

Analysis of Delay Factors Leading to Contract Disputes in Construction Projects: A Case Study of Badung Regency

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ABSTRACT

In every construction project implementation, what is often a source of problems and disputes is project delays where debates about who and what are the causes and also demands between the owner and the implementer. This study aims to identify the factors causing delays that have the potential to cause disputes. The method used is descriptive statistical analysis. After obtaining the factors causing delays that have the potential to cause disputes, the second stage questionnaire was distributed again to see the level of agreement of each cause of project delays that have the potential to cause disputes. The results of this study found 53 variables that were successfully identified as causes of construction project delays that have the potential to cause disputes. For the results of the factor analysis, it was found that the most dominant factor causing construction project delays that have the potential to cause disputes was the coordination, control and evaluation of work. The coordination, control and evaluation of work factors had the largest percentage variance value among the other formed factors, amounting to 49.914%.

Keywords: dispute; delay; construction project

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1. INTRODUCTION

Every construction project is bound by a specific plan and execution schedule that dictates its commencement, completion, and resource allocation [1]. During this process, intensive collaboration and interaction between project owners, consultants, and contractors are fundamental to achieving project objectives [2]. However, this partnership is often susceptible to conflicts when project goals are not met [3]. If these issues are not managed effectively, they carry a high potential to escalate into formal disputes, which can severely hinder project progress [4].

Inaccurate planning, execution, and control activities are primary drivers of project delays, causing completion times to exceed contract agreements [5]. Previous studies suggest that delays frequently stem from design changes during execution, poor managerial organization, integrated work plan failures, and incomplete contract specifications [6]. These delays do not only disrupt the timeline but also trigger debates over responsibility and accountability among stakeholders [7]. When left unresolved, these disagreements can deteriorate into litigation, involving court proceedings that ultimately degrade overall construction

performance [8]. Given the increasing complexity of construction technology, the potential for misunderstandings and contradictions in construction contracts is higher than ever.

While existing literature extensively documents delay factors, there is a critical void in understanding the causal mechanisms that transform operational delays into formal legal disputes. Current research often treats delay and dispute as synonymous, overlooking how local regulatory inconsistencies and asymmetric information in procurement uniquely aggravate contractual conflicts. This study fills this gap by developing a Dispute Trigger Matrix that quantifies the probability of litigation arising from specific regional administrative bottlenecks [9]. This research addresses this gap by focusing on identifying the primary and dominant factors of construction delays that lead to disputes in the Badung Regency area [10]. The study categorizes these potential factors into three project characteristics: people aspects, process aspects, and project aspects. Specifically, this research examines variables such as design, contract, resources, control, and change factors throughout the project life cycle [11].

The objective of this research is to identify the main causes of construction delays that have the potential to cause disputes and to determine the most dominant factors among them. To ensure a focused analysis, the scope of this study is limited to small (K1, K2, K3) and medium-sized (M1, M2) contractors domiciled in Badung Regency and registered as members of the Indonesian National Construction Contractors Association (GAPENSI) [12]. The respondents selected are professionals with at least three years of experience in the construction field, holding management or operational positions, and having a minimum of senior high school/vocational education [13].

The methodological approach of this study involves descriptive analysis to map out the potential factors of disputes, followed by factor analysis to determine the dominant triggers using Statistical Product and Service Solutions (SPSS) software. The novelty of this research lies in its empirical identification of specific operational determinants that trigger contract disputes within the small-to-medium construction sector. Unlike broader studies, this research reveals that Coordination, Control, and Work Evaluation factors serve as the primary catalysts for disputes, accounting for a significant 49.91% variance in regional project delays. This provides a specialized predictive framework for regional contractors (K1-M2) to mitigate legal risks by prioritizing managerial oversight rather than just technical constraints. By providing a clear mapping of these critical determinants, this study offers actionable insights for both contractors and owners to implement targeted preemptive measures. These findings emphasize that enhancing managerial coordination is key to preventing dispute-triggering delays, ultimately contributing to greater project stability and performance within the regional construction industry.

2. RESEARCH METHOD

This research employed a quantitative approach with a descriptive and factor analysis design. The study was conducted in Badung Regency, focusing on a population of 20 construction companies registered as members of the Indonesian National Construction Contractors Association (GAPENSI) with small (K1, K2, K3) and medium (M1, M2) classifications. A purposive sampling technique was applied to select 65 respondents who met specific criteria. These criteria included: a minimum of three years of experience in the construction field, holding management or operational positions, and having at least a senior high school or vocational education background. Data acquisition involved distributing structured questionnaires to the selected respondents to ensure comprehensive data collection for the factor analysis.

The research procedure followed a systematic chronological flow. First, an identification of potential delay factors was conducted based on a literature review, categorizing them into design factors, contract factors, resource factors, control factors, and change factors. These variables were integrated into a structured questionnaire using a 5-point Likert scale to measure respondents' level of agreement. The scale was defined as follows: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). This approach quantified the collective perception of construction professionals regarding which delay factors most significantly contribute to contract disputes. After the data collection phase, the responses were processed through several testing stages using Statistical Product and Service Solutions (SPSS) software [15].

The data analysis was conducted in two stages. First, a descriptive analysis identified primary delay factors. Second, factor analysis was employed to determine dominant variables. Before the factor analysis, a variable reduction process was performed based on the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. Variables with an Anti-image Correlation (MSA) value below 0.50 were eliminated from the model. Subsequently, only variables meeting these statistical requirements were included in the Principal Component Analysis (PCA) to ensure the validity of the final factor groupings. Furthermore, both validity and reliability tests were conducted alongside the KMO and Bartlett's Test of Sphericity to ensure data suitability. This rigorous analytical framework ensures that the findings are scientifically robust, providing a reliable mapping of dispute-triggering delays specifically tailored to the regional construction industry.

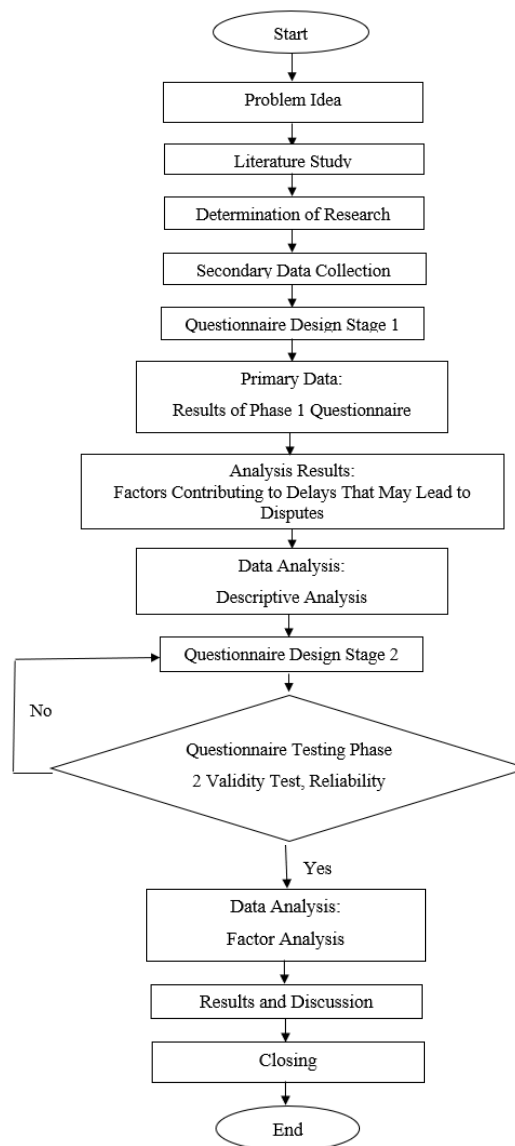


Figure 1. Research Framework

3. RESULTS AND DISCUSSION

Data collection was conducted through a two-stage survey using questionnaires. The first stage involved the identification of research variables through descriptive analysis. Once the variables were validated by the respondents, the second stage of data collection was carried out by distributing questionnaires to the same respondents to identify the dominant factors. The respondents' answers were tabulated to determine the cumulative frequency of responses to the questionnaire statements, thereby identifying the factors that dominate the occurrence of disputes in construction project execution.

Due to limitations in time, cost, and labor, this study employed a purposive sampling technique (non-probability sampling) to select 65 respondents who met the established criteria. This sample size represents a comprehensive coverage of the qualified management and operational staff from the 20 registered GAPENSI member companies in Badung Regency. According to the rule of thumb for factor analysis [17], a sample size of 65 is considered sufficient and statistically stable for regional-scale studies where the total population of qualified professionals is inherently limited. The data of the construction companies serving as the research objects in this study can be seen in Table 1.

Table 1. Construction Companies in Badung Regency

No	Name of the Contractor Company	Gred
1.	PT. TN	M2
2.	PT. PIL	M2
3.	PT. SKI	M2
4.	PT. CTB	M2
5.	PT. KBUP	M1
6.	PT. JAHY	M1
7.	PT. KK	M1
8.	PT. KMTS	M1
9.	PT. HY	M1
10.	PT. UR	K3
11.	CV. BP	K3
12.	CV. AG	K3
13.	CV. LC	K3
14.	CV. WJ	K3
15.	CV. PN	K3
16.	CV. KKP	K3
17.	CV. PA	K3
18.	CV. DKM	K3
19.	CV. VMN	K1
20.	CV. PK	K1

3.1. Data identitas responden

3.1.1 Respondent's Position

Based on the research results, the distribution of the respondents' positions indicates that the individuals who completed the questionnaires hold strategic authority within construction projects. The respondents are dominated by Directors/Company Leaders, totaling 30 people (46.2%), and Site Engineers (*Pelaksana*), totaling 21 people (32.3%), while the remainder are distributed across Project Manager and Site Manager positions. This ensures that information regarding contract dispute factors was obtained from the perspectives of both policy decision-makers and technical practitioners in the field.

3.1.2 Respondent's Education

The educational background of the respondents reflects an adequate level of intellectual understanding in responding to the research instruments concerning project delays. The majority of respondents are Bachelor's degree (S1) graduates, totaling 36 people (55.4%), followed by Vocational/Senior High School (SMK/SMA) graduates totaling 17 people (26.2%), Diploma graduates totaling 8 people (12.3%), and Master's degree (S2) graduates totaling 4 people (6.2%). This dominance of university graduates indicates that the respondents possess sufficient capacity to analyze contractual aspects.

3.1.3 Respondent's Work Experience

The level of the respondents' work experience provides professional validity to the assessment results of the dispute-causing factors. The respondents in this study possess mature work experience, with the largest group falling within the 5–10 year range, totaling 25 people (38.5%), and those with over 10 years of experience totaling 21 people (32.3%). Meanwhile, respondents with 1–5 years of experience numbered 19 people (29.2%). With the majority of respondents having worked for more than 5 years, the resulting data is considered highly credible as it is based on real-world experience in the construction industry.

3.2. Descriptive Analysis

3.2.1 Descriptive Analysis of Material Factors

Material is a crucial element in any construction project. A lack of quantity or quality in materials can hinder the construction process. Furthermore, delays in material delivery to the construction site lead to delays in the completion of sequential tasks. The frequency of respondents' perceptions regarding material factors as causes of project delays with the potential to trigger disputes is as follows:

1. **Shortage of Construction Materials (X1):** The data reveals that 83.0% of respondents identified material shortages as a significant catalyst for project delays and subsequent contract disputes. From a project management perspective, this high percentage underscores the critical role of supply chain reliability in regional construction. Material scarcity triggers a domino effect on interrelated work packages, disrupting the critical path and forcing indefinite halts in production. Legally, such delays often become a point of contention (dispute) regarding which party bears the 'excusable' versus 'non-

excusable' delay risk, especially when price fluctuations or logistics failures are involved. This finding aligns with the reality of the Badung Regency market, where dependence on external suppliers increases the vulnerability of small-to-medium contractors to material-driven disputes.

2. **Material Changes in Form, Function, and Specification (X2):** Out of 65 respondents, 55 (84.6%) chose "Yes" and 10 (15.3%) chose "No." Data analysis shows that 84.6% of respondents agree that changes in material form, function, and specifications are factors causing delays that potentially trigger disputes. This is often due to material changes requested by the owner for items that are rare in the market; besides the lengthy procurement process, this can also cause disputes between the owner and the contractor.
3. **Delay in Material Delivery (X3):** Out of 65 respondents, 53 (81.5%) chose "Yes" and 12 (18.5%) chose "No." The majority (81.5%) of respondents agree that delays in material delivery can potentially trigger disputes. This shows that delivery delays are a significant issue, where necessary materials arrive late at the project site, causing scheduled work to fall behind and wasting time.
4. **Damage to Construction Materials (X4):** Out of 65 respondents, 54 (83.0%) chose "Yes" and 11 (17.0%) chose "No." Since the majority chose "Yes," this variable is considered a factor causing delays that potentially trigger disputes. Material damage occurs when necessary items are damaged or unfit for use, necessitating a work suspension while waiting for new materials to arrive.
5. **Delay in Specialized Building Material Fabrication (X5):** Out of 65 respondents, 55 (84.6%) chose "Yes" and 10 (15.3%) chose "No." Data analysis shows that 84.6% of respondents agree that delays in specialized fabrication are a cause of delays that potentially trigger disputes. These delays are usually caused by the scarcity of available natural resources, the manufacturing process, and lengthy shipping times.
6. **Scarcity due to Material Specificity (X6):** Out of 65 respondents, 52 (80%) chose "Yes" and 13 (20%) chose "No." 80% of respondents agree that scarcity due to material specificity causes delays that potentially trigger disputes. This occurs when an owner insists on using specific materials that are difficult to obtain domestically, necessitating imports and long waiting periods for the items to arrive.
7. **Inaccuracy in Execution Timing (X7):** Out of 65 respondents, 53 (81.5%) chose "Yes" and 12 (18.5%) chose "No." 81.5% of respondents agree that inaccuracy in execution timing is a cause of delay that potentially triggers disputes. This inaccuracy is partly caused by technical issues in the field, such as design changes during project implementation.
8. **Poor Material Quality (X8):** Out of 65 respondents, 51 (78.5%) chose "Yes" and 14 (21.5%) chose "No." Data analysis reveals that 78.5% of respondents agree that poor material quality is a cause of delay that potentially triggers disputes. This is primarily due to the technical difficulties of working with such materials in the field.

3.2.2 Descriptive Analysis of Labor Factors (Labors)

In every construction project, the role of labor is essential. Selecting labor that matches the required field of work is crucial, as the speed of project completion is significantly influenced by their performance. The frequency of respondents' assessments regarding labor factors as causes of construction project delays with the potential to trigger disputes is as follows:

1. **Labor Shortage (X9):** Out of 65 respondents, 52 (80%) chose "Yes" and 13 (20%) chose "No." This indicates that 80% of respondents agree that labor shortages are a cause of delays that potentially trigger disputes. This is because a lack of workers will slow down construction progress, thereby extending the project's completion target.
2. **Labor Capability (X10):** Out of 65 respondents, 51 (78.5%) chose "Yes" and 14 (21.5%) chose "No." Based on the data analysis, 78.5% of respondents agree that labor capability can be a cause of delay that potentially triggers disputes. In addition to physical strength, the expertise or skill of the workforce and their experience in construction projects are also key factors. This clearly affects the execution time and carries a high potential for disputes.
3. **Ethnicity or Nationalism/Labor Culture (X11):** Out of 65 respondents, 18 (27.6%) chose "Yes" and 47 (72.3%) chose "No." Based on the data analysis, 72.3% of respondents disagreed; therefore, this variable is excluded as a cause of delay that potentially triggers disputes.
4. **Poor Communication Between Labor and Foremen (X12):** Out of 65 respondents, 54 (83.1%) chose "Yes" and 11 (16.8%) chose "No." Based on the data analysis, 83.1% of respondents agree that poor communication between labor and foremen can be a cause of delay that potentially triggers disputes. Misunderstandings between workers and foremen will impact the progress of project execution and disrupt the contractor's work schedule. The potential for disputes increases as problems begin to arise.

3.2.3 Descriptive Analysis of Equipment Factors (Equipment)

As technology advances, innovation continues to facilitate human tasks, particularly in the construction sector. Equipment is utilized to simplify and accelerate construction work. the frequency of respondents' assessments regarding equipment factors as causes of construction project delays with the potential to trigger disputes is as follows:

1. **Equipment Damage (X13):** Out of 65 respondents, 43 (66.2%) chose "Yes" and 22 (33.7%) chose "No." Based on the data analysis, 66.2% of respondents agree that equipment damage can be a cause of delay that potentially triggers disputes, as it can slow down the execution of specific work items.
2. **Unavailability of Adequate or Appropriate Work Equipment (X14):** Out of 65 respondents, 51 (78.5%) chose "Yes" and 14 (21.5%) chose "No." Based on the data analysis, the unavailability of adequate or appropriate work equipment can be a cause of delay that potentially triggers disputes. This lack of proper equipment leads to inefficiency in completing specific work items.
3. **Delay in Equipment Delivery or Provision (X15):** Out of 65 respondents, 45 (69.2%) chose "Yes" and 20 (30.7%) chose "No." Based on the data analysis, 69.2% of respondents agree that delays in equipment delivery or provision can be a cause of delay that potentially triggers disputes, which in turn slows down the execution of work items.
4. **Lack of Operator Capability in Operating Equipment (X16):** Out of 65 respondents, 49 (75.4%) chose "Yes" and 16 (24.5%) chose "No." Based on the data analysis, 75.4% of respondents agree that the lack of operator capability in operating equipment can be a cause of delay that potentially triggers disputes. Insufficient operator skills slow down the progress of work items.
5. **Equipment Management Errors (X17):** Out of 65 respondents, 47 (72.3%) chose "Yes" and 18 (27.6%) chose "No." Based on the data analysis, 72.3% of respondents agree that equipment management errors can be a cause of delay that potentially triggers disputes. Such errors can hinder field operations and require additional costs for repairing or purchasing equipment.
6. **Poor Equipment Quality (X19):** Out of 65 respondents, 53 (81.5%) chose "Yes" and 12 (18.5%) chose "No." Based on the data analysis, since the majority (81.5%) chose "Yes," this variable can be a factor causing delays that potentially trigger disputes. Poor equipment quality in the field leads to suboptimal performance in completing work items.

3.2.4 Descriptive Analysis of Financial Factors

Based on the frequency of respondents' assessments regarding financial factors as causes of construction project delays with the potential to trigger disputes, the results are as follows:

1. **Financial Availability During Execution (X19):** Out of 65 respondents, 55 (84.6%) chose "Yes" and 10 (15.3%) chose "No." Based on the data analysis, 84.6% of respondents agree that financial availability during execution can be a cause of delay that potentially triggers disputes. Financial availability is required to purchase materials, pay labor, and cover emergency expenses. A lack of funds can hinder project execution and lead to disputes.
2. **Payment Process Delays by the Owner (X20):** Out of 65 respondents, 54 (83.1%) chose "Yes" and 11 (16.8%) chose "No." Since the majority chose "Yes," this variable is considered a cause of delay with the potential to trigger disputes. Payment terms are stipulated in the contract; if these boundaries are violated, the contractor may seek legal recourse, which inevitably causes disputes.
3. **Absence of Incentive Payments for Early Completion (X21):** Out of 65 respondents, 32 (49.2%) chose "Yes" and 33 (50.7%) chose "No." As the majority chose "No," this variable is not considered a cause of delay that potentially triggers disputes. This is because most contracts do not include clauses for early completion incentives.
4. **Fluctuation of Rupiah Exchange Rate Against the Dollar (X22):** Out of 65 respondents, 25 (38.5%) chose "Yes" and 40 (61.5%) chose "No." Based on the data analysis, this variable is not a cause of delay that potentially triggers disputes.
5. **Material Price Changes (X23):** Out of 65 respondents, 35 (53.8%) chose "Yes" and 30 (46.1%) chose "No." 53.8% of respondents agree that changes in material prices can be a cause of delay that potentially triggers disputes.

3.2.5 Descriptive Analysis of Site Characteristics Factors

The assessment of site characteristic factors as causes of delays that potentially trigger disputes is as follows:

1. **Surface and Subsurface Soil Conditions (X24):** 37 respondents (56.9%) chose "Yes" and 28 (43.0%) chose "No." Therefore, this variable can cause delays that potentially trigger disputes. Soil contours and subsurface conditions often require specialized foundations, which extends the processing time for specific work items.

2. **Material Storage Location (X25):** 40 respondents (61.5%) chose "Yes" and 25 (38.5%) chose "No." A strategic storage location is vital for the efficient flow of materials and site security; loss or shortage of materials due to poor storage can cause financial losses and technical delays.
3. **Access to the Project Site (X26):** 54 respondents (83.1%) chose "Yes" and 11 (16.8%) chose "No." Difficult access hinders the delivery of construction materials and the mobilization of heavy equipment.
4. **Work Space Requirements at the Project Site (X27):** 44 respondents (67.7%) chose "Yes" and 21 (32.2%) chose "No." Based on the majority response, this variable can be a cause of delay that potentially triggers disputes.
5. **Geological Problems at the Project Site (X28):** 38 respondents (58.5%) chose "Yes" and 27 (41.5%) chose "No." Difficult soil contours, such as rocky terrain, complicate technical execution for the contractor.
6. **Environmental Security Influence on Project Development (X29):** 50 respondents (77%) chose "Yes" and 15 (22%) chose "No." Security disturbances in the project environment cause discomfort and reduce field productivity.

3.2.6 Descriptive Analysis of Scope and Contract/Work Document Factors

The assessment of factors related to work scope and documents is as follows:

1. **Incomplete Design Drawings and Specifications (X30):** 53 respondents (81.5%) chose "Yes" and 12 (18.5%) chose "No." A lack of detailed drawings makes it difficult for the contractor to realize the project plan, leading to delays.
2. **Changes in Design/Work Details During Execution (X31):** 57 respondents (87.7%) chose "Yes" and 8 (11.2%) chose "No." This variable is highly significant as a cause of delay that potentially triggers disputes.
3. **Changes in Scope of Work During Execution (X32):** 54 respondents (83.1%) chose "Yes" and 11 (16.8%) chose "No." Scope changes not specified in the initial contract create imbalances in field execution.
4. **Misunderstanding of Shop Drawing Regulations Between Designer and Contractor (X33):** 50 respondents (77%) chose "Yes" and 15 (23%) chose "No." If a designer's shop drawings cannot be realized by the contractor, re-planning is required, causing field delays and disputes between the two parties.
5. **Requests for Changes to Completed Work (X34):** 56 respondents (86.1%) chose "Yes" and 9 (13.8%) chose "No." This variable significantly contributes to delays and potential disputes.
6. **Frequent Additional Work (Change Orders) (X35):** 52 respondents (80%) chose "Yes" and 13 (20%) chose "No." Frequent additions to the workload during the process lead to delays and potential conflict.

3.2.7 Descriptive Analysis of Planning and Scheduling Factors

Planning and scheduling are vital to a project as they determine the planned schedule, project progress, duration, and time frames for completion. This is essential to achieve maximum results within existing constraints. The results are as follows:

1. **Difference in Subcontractor Schedules (X36):** Out of 65 respondents, 47 (72.3%) chose "Yes" and 18 (27.6%) chose "No." A mismatch between the main contractor's and subcontractor's schedules causes delays; for example, if an MEP subcontractor is late with pipe installation, the pool concreting process will be pushed back.
2. **Errors in Soil Investigation (X37):** 46 respondents (70.8%) chose "Yes" and 19 (29.1%) chose "No." Lack of precision in soil investigation can lead to foundation failure, resulting in massive financial losses and long delays.
3. **Design Errors by the Designer (X38):** 52 respondents (80%) chose "Yes" and 13 (20%) chose "No." Design errors cause discrepancies between the work contract and the initial planning, triggering disputes.
4. **Poorly Integrated Work Sequence (X39):** 55 respondents (84.6%) chose "Yes" and 10 (15.3%) chose "No." An unorganized work sequence leads to overlapping work items.
5. **Inaccurate Work Duration Determination (X40):** 55 respondents (84.6%) chose "Yes" and 10 (15.3%) chose "No." This causes tasks to exceed their allotted time, deviating from the project's time schedule.
6. **Frequently Changing Owner Work Plans (X41):** 57 respondents (87.7%) chose "Yes" and 8 (12.2%) chose "No." Constant changes make it difficult for the contractor to finalize shop drawings.
7. **Incorrect Construction/Execution Methods (X42):** 54 respondents (83.1%) chose "Yes" and 11 (16.8%) chose "No." Proper execution methods are essential for accelerating project completion.

3.2.8 Descriptive Analysis of Inspection, Control, and Evaluation Factors

1. **Lack of Cooperation between Contractor and Owner (X43):** 52 respondents (80%) chose "Yes" and 13 (20%) chose "No." Frequent miscommunication between these parties often leads to disputes.
2. **Unscheduled Material Sample Submissions (X44):** 45 respondents (69.2%) chose "Yes" and 20 (30.7%) chose "No." Unscheduled submissions disrupt the execution schedule, compounded by lengthy approval processes.
3. **Lengthy Material Sample Approval Process (X45):** 52 respondents (80%) chose "Yes" and 13 (20%) chose "No." If material test quality does not meet planning standards, it slows down field realization.
4. **Lengthy Inspection and Testing of Materials (X46):** 46 respondents (70.8%) chose "Yes" and 19 (29.1%) chose "No." Waiting for test results to ensure planned quality causes significant delays.
5. **Contractor's Failure to Execute Work (X47):** 50 respondents (77%) chose "Yes" and 15 (23%) chose "No." This variable is a significant cause of delays and potential disputes.
6. **Extensive Rework Due to Defects (X48):** 49 respondents (75.4%) chose "Yes" and 16 (24.5%) chose "No." Fixing defective work requires additional time, extending the project duration.
7. **Delayed Work Progress Evaluation (X49):** 56 respondents (86.2%) chose "Yes" and 9 (13.7%) chose "No." This slows down the contractor's progress payment requests, leading to a lack of funds for the next stages.

3.2.9 Descriptive Analysis of Managerial Factors

1. **Owner's Delay in Decision Making (X50):** 57 respondents (87.7%) chose "Yes" and 8 (12.2%) chose "No." Delays in decisions directly cause delays in the project execution schedule.
2. **Work Disputes Between Project Departments (X51):** 51 respondents (78.5%) chose "Yes" and 14 (21.5%) chose "No." A lack of cooperation between departments hinders the realization of work items.
3. **Lack of Communication between Owner and Designer (X52):** 55 respondents (84.6%) chose "Yes" and 10 (15.3%) chose "No." Poor communication leads to suboptimal planning, obstructing the contractor's execution process.

3.2.10 Descriptive Analysis of Other Factors (Others)

1. **Force Majeure Events (X53):** 51 respondents (78.5%) chose "Yes" and 14 (21.5%) chose "No." Natural disasters cause losses in time and cost, and make resources difficult to obtain.
2. **Changes in Government Policy or Political/Economic Situation (X54):** 37 respondents (57%) chose "Yes" and 28 (43%) chose "No." Such shifts are seen as factors contributing to delays and disputes.
3. **Damage Caused by Third-Party Negligence (X55):** 56 respondents (86.1%) chose "Yes" and 9 (13.8%) chose "No." Contractors require extra time to repair damages caused by external parties.
4. **Labor Strikes (X56):** 53 respondents (81.5%) chose "Yes" and 12 (18.5%) chose "No." Strikes, usually due to delayed wage payments by the owner, cause temporary work stoppages.

3.3.1. Pilot Study

After designing the questionnaire, a pilot study (preliminary test) must be conducted. The pilot study aims to determine the level of validity and reliability of the questionnaire. In this study, the validity and reliability tests were performed by distributing 65 sample questionnaires, from which 20 were selected for the pilot study. These tests were processed using SPSS 25 software. Once the testing was completed and the results were confirmed to be valid and reliable, the process continued to the next stage: the distribution of the final questionnaires to contractors domiciled in Badung Regency. Prior to conducting the pilot study, the 20 questionnaires were tabulated to provide a comprehensive overview of the respondents' profiles, ensuring they met the predetermined criteria. Subsequently, a recapitulation of the respondents' answers was created to facilitate the pilot study analysis.

3.3 Pilot Study Validity Test

An instrument is considered valid if the calculated r-value (r-calculated) is greater than or equal to the r-table value (r-table). The calculated r-value can be observed in the instrument testing results regarding the factors causing construction project delays that potentially trigger disputes, processed using the SPSS program. The results of the instrument validity test for the pilot study are as follows:

Tabel 2. Pilot Study Validity Test

No.	Statement Item	r count	r Table	Information
1.	X1	0,915	0,444	Valid
2.	X2	0,859	0,444	Valid

No.	Statement Item	r count	r Table	Information
3.	X3	0,936	0,444	Valid
4.	X4	0,890	0,444	Valid
5.	X5	0,935	0,444	Valid
6.	X6	0,922	0,444	Valid
7.	X7	0,853	0,444	Valid
8.	X8	0,844	0,444	Valid
9.	X9	0,818	0,444	Valid
10.	X10	0,905	0,444	Valid
11.	X12	0,864	0,444	Valid
12.	X13	0,922	0,444	Valid
13.	X14	0,926	0,444	Valid
14.	X15	0,873	0,444	Valid
15.	X16	0,866	0,444	Valid
16.	X17	0,854	0,444	Valid
17.	X18	0,870	0,444	Valid
18.	X19	0,779	0,444	Valid
19.	X20	0,862	0,444	Valid
20.	X23	0,885	0,444	Valid
21.	X24	0,953	0,444	Valid
22.	X25	0,937	0,444	Valid
23.	X26	0,895	0,444	Valid
24.	X27	0,940	0,444	Valid
25.	X28	0,908	0,444	Valid
26.	X29	0,909	0,444	Valid
27.	X30	0,717	0,444	Valid
28.	X31	0,861	0,444	Valid
29.	X32	0,869	0,444	Valid
30.	X33	0,847	0,444	Valid
31.	X34	0,824	0,444	Valid
32.	X35	0,755	0,444	Valid
33.	X36	0,882	0,444	Valid
34.	X37	0,902	0,444	Valid
35.	X38	0,839	0,444	Valid
36.	X39	0,865	0,444	Valid
37.	X40	0,851	0,444	Valid
38.	X41	0,733	0,444	Valid
39.	X42	0,767	0,444	Valid
40.	X43	0,869	0,444	Valid
41.	X44	0,893	0,444	Valid
42.	X45	0,814	0,444	Valid
43.	X46	0,879	0,444	Valid
44.	X47	0,823	0,444	Valid
45.	X48	0,903	0,444	Valid
46.	X49	0,905	0,444	Valid
47.	X50	0,749	0,444	Valid
48.	X51	0,765	0,444	Valid
49.	X52	0,870	0,444	Valid
50.	X53	0,910	0,444	Valid
51.	X54	0,826	0,444	Valid
52.	X55	0,851	0,444	Valid
53.	X56	0,864	0,444	Valid

3.4 Pilot Study Reliability Test

Reliability testing is the process of measuring the precision and consistency of an instrument. The purpose of this test is to demonstrate the consistency of scores provided by different respondents (Husaini et al., 2003). In this study, the instrument's reliability was assessed by observing the resulting Cronbach's Alpha value. According to Nunnally (1978), a statistical test in the SPSS 25 program is considered reliable if the Cronbach's Alpha value is greater than 0.7.

Based on the reliability test results for the questionnaire regarding factors causing construction project delays that potentially trigger disputes (processed using SPSS and attached in Appendix G), a Cronbach's Alpha value of 0.994 was obtained. Since $0.994 > 0.7$, all items studied are considered reliable and can be used for further analysis. Based on the overall results of the validity and reliability tests, it is concluded that all tested items are valid and reliable; therefore, the questionnaire is suitable for subsequent data analysis.

3.5 Factor Analysis

Factor Analysis of Delay Causes with Potential to Trigger Disputes

Tabel 3. Result KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,590
Bartlett's Test of Sphericity	Approx. Chi-Square	5251,883
	df	1378
	Sig.	,000

Based on Table 3, it can be explained that the **Kaiser-Meyer-Olkin (KMO)** value aims to test the suitability of using factor analysis. The requirement for the KMO value is > 0.5 with a significance level of 0. From the table above, a KMO value of **0.590** was obtained, which means the data is suitable for further analysis. In addition to the KMO and Bartlett's Test values mentioned above, the **total extraction value (eigenvalues)** was also observed. By applying the requirement of a value > 1, a total of **9 (nine) factors** were formed. The total extraction values can be found in Appendix J.2. Based on the factor analysis output, the 9 formed factors are presented in Table 4 as follows:

Tabel 4. Factor Analysis Results of Project Delay Causes with the Potential to Trigger Disputes

Formed Factors	Items are formed		Loading Factor	Key Variables
	item code	Item Description		
Factor 1	X52	Poor communication between owner and designer during project planning	0,795	Coordination, Control, and Work Evaluation
	X53	Force majeure events (fire, bad weather, storms, earthquakes, landslides, etc.)	0,748	
	X55	Damage or vandalism caused by third-party negligence/actions	0,737	
	X45	Lengthy material sample approval process by the owner	0,727	
	X48	Extensive rework required due to defects	0,720	
	X49	Lengthy and unscheduled work progress evaluation procedures	0,699	
	X47	Contractor's failure to execute work	0,654	
	X54	Changes in government political/economic policies or situations	0,637	
	X50	Owner's delay in decision making	0,635	
	X43	Lack of cooperation between contractor and owner	0,633	
Factor 2	X46	Lengthy inspection and material testing process	0,614	Planning and Contractual Documentation
	X41	Frequently changing owner work plans	0,890	
	X20	Payment process delays by the owner	0,868	
	X35	Frequent additional work (change orders)	0,860	
	X17	Equipment management errors	0,847	
	X38	Design errors by the designer	0,840	
	X31	Changes in design/work details during execution	0,816	
	X34	Requests for changes to completed work	0,801	
Factor 3	X33	Misunderstanding of shop drawing regulations between designer and contractor	0,765	Operational Control and Inspection Systems
	X12	Poor communication between labor and foremen	0,559	
	X18	Poor equipment quality	0,862	
	X29	Environmental security influence on project development	0,848	
	X40	Inaccurate work duration determination	0,818	
	X27	Work space requirements at the project site	0,706	
	X8	Poor material quality	0,633	
Factor 4	X13	Equipment damage	0,629	Resource Management
	X42	Incorrect or inappropriate construction/execution methods	0,561	
	X4	Damage to construction materials	0,780	
	X9	Labor shortage	0,771	
	X25	Material storage location	0,718	
	X16	Lack of operator capability in operating equipment	0,667	
	X2	Material changes in form, function, and specification	0,635	
	X51	Work disputes between project departments	0,635	
X56	Labor strikes	0,630		
X44	Unscheduled material sample submissions by the contractor	0,597		

Factor 5	X36	Difference in subcontractor schedules for project completion	0,808	Work Preparation
	X19	Financial availability during execution	0,790	
	X30	Incomplete design drawings and specifications	0,773	
	X3	Delay in material delivery	0,721	
	X39	Poorly integrated/unorganized work sequence	0,716	
	X10	Labor capability	0,603	
Factor 6	X14	Unavailability of adequate or appropriate work equipment	0,737	Equipment and Materials
	X6	Scarcity due to material specificity	0,708	
	X1	Shortage of construction materials	0,670	
	X15	Delay in equipment delivery or provision	0,663	
	X5	Delay in specialized building material fabrication	0,598	
Factor 7	X26	Access to project site	0,839	Geographical Constraints
	X28	Geological problems at project site	0,799	
	X37	Errors in soil investigation	0,798	
Factor 8	X24	Surface and subsurface soil conditions	0,608	Project Alterations
	X32	Changes in scope of work during execution	0,600	
Factor 9	X7	Inaccuracy in execution timing	0,496	Unforeseen Factors
	X23	Material price changes	0,447	

Based on the analysis, all measured variables met the minimum **loading factor threshold of 0.5**. The loading factor value represents the degree of correlation between a specific variable and the identified delay factors that potentially trigger disputes. For instance, item **X52** yielded a loading factor of **0.795**, indicating a **79.5% correlation** with the latent factor. A higher loading factor signifies a stronger relationship between the variable and the underlying cause of project delays. The naming of the nine identified factors was determined by the common characteristics of the clustered variables and subjective analytical interpretation (Utama, 2011).

Table 5. Percentage of Variance for the Dominant Delay Factors Potentially Triggering Project Disputes

No.	Factor Name	Number of Variables	Variance (%)
1	Coordination, Control, and Work Evaluation	11	49.914%
2	Planning and Contractual Documentation	9	7.583%
3	Operational Control and Inspection Systems	7	6.372%
4	Resource Management	8	5.745%
5	Work Preparation	6	4.594%
6	Equipment and Materials	5	3.384%
7	Geographical Constraints	3	3.068%
8	Project Alterations	3	2.368%
9	Unforeseen Factors	1	2.022%

According to the *Total Variance Explained* results, **Coordination, Control, and Work Evaluation (Factor 1)** emerged as the most dominant factor, accounting for a substantial **49.914%** of the variance. This factor consists of 11 variables, underscoring that construction project success relies heavily on the synergy between field control and continuous evaluation. Inadequate coordination among stakeholders often leads to misunderstandings and contractual disputes.

Overall, this study identifies nine factor groups contributing to construction delays in Badung Regency. These factors, ranging from planning and contractual issues to unforeseen events, require focused attention from construction practitioners to mitigate delays and prevent potential legal or professional disputes.

Based on the factor analysis, this study identifies nine primary factor groups contributing to construction project delays and potential disputes in Badung Regency. These factors require significant attention from all stakeholders involved in construction contracts to prevent delays that may lead to professional or legal disputes. The identified factors are: (1) Coordination, Control, and Work Evaluation; (2) Planning and Contractual Documentation; (3) Operational Control and Inspection Systems; (4) Resource Management; (5) Work Preparation; (6) Equipment and Materials; (7) Geographical Constraints; (8) Project Alterations; and (9) Unforeseen Factors. These findings serve as a strategic guide for contractors to mitigate the risks of delays and disputes.

4. CONCLUSION

Through factor analysis, nine dominant factor groups were established, with Coordination, Control, and Work Evaluation emerging as the most significant contributor, accounting for 49.914% of the total variance. The magnitude of this variance suggests that the majority of project delays in Badung Regency are not caused by isolated technical failures, but by systemic managerial weaknesses. In the context of regional contractors (K1-M2), coordination often becomes the primary bottleneck due to informal communication patterns and a lack of standardized oversight protocols. Practically, this implies that to reduce contract disputes,




stakeholders must shift their focus from purely technical solutions to integrated project management systems. Implementing mandatory periodic evaluation meetings and digitalized reporting tools could significantly mitigate the communication gaps that currently trigger nearly half of the delay-related conflicts in the region.

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