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Analysis of The Factors Causing Contract Addenda and Their Impact on the Implementation of Construction Projects Within the Government of Gianyar Regency

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Abstract

Contract addenda frequently occur before, during, or at the completion of construction projects due to technical, administrative, and external factors that influence project implementation. This study aims to identify the dominant factors causing contract addenda and examine their effects on the implementation of government construction projects in Gianyar Regency. A quantitative research design was employed using questionnaire surveys distributed to project stakeholders. Data were analyzed using factor analysis and multiple linear regression with SPSS version 27. The analysis identified seven factors contributing to contract addenda: project disruptions caused by external conditions and internal coordination, planning and design discrepancies, intervention and dependence on external parties, coordination and administrative processes during project preparation together with unpredictable natural conditions, project execution and work methods, changes in work scope, and technical discrepancies. The regression model obtained was Y = 37.980 + 2.524XF1 + 2.853XF2 + 1.845XF3 + 1.831XF4 + 2.127XF5 + 1.720XF6 + 1.844XF7, indicating that all seven factors significantly affect construction project implementation. The findings demonstrate that increases in these factors are associated with a higher likelihood of contract addenda, leading to significant impacts on project cost, quality, and completion time. These results highlight the importance of improving project planning, coordination, and contract management to minimize contract modifications and enhance project performance.

Keywords: Contract Addendum, Project Implementation

Introduction

The Government of Gianyar Regency implemented numerous construction projects during the 2025 fiscal year. Nearly all construction projects undertaken by the Government of Gianyar Regency experienced contract addenda. Based on project data from 2025 obtained from the Human Settlements Division of the Gianyar Regency Public Works and Spatial Planning Office and the Gianyar Regency Education Office, 85.94% of the 64 construction projects underwent contract addenda during the implementation phase. The occurrence of contract addenda in construction projects may have significant impacts on both contractors and the project owner, namely the Government of Gianyar Regency. For the Government of Gianyar Regency, contract addenda may result in losses related to project cost, quality, and completion time, causing deviations from the original project plan in terms of budget, quality standards, and schedule.

He impacts of contract addenda are highly complex and have a significant influence on the implementation of construction projects (Papadonikolaki, 2018; Seboka & Gidebo, 2026). Therefore, it is necessary to conduct research to identify the factors causing contract addenda and to analyze their effects on the implementation of construction projects within the

Government of Gianyar Regency. The findings are expected to provide a basis for formulating strategies to minimize the occurrence of contract addenda.

Definition of Contract Addendum

A contract addendum is a written agreement between the project owner and the contractor that modifies certain provisions of the original contract documents, such as adding or reducing the scope of work. These modifications may result in changes to the contract value, payment schedule, and project schedule.

In brief, a contract addendum can be defined as a modification to the original contract (Assaad et al., 2020; Guarda et al., 2015). A contract addendum serves as a written work order that formalizes revisions to the project plans and specifies the amount of cost compensation payable to the contractor during the construction phase after the contract has been signed by the project owner and the contractor (Abotaleb & El-adaway, 2017; Nasir & Hadikusumo, 2019)

Based on the definitions presented above, a contract addendum can be concluded as a written agreement signed by the project owner, contractor, and designer to modify or revise the work specified in the contract documents. Such modifications may result in adjustments to the project cost and completion time.

The implementation of a contract addendum to accommodate changes in project planning requirements and/or the project construction scope generally requires an increase in the contract value and/or an extension of the contract duration. According to Fleischer et al. (2017), contractors submit contract addendum proposals for several purposes, including: (a) to modify the contract plan by introducing a special payment method; (b) to revise the contract specifications, including changes to payment terms and contract duration; (c) to obtain approval for additional work, including the corresponding payment and contract modifications; (d) for administrative purposes in establishing payment methods for extra work and additional quantities; (e) to adjust contract unit prices in cases of overruns and underruns in accordance with the contract specifications; (f) to propose cost reductions through value engineering proposals; and (g) to facilitate payments made after claims have been settled.

Contract addenda generally result in adjustments to both project cost and completion time. The provisions governing contract amendments are stipulated in Article 54 of Presidential Regulation of the Republic of Indonesia No. 16 of 2018, which states that if a contract amendment, as referred to in paragraph (1), results in an increase in the contract value, the final increase shall not exceed 10% (ten percent) of the original contract price. In addition, the Special Conditions of Contract specify that any contract modifications shall be documented through a Contract Addendum.

Factors Influencing Contract Addenda

Contract addenda are recognized as one of the primary causes of project delays and a major source of disputes, misunderstandings, and conflicts in the construction industry (Cakmak, 2022; Silva et al., 2024; Liyanawatta et al., 2024; Indahwati et al., 2024). Disputes among project stakeholders including the project owner, contractor, and architect/engineer or between the project owner and the contractor often become contentious when contract addenda arise during project execution. If such disputes cannot be resolved through agreement, negotiation, and proper evaluation of the proposed contract addendum, they may not only affect project cost and schedule but may also escalate into contractual claims.

The factors causing contract addenda can be classified into three categories based on the parties involved in the project, as follows: (1) Changes caused by the project owner or designer, including : (a) large number of contract addenda issued during the tendering stage; (b) Poor owner performance; (c) Deficiencies in design and specifications due to design errors, incomplete design, or design changes; (d) Delays in providing construction drawings or approved design clarifications; (e) Acceleration instructions; and f) Additions to or reductions in the project scope of work; (2) Changes caused by the contractor, including: (a) Failure to commence the work as planned; (b)Failure to provide an adequate labor supply; (c) Poor performance of the contractor or subcontractors; (d) Defective or substandard quality of completed work; and (e) Delays in the construction schedule or subcontractor procurement schedule; (3) Changes caused by other factors, which include third-party negligence or external conditions, such as: (a) Weather conditions or other natural events; (b) Changes in subsurface site conditions; (c) Labor disputes; (d) Site conditions; and (e) Economic or monetary conditions.

Stages of Contract Addendum Implementation

As a project progresses, the impact caused by changes in the scope of work becomes increasingly significant. To address these impacts, the project owner, consultant/designer, contractor, and operational organizations must work together to minimize changes in the project scope. There are four basic stages related to the implementation process of a contract addendum, namely: (1) Submission of an addendum request by the initiator (which may be the contractor or architect/engineer) to obtain approval from the project owner or architect/engineer; (2) Discussion and evaluation of the addendum proposal documents during the approval process initiated by the initiator, involving the contractor and relevant parties, to determine the impacts of the proposed changes on the contract duration and cost; (3) Submission of the signed addendum proposal by the contractor to the project owner, including details of all additional costs and time extensions requested; (4) Acceptance of the signed proposal by the project owner and issuance of instructions for the implementation of the specified additional or revised work.

Construction Project Performance

Construction project performance refers to the manner in which a project is executed by comparing the actual work results with the planned performance stated in the work contract agreed upon by the project owner and the implementing contractor (Soeharto, 1999). In a project activity report, a project may be completed faster than the expected schedule; however, the actual costs incurred may exceed the allocated budget. If corrective control measures are not implemented immediately, the project may not be completed entirely due to insufficient funding. Project performance can be measured based on three main aspects: cost, time, and quality, which are considered the dimensions of productivity. Performance evaluation can be conducted using these three dimensions, namely cost, time, and quality. These dimensions are also applicable in the construction sector, particularly during the preparation of construction project planning. The descriptions of each productivity dimension in the construction field are explained as follows (Alinaitwe et al., 2007).

Cost Dimension

Construction project cost, also known as construction cost engineering, is an area of engineering activities in which engineering experience and judgment are applied through the principles of engineering and scientific knowledge to address cost estimation and cost control issues (Soeharto, 1999). Based on this definition, a comprehensive understanding of scientific and technical aspects is essential for preparing cost plans and determining the actual costs incurred upon completion of a construction project.

Time Dimension

The time dimension in construction productivity refers to the planning and development of a work network that can determine the shortest possible completion time, accompanied by float allowances that indicate delay management without affecting the overall project schedule (Soeharto, 1999). Based on this concept, the time dimension focuses on: (1) preparing a project implementation schedule with relatively economical costs; (2) developing schedules under limited resource conditions; and (3) preparing schedules that optimize the combination and utilization of available resources. The time dimension, as described above, is strongly related to the objective of minimizing cost risks.

Quality Dimension

The discussion of cost dimensions has highlighted aspects related to cost risks in construction project implementation. In general, the construction project planning process plays the most important role in achieving productivity during project execution. Through effective planning, the difference between estimated costs and actual costs can be minimized. This aspect is referred to as the quality dimension in construction project implementation, which represents the quality of cost estimation related to the accuracy and completeness of the elements that constitute the estimate. According to Soeharto (1999), the elements determining the quality dimension include: (a) the availability of data and information; (b) the techniques and methods used; (c) the skills and experience of the estimator; and d) the purpose of the cost estimate.

The Impact of Contract Addenda on Project Implementation

Contract addenda may influence or affect project implementation in terms of cost, quality, and time. The impacts of contract addenda on cost include additional expenses, increased overhead costs, compensation funds, changes in cash flow, loss of profit, and additional payments to contractors, which may ultimately result in financial losses for the project owner.

Regarding time, contract addenda in construction projects are one of the causes of project delays due to time overruns. Time-related impacts include delays in work completion, delays in logistics and material delivery, delayed procurement requirements, rework, demolition, and project replanning.

In terms of quality, contract addenda in construction work may affect work productivity and quality. These impacts include decreased productivity of both equipment and human resources, as well as compressed project schedules that may reduce the quality of the completed work (Webb et al., 2016; Karimi et al., 2017; Nepal et al., 2006).

The possible consequences or impacts of contract addenda may affect project performance, particularly in terms of project cost, completion time, and the quality of the intended outcomes. Unplanned changes in construction projects may result in additional work beyond the original expectations, leading to increased costs and extended project durations (Chen & Hsu, 2007).

The impacts of contract addenda on construction project implementation, viewed from the aspects of cost, quality, and time, are as follows (Sun & Meng, 2009): (1) Cost, including: Increased overhead costs; Increased equipment and material costs; Additional demolition costs; and Additional overtime costs; (2) Time, including: Extension of the project duration; Extension of time due to additional work; Rework/redesign activities; and Delays in equipment and material procurement; (3) Quality, including: Decreased quality of work; Occurrence of rework and demolition; and Defects in the final product.

Changes in the project completion schedule due to additional time requirements resulting from contract addenda may cause project delays. Therefore, contract addenda are considered one of the main causes of project delays, as well as a source of various disputes in the current construction industry (Othman et al., 2004).

Project delay is defined as a condition in which part of the planned implementation period cannot be utilized as intended, causing subsequent work activities to be delayed and preventing completion within the previously planned schedule or contractual timeframe (Dewi et al., 2006). Changes in construction project work scope may lead to construction delays, where additional construction time extends beyond the overall contract completion period or exceeds the project handover deadline previously agreed upon by the relevant parties (Abd El-Razek et al., 2008).

Construction completion that exceeds the specified contractual timeframe may result in overall project delays or delays in only certain construction activities (Doyle et al., 2008). In general, project delays can be categorized into three types: (1) Delays that are the responsibility of the project owner/supervisor, for example, delays caused by changes to contract documents; (2) Delays that are the responsibility of the contractor, for example, delays caused by inadequate supervisory and technical support, as well as delays in obtaining approvals from subcontractors or suppliers; (3) Delays that are not the responsibility of the contracting parties, for example, delays caused by labor strikes or abnormal weather conditions.

Validity and Reliability

Validity refers to the extent to which a variable measures what it is intended to measure. In research, validity indicates the degree of accuracy of a research instrument in measuring the actual content or concept being measured. The validity test is used to determine whether a questionnaire is valid or not. A questionnaire is considered valid if the statements or questions contained in the questionnaire are able to reveal the aspects that the questionnaire is intended to measure (Sugiyono, 2015). Reliability is a measurement tool used to assess a questionnaire as an indicator of a variable or construct. A questionnaire is considered reliable if the respondents' answers to the questions or statements are consistent or stable over time. Statistical testing using the Cronbach's alpha technique in the SPSS program determines that an instrument is reliable for measuring a variable when the alpha value is greater than 0.70. Conversely, if the Cronbach's alpha value is less than 0.70, the questionnaire items are considered unreliable or inconsistent (Sugiyono, 2015).

Factor Analysis

Factor analysis is a statistical technique used to identify factors that can explain the relationships or correlations among observed independent indicators. It is an extension of principal component analysis (PCA). Factor analysis is also used to identify a relatively small number of factors that can explain a large set of interrelated variables. As a result, variables within the same factor exhibit high correlations with one another, while their correlations with variables in other factors are relatively low. Each group of variables represents an underlying construct known as a factor (Utama, 2012). The primary objective of factor analysis is to explain the structure of relationships among multiple variables in terms of factors, latent variables, or constructed variables. The resulting factors are random quantities that cannot be directly observed, measured, or determined beforehand.

Factor Analysis Procedure

Problem Formulation

The problem formulation stage in factor analysis includes several key steps: a) The objective of the factor analysis must be clearly identified. b) The variables to be included in the factor analysis should be specified based on previous research, relevant theories, and the researcher's professional judgment. c) The variables should be measured using an interval or ratio scale. d) The sample size (n) must be adequate to ensure reliable and valid results.

Constructing the Correlation Matrix

In factor analysis, the first decision a researcher must make is whether the available data meet the assumptions required for the analysis. This initial step involves examining the correlation matrix among the observed indicators. Several measures can be used as rules of thumb to assess the adequacy of the data, including: a) The correlation matrix among the observed indicators. b) Partial correlations. c) The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy.

Factor Extraction

Factor extraction is a method used to reduce a large number of observed indicators into a smaller set of factors that can adequately explain the correlations among the observed variables. According to Kaiser (1960), the commonly used criterion for factor extraction is an eigenvalue greater than 1 (eigenvalue > 1). Several methods can be employed for factor extraction, including: a) Principal Components Analysis (PCA). b) Principal Axis Factoring (PAF). c) Unweighted Least Squares (ULS). d) Generalized Least Squares (GLS). e) Maximum Likelihood (ML).

Factor Rotation

After the factor extraction process, the next step is factor rotation. Factor rotation is necessary when the extraction method does not produce a clear and interpretable factor structure. The purpose of factor rotation is to obtain a simpler factor structure that facilitates interpretation. Several factor rotation methods can be used, including: (a) Varimax Method. (b) Quartimax Method. (c) Equamax Method.

Factor Interpretation

Once a valid set of factors has been obtained, the next step is to interpret and assign appropriate names to the factors, since a factor is a construct and becomes meaningful only when it can be interpreted. Factor interpretation is carried out by examining the variables that load onto each factor. The interpretation relies on the researcher's judgment. Because this process is subjective, the results may differ depending on the individual conducting the analysis.

Computing Factor Scores

Factor scores are computed when further statistical analyses are to be performed, such as regression analysis, discriminant analysis, or other multivariate analyses. These scores represent the values of the extracted factors for each observation and can be used as input variables in subsequent analyses.

Selecting Surrogate Variables or Constructing a Summated Scale

A surrogate variable is a single variable that best represents a particular factor. For example, if Factor 1 consists of variables X1, X2, and X3, the variable with the highest factor loading is considered the best representative of that factor. However, if two variables within the same factor have similarly high factor loadings, the surrogate variable may be selected based on theoretical considerations that is, the variable that is theoretically most representative of the underlying factor. Alternatively, a summated scale may be constructed.

A summated scale is a composite measure formed by combining multiple variables within the same factor. It may be calculated as either the average of all variables associated with the factor or the sum of the values of those variables.

Multiple Linear Regression Analysis

Multiple regression is a regression or prediction model that involves more than one independent variable or predictor. It is commonly referred to as multiple regression, where the term *multiple* indicates the inclusion of two or more independent variables.

Multiple linear regression is a type of multiple regression model in which the dependent variable is measured on an interval or ratio scale (i.e., quantitative or numerical data). The independent variables are also generally measured on interval or ratio scales. Multiple linear regression analysis examines the linear relationship between two or more independent variables (X) and a dependent variable (Y). This analysis is used to predict the value of the dependent variable when the independent variables increase or decrease and to determine the direction of the relationship between the independent and dependent variables, indicating whether each independent variable is positively or negatively associated with the dependent variable. The multiple linear regression model can be expressed by the following equation (Ghozali, 2018).

Methods

This study employed an exploratory research design using a quantitative approach. Data were collected through questionnaires. Two types of questionnaires were distributed simultaneously to the respondents: one addressing the factors causing contract addenda and the other focusing on indicators of construction project implementation. The questionnaire data were used to address the first and second research questions, namely to identify the dominant factors contributing to contract addenda and to analyze their effects on project implementation. Accordingly, a single round of questionnaire distribution was conducted to answer both research questions. Data for the third research question, concerning strategies to prevent the occurrence of contract addenda, were collected through expert interviews and subsequently analyzed. The primary data in this study consisted of information obtained directly from questionnaires distributed to a sample of respondents who met the target criteria and were considered representative of the study population. The primary data collection process, which served as the main input for this research, was carried out by administering questionnaires to the selected respondents. The secondary data consisted of construction project implementation reports from Gianyar Regency for the year 2025. These data were obtained from the Human Settlements Division of the Public Works and Spatial Planning Office and the Education Office of Gianyar Regency.

Result and Discussion

In this study, the respondents' characteristics were analyzed based on gender, age, educational background, and job position. The research data were obtained from questionnaires distributed to a total of 49 respondents. The results showed that the respondents were predominantly male, accounting for 82% of the sample. Most respondents were over 35 years of age (73%). Regarding educational attainment, the largest proportion of respondents held a bachelor's degree (47%). In terms of work experience, 39% of the respondents had more than 15 years of professional experience, while the most common job position was Director, representing 43% of the respondents.

The validity test in this study employed construct validity. The degrees of freedom (df) were calculated as the number of respondents (49) minus 2, resulting in a df of 47. Using a significance level (α) of 5%, the critical value of the Pearson correlation coefficient (r-table) was 0.288. For the Contract Addendum Factors variable, all 22 questionnaire items were found to be valid, as each item exceeded the required validity threshold. Similarly, the validity test for the Effects of Contract Addenda on Project Implementation variable indicated that all 10 questionnaire items were valid. Therefore, all questionnaire items were considered suitable for further analysis, namely the reliability test.

The reliability of the questionnaire was assessed using the one-shot (single-administration) measurement method. A construct or variable is considered reliable if it has a Cronbach's alpha value greater than 0.70 (Ghozali, 2016). The reliability analysis was performed using IBM SPSS Statistics Version 27, and the results are presented in Table 1.

Table 1 Reliability Test Results for the Contract Addendum Factors and the Effects of Contract Addenda on Project Performance.

Table 1. Reliability Statistics

Variable	Cronbach's Alpha	Number of Items
Contract Addendum Factors	0.815	22
Effects of Contract Addenda on Project Performance	0.806	10

Based on the reliability test results presented in Table 1, all variables obtained values above 0.70. Therefore, the reliability test results indicate that the questionnaire is reliable and can proceed to the next stage of analysis in accordance with the applied research method.

The first step in the factor analysis procedure is to determine the Kaiser–Meyer–Olkin (KMO) value, where the KMO value should be greater than 0.50 and the significance value of Bartlett's Test of Sphericity should be less than 0.05 (Malhotra and Birks, 2007). The KMO value is used to determine whether factor analysis can be conducted, while Bartlett's Test of Sphericity is used to assess whether the correlations among variables are sufficiently large to justify factor analysis.

For the variables Contract Addendum Factors and Effects of Contract Addenda on Project Implementation, all statements obtained Measure of Sampling Adequacy (MSA) values greater than 0.50. Therefore, all questionnaire items met the requirements and could be included in the subsequent factor analysis.

Factor extraction is the process of determining the number of factors based on eigenvalues. The criterion proposed by Kaiser (1960) states that factors with an eigenvalue > 1 should be retained. The results of the factor extraction show that Components 1 to 7 have eigenvalues greater than 1, with values of 5.225, 4.131, 2.077, 1.797, 1.480, 1.080, and 1.004, respectively. Components 1 to 7 explain the variance by 23.749%, 18.778%, 9.439%, 8.169%, 6.726%, 4.908%, and 4.565%, respectively, resulting in a cumulative explained variance of 76.335%.

Based on the factor analysis results, the factors causing contract addenda that influence construction project implementation within the Government of Gianyar Regency are identified as follows: project implementation disruptions originating from external factors and project coordination, planning and design, intervention and dependence on other parties, resources and site conditions, implementation and work methods, work changes (change orders), and technical discrepancies. Based on the t-test results, all research factors were proven to have a significant effect on construction project implementation, as they obtained significance values lower than 0.05.

Conclusion

Based on the results of the data analysis conducted in accordance with the research method applied, the following conclusions can be drawn. The factors causing contract addenda in construction projects within the Government of Gianyar Regency were identified through factor analysis, resulting in seven new factors contributing to contract addenda. These factors are: Disruptions to Project Implementation Originating from External Factors and Internal

Project Coordination (XF1), Planning and Design Inconsistencies (XF2), Intervention and Dependence on Other Parties (XF3), Project Preparation Coordination and Administration Processes as well as Uncertain Natural Conditions (XF4), Implementation and Work Methods (XF5), Work Changes (Change Orders) (XF6), and Technical Inconsistencies (XF7). To examine the influence of the factors causing contract addenda on construction project implementation within the Government of Gianyar Regency, multiple linear regression analysis was conducted. Based on the seven identified factors, all factors were found to have a significant influence on construction project performance within the Government of Gianyar Regency. This indicates that an increase in any of the seven independent variables will lead to an increase in contract changes (addenda), which subsequently affects project performance, particularly in terms of cost, quality, and implementation time.

Suggestions

The project owner (Commitment Making Official/PPK) should require documentation that has been verified by the technical team and building users regarding the planning design concept. In addition, factual site condition assessments and joint reviews involving all relevant parties should be conducted to verify the planning documents before the project enters the tender stage.

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