awareness of workers regarding the importance of performance improvement to conduct training regularly. 2. Integrating training with a performance-based incentive system. . Utilizing communication between workers and supervisors to enhance work coordination. . Utilizing scheduling arrangements and a good working environment to support productivity.	**Strategi ST** . Improve communication between workers and supervisors to prevent work errors. Provide training to reduce risks due to skill limitations. Give rewards to workers who achieve targets and implement workplace safety. Implement realistic work schedules to reduce work pressure.
Weaknesses (W)	**Strategi WO** Making regular training a priority as 96% of employees have never attended training. 2. Developing training programs according to job needs. Conducting performance evaluations before and after training. 4. Providing training opportunities equally to all employees.	**Strategi WT** 1. Developing a realistic work schedule to reduce work-related stress. 2. Enhancing briefings and routine communication. 3. Preparing SOPs and occupational safety training. 4. Conducting performance monitoring and regular evaluations.

Table 21 Priority Strategy

Priority	**Strategy**	**Basis of Consideration**
1	Periodic skills training	96% of workers have never participated in training
2	Realistic work schedule planning	The highest average, namely 4,12
3	Improvement of a safe and comfortable work environment	Average 4,11
4	Improvement of worker–foreman communication	Average 4,09
5	Performance-based incentives	Average 4,03

IV. DISCUSSION

Factor analysis in this study was conducted on 35 statement items covering variables X1–X7 using the Principal Component Analysis (PCA) method and Varimax rotation. Factor analysis is a multivariate statistical technique aimed at reducing a number of variables or indicators into fewer factors, while still retaining most of the information or variance contained in the original data. [1].

Based on the results of the factor analysis conducted, 35 research items were successfully reduced and grouped into 4 main factors based on factor loading values and the characteristics of the indicators forming each factor. The formation of these factors indicates that several indicators with relatively strong correlations or relationship patterns can be grouped into the same dimension, resulting in a simpler and more interpretable factor structure. The four resulting factors were then named based on the similarity of characteristics and the substance of the indicators contained within each factor.

The first factor is named the Labor Productivity Supporting Factor, which describes various conditions that support the workforce's ability to achieve work productivity. Based on the factor analysis results, this factor is the most

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dominant factor with a variance contribution of 53.113%, indicating that aspects related to workforce capability, achievement of work targets, suitability of equipment, availability of materials, work methods, as well as work management are the main components influencing labor performance. These conditions are consistent with field findings, where the majority of workers already have sufficient work experience and are able to carry out tasks according to the targets provided. However, on the other hand, some obstacles are still found, particularly regarding competency development through training, as 96% of workers have never participated in training. This condition indicates that although worker productivity has generally been running well, there are still gaps in the improvement of labor skills and competencies. Thus, the results of the factor analysis and field conditions show that productivity improvement not only depends on worker experience but also needs to be supported by continuous training, the availability of adequate materials and equipment, appropriate work methods, as well as effective job management.

The second factor is named Project Resource and Operational Readiness, which relates to the readiness of resources as well as operational aspects that support the smooth execution of construction work. Based on the results of the factor analysis, this factor contributes a variance of 13.478%, indicating that the readiness of resources and operational systems is one of the important aspects in supporting workforce performance. This condition aligns with the situation in the field, where the smoothness of work is highly influenced by the availability of materials, equipment readiness, the suitability of work methods, as well as the management and organization of work at the project site. In its implementation, when materials and equipment are available as needed, workers can carry out their tasks more smoothly and reduce waiting time that could hinder productivity. Conversely, delays in the provision of materials or equipment unpreparedness can cause work to be postponed and affect the achievement of the project's time targets. Therefore, the results of the factor analysis indicate that the readiness of project resources and operations needs to be consistently monitored, particularly through controlling material availability, equipment maintenance, work method arrangements, and good operational coordination so that the execution of work can proceed effectively and support the improvement of skilled labor performance.

The third factor is named Compliance with Work Standards, Quality, and Project Occupational Safety and Health (OSH), which reflects the implementation of work standards, quality control of tasks, as well as safety and health aspects in project execution. Based on the factor analysis results, this factor contributes a variance of 10.966%, indicating that compliance with work standards, quality, and OSH is one of the aspects that play a role in supporting skilled labor performance. This condition aligns with field findings, where construction work requires workers to follow established procedures and work methods, maintain the quality of work results, and pay attention to safety during work. The implementation of OSH becomes important because construction activities carry various potential hazards that can disrupt the smooth progress of work if not properly controlled. In the field, compliance with work standards and occupational health and safety (OHS) is also related to supervision by implementers or foremen, the use of appropriate work equipment, and the application of safety procedures during work activities. Thus, the results of the factor and condition analysis in the field indicate that improving discipline in following work standards, quality control, and consistent implementation of OHS is necessary to reduce work errors, prevent accidents, and maintain the quality and smooth execution of construction projects.

The fourth factor is named Work Discipline and Equipment Availability, which describes aspects of workforce discipline as well as the support provided by the availability of equipment in facilitating the execution of work. Based on the factor analysis results, this factor contributes a variance of 4.569%. Although it has the smallest variance contribution compared to other factors, it remains an important part in supporting the smooth operation and achievement of workforce performance in the field. This condition aligns with the situation observed during project implementation, where worker discipline in adhering to work schedules, performing tasks according to responsibilities, and following directions from supervisors or foremen affects the smoothness of work. In addition, the availability of equipment that meets job requirements also determines the effectiveness of the workforce. If the equipment is available and can be used properly, workers can complete the work without significant obstacles, whereas limitations or damage to the equipment can lead to wasted working time and hinder the achievement of targets. Therefore, the conditions in the field indicate that labor discipline needs to be balanced with the provision and maintenance of adequate equipment, so that work can be carried out in a timely, effective manner, and in accordance with established standards.

Thus, the results of the factor analysis indicate that the 35 indicators, which were initially distributed across seven groups of variables (X1–X7), can be represented by four main factors. These four factors become more concise dimensions for explaining the factors that influence the performance of skilled labor in housing construction projects in Palu City. These results also show that factor analysis can simplify the structure of research variables without eliminating important information contained in the data, so the four resulting factors can be used as a basis for further discussion as well as in the formulation of strategies to improve labor performance based on SWOT analysis.

SWOT analysis is a strategic planning tool used to identify and analyze internal factors in the form of strengths and weaknesses, as well as external factors in the form of opportunities and threats, in order to formulate appropriate strategies to achieve organizational goals [7]. The priority strategy for improving the performance of skilled workers is determined based on the level of urgency and the magnitude of the gap in each indicator. Periodic skills training becomes the first priority strategy because 96% of workers have never attended training, indicating a gap between the need for competency improvement and the implementation of

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workforce development in the field. This condition aligns with findings in the field, where most workers acquire skills through work experience and direct learning from more experienced workers or guidance from supervisors, while opportunities to participate in formal training remain very limited. This situation can result in uneven development of workers' abilities and is dependent on each individual's experience. In fact, construction work requires skills that match work methods, use of equipment, quality standards, as well as the application of occupational health and safety (OHS) measures. Therefore, conducting regular skills training is important to bridge the competency gaps found in the field, enhance workers' technical abilities, and support improvements in productivity, work quality, and workplace safety.

V. CONCLUSION

Based on the results of research conducted on 75 respondents regarding the factors influencing and strategies for improving the performance of skilled labor in residential construction in Palu City, it can be concluded as follows:

- The factors influencing the improvement of skilled labor performance in this study include regular skills training, performance-based incentives, a safe and comfortable working environment, good communication between workers and supervisors/foremen, as well as realistic work schedule planning. Overall, the five indicators received an average score of 4.08 with an index of 81.55% and fall into the very high category. This indicates that these factors are considered to have a significant impact on supporting the enhancement of worker performance.

- The level of influence of individual, work environment, and managerial factors has a high to very high impact on the performance of skilled labor in residential construction projects in Palu City. Individual and managerial factors show the highest positive influence, at 82.7% each, while the work environment factor accounts for 78.7%. These results indicate that improving the performance of skilled labor needs to be supported by enhancing individual competence and discipline, creating a safe and comfortable work environment, and managing managerial aspects effectively through good coordination, communication, and supervision.

- The most prioritized performance improvement strategy is periodic skills training, followed by realistic work schedule planning, enhancement of workplace safety and comfort, improvement of worker–supervisor communication, and the development of performance-based incentives. Training is given the highest priority because 96% of workers have never received training.

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