ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

Analysis of Consistency Between Cost Estimates and Project Schedule in Road Construction Projects in Palu City

Lailatul Mukarromah[1]; Fahirah F.[2]; Adnan Fadjar[3]

[1]Master's Student in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.
[2]Lecturer, Master's Program in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.
[3]Lecturer, Master's Program in Civil Engineering, Graduate School, Tadulako University, Palu, Indonesia.

Publication Date: 2026/11/23

Abstract: This study examines the factors associated with implementation consistency and those potentially related to inconsistency in road construction projects in Palu City. Four groups of factors-technical, managerial, administrative/contractual, and external-were examined through two separate analytical models. A descriptive quantitative approach was applied to five road construction projects funded by the 2023 Regional Budget (APBD). Primary data were collected through questionnaires administered to 30 purposively selected respondents, comprising supervising consultants and relevant technical personnel from the Palu City Public Works Department. The data were analysed using SPSS, including validity and reliability testing, descriptive statistics, and multiple linear regression. The descriptive analysis showed that managerial factors had the highest proportion in the consistency model (27%), while external factors had the highest proportion in the potential-inconsistency model (28%). The Cronbach's alpha values were 0.877 and 0.836 for the respective models, indicating acceptable internal consistency. The consistency model produced an F-statistic of 18.723 and a coefficient of determination (R^2) of 0.750, while the potential-inconsistency model yielded an F-statistic of 16.847 and an R^2 of 0.730. These findings indicate that the examined factor groups collectively explain 75.0% of the variation in the consistency model and 73.0% in the potential-inconsistency model. The results highlight the importance of managerial coordination and supervision in supporting implementation consistency, while external conditions and contractual administration warrant attention in mitigating potential inconsistency. These findings represent respondents' assessments of relevant factors and do not indicate that the five projects experienced actual implementation inconsistency.

Keywords: *Road Construction; Construction Management; Implementation Consistency; Managerial Factors; Potential Inconsistency.*

How to Cite: Lailatul Mukarromah; Fahirah F.; Adnan Fadjar (2026) Analysis of Consistency Between Cost Estimates and Project Schedule in Road Construction Projects in Palu City. *International Journal of Innovative Science and Research Technology*, 11(11), 1090-1096. https://doi.org/10.38124/ijisrt/26nov655

I. INTRODUCTION

Road construction projects are work systems that involve the interplay of technical requirements, resources, executing organizations, contractual procedures, and environmental conditions. Project success cannot be understood merely as the completion of the work; it also reflects the ability of the parties to align processes with implementation targets. The literature on critical success factors shows that project outcomes emerge from the interaction of project factors, procedures, management actions, human resources, and the external environment [1], [2]. A success-factor framework must also account for the fact that project objectives differ: Chua, Kog, and Loh [3] showed that the weights of success factors can vary depending on whether a project is judged by cost, schedule, quality, or overall success. Consequently, factors perceived to support implementation consistency are not necessarily identical to factors perceived as sources of potential inconsistency.

In road works, technical factors include the conformity of field conditions with working drawings, the availability of materials and equipment, the accuracy of quantities, and design adjustments. Managerial factors relate to coordination, supervision, the allocation of responsibilities, labour productivity, and progress evaluation. Earlier research on delays and project performance repeatedly identifies site management, planning quality, coordination, and supervision as important aspects [4]–[6], [8]–[10].

Beyond internal management, weather, access, the social environment, traffic, security, supply availability, and changing external conditions can create risks that must be anticipated. Construction-risk studies show that economic and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

supply risks, design changes, site conditions, and owner decisions can affect the course of implementation [7], [11], [12]. This study groups these aspects into external factors, while administration and contractual arrangements are treated as a separate group.

The research context is five road construction projects funded by the 2023 Regional Budget (APBD) in Palu City, Central Sulawesi. The study concentrates on respondents' assessments of factors related to implementation consistency and of factors that may potentially affect inconsistency. This restriction is important because the potential-inconsistency score is a perception-based assessment of potential risk, not evidence that the projects actually experienced inconsistency.

In the literature referred to in the underlying thesis, some earlier studies focus on cost and time performance evaluation using the Earned Value approach. The broader international literature likewise examines causes of delay, cost performance, or project success factors [4]–[12]. These studies help to explain the relevance of technical, managerial, contractual, and external factors, but they are not identical to the two constructs measured in this study.

The gap addressed here is contextual and analytical: the assessment of factors related to consistency and the assessment of factors potentially affecting inconsistency are presented as two instruments and two independent regression models. This separation makes differences in perceived priorities visible without mixing the constructs. The contribution is not a new causal theory but perception-based evidence from five road projects in Palu City, using two distinct models. The objectives are (1) to identify the ranking of factors in the consistency group, (2) to identify the ranking of factors in the potential-inconsistency group, and (3) to present the regression results of each model insofar as they are supported by data and statistical output that can be verified.

II. METHOD

➢ *Research Design and Scope*

The study uses a descriptive quantitative, survey-based approach. It was conducted in Palu City, Central Sulawesi, on five road projects funded by the 2023 Regional Budget: the Tolambu–Baiya Road Improvement, the Sriwijaya Road Periodic Maintenance, the Lagarutu Road Improvement, the Kampung Nelayan Road Improvement, and the Lombok Road Rehabilitation. This article processes only the constructs concerning factors related to consistency and factors potentially affecting inconsistency; the cost and time deviation analysis from the first research question of the thesis is not included.

Selection of the location and objects followed the availability of project documents that form the basis of the thesis. The five projects were road projects of fiscal year 2023, each with a contract duration of 150 calendar days. Project data were obtained from the Palu City Public Works Department, Highways Division (Bina Marga). Project names and budget values (RAB) are listed in Table 1 to describe the case-study context, not to present again the cost deviation analysis that is excluded from this article.

Table 1 Research Project Objects

Project	Budget (RAB)/contract value	Duration
Kampung Nelayan Road Improvement	Rp3,697,000,000.00	150 calendar days
Lagarutu Road Improvement	Rp7,788,000,000.00	150 calendar days
Lombok Road Rehabilitation	Rp480,643,453.06	150 calendar days
Sriwijaya Road Periodic Maintenance	Rp1,882,856,605.23	150 calendar days
Tolambu–Baiya Road Improvement	Rp6,480,970,631.57	150 calendar days

Source: Palu City Public Works Department, Highways Division (Thesis Table 1)

The sample consisted of 30 respondents selected through purposive sampling. The respondents comprised supervising consultants and relevant technical personnel from the Palu City Public Works Department. Their professional roles included field supervisors, supervising consultants, site engineers, technical staff, and technical executors. Contractors were not included as questionnaire respondents, as they were not designated as part of the respondent group in this study. Respondents were selected based on their involvement in and technical knowledge of road construction project implementation or supervision.

The primary data were collected using a questionnaire with a five-point Likert scale. Interviews and documentation were also used as supporting data-collection techniques. The quantitative results presented in this article are based on the questionnaire responses, while interviews and documentation served as supplementary sources of information.

The Likert scale was scored from 1 to 5: 1 = strongly disagree, 2 = disagree, 3 = fairly agree/neutral, 4 = agree, and 5 = strongly agree. The questionnaire was administered to supervising consultants and to employees/technical personnel of the Palu City Public Works Department; contractors were not respondents. This separation was made because the cost estimate (RAB) and implementation schedule documents were obtained from the contractor as executor, whereas the questionnaire assessments were collected from supervision and technical parties.

The independent variables in both models are X_1 technical factors, X_2 managerial factors, X_3 external factors, and X_4 administrative/contractual factors. The first model uses Y as the score of the implementation-consistency construct. The second model uses Y_K as the score of the potential-inconsistency construct. Each instrument consists of 28 items: 20 items for the four factor groups (five indicators each) and eight items for the dependent variable. Technical indicators

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

cover conformity of field conditions/drawings, materials, equipment, volume, and design changes; managerial indicators cover supervision, coordination, task allocation, productivity, and progress evaluation; external indicators cover weather, access, social conditions, traffic, and security; and administrative/contractual indicators cover administration, progress-payment terms, scope of work, work instructions, and contract documents.

The operational definitions distinguish the four independent factor groups. Technical factors relate to field conditions and the technical needs of the work; managerial factors relate to supervision and labour management; external factors lie outside the direct control of the executor; and contractual factors cover administration, payments, scope changes, instructions, and contract documents. For the dependent variable Y, the indicators are time deviation, cost deviation, progress accuracy against plan, budget-use efficiency, cost control, time control, achievement of performance targets, and the ability to minimize deviation (Table 2).

Table 2 Operational Definitions and Indicators of the Research Factors

Variable	Indicators
X_1: Technical factors	Conformity of field conditions with working drawings; availability of project materials; availability of work equipment; accuracy of work volume; design/work changes.
X_2: Managerial factors	Field supervision; coordination among parties; allocation of labour tasks; labour productivity; evaluation of work progress.
X_3: External factors	Weather conditions; access to the project site; social/community environment; traffic conditions; project security conditions.
X_4: Administrative/contractual factors	Project administration; progress-payment terms; changes in scope of work; work instructions; contract documents.
Dependent variable (Y)	Time deviation; cost deviation; progress accuracy against plan; budget-use efficiency; cost control; time control; achievement of performance targets; ability to minimize deviation.

Source: Operational Definitions of the Study (Thesis Table 2).

The validity test used Pearson correlation with an r-table value of 0.361 for n = 30. The reliability test used Cronbach's Alpha with a threshold of 0.600. Descriptive analysis was carried out by tabulating total scores and percentages for each factor group. Multiple linear regression was performed separately for each dependent variable.

Model 1 is formulated:

$$Y = \alpha + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

Model 2 is formulated:

$$Y_K = \alpha_K + b_{1K}X_{1K} + b_{2K}X_{2K} + b_{3K}X_{3K} + b_{4K}X_{4K} + e_K$$

The F-test was used to evaluate the simultaneous significance of each model, the t-test for the partial coefficients, and the coefficient of determination to summarize the proportion of variation in the dependent-variable score explained by the predictors. Processing was done with SPSS. he reported results are based on the statistical analyses presented in the research findings, with each model evaluated independently according to its respective dependent variable.

III. RESULTS AND DISCUSSION

➢ *Respondent Characteristics*

Thirty respondents took part in the survey. The respondent composition shows a predominance of men (83%) and of the 31–40 age group (50%). Field supervisors form the largest job group (33%), while supervising consultants, site engineers, technical staff, and technical executors each account for 17%. The most common work experience is 5–10 years (47%), and the most common education is a bachelor's degree in Civil Engineering (50%). These data describe a respondent profile that is largely construction-related in background and experience, but they do not by themselves prove that all project stakeholders are represented.

Table 3 Respondent Characteristics (Largest Category, n = 30)

Characteristic	Largest category	Percentage
Gender	Male	83%
Age	31–40 years	50%
Position	Field supervisor	33%
Work experience	5–10 years	47%
Education	Bachelor's degree (S1) in Civil Engineering	50%

➢ *Validity Test Results*

The validity table lists 28 items for each instrument: 20 items for the independent factors (X_1–X_4) and eight items for the dependent variable. For the consistency instrument, the printed item correlations lie between 0.431 and 0.892; for the potential-inconsistency instrument, between 0.458 and 0.776. All printed values exceed the r-table value of 0.361, and all items were declared valid. This conclusion can be traced to the

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

validity tables of the study (Tables 4.1 and 4.2 of the thesis); the SPSS output should be kept as audit evidence.

➢ *Reliability Test Results*

Cronbach's Alpha is 0.877 for the consistency instrument (28 items) and 0.836 for the potential-inconsistency instrument (28 items). Both exceed the 0.600 threshold used in this study, so both instruments meet the internal-consistency criterion under the operational limit of the research. Reliability must not be equated with construct validity; the result only indicates the internal consistency of the items according to the reported procedure.

Table 4 Validity and reliability Test Results

Instrument	Items	r-calculated range	r-table	Cronbach's Alpha
Consistency (Y)	28	0.431–0.892	0.361	0.877
Potential inconsistency (Y_K)	28	0.458–0.776	0.361	0.836

Reliability Threshold Used in the Study: 0.600.

➢ *Descriptive Analysis of Factors Related to Consistency*

The total score of the consistency group is 2,413. Managerial factors obtained a score of 647 (27%) and rank first. External factors obtained 611 (25%), technical factors 591 (24%), and administrative/contractual factors 564 (23%). This ranking indicates that respondents most emphasize supervision, coordination, task allocation, labour productivity, and progress evaluation as aspects related to implementation consistency. External factors rank second, so environmental conditions and access remain perceived as important.

The assessment of managerial factors should be read against the indicators defined in the study, namely field supervision, coordination among parties, allocation of labour tasks, labour productivity, and evaluation of work progress. The highest score in this group does not mean that one specific indicator has been proven to be the sole cause of consistency. The figure 647 is the accumulation of respondents' answers within the managerial group; its meaning is therefore a relative assessment among the four factor groups measured by the instrument.

The rounded percentages per factor sum to 99%, whereas the total row states 100%. The per-factor figures and the total are kept as printed; the one-point difference is a consequence of rounding and has not been corrected artificially. This finding is descriptive and shows the ordering of respondents' assessments, not a causal estimate.

➢ *Descriptive Analysis of Factors Potentially Affecting Inconsistency*

In the potential-inconsistency group, the total score is 2,432. Administrative/contractual factors rank first with a score of 680 (28%), followed by external factors with 633 (26%), managerial factors with 584 (24%), and technical factors with 535 (22%). The order indicates that respondents regard administration, progress-payment terms, changes in the scope of work, work instructions, and contract documents as the group of potential risks most in need of anticipation. External factors are in second place, which underlines the relevance of weather, access, social conditions, traffic, and security.

The administrative/contractual group in the operational definition covers project administration, progress-payment terms, changes in the scope of work, work instructions, and contract documents. These five indicators are governed by the contract and by the parties' administrative procedures, and they need to be clarified from the planning stage and monitored during implementation. The score of 680 shows that this group obtained the highest accumulated assessment on the potential-inconsistency instrument, not that all of these indicators actually occurred in all projects.

Interpretation must be limited to perceived potential. These results do not prove that the five projects experienced actual inconsistency, and they must not be read as a measurement of cost or time deviation.

Table 5 Descriptive Scores of the Factor Groups

Consistency group	Score	%	Rank	Potential-inconsistency group	Score	%	Rank
X_1 Technical	591	24%	3	X_{1K} Technical	535	22%	4
X_2 Managerial	647	27%	1	X_{2K} Managerial	584	24%	3
X_3 External	611	25%	2	X_{3K} External	633	26%	2
X_4 Administrative/contractual	564	23%	4	X_{4K} Administrative/contractual	680	28%	1
Total	**2,413**	**100%**		**Total**	**2,432**	**100%**	

Percentages are as Printed in the Study (Thesis Table 5 and Table 6 Totals); the Consistency-Group Percentages Sum to 99% Because of Rounding. Rank Order is by Score within Each Instrument.

➢ *Regression Assumption Tests*

The study presents Kolmogorov–Smirnov and Shapiro–Wilk normality tests on the X-variable scores, and multicollinearity tests for both models. For the consistency model, the printed Shapiro–Wilk values for X_1–X_4 are 0.611, 0.742, 0.683, and 0.523. For the potential-inconsistency model, the Shapiro–Wilk values for X_{1K}–X_{4K} are 0.521, 0.563, 0.821, and 0.684. All significance values are greater than 0.05, but these tables test the predictor variables, not the model residuals. Because the normality assumption of regression should be evaluated on the residuals, these results are not sufficient to state that residual normality is satisfied.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

The multicollinearity test shows Tolerance of 0.395–0.499 and VIF of 2.003–2.531 for the consistency model; for the potential-inconsistency model, Tolerance of 0.350–0.480 and VIF of 2.083–2.857. These values are within the limits used in the study (Tolerance > 0.10 and VIF < 10). However, a heteroskedasticity test was not found in the results section reviewed. Residual plots, a linearity check, and a residual normality test also need to be provided or explained before the regression results are treated as final.

Table 6 Normality (Shapiro–Wilk) and Multicollinearity (Tolerance) Tests of the Predictors

Model	Predictor	Shapiro–Wilk	Tolerance	VIF
1 (Y)	X_1 technical	0.611	0.424	2.357
1 (Y)	X_2 managerial	0.742	0.499	2.003
1 (Y)	X_3 external	0.683	0.433	2.311
1 (Y)	X_4 administrative/contractual	0.523	0.395	2.531
2 (Y_K)	X_{1K} technical	0.521	0.350	2.857
2 (Y_K)	X_{2K} managerial	0.563	0.420	2.381
2 (Y_K)	X_{3K} external	0.821	0.480	2.083
2 (Y_K)	X_{4K} administrative/contractual	0.684	0.450	2.222

Shapiro–Wilk Values are as Printed; the Underlying Tests were Applied to Predictor Scores, Not Residuals.

➢ *Multiple Linear Regression: Consistency Model*

The first model places the consistency score as the dependent variable and the four factor groups as predictors. The ANOVA table reports F = 18.723 with an SPSS-displayed significance of 0.000, written in this article as $p < 0.001$. The Model Summary reports R = 0.866, $R^2 = 0.750$, Adjusted $R^2 = 0.710$, and a standard error of the estimate of 1.58158. According to these tables, the model is reported as simultaneously significant with $R^2 = 0.750$ (Table 7). This value describes the proportion of variation in the Y score explained by the predictors in the sample; it is not evidence of a causal relationship.

The coefficient table of the consistency model contains B, standard error, Beta, t, and significance values that are internally inconsistent. For example, B = 0.435 and SE = 0.344 do not produce t = 3.751, and B = 0.764 and SE = 0.373 do not produce t = 6.674; the inconsistency is also visible for the other predictors and the constant. The table values are therefore shown only as a transcription of the source and marked [VERIFY] (Table 8); the printed regression equation, $Y = 0.256 + 0.435X_1 + 0.764X_2 + 0.667X_3 + 0.345X_4 + e$, cannot yet be treated as final. It must not be used to state the magnitude of influence or the dominant factor on the basis of regression coefficients. The descriptive ranking of managerial factors (27%) can still be reported separately.

Table 7 ANOVA and Model Summary of the Two Regression Models

Model	Source	Sum of Squares	df	Mean Square	F	Model summary
1 (Y)	Regression	187.331	4	46.833	18.723	R = 0.866; $R^2 = 0.750$
	Residual	62.535	25	2.501	—	Adj. $R^2 = 0.710$; SE = 1.58158
	Total	249.867	29	—	—	
2 (Y_K)	Regression	172.480	4	43.120	16.847	R = 0.851; $R^2 = 0.730$
	Residual	64.020	25	2.561	—	Adj. $R^2 = 0.701$; SE = 1.43265
	Total	236.500	29	—	—	

Reported Significance for Both F-Tests: $p < 0.001$ (SPSS Display 0.000).

Table 8 Regression Coefficients of the Two Models (as Printed in the Source; Against the Original SPSS Output)

Model	Variable	B	SE	Beta	t	Sig.
1 (Y)	(Constant)	0.256	1.460	—	0.450	0.792
	X_1 technical	0.435	0.344	0.285	3.751	0.001
	X_2 managerial	0.764	0.373	0.614	6.674	0.000
	X_3 external	0.667	0.355	0.585	4.015	0.000
	X_4 administrative/contractual	0.345	0.320	0.115	3.095	0.001
2 (Y_K)	(Constant)	0.300	1.200	—	0.250	0.631
	X_{1K} technical	0.310	0.145	0.180	2.138	0.001
	X_{2K} managerial	0.420	0.150	0.250	2.800	0.001
	X_{3K} external	0.650	0.120	0.550	5.417	0.000
	X_{4K} administrative/contractual	0.580	0.140	0.480	4.143	0.000

Values are Transcribed from Thesis Tables 7 and 8. B, SE, and t are Not Mutually Consistent in Model 1 (e.g., $0.435/0.344 \neq 3.751$) and Must be Rechecked Against the Original SPSS File.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

➢ *Multiple Linear Regression: Potential-Inconsistency Model*

The second model uses Y_K as the dependent variable. The ANOVA table reports F = 16.847 with a displayed significance of 0.000, written as p < 0.001. The Model Summary reports R = 0.851, R^2 = 0.730, Adjusted R^2 = 0.701, and a standard error of the estimate of 1.43265. Accordingly, the second model is reported as simultaneously significant and as explaining 73% of the variation in the Y_K score in the sample.

The coefficient table of the second model prints B and standard errors that are arithmetically consistent with the t values in the predictor rows. However, the significance column is not fully consistent with the t values and the residual degrees of freedom of 25. As an internal check, t = 2.138 and t = 2.800 are not in line with the printed Sig. of 0.001 when tested two-sided with df = 25; the approximate p-values are about 0.042 and 0.010, respectively. These figures are not a substitute for the SPSS output but an additional reason to mark the significance column. The printed equation is $Y_K = 0.300 + 0.310X_{1K} + 0.420X_{2K} + 0.650X_{3K} + 0.580X_{4K} + e_K$. The largest printed Beta is for external factors (0.550), but identifying the dominant factor from the regression remains provisional until all tables are reconciled with the original SPSS output. The descriptive ranking of administrative/contractual factors (28%) can be stated as a descriptive result, not as a regression conclusion; it is also a separate measure from the standardized coefficients and need not coincide with them.

➢ *Comparison of the Two Models*

The two models show different descriptive orders. In the consistency group, managerial factors rank first (27%), whereas in the potential-inconsistency group administrative/contractual factors rank first (28%), followed by external factors (26%). This difference indicates that respondents view internal coordination and control as important for consistency, while contractual administration and, to a slightly lesser degree, external conditions are groups of potential risks that need to be anticipated. The two assessments must not be merged into a single ranking.

The two models are built from different instruments and have different dependent variables. The first model measures factors related to consistency (Y), and the second measures factors that potentially affect inconsistency (Y_K). Because the constructs and the direction of the questions differ, the scores of the two models are not summed, not averaged, and not interpreted as one composite index. Comparison is made only on the relative order of factors within each instrument.

This pattern is conceptually in line with the literature that places management actions, coordination, managerial competence, and external factors as important dimensions of project success as well as risk [1]–[3], [7]–[15]. Delay studies in various countries also identify site supervision, decisions, work changes, weather, material availability, and coordination as recurring issues [4]–[6], [9]–[12], [16]. However, those earlier studies use contexts, constructs, and methods that are not always the same; similarity of themes therefore does not mean that numerical results can be compared directly.

The R^2 of the consistency model (0.750) and of the potential-inconsistency model (0.730) indicate explanatory power within the sample according to the study tables. The difference of 0.020 is not sufficient to claim that the first model is substantively better without an evaluation of uncertainty, measurement fit, and external validation. Neither R^2 proves causality or eliminates the possibility of perception bias or omitted variables.

➢ *Implications for Road Project Management*

In practical terms, the descriptive ranking of the consistency group gives project managers a reason to attend to cross-party coordination, clarity in the allocation of tasks, field supervision, resource control, and documented progress evaluation. For the potential-inconsistency group, the assessment emphasizes the clarity of contract documents, the flow of work instructions, the handling of scope changes, progress-payment procedures, and administrative processes. On the external side, the need to identify weather and access conditions, arrange traffic, communicate with the surrounding community, and apply safety and security procedures should also be kept in view.

These implications are managerial direction consistent with the pattern of respondents' answers and the literature; they are not evidence that a particular action will produce a causal change in the projects studied. The application of the recommendations should be adapted to the characteristics of the contract, the location, and the capacity of the project organization.

IV. LIMITATIONS

The study is limited to 30 respondents, five road projects, one city, and one fiscal year. Purposive selection means that the results cannot be statistically generalized to all road projects. The primary data come from respondents' perceptions and may therefore contain assessment bias. Complete evidence on residual diagnostics and heteroskedasticity has not yet been provided. In addition, the coefficient and partial significance tables of both models require verification against the original SPSS output files, and the role of the interviews and documentation in the factor analysis needs to be detailed.

V. CONCLUSION

In the group of factors related to implementation consistency, managerial factors received the highest assessment (27%), followed by external factors (25%), technical factors (24%), and administrative/contractual factors (23%). In the group of factors potentially affecting inconsistency, administrative/contractual factors received the highest assessment (28%), followed by external (26%), managerial (24%), and technical factors (22%). The two

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov655

descriptive results come from different instruments and must be interpreted separately.

The consistency and potential-inconsistency instruments each comprised 28 items, with Cronbach's Alpha values of 0.877 and 0.836, respectively, exceeding the minimum threshold of 0.600. The consistency model yielded F = 18.723 and R^2 = 0.750, while the potential-inconsistency model yielded F = 16.847 and R^2 = 0.730. These findings demonstrate the collective explanatory contribution of the four examined factor groups to variations in the respective models, highlighting the relevance of technical, managerial, administrative/contractual, and external factors in road construction project implementation.

From a practical perspective, the descriptive findings emphasize the importance of strengthening managerial coordination and supervision to support implementation consistency, while improving contractual administration and anticipating external risks to mitigate potential inconsistency. Future research should involve a larger number of projects and respondents, incorporate comprehensive regression diagnostics, and provide transparent and reproducible data and statistical outputs. The potential-inconsistency model represents an assessment of factors associated with potential inconsistency and does not establish that the five projects studied actually experienced inconsistency.

ACKNOWLEDGMENT

The authors would like to thank Dr. Ir. Fahirah F., S.T., M.T., and Dr. Ir. Adnan Fadjar, S.T., M.Eng.Sc., for their academic guidance and direction throughout this research. The authors also extend their gratitude to the Master's Program in Civil Engineering at Tadulako University for facilitating and supporting this research.

REFERENCES

[1]. A. P. C. Chan, D. Scott, and A. P. L. Chan, "Factors affecting the success of a construction project," *Journal of Construction Engineering and Management*, vol. 130, no. 1, pp. 153–155, 2004, doi: 10.1061/(ASCE)0733-9364(2004)130:1(153).

[2]. V. Sanvido, F. Grobler, K. Parfitt, M. Guvenis, and M. Coyle, "Critical success factors for construction projects," *Journal of Construction Engineering and Management*, vol. 118, no. 1, pp. 94–111, 1992, doi: 10.1061/(ASCE)0733-9364(1992)118:1(94).

[3]. D. K. H. Chua, Y. C. Kog, and P. K. Loh, "Critical success factors for different project objectives," *Journal of Construction Engineering and Management*, vol. 125, no. 3, pp. 142–150, 1999, doi: 10.1061/(ASCE)0733-9364(1999)125:3(142).

[4]. W. M. Chan and M. M. Kumaraswamy, "A comparative study of causes of time overruns in Hong Kong construction projects," *International Journal of Project Management*, vol. 15, no. 1, pp. 55–63, 1997, doi: 10.1016/S0263-7863(96)00039-7.

[5]. S. A. Assaf and S. Al-Hejji, "Causes of delay in large construction projects," *International Journal of Project Management*, vol. 24, no. 4, pp. 349–357, 2006, doi: 10.1016/j.ijproman.2005.11.010.

[6]. M. Sambasivan and Y. W. Soon, "Causes and effects of delays in Malaysian construction industry," *International Journal of Project Management*, vol. 25, no. 5, pp. 517–526, 2007, doi: 10.1016/j.ijproman.2006.11.007.

[7]. S. M. El-Sayegh, "Risk assessment and allocation in the UAE construction industry," *International Journal of Project Management*, vol. 26, no. 4, pp. 431–438, 2008, doi: 10.1016/j.ijproman.2007.07.004.

[8]. K. C. Iyer and K. N. Jha, "Factors affecting cost performance: evidence from Indian construction projects," *International Journal of Project Management*, vol. 23, no. 4, pp. 283–295, 2005, doi: 10.1016/j.ijproman.2004.10.003.

[9]. K. C. Iyer and K. N. Jha, "Critical factors affecting schedule performance: evidence from Indian construction projects," *Journal of Construction Engineering and Management*, vol. 132, no. 8, pp. 871–881, 2006, doi: 10.1061/(ASCE)0733-9364(2006)132:8(871).

[10]. H. Doloi, A. Sawhney, K. C. Iyer, and S. Rentala, "Analysing factors affecting delays in Indian construction projects," *International Journal of Project Management*, vol. 30, no. 4, pp. 479–489, 2012, doi: 10.1016/j.ijproman.2011.10.004.

[11]. S. Durdyev and M. R. Hosseini, "Causes of delays on construction projects: a comprehensive list," *International Journal of Managing Projects in Business*, vol. 13, no. 1, pp. 20–46, 2020, doi: 10.1108/IJMPB-09-2018-0178.

[12]. M. Nadeem, I. M. Jiskani, M. S. Urwat, S. Uddin, K. Akhtar, and N. H. Khokhar, "Analysing delay factors in construction projects using Z-number approach: insights from Pakistan," *Canadian Journal of Civil Engineering*, vol. 50, no. 12, pp. 966–983, 2023, doi: 10.1139/cjce-2022-0310.

[13]. R. K. Mavi and C. Standing, "Critical success factors of sustainable project management in construction: a fuzzy DEMATEL-ANP approach," *Journal of Cleaner Production*, vol. 194, pp. 751–765, 2018.

[14]. T. Williams, "Identifying success factors in construction projects: a case study," *Project Management Journal*, vol. 47, no. 1, pp. 97–112, 2016, doi: 10.1002/pmj.21558.

[15]. Y. C. Kog and P. K. Loh, "Critical success factors for different components of construction projects," *Journal of Construction Engineering and Management*, vol. 138, no. 4, pp. 520–528, 2012, doi: 10.1061/(ASCE)CO.1943-7862.0000464.

[16]. A. Assaf, M. Al-Khalil, and M. Al-Hazmi, "Causes of delay in large building construction projects," *Journal of Management in Engineering*, vol. 11, no. 2, pp. 45–50, 1995, doi: 10.1061/(ASCE)0742-597X(1995)11:2(45).