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Unveiling Latent Dispute Causes in Construction: A Social Network Perspective

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Abstract

Construction disputes often arise not from isolated incidents but from interconnected latent causes, underlying systemic issues that remain hidden until activated by project dynamics. This study explores these latent dispute causes within the Kenyan construction industry using Social Network Analysis (SNA). A dataset of 30 documented dispute cases was analyzed, supported by expert validation, to identify 14 latent causes such as inequitable contractual practices, ambiguous contract terms, conflicts of interest, and incomplete designs. The analysis was conducted using the University of California Network (UCINET) software, which enabled the generation of adjacency matrices and calculation of centrality measures to map the interdependencies and influence among dispute causes. Results indicate that disputes often stem from power asymmetries, unclear scopes, and overlapping roles, particularly prevalent in Design-Bid-Build procurement systems where a single agent handles design, supervision, and certification. Centrality scores revealed inequitable practices and contract ambiguities as the most influential latent factors. The study highlights the inadequacy of traditional linear models in capturing these non-linear and weighted relationships. Key recommendations include clear role segregation, adaptive risk management, transparent contract structuring, and integration of predictive analytics like SNA. This research provides a robust, system-level framework for proactively identifying and mitigating latent dispute risks in construction.

Keywords

Contract Administration, Construction Disputes, Information Asymmetry, Social Network Analysis

1. Introduction

The construction industry is characterized by complex contractual relationships

and high interdependencies among project stakeholders, arising from layered contractual obligations, multi-party engagements, and dynamic project environments [1]. These complexities often create latent conditions that can escalate into disputes when contractual provisions fail to address emerging risks and ambiguities. While patent causes of disputes such as cost overruns and defective workmanship are well-documented [2] [3], they do not fully account for the hidden mechanisms that contribute to dispute propagation. Latent causes, such as contractual ambiguities [4], asymmetric risk allocation, and hidden project uncertainties [5], are not immediately observable but play a crucial role in dispute escalation [6]. The inability to proactively identify and mitigate these latent factors can lead to prolonged conflicts and inefficiencies in dispute resolution. This study addresses the gap in existing literature by systematically categorizing and assessing these latent factors, providing a framework for understanding their influence on dispute dynamics.

Previous research has explored underlying causes of construction disputes, often referring to them as "pathogens" or contextual elements such as uncertainty, opportunism, and bounded rationality. While these studies recognize that latent factors play a critical role in dispute emergence, they generally treat these causes in isolation. For example, [7] [8] highlighted how bounded rationality and opportunistic behaviors influence disputes. [5] emphasized that existing dispute resolution mechanisms fall short because they overlook connections between root causes and the consequences of disputes. However, these prior studies do not examine how different causes interact or influence one another. As a result, they offer limited insights into the effectiveness of dispute resolution strategies when faced with complex, interrelated factors.

Current dispute analysis frameworks predominantly rely on linear models such as Bayesian Belief Networks (BBN) [9] and Fault Tree Analysis (FTA) [10], which fail to capture the interdependencies and propagation mechanisms of disputes. As a consequence, these models provide an oversimplified view of dispute causation, leading to inadequate risk assessment and ineffective mitigation strategies. The inability to account for complex interactions between dispute causes can result in delayed dispute resolution, increased project costs, and a higher likelihood of litigation. This limitation necessitates an alternative approach, specifically Social Network Analysis (SNA), to better model the interconnected nature of dispute causes. SNA is particularly suitable because it enables the identification of both direct and indirect relationships between dispute causes, allowing for a more comprehensive understanding of how latent factors influence dispute propagation [11]. Unlike traditional linear models, SNA captures the complexity of construction disputes by mapping interactions among multiple variables and quantifying their influence through centrality measures [12]. Recent studies have demonstrated that SNA provides a more accurate representation of risk interdependencies in construction disputes [13] [14], leading to improved predictive capabilities and mitigation strategies. This approach provides valuable insights into how dis-

putes evolve and offers a structured methodology for preemptive mitigation strategies.

Contribution of the study: identifying and categorizing key latent dispute causes in construction projects; assessing how these latent factors contribute to dispute propagation using SNA.

2. Literature Review

2.1. Definition and Nature of Latent Dispute Causes

Latent dispute causes are underlying conditions that remain inactive until triggered by project conditions [15]. Recent studies emphasize that such causes are deeply embedded in the structure of construction contracts and project governance [6]. For instance, contractual incompleteness often arises from ambiguities in risk allocation and undefined responsibilities, leading to misinterpretations that can escalate into disputes [1]. Power imbalances, particularly in client-contractor relationships, have been found to create adversarial conditions where dispute resolution mechanisms are biased or ineffective [16]. Furthermore, strategic uncertainties, including fluctuating regulatory frameworks and unforeseen market conditions, introduce external volatility that exacerbates latent disputes [7].

This conceptualization of latent dispute causes differs from the contextual factors outlined by [7], who focus on external and internal project environments as key contributors to disputes. Their framework emphasizes project-specific constraints such as regulatory shifts, market conditions, and cultural differences, alongside organizational factors like stakeholder misalignment and resource dependencies. [8] linked occurrence of construction disputes to contextual factors of contracting such as opportunism and bounded rationality. Ambiguity, deficiency, inconsistency and defectiveness of construction contracts were used to indicate opportunism. [5] linked the use on less optimal dispute resolution methods to the failure to consider hidden factors associated with the concept of decisional uncertainties in the contracting process. Decisional uncertainties were dimensioned into substantive, strategic and institutional forms. While decisional uncertainties are often immediate and observable in court proceedings, latent causes operate more subtly, remaining dormant until certain project conditions activate them. While their approach highlights contextual influences on disputes, the latent dispute cause matrix model presented in this study delves deeper into hidden, systemic vulnerabilities that may not be immediately apparent but contribute to dispute propagation over time.

2.2. Existing Analytical Approaches and Their Limitation

Understanding the causes of disputes in construction requires robust analytical methods that can capture the complexity of interdependencies among various factors. Different modeling approaches have been applied to analyze dispute causation, each with unique strengths and limitations. Traditional approaches such as Fault Tree Analysis [17] and Bayesian Belief Networks (BBN) (FTA) [18] have

been widely used to identify dispute pathways, yet they fail to fully account for the weighted and non-linear relationships that characterize dispute propagation [19].

In contrast, SNA offers a more comprehensive approach by mapping interactions between dispute causes and quantifying their influence [20] [21]. Other methods applied in construction dispute literature include System Dynamics (SD), which captures feedback loops and time-dependent interactions between dispute factors [22] [23]. However, it for example lacks detailed cause-effect quantification metrics [24]. Multi-Criteria Decision Analysis (MCDA) has also been utilized to assess dispute resolution options [1], though it typically focuses on ranking rather than understanding underlying causal structures. This section reviews these analytical approaches, their limitations, and the advantages of SNA in construction dispute analysis.

Fault Tree Analysis (FTA) models dispute causation hierarchically but fails to capture weighted relationships [10]. Unlike unweighted relationships, which treat all connections as equally influential, weighted relationships allow for the differentiation of causal strength, making them crucial in modeling construction disputes [21]. Recent studies highlight those weighted relationships provide a more nuanced understanding of dispute propagation, revealing key nodes that disproportionately influence outcomes [25]. In contrast, FTA's binary structure limits its capacity to reflect varying dispute intensities [17], leading to oversimplified causation models that fail to capture the systemic nature of construction conflicts.

Bayesian Belief Networks (BBN) predict dispute occurrences based on linear dependencies but overlook non-linear interdependencies [9]. Linear dependencies assume a direct, proportional relationship between variables, which simplifies causation analysis but fails to capture the complex nature of construction disputes. In contrast, non-linear interdependencies reflect the reality that dispute causes interact dynamically [25], where small changes in one factor can lead to disproportionate outcomes or trigger cascading effects across multiple contractual relationships. Recent studies highlight that non-linear modeling better represents dispute propagation patterns [20], particularly in cases where disputes evolve unpredictably due to compounding latent factors. Consequently, analytical models that fail to incorporate non-linear interdependencies may lead to incomplete risk assessments and ineffective dispute mitigation strategies.

SNA, in contrast, enables a holistic, system-wide perspective by mapping dispute causes as interconnected nodes [11]. SNA originates from sociology and network science, where it has been used to study relationships, influence, and power dynamics within structured systems [26]. Its application in construction management has grown significantly, particularly in analyzing risk networks [27], stakeholder influence [28], and contractual interdependencies [24]. In construction contracting, SNA has been used to model dispute pathways by visualizing how contractual ambiguities, misaligned incentives, and power imbalances contribute to conflict propagation [20]. By quantifying the significance of different dispute causes through centrality measures such as degree and betweenness, SNA enables

practitioners to identify key nodes within dispute networks, thereby enhancing mitigation strategies.

2.3. Categorization of Latent Dispute Causes

Table 1 Categorization of Latent Dispute Causes, Their Causes, and Indicators in Construction Disputes. Categorization is crucial in construction dispute analysis as it provides a structured framework for identifying patterns, assessing risk factors, and developing targeted mitigation strategies [6]. By grouping dispute causes into contractual, behavioral, and project-specific factors, researchers and practitioners can better understand their interdependencies and prioritize interventions accordingly [25]. This structured approach not only enhances dispute resolution efficiency but also informs policy and contractual improvements to prevent future conflicts.

Table 1. Latent causes categorization framework.

Category	*Causes*	*Indicators*	*Summarized Meaning*
Contractual Factors	Contract ambiguities [9], incomplete risk allocation [6], misaligned incentives [12].	Frequent contract disputes [2], inconsistent risk-sharing mechanisms [33], contract renegotiations [34].	Lack of clarity or fairness in contract terms, leading to disputes over rights, responsibilities, and risks.
Behavioral and Organizational Factors	Conflicts of interest [29], decision-making asymmetry [30], stakeholder power dynamics [31]	Unilateral decision-making [35], disputes over authority [35], lack of stakeholder consensus [9].	Power struggles, misalignment of stakeholder interests, and ineffective decision-making structures that escalate disputes.
Project-Specific Factors	Hidden uncertainties [5], lack of prior interactions [31], information asymmetry [32].	Unexpected cost escalations [2], communication breakdowns [6], misinformation in project execution [36].	Unforeseen project complexities, lack of prior collaboration, or uneven access to critical information that creates misunderstandings.

Source: Researchers' field data.

This categorization differs from frameworks such as that of [10], who focus on dispute events and escalation pathways, emphasizing triggers like claim-related issues, contract administration deficiencies, and behavioral misalignments. While their approach is event-driven, highlighting immediate dispute triggers, the categorization in this study focuses on latent dispute causes and their propagation mechanisms. By using SNA, this study models how latent causes interact systemically, providing a broader understanding of dispute interdependencies rather than isolated dispute occurrences. This approach allows for targeted mitigation strategies that address systemic vulnerabilities rather than just reactive dispute resolution.

3. Methodology

3.1. Step-by-Step

3.1.1. Objective 1: Identifying and Categorizing Key Latent Dispute Causes

Literature Review: A comprehensive review of prior studies on construction dispute causation was conducted to identify common latent causes [5]-[7].

Data Collection: A dataset of 30 construction dispute cases was sourced from Kenya's arbitration and legal dispute records.

Textual Analysis: Each case was examined to extract underlying dispute causes, particularly those that were not immediately apparent at the onset of the dispute.

Categorization: The identified causes were classified into contractual, behavioral, and project-specific factors based on their characteristics and role in dispute propagation.

3.1.2. Objective 2: Assessing How Latent Dispute Causes Contribute to Dispute Propagation

The process of identifying latent construction dispute causes began with a comprehensive literature review to determine the most frequently cited factors in prior research. These findings were synthesized into a preliminary list of causes, which served as the foundation for developing a structured interview guide.

3.2. Latent Causes and Indicators Measured

Table 2 presents 14 latent causes of construction disputes and their indicators that were extracted from the literature. Unlike patent causes, latent factors are characterized by a state of dormancy, which becomes active if triggered by interactions with other causes. Accordingly, the latent causes were rated by the Subject Matter Experts whose profile is shown at Table 3.

Table 2. Latent causes and indicators measured.

Node ID	*Latent cause*	*Indicator*
LC1	Inequitable contractual practices	Employer's agent certification authority, site asset specificities
LC2	Mismatch between contractual practices	Mismatching fixed price with cost-plus
LC3	Unequal information distribution	Information withholding
LC4	Conflict of interest	Kickbacks, fictitious claims
LC5	Ambiguities in contract terms	Unclear scope, Unclear specifications
LC6	Incomplete design	Drawing's insufficient details
LC7	Contractual inconsistency	Discrepancies between documents
LC8	Defectiveness	Missing & over measured items
LC9	Substantive uncertainty	Contract misinterpretation
LC10	Strategic misrepresentation	Intentional under estimation
LC11	Institutional uncertainty	Lack of a common understanding
LC12	Hidden characteristics	Understated or overstated capacity

Continued

LC13	Lack of prior relationships	Mistrust
LC14	Hold-up	Forced renegotiations, Termination threats
LC1	Inequitable contractual practices	Employer's agent certification authority, site asset specificities

Source: Researchers' field data.

To ensure the data collected would be reliable and relevant, the study applied purposive sampling to select 17 expert respondents from the Chartered Institute of Arbitrators (CIArb), Kenya Chapter. These professionals were chosen based on their qualifications, such as holding chartered or fellow status within CIArb, and their practical experience in construction dispute resolution through arbitration or adjudication.

The interview guide was designed to elicit expert opinions through two core components: a demographic section capturing professional background, and a second section consisting of Likert-scale items used to evaluate the perceived significance of each identified dispute cause. To ensure its effectiveness and clarity, the tool was piloted with two experienced practitioners. Their feedback informed necessary revisions to improve the guide prior to its deployment in the main study.

Data collection involved conducting structured online interviews with 15 of the 17 initially identified experts. During these interviews, participants evaluated each dispute cause according to its perceived frequency and importance based on their field experience. The responses were documented and systematically entered into a Microsoft Excel spreadsheet in preparation for network analysis.

Before analysis, the data was formatted to capture the relational links between dispute causes, illustrating how one cause could trigger or influence another. This structure was essential for the application of SNA, which was conducted using UCINET software. The analysis relied on three key centrality measures: degree centrality, which identified the number of direct connections a cause had; Bonacich power centrality (also known as BetaCent), which measured the overall influence of a cause within the network; and eigenvector centrality, which indicated a cause's influence based on its association with other prominent nodes.

4. Results and Discussion

4.1. Demographic Profile

TABLE III. shows that the study engaged 13 subject matter experts (SMEs), predominantly quantity surveyors (80%) and civil engineers (20%). Their years of professional experience ranged from 8 to 37, with an average of 16.8 years. A trend emerged showing that those with more experience had handled a larger number of dispute cases, indicating a strong link between practice duration and dispute resolution involvement.

4.2. Latent Cause by Event Matrix

Table 3 presents a matrix that links each of the 14 identified latent causes of construction disputes with individual subject matter experts (SMEs) who evaluated them. The rightmost column of the table tallies how frequently each cause was cited. The most commonly identified cause was unfair contractual practices, especially those associated with the employer's agent's authority and the unique nature of the project site. This aligns with [37], findings that unilateral authority by contract administrators often correlates with disputes. The next most frequent cause was ambiguity in contract terms, such as unclear scopes and specifications, which supports [4] conclusion that such uncertainties can lead to misinterpretation and conflict. Incomplete design documentation, indicated by insufficient drawings, was also frequently cited. These echoes [38], who noted that design flaws are a major source of conflict, particularly in contracts that assign the same party both design and supervisory responsibilities.

Table 3. Background of interviewees.

Interviewee	Profession	Years of experience	Number of cases involved in
SME 1	C.Eng.	12	16
SME 2	QS	37	46
SME 3	QS	10	8
SME 4	QS	21	21
SME 5	QS	29	42
SME 6	QS	20	48
SME 7	QS	26	27
SME 8	QS	8	9
SME 9	QS	9	15
SME10	C.Eng.	8	9
MSE11	QS	12	17
SME12	QS	16	15
SME 13	C.Eng.	10	11
		Average = 16.8	

Key: SME = Subject matter expert; QS = Quantity surveyor; C. Eng. = Civil Engineer. Source: Researcher's field data.

Table 4 also highlights that flaw in the contract specifically, items being omitted, overestimated, or underestimated, rank as the third most frequent source of disputes. Similarly, conflicts of interest, exemplified by practices such as bribery or fraudulent claims, are equally prevalent. These findings suggest that disputes often stem from a combination of poorly structured contracts and questionable behaviors among involved parties. Given that construction projects are not yet

built at the time contracts are made, some necessary information is inherently unavailable, making it difficult to plan for every possible future condition. This uncertainty, combined with self-serving conduct among parties, creates an environment of mutual distrust, which significantly contributes to disputes. Therefore, it is crucial to examine how these latent causes interact with one another.

Table 4. A latent by SME event matrix.

	SME1	SME2	SME3	SME4	SME5	SME6	SME7	SME8	SME9	SME10	SME11	SME12	SME13	Fre
LC1	4	4	3	2	4	2	4	4	3	2	4	3	3	42
LC2	1	1	1	1	0	0	1	0	0	1	1	0	1	8
LC3	2	1	2	0	2	3	2	1	2	0	2	0	1	18
LC4	3	3	2	3	2	3	3	1	2	3	1	3	3	32
LC5	4	4	3	4	4	3	2	3	4	3	1	2	2	39
LC6	3	2	2	1	4	2	3	3	4	4	3	1	2	34
LC7	3	4	4	4	0	3	1	2	3	0	4	0	2	30
LC8	3	3	2	3	0	4	2	4	3	1	2	4	1	32
LC9	2	2	1	2	4	4	4	0	3	1	1	3	3	30
LC10	0	0	2	0	3	4	3	1	2	3	2	2	4	26
LC11	1	2	0	2	4	4	0	2	1	3	3	0	2	24
LC12	3	3	1	3	4	2	4	1	1	3	1	2	2	30
LC13	0	1	0	1	0	1	1	1	0	0	1	2	1	9
LC14	1	0	1	0	1	3	0	2	1	0	0	2	1	12

Source: Researcher's field data.

4.3. Co-Occurrence between Latent Causes

The adjacency matrix in Table 5 maps out the relationships among the different latent causes of disputes, with each row and column representing one such cause. The values along the diagonal reflect the frequencies from Table 4, confirming the accuracy of the data transformation. Since the matrix is symmetrical, meaning values above and below the diagonal mirror each other, either side can be used for analysis. Any value above one suggests that two causes appeared together in dispute events, and higher values indicate stronger connections or interdependencies among them.

One key insight from the analysis is the strong relationship between unfair contractual practices, such as the broad authority given to the owner's agent and reliance on site-specific assets, and ambiguities in contract terms, like unclear project scope or specifications. This issue often arises in FIDIC-based contracts, where a single agent is responsible for multiple roles: design, supervision, certification, and acting as the first line of dispute resolution. Since this agent is employed and paid by the project owner, there's a natural concern about bias in decision-making. When the same person is responsible for both creating the design and inter-

preting ambiguous clauses, it becomes difficult for them to remain neutral, especially when disputes arise between the contractor and the owner. This overlap of roles increases the risk of disputes by creating an imbalance of power and undermining trust in the fairness of contract enforcement.

The second most prominent connection in the co-occurrence analysis is between inequitable contractual practices (LC1) and incomplete design (LC6). This pairing highlights a frequent issue where the same party, typically the owner's agent, is responsible for both contract administration and design duties, creating a breeding ground for disputes. This dual-role scenario often results in biased contract execution and increased room for interpretation or error. This aligns with findings by [27], who noted that contracts assigning design responsibilities along with certification authority are often linked to disputes, especially those involving payment claims.

The third key finding from **Table 5** is the strong interconnection between contract ambiguities (LC5) and incomplete design (LC6). This reinforces the idea that disputes often arise when contract administration responsibilities are combined with design duties. This observation aligns with [2], who identified design errors as one of the leading causes of disputes. Although design flaws are generally considered direct (or "patent") causes, this linkage reveals how they may originate from deeper, hidden ("latent") issues, such as unclear design responsibilities, thereby demonstrating the interplay between latent and patent causes of construction disputes.

The fourth notable finding from **Table 5** highlights a strong link between inequitable contractual practices (LC1) and conflict of interest (LC4). Conflict of interest in this context includes behaviors such as kickbacks and false claims made by the owner's agent. This relationship supports the findings of [6], who associated the agent's power with self-serving behavior. The root of this issue lies in the dual roles often assigned to the agent, acting both on behalf of the owner and as a neutral party. This combination leads to a conflict of roles, making the agent's decisions more prone to bias and manipulation. Therefore, merging agency duties with neutral arbitration responsibilities significantly increases the risk of disputes in construction projects.

Table 5. Latent cause by latent cause matrix.

	LC1	LC2	LC3	LC4	LC5	LC6	LC7	LC8	LC9	LC10	LC11	LC12	LC13	LC14
LC1	42	8	17	29	34	31	26	28	28	22	21	28	9	11
LC2	8	8	6	8	8	8	7	8	8	5	6	8	5	3
LC3	17	6	18	17	17	17	15	16	15	15	12	14	6	9
LC4	29	8	17	32	29	25	21	25	25	22	18	27	9	11
LC5	34	8	17	29	39	30	26	27	25	21	21	28	9	12
LC6	31	8	17	25	30	34	21	23	23	21	21	25	8	10
LC7	26	7	15	21	26	21	30	23	17	13	16	18	7	9

Continued

LC8	28	8	16	25	27	23	23	32	22	17	16	21	9	11
LC9	28	8	15	25	25	23	17	22	30	20	18	24	8	10
LC10	22	5	15	22	21	21	13	17	20	26	16	19	7	10
LC11	21	6	12	18	21	21	16	16	18	16	24	19	6	9
LC12	28	8	14	27	28	25	18	21	24	19	19	30	9	10
LC13	9	5	6	9	9	8	7	9	8	7	6	9	9	5
LC14	11	3	9	11	12	10	9	11	10	10	9	10	5	12

Source: Researchers' field data.

4.4. The Significant Latent Causes of Construction Disputes

Table 6 outlines the centrality scores for various latent causes of disputes in construction, enabling their prioritization. Measures like degree centrality, Bonacich power (BetaCent), normalized degree, and eigenvector centrality show that the most influential latent causes are inequitable contractual practices, ambiguous contract terms, conflicts of interest, incomplete designs, hidden characteristics, contract defectiveness, and substantive uncertainties.

Among the various latent causes analyzed, inequitable contractual practices stood out as the most influential factor contributing to construction disputes. One of the critical dimensions of this issue is site asset specificity, a concept that highlights the unique, immovable nature of a construction project relative to its location. In simpler terms, once a project is built on a particular site, it cannot be relocated or repurposed without substantial loss or cost. This characteristic inherently ties the project's value and function to a fixed geographical space, thereby giving rise to power asymmetries between contracting parties, particularly between project owners and contractors.

These power imbalances become especially apparent when disputes emerge concerning payment obligations or valuation of completed work. Since the project cannot be transferred elsewhere, contractors are effectively locked into that site and project. In the event of delayed payments or contested certifications of work done, contractors often find themselves financially exposed and without viable alternatives. They cannot withdraw their work or seek compensation elsewhere, which puts them in a vulnerable bargaining position. This phenomenon significantly increases the risk of disputes and prolongs their resolution.

Supporting this view, [39] emphasized that site asset specificity creates an environment where the party controlling certification or payment processes, typically the employer's agent, can wield disproportionate influence. Because contractors cannot walk away from the site without suffering financial loss, employers or their agents may exploit this dependence, either intentionally or unintentionally. This structural imbalance complicates dispute resolution and often leads to protracted conflicts.

In essence, the embedded nature of site-specific construction projects intro-

duces a non-negotiable physical constraint that alters power dynamics. These dynamics, if not addressed contractually or through neutral oversight mechanisms, can act as latent triggers for significant disputes later in the project lifecycle.

Another major contributor to construction disputes identified in the study is ambiguity in contract terms, which is closely associated with the broader concept of contractual incompleteness. In the construction context, contractual incompleteness refers to the inherent limitation of contracts to fully anticipate and detail every possible scenario, risk, or condition that might arise over the life of a project. This limitation stems from the complexity and unpredictability of construction environments, where changes in scope, design, site conditions, or market variables can introduce challenges that were not originally envisioned during contract drafting.

Ambiguities in a contract often manifest in areas such as vague scope definitions, poorly articulated specifications, or unclear criteria for payment and performance evaluation. These gaps create room for divergent interpretations by project stakeholders, owners, contractors, and consultants, each of whom may have competing interests. As a result, disagreements frequently arise over what was agreed upon versus what is being delivered, especially when the project encounters unforeseen conditions or scope adjustments.

These ambiguities are not merely minor drafting oversights, they represent structural vulnerabilities that can become activated under stress. For example, when there is a lack of clarity about how changes should be evaluated or priced, contractors might interpret this in a way that maximizes their claim potential, while employers might resist additional payments, citing insufficient justification. This misalignment of expectations becomes a fertile ground for disputes, especially if there is no clear dispute resolution mechanism embedded in the contract.

The findings of this study are consistent with those of [1], who observed that contractual ambiguity, particularly in the form of excessive change demands and frequent scope modifications, was a dominant factor driving project conflicts. Their work reinforces the view that ambiguity is not simply a linguistic or legal issue but a practical risk factor that influences how responsibilities, liabilities, and costs are interpreted and enforced on site.

Thus, while ambiguity may appear as a passive characteristic of the contract at first, it becomes a latent driver of disputes once activated by project events such as variations, delays, or claims. Addressing such ambiguity requires not only more precise contract drafting but also improved processes for risk allocation, communication, and interpretation among stakeholders throughout the project lifecycle.

5. Conclusion and Recommendations

5.1. Conclusion

This study offers vital insights into how hidden or "latent" causes contribute to the emergence and escalation of disputes in construction projects. The findings demonstrate that disputes rarely arise from isolated issues; rather, they are often

Table 6. Latent cause of construction disputes by centrality measures.

Node	Latent Causes	Degree	nDegree	BetaCent	Normalized Beta Cent	Eigenvector	Rank
LC1	Inequitable contractual practices	292	0.661	289011.1	1.309	0.35	1
LC2	Mismatch between contractual practices	88	0.199	88538.54	0.401	0.107	14
LC3	Unequal information distribution	176	0.398	177123.5	0.802	0.214	11
LC4	Conflict of interest	266	0.602	264274.9	1.197	0.32	3
LC5	Ambiguities in contract terms	287	0.649	284000	1.286	0.344	2
LC6	Incomplete design	263	0.595	262554.6	1.189	0.318	4
LC7	Contractual inconsistency	219	0.495	222036	1.005	0.269	8
LC8	Defectiveness	246	0.557	245500.4	1.112	0.297	6
LC9	Substantive uncertainty	243	0.55	243485.4	1.102	0.295	7
LC10	Strategic misrepresentation	208	0.471	210312.7	0.952	0.254	9
LC11	Institutional uncertainty	199	0.45	201913.4	0.914	0.244	10
LC12	Hidden characteristics	250	0.566	250522.1	1.134	0.303	5
LC13	Lack of prior relationships	97	0.219	97002.98	0.439	0.117	13
LC14	Hold-up	120	0.271	121364.3	0.549	0.147	12

Source: Researchers' field data.

the result of interconnected conditions that amplify one another. Among these, the most prominent and strongly correlated latent causes are inequitable contractual practices and ambiguities in contract terms.

Inequitable practices are typically associated with excessive control held by contract administrators, particularly when they have unilateral authority to make decisions such as certifying payments. This power dynamic becomes even more problematic when paired with ambiguities in contract documents, including unclear project scopes, vague specifications, or undefined roles. Together, these factors create a high-risk environment for misunderstandings and perceived unfairness, fertile ground for disputes to flourish.

The research found that this combination is especially prevalent in Design-Bid-Build (D-B-B) procurement systems, where a single agent or firm often fulfills multiple roles: designer, supervisor, certifier, and initial dispute arbiter. This overlapping of roles blurs the lines of accountability and introduces bias, which can undermine the neutrality expected in contract administration. Thus, disputes tend to co-occur most frequently in projects where there is insufficient separation of these responsibilities.

Three key latent causes emerged as most significant: inequitable contractual practices, rooted in power asymmetries and discretionary authority granted to ad-

ministrators, often leading to biased decisions.

Ambiguities in contract terms, inadequately defined scope and specifications increase the likelihood of conflicting interpretations. Conflict of Interest, particularly problematic when agents act in self-interest, sometimes colluding with contractors through unethical behaviors like kickbacks or misrepresentation.

The third cause is especially concerning in environments where agents act on behalf of both the client and as dispute evaluators, situations that inherently compromise objectivity. This type of collusion becomes more likely when the agent holds superior project knowledge, which allows them to exploit information gaps and manipulate outcomes to their advantage. Such dynamics expose less-informed stakeholders, often the client or contractor, to unfair treatment and escalate the potential for conflict.

5.2. Recommendations

To address the systemic nature of these latent dispute causes, the study proposes the following five recommendations: Proactive and transparent contract structuring: contracts should be designed to distribute responsibilities and decision-making authority clearly and fairly. Special attention must be given to limiting the discretionary powers of certifiers and administrators to avoid excessive influence over dispute outcomes. Early stakeholder engagement and information transparency: Enhancing openness and inclusivity through digital collaboration platforms (such as BIM, shared dashboards) fosters trust and minimizes the risk of information asymmetry. Regular communication and early involvement of all stakeholders create shared understanding and mitigate misunderstandings.

Segregation of oversight and evaluative roles: roles such as project supervision, certification, and dispute adjudication should be assigned to separate, independent entities. This structural change promotes accountability and maintains impartiality in project governance. Adaptive risk management through dynamic risk registers: risk registers should not be static. They need to evolve throughout the project lifecycle, incorporating real-time inputs and identifying emerging uncertainties, especially those related to institutional, strategic, or behavioral shifts that might activate latent risks.

Integration of predictive analytics and network-based tools: applying tools like SNA can help uncover patterns of cause-and-effect among dispute factors. Embedding such tools into project monitoring systems enables early warning and proactive interventions before minor issues escalate into formal disputes. By addressing both the structural flaws in contract design and the behavioral dynamics within project teams, these strategies aim not only to reduce the frequency of disputes but also to enhance the overall governance and resilience of construction projects. The emphasis is on anticipation, clarity, and structural integrity, key pillars for minimizing conflict in an increasingly complex construction environment. A comparative analysis is recommended for future studies in order to outline the global trend on the causes of dispute.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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