*International Journal of Research in Engineering and Science (IJRES)*
*ISSN (Online): 2320-9364, ISSN (Print): 2320-9356*
*www.ijres.org Volume 12 Issue 7 ǁ July 2024 ǁ PP. 10-20*

# Factors Influencing Project Success Based On Contractor Perceptions in Palu City

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***ABSTRAK***
*Construction projects such as roads, bridges, public service buildings and others are developing very rapidly. so that project success becomes the main target for construction project implementers. In its implementation, you mustfirst know the factors that influence the success of the project. This research data processing uses factor analysis. Material quality and K3 management factors, project manager skill factors, material maintenance and control factors, and human resource factors are four factors that influence the success of project construction.*
***Word Keywords:*** *Project, Factors, success, contractors.*

Date of Submission: 25-06-2024 Date of acceptance: 04-07-2024

## I. INTRODUCTION

Indonesia is one of the developing countries that is doing a lot of development. One of them is the construction of construction projects in the city of Palu which is currently growing rapidly, such as the constructionof buildings, bridges, roads, community service buildings, etc. In carrying out construction projects, project successis very necessary [1].

Project success is the main target for companies engaged in the construction services sector. A project is said to be successful if the project is able to be completed with cost, quality, and time. Competitive costs, able to be completed on time or even faster than the scheduled time, and with the achievement of quality[2].

## II. LITERATURE REVIEW

The following is a literature review related to the object of this research :

### 2.1 Definition Of Construction Project

Construction projects are activities that are carried out and interrelated to achieve certain goals that must achieve certain time, cost and quality targets. The resources needed to achieve project success are Human, materials, Machines, methods, money, time [3].

According to [4], the parties involved in implementing construction projects include:

1. Owner (Project Owner)

The project owner (owner) is the person or entity who owns the project and provides or orders work to be providedto the service provider and who pays the costs of the work

2. Planning Consultant

A person/organization that carry out construction planning in the fields of architecture, civil engineering and other fields resulting in a construction are called planning consultants. Planning consultants can be separated based on their specializations, namely architectural consultants, civil engineering consultants, mechanical and electrical consultants and so on.

3. Supervisory Consultant

A person/organization appointed directly by the service user to help carry out construction work from the start of the project is called a supervising consultant

4. Contractor

A contractor is a person or body that accepts work and carries out the work according to the costs that have been determined based on the plans and regulations and conditions that have been determined. Contractors can be individual companies with legal entities that are engaged in carrying out work

### 2.2 Construction Project Success Indikators

A. Cost

Every construction project requires costs or a budget to complete the project. Precise budget planning and cost estimates without causing cost overruns are highly desired criteria for project success [5].

B. Quality

The quality of the work and the work implementation process must meet standards in accordance with the agreed contract documents. If changes occur, they must be followed up by carrying out necessary repairs and prevention.So quality becomes a criterion for determining the success of a construction project [6].

C. Time

When carrying out a construction project, the construction time is determined. So the project must be carried out according to the specified time period and end date and delivery must not exceed the specified time limit. Time is a criterion used as a benchmark for the success of construction projects [7].

D. Occupational Safety and Health

Occupational health and safety criteria provide protection to construction workers who are in the workplace to prevent accidents from occurring and avoid their recurrence if an accident has occurred. If the criteria for cost, quality and time have met the standards of success, it means nothing if the level of work safety is neglected [8].

### 2.3 Definition of Factor Analysis

Factor analysis is a multivariate static analysis technique that functions to reduce data by stating the original variables as a linear combination of a number of general factors or common factors added to special factors or specific factors, such that a number of general factors are able to explain as much as possible the diversity of data explained by the original variables[9].

According to [10] Most research data variables are correlated with each other, so factor analysis tries to find several variables that are fewer than the number of initial variables. Factor analysis in this research used the Statistical Program for Social Science (SPSS)

### 2.4 Factor Analysis Process

Basic process of factor analysis includes the following:

1. Selection Factors

The selection of this analysis factor aims to determine the size of the correlation between factors or identify the relationship in a set of factors. Measure of Sampling Adequacy (MSA) and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett test of sphericity are used in this study. To find out whether the variables are adequate for further analysis, it is necessary to conduct a Measure of Sampling Adequacy (MSA). If the MSA value is greater than 0.5, then the variable is adequate for further analysis. If there is an MSA value from the initial variables that is less than 0.5, they must be removed one by one from the analysis and sorted from the variable withthe smallest MSA value until it is no longer used [11]. After each initial variable to be entered in the analysis is obtained, the next step is to examine the accuracy of the use of factor analysis using Kaiser-Meyer-Olkin (KMO). If the KMO value is between 0.5 and 1, it can be interpreted that factor analysis is appropriate to use [12].

2. Factor Formation

The next stage is to form factors to find the relationship between the initial variables. The method used in formingfactors is the principal component analysis method. The main steps taken are determining the number of factors and rotating the factors formed [11].

a. Determinant Of The Number Factors

The number of factors will be formed by combining several criteria to obtain the most appropriate number according to the research data. The eigenvalue is the first criterion used. Factors that have an eigenvalue of more than 1 will be retained and factors that have an eigenvalue of less than 1 will not be included. The second criterionis to determine the percentage of total variance that can be explained by the number of factors formed. If the cumulative percentage of variance is sufficient or more than half of the total variance of the initial factor, then factor extraction can be stopped. The third criterion is the determination based on the scree plot. The scree plot is a plot of eigenvalues against the number of factors extracted. If the scree point starts to flatten, it indicates that thenumber of factors is right [13].

b. Factor Rotation

According to [14] The factor rotation process is useful for simplifying factors and increasing interpretation capabilities. The rotation methods in factor analysis that many researchers use are the orthogonal rotation method and the oblique rotation method. Orthogonal rotation is a rotation that maintains the axes perpendicular to each other. By doing this rotation, each factor is independent of the other factors because the axes are perpendicular to each other, so it aims to reduce the number of variables without considering how meaningful the extracted factorsare.

The varimax method makes its analysis on the simplification of the factor matrix column. The maximum simplification can occur if there are only 0 and 1 values in a column. The varimax technique produces large factor loading values or other factors as small as possible. The resulting structure is much simpler when compared to the quartimax method. In addition, this varimax method can distinguish factors more clearly [15].

From the explanationabove, what will be used in this research is the varimax method.

c. Interpretation Of Factor Analysis Result

The next step is to determine the significance of the factor loading value which is useful for determining the grouping of variables into appropriate factors. The factor loading value of 0.55 has been considered significant fora sample size of 100 respondents at a significance level of $\alpha = 0.05$. Based on this, the factor loading will be considered significant if its value is 0.55 or more [16].

d. Factor Naming

If the main factors, each of which consists of the factors studied, have been formed, then the factors are named based on the characteristics that correspond to their members. To name the main factors, first look at the underlyingthings and represent the characteristics of the initial variables that are collected in one factor [10].

## III. RESEARCH METHODS

This section begins with the background of the factors that influence project success. Using descriptive statisticalmethods, and reliability tests are carried out to ensure the consistency of measurement results. To find out the most dominant and influencing factors in this research, factor analysis was carried out.

### III.1 Techniques for gathering

This research was conducted on 174 contractors in Palu City who carried out construction projects in the last five years. To collect the data in this research, the researcher encountered various obstacles which caused the data collection to take quite a long time. The data collection process in this research is as follows:

1. To distribute the questionnaire, the researcher first contacted the contractor company, and if there was noresponse, the researcher went to the company address
2. Introduce yourself and ask whether you want to fill out the questionnaire in person or online via the link forfilling out the questionnaire, namely:

https://bit.ly/SurveiKuesionerFactorYangMembanguniKeberhasilanProyek

3. If directly, the researcher provides an explanation of the questionnaire as well as interviews related to the researchtheme and explains the questionnaire process again if necessary.

The obstacles experienced while distributing the questionnaire included:

1. Respondents do not respond when contacted
2. The company address when arriving is not correct
3. Respondents who responded wanted to fill out the questionnaire online but did not do so

### III.2 Data analysis technique

The next stage in the research process is data analysis. The data analysis method is very dependent on the type ofresearch and research methods. The steps taken in analyzing the data in this research used Descriptive Statistics techniques, Reliability Tests, and Factor Analysis with the help of SPSS software

## IV. RESULTS AND DISCUSSION

Respondents in this research are service providers, in this case contractors who have experience implementing projects or are currently implementing projects in Palu City. From this research, the total number of respondents was 55 respondents who filled out and returned the questionnaire.

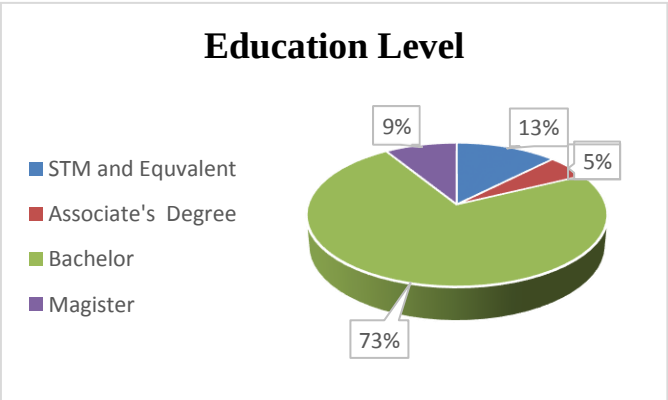


Figure 1. Education level presentage diagram

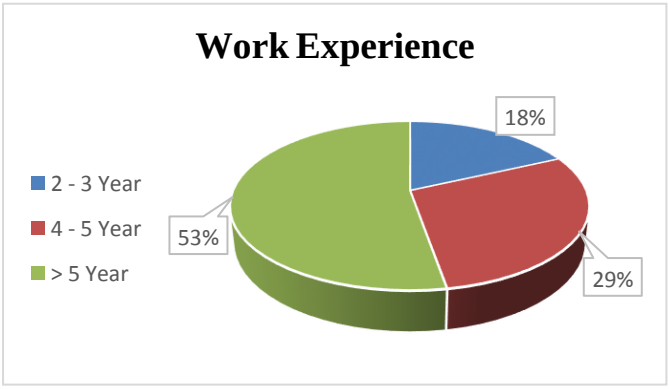


Figure 2: Work experience percentage diagram

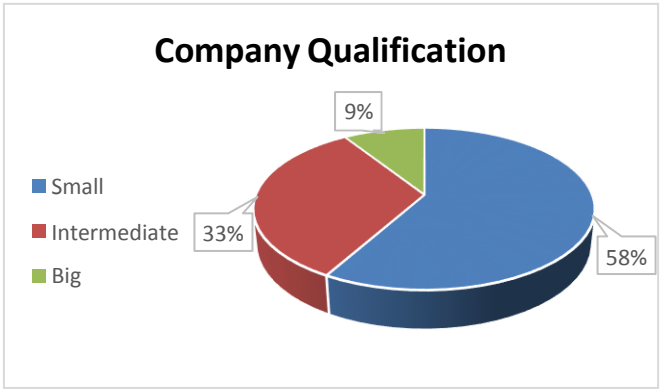


Figure 3: Company qualification percentage diagram

### IV.1 Reliability test

Reliability testing is useful for determining the level of consistency of research variables. If a variable has respondents' answers to questions that are consistent over time, it can be said to be reliable. To determine the reliability of the instrument, Cronbach Alpha is used. If the Cronbach Alpha value is greater than 0.6, the questionnaire instrument is declared reliable. [17].

Table 1. Results of the reliability

| Variables | Cronbach's Alpha | Description |
|---|---|---|
| Communication system of the parties involved (MPK1) | 0,914 | Reliabel |
| Implement an effective workplacesafety program (MPK2) | 0,913 | Reliabel |
| Implementation schedule plan used(MPK3) | 0,915 | Reliabel |
| Project Monitoring (MPK4) | 0,914 | Reliabel |
| Effectiveness of decision making(MPK5) | 0,915 | Reliabel |
| Turn – Over of employees (MPK6) | 0,935 | Reliabel |
| Project manager experience (MP1) | 0,913 | Reliabel |
| Project manager technical skills(MP2) | 0,912 | Reliabel |
| Project manager involvement fromstart to finish of the project (MP3) | 0,913 | Reliabel |
| Project manager's commitment toachieving cost, quality and time (MP4) | 0,912 | Reliabel |
| Project manager motivation skills(MP5) | 0,913 | Reliabel |
| Material procurement schedule(PMP1) | 0,913 | Reliabel |
| Material quality control (PMP2) | 0,915 | Reliabel |
| Technical specifications used(PMP3) | 0,92 | Reliabel |

| | | |
|---|---|---|
| Capacity of the equipment used(PMP4) | 0,914 | Reliabel |
| Equipment maintenance and fuelavailability (PMP5) | 0,913 | Reliabel |
| Permission to release materials fromthe warehouse (PMP6) | 0,915 | Reliabel |
| Workforce expertise based onexperience (TK1) | 0,914 | Reliabel |
| Planned number of workers (TK2) | 0,913 | Reliabel |
| Workforce skills based on education(TK3) | 0,922 | Reliabel |

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

### IV.2 Test Keiser Meyer Olkin (KMO) testing as well as Bartlett's test

he KMO (Keiser Meyer Olkin) test and Bartlett's test are useful for determining the feasibility of a variable that can be further processed using the factor analysis method or not (Santoso, 2012) 18. In this study, if the KMO testresults obtain a KMO value greater than 0.50 to 1.0 and Bartlet's significance must be less than 0.05, then the datacan be subjected to factor analysis [18]. The results of the KMO and Bartlett's Test are shown in Table 2 above.

Table 2. KMO and Bartlett"s Test

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .855 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 802.709 |
| | df | 190 |
| | Sig. | .000 |

Based on table 2, the result of KMO calculation is 0.855 and the value of Bartlett's Test of Sphericity is 820.709 ata significance of 0.000. Thus, the factors can be predicted and analyzed further.

### IV.3 Measure of Sampling Adequacy (MSA) Test

The Measure of Sampling Adequacy test is used to measure the intercorrelation between variables and the suitability of factor analysis. Anti-Image Matrices are useful for knowing and determining which variables are worthy of factor analysis. If the diagonal value of the Anti-Image Matrices in this study obtains MSA ≥ 0.50, thenthe factor can be analyzed further [18].

Table 3. Individual MSA Test Results of Variables

| Number | Instrument | Faktor - faktor | MSA |
|---|---|---|---|
| 1 | MPK5 | Project manager motivation skills | 0,926 |
| 2 | MP1 | Project manager experience | 0,902 |
| 3 | MP2 | Project manager technical skills | 0,889 |
| 4 | MPK1 | Communication system of the parties involved | 0,888 |
| 5 | PMP3 | Technical specifications used | 0,885 |
| 6 | MPK2 | Implement an effective workplace safety program | 0,882 |
| 7 | MP4 | Project manager's commitment to achieving cost, quality and time | 0,879 |
| 8 | TK2 | Planned number of workers | 0,878 |
| 9 | MPK3 | Implementation schedule plan used | 0,868 |
| 10 | PMP2 | Material quality control | 0,862 |
| 11 | TK1 | Workforce expertise based on experience | 0,860 |
| 12 | PMP1 | Material procurement schedule | 0,853 |
| 13 | MP3 | Project manager involvement from start to finish of the project | 0,843 |
| 14 | PMP6 | Permission to release materials from the warehouse | 0,841 |
| 15 | PMP5 | Equipment maintenance and fuel availability | 0,822 |
| 16 | PMP4 | Capacity of the equipment used | 0,815 |
| 17 | MPK4 | Project Monitoring | 0,799 |
| 18 | MP5 | Project manager motivation skills | 0,799 |
| 19 | TK3 | Workforce skills based on education | 0,694 |
| 20 | MPK6 | Turn – Over of employees (MPK6) | 0,433 |

It can be seen in table 3 from the results of the analysis of individual variable MSA tests, it is known that there is 1 factor studied that has a value <0.5, this shows that the analysis results still need to be tested MSA on each individual factor, by removing factors that have MSA and partial correlation values <0.5 and must be removed one by one with the smallest partial correlation value and then retested, until all individual MSAs and partial correlations have a value of >0.5 (Hair et al., 2010), therefore the researcher retested the MSA and Partial correlation until the value of the entire variable was >0.50.

The next MSA test is 0.859 and all factors already have individual MSA values of variables > 0.5. Therefore, the analysis can be continued. The results of the individual MSA test of variables can be seen in the following table.

Table 4. Individual MSA Test Results of Variables

| Number | Instrument | Faktor - faktor | MSA |
|---|---|---|---|
| 1 | MPK5 | Project manager motivation skills | 0,926 |
| 2 | MP1 | Project manager experience | 0,905 |
| 3 | MP2 | Project manager technical skills | 0,889 |
| 4 | MPK1 | Communication system of the parties involved | 0,887 |
| 5 | PMP3 | Technical specifications used | 0,885 |
| 6 | MPK2 | Implement an effective workplace safety program | 0,883 |
| 7 | MP4 | Project manager's commitment to achieving cost, quality and time | 0,872 |
| 8 | TK2 | Planned number of workers | 0,881 |
| 9 | MPK3 | Implementation schedule plan used | 0,866 |
| 10 | PMP2 | Material quality control | 0,862 |
| 11 | TK1 | Workforce expertise based on experience | 0,857 |
| 12 | PMP1 | Material procurement schedule | 0,854 |
| 13 | MP3 | Project manager involvement from start to finish of the project | 0,854 |
| 14 | PMP6 | Permission to release materials from the warehouse | 0,842 |
| 15 | PMP5 | Equipment maintenance and fuel availability | 0,827 |
| 16 | PMP4 | Capacity of the equipment used | 0,826 |
| 17 | MPK4 | Project Monitoring | 0,802 |
| 18 | MP5 | Project manager motivation skills | 0,787 |
| 19 | TK3 | Workforce skills based on education | 0,693 |

### IV.4 Determining The Number Of Factors

to determine the number of factors, what must be seen is the total initial eigenvalue > 1. There are 19 factors in this study that will be studied which are expected to provide Cumulative Percentage Variance > 60% [19]. For more details, see table 5 below :

Table 5. Total Variance Explained

| Total Variance Explained | | | | | | |
|---|---|---|---|---|---|---|
| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 9.499 | 49.994 | 49.994 | 9.499 | 49.994 | 49.994 |
| 2 | 2.124 | 11.176 | 61.170 | 2.124 | 11.176 | 61.170 |
| 3 | 1.382 | 7.273 | 68.443 | 1.382 | 7.273 | 68.443 |
| 4 | 1.017 | 5.355 | 73.798 | 1.017 | 5.355 | 73.798 |
| 5 | .793 | 4.172 | 77.970 | | | |
| 6 | .705 | 3.709 | 81.679 | | | |
| 7 | .622 | 3.273 | 84.953 | | | |
| 8 | .521 | 2.742 | 87.694 | | | |
| 9 | .486 | 2.560 | 90.254 | | | |
| 10 | .332 | 1.750 | 92.004 | | | |
| 11 | .315 | 1.657 | 93.660 | | | |
| 12 | .247 | 1.302 | 94.963 | | | |
| 13 | .235 | 1.236 | 96.198 | | | |
| 14 | .215 | 1.130 | 97.328 | | | |
| 15 | .139 | .732 | 98.060 | | | |
| 16 | .112 | .591 | 98.652 | | | |
| 17 | .093 | .488 | 99.140 | | | |
| 18 | .088 | .463 | 99.603 | | | |
| 19 | .076 | .397 | 100.000 | | | |

Based on table 5, it shows that the 4 factors formed can represent 19 success factors of a construction project basedon contractor perception. Based on the number of new factors formed, a Scree Plot graph is then created. Scree plotis a graph that shows the relationship between factors and their eigenvalues. The Scree Plot illustration in Figure 4is as follows:

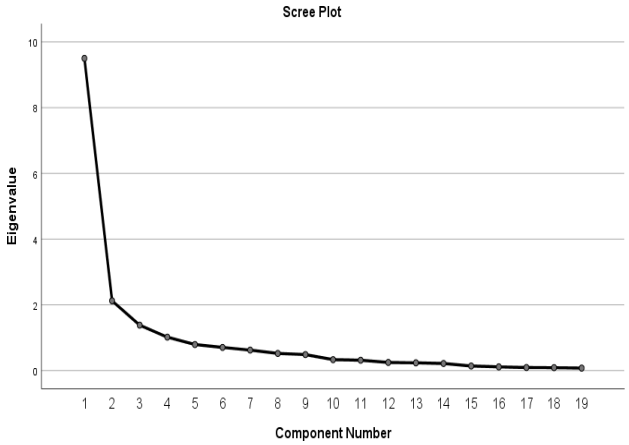


Figure 4: Curve of Scree Plot

**IV.5 Variable Extraction and Factor Rotation**

Factor extraction is the process of reducing a number of variables into a number of new variable sets or several factors that are fewer in number, which is the core step of factor analysis with the Principal Component Analysis method [19]. By using the PCA (Principal Component Analysis) method, the Component Matrix value is obtainedfrom the 4 components that have been extracted, then the Component Matrix value is obtained as in table 6.

Table 6. Component Matrix[a]

**Component Matrix[a]**

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| MPK1 | .721 | -.030 | -.090 | -.132 |
| MPK2 | .742 | -.015 | .304 | -.240 |
| MPK3 | .696 | -.271 | -.226 | .174 |
| MPK4 | .677 | .187 | -.470 | -.060 |
| MPK5 | .618 | .373 | -.020 | .085 |
| MP1 | .758 | -.150 | .021 | .405 |
| MP2 | .824 | -.174 | -.159 | .108 |
| MP3 | .716 | -.013 | -.559 | -.030 |
| MP4 | .809 | -.173 | -.377 | .034 |
| MP5 | .626 | .502 | -.138 | .012 |
| PMP1 | .765 | -.328 | .110 | -.273 |
| PMP2 | .703 | -.431 | .296 | -.230 |
| PMP3 | .841 | -.352 | .123 | -.105 |
| PMP4 | .717 | .174 | .073 | -.200 |
| PMP5 | .671 | .486 | .245 | -.122 |
| PMP6 | .559 | .601 | .065 | -.350 |
| TK1 | .723 | -.163 | .481 | .146 |
| TK2 | .748 | -.160 | .199 | .464 |
| TK3 | .384 | .667 | .232 | .413 |

To determine the factors that are included in the new factor, component rotation is carried out, which can be seen intable 7 :

Table 7. Rotated Component Matrix[a]

**Rotated Component Matrix[a]**

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| MPK1 | .457 | .479 | .309 | .113 |
| MPK2 | .696 | .164 | .414 | .137 |
| MPK3 | .359 | .617 | .023 | .360 |
| MPK4 | .115 | .737 | .400 | .032 |
| MPK5 | .139 | .316 | .589 | .251 |
| MP1 | .353 | .440 | .164 | .645 |
| MP2 | .449 | .619 | .186 | .356 |
| MP3 | .179 | .859 | .226 | .065 |
| MP4 | .369 | .786 | .153 | .223 |
| MP5 | .058 | .397 | .693 | .143 |
| PMP1 | .783 | .377 | .126 | .089 |
| PMP2 | .865 | .205 | .035 | .169 |
| PMP3 | .771 | .417 | .119 | .271 |
| PMP4 | .463 | .315 | .519 | .079 |
| PMP5 | .332 | .109 | .784 | .152 |
| PMP6 | .226 | .171 | .835 | -.152 |
| TK1 | .670 | .040 | .252 | .537 |
| TK2 | .410 | .292 | .171 | .746 |
| TK3 | -.166 | -.052 | .729 | .504 |

The results of the factor analysis in table 7 show that all variables have a loading factor value above 0.4, which means that all variables that have been analyzed have an influence on the success of the construction project basedon the contractor's perception. The grouping of these variables into 4 new factors starts from the variable with the highest to the smallest loading factor value in table 8 below:

Table 8. Grouping Of Factors

| Number | Factor | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1 | PMP2 | 0,865 | 0,205 | 0,035 | 0,169 |
| 2 | PMP1 | 0,783 | 0,377 | 0,126 | 0,089 |
| 3 | PMP3 | 0,771 | 0,417 | 0,119 | 0,271 |
| 4 | MPK2 | 0,696 | 0,164 | 0,414 | 0,137 |
| 5 | TK1 | 0,670 | 0,040 | 0,252 | 0,537 |
| 6 | PMP4 | 0,463 | 0,315 | 0,519 | 0,079 |
| 7 | MPK1 | 0,457 | 0,479 | 0,309 | 0,113 |
| 8 | MP2 | 0,449 | 0,619 | 0,186 | 0,356 |
| 9 | TK2 | 0,410 | 0,292 | 0,171 | 0,746 |
| 10 | MP4 | 0,369 | 0,786 | 0,153 | 0,223 |
| 11 | MPK3 | 0,359 | 0,617 | 0,023 | 0,360 |
| 12 | MP1 | 0,353 | 0,440 | 0,164 | 0,645 |
| 13 | PMP5 | 0,332 | 0,109 | 0,784 | 0,152 |
| 14 | PMP6 | 0,226 | 0,171 | 0,835 | -0,152 |
| 15 | MP3 | 0,179 | 0,859 | 0,226 | 0,065 |
| 16 | MPK5 | 0,139 | 0,316 | 0,589 | 0,251 |
| 17 | MPK4 | 0,115 | 0,737 | 0,400 | 0,032 |
| 18 | MP5 | 0,058 | 0,397 | 0,693 | 0,143 |
| 19 | TK3 | -0,166 | -0,052 | 0,729 | 0,504 |

**IV.6 Naming Factors**

Based on table 8, it is known that the results of the factor analysis in this study produced 4 new factors which werenamed by the researcher based on the characteristics that correspond to the factors, including:

a. New factor 1

The new factor 1 that was formed has 5 factors or variables in it, namely PMP1 "Material procurement schedule", PMP2 "Material quality control", PMP3 "Technical specifications", MPK2 "Effective work safety program", and TK1 "Workforce expertise based on experience". From several factors above related to procurement of materials, material quality, and the K3 program, the researcher named factor 1, namely the aspect of material quality management and K3

b. New factor 2

The new factor 2 that was formed has 5 factors or variables in it, namely MP2 "Project manager technical ability", MP3 "Project manager involvement", MP4 "Project manager commitment", MPK3 "Implementation schedule plan used", and MPK4 "Project monitoring". From several factors above related to project managers and project management, the researcher gave the name factor 2, namely the aspect of project manager expertise.

c. New Factor 3

The new factor 3 that was formed has 4 factors or variables in it, namely PMP5 "Equipment maintenance and fuelavailability", PMP6 "Permit to release materials from the warehouse", TK 3 "Workforce expertise based on education", and MP5 "Project manager motivation expertise". From several factors above related to equipment and material maintenance along with workforce expertise, the researcher named factor 3, namely the

Maintenance andMaterial Control aspect.

d. New Factor 4

The new factor 4 that was formed has 2 factors or variables in it, namely TK2 "Number of planned workers" and MP1 "Experience of project managers. From the 2 factors above related to experience and number of workers, theresearcher named factor 4, namely the Human Resources aspect.

**IV.7 Discussion**

Based on the results of factor analysis with the help of the SPPS version 26 application, the results of the study were 4 new aspects or factors that influence the success of construction projects in PALU City based on contractorperceptions. These new factors or aspects have the following variables:

a. Material Quality Management and K3 Aspects

For the material quality management and K3 aspects, it consists of material procurement schedules, material quality control, technical specifications, effective work safety programs and workforce expertise based on experience. Forthe factor that has the highest factor loading value, namely material quality control with a value of 0.865. Material quality control in the form of testing the quality of construction materials in the laboratory greatly influences the success of construction projects [20]. While the smallest factor loading value is workforce expertise based on experience with a value of 0.670, in this case work experience is needed to increase the effectiveness and productivity of the workforce in order to carry out a job according to their responsibilities so that the success of theconstruction project is achieved on time and with the right quality [21]. For the material quality management and K3 aspects, it can be seen in table 9.

Table 9. Material Quality Management and K3 Aspects

| No | | Factors | *Loading* Factor |
|---|---|---|---|
| 1 | PMP2 | Material quality control | 0,865 |
| 2 | PMP1 | Material procurement schedule | 0,783 |
| 3 | PMP3 | Technical specifications used | 0,711 |
| 4 | MPK2 | Implement an effective workplace safety program | 0,696 |
| 5 | TK1 | Workforce expertise based on experience | 0,670 |

b. Project Manager Expertise Aspects

For the project manager expertise aspect, it consists of the project manager's technical ability, project manager involvement, project manager commitment, the implementation schedule plan used, and project monitoring. For the factor that has the highest factor loading value, namely the involvement of the project manager with a value of0.859. This illustrates that the project manager must be involved in dealing with difficulties that arise at the project site, and how the project manager solves the problems that occur. So that the involvement of the project manager greatly helps the success of the construction project [22]. While the smallest factor loading value is the implementation schedule plan used with a value of 0.617. In this case, the existence of a construction project implementation schedule helps organize activities by following the sequence of implementation schedules that have been made. So that the construction project work reaches an effective and efficient implementation time [23]. For the project manager expertise aspect, it can be seen in table 10.

Table 10. Project Manager Expertise Aspects

| No | | Factors | *Loading* Factor |
|---|---|---|---|
| 1 | MP3 | Project manager involvement from start to finish of the project | 0,859 |
| 2 | MP4 | Project manager's commitment to achieving cost, quality and time | 0,786 |
| 3 | MPK4 | Project Monitoring | 0,737 |
| 4 | MP2 | Project manager technical skills | 0,619 |
| 5 | MPK3 | Implementation schedule plan used | 0,617 |

c. Material Maintenance and Control Aspects

For the maintenance and control aspects of project materials, it consists of equipment maintenance and fuel availability, permits for issuing materials from the warehouse, workforce expertise based on education, project manager motivational expertise. For the factor that has the highest factor loading value, namely the permit for issuing materials from the warehouse with a value of 0.835. Permission to issue materials from the warehouse is needed for the smooth running of the project work, for those who need materials, they must complete some data that informs the amount and type of materials taken so that the warehouse knows the amount of materials remainingso that the availability of materials is always there when needed by the construction project [2]. While the smallest factor loading value is the project manager's motivational expertise with a value of 0.693. In this case, providing support for behavior in achieving a goal, so that a good leader not only provides a sense of achievement for his employees but also makes them feel like they are part of an organization that cares about its

employees[24]. For the maintenance and control aspects of materials, it can be seen in table 11.

Table 11. Material Maintenance and Control Aspects

| No | | Factors | *Loading* Factor |
|---|---|---|---|
| 1 | PMP6 | Permission to release materials from the warehouse | 0,835 |
| 2 | PMP5 | Equipment maintenance and fuel availability | 0,784 |
| 3 | TK3 | Workforce skills based on education | 0,729 |
| 4 | MP5 | Project manager motivation skills | 0,693 |

d. Human Resources Aspect

For the human resources aspect, it consists of the number of planned workers and the experience of the project manager. For the factor that has the highest loading factor value, namely the number of planned workers with a value of 0.746. In this case, the number of workers used must be right, because the lack of workers will slow downthe project, and too many workers can reduce work productivity. So that the right number of workers is needed to facilitate the success of the construction project [24]. While the smallest loading factor value is the experience of the project manager with a value of 0.644. The experience of the project manager makes a significant contribution to the ability to solve problems, based on previous projects the project manager can develop strategies and insights to overcome problems that occur so as to help the success of the construction project [25]. For the human resourcesaspect, it can be seen in table 12

Table 12. Human Resources Aspect

| No | | Factors | *Loading* Factor |
|---|---|---|---|
| 1 | TK2 | Planned number of workers | 0,746 |
| 2 | MP1 | Project manager experience | 0,644 |

## V. CONCLUSIONS

From the results of the factor analysis, 4 aspects were obtained that influenced the success of the project. The 4 factors are material quality management and K3 factors consisting of 5 factors, project manager expertise factors consisting of 5 factors, material maintenance and control factors consisting of 4 factors and human resource factors consisting of 2 factors that influenced the success of the project based on the perception of contractors in PALU City. With the most dominant factors being material quality control, project manager involvement, and permitsfor the release of materials from the warehouse.

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