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Towards Resilient Construction Contracts: Defining Adaptive Clause Characteristics for Disaster Risk in Indonesia

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Abstract

Indonesia is one of the most disaster-prone countries in the world, facing frequent earthquakes, floods, volcanic eruptions, and other natural hazards that significantly disrupt infrastructure development. However, most construction contracts used in Indonesia remain rigid and ill-equipped to accommodate such risks. This study aims to identify the key characteristics required for disaster-responsive contract clauses that are contextually grounded, legally sound, and operationally feasible. Using a qualitative desktop study approach, this research analyzes standard contract models commonly used in Indonesia, namely based on Presidential Regulation No. 16/2018, MPWH templates, and FIDIC, and compares them against the country's disaster risk landscape. The findings reveal gaps in disaster-specific risk allocation, post-disaster recovery procedures, and integration of local hazard data. To address these challenges, the paper proposes a set of adaptive contract characteristics, including context-based risk mapping, actionable emergency protocols, legally grounded thresholds for clause activation, and flexible mechanisms for suspension, renegotiation, and compensation. These characteristics can serve as a foundation for revising standard contract documents and improving legal resilience in infrastructure contracting, which would ultimately enhance project continuity and reduce disputes.

Keywords

Construction, Contract clauses, Disaster-responsive, Indonesia

Introduction

Indonesia's geographic position on the Pacific Ring of Fire makes it one of the most disaster-prone countries globally, facing regular earthquakes, floods, volcanic eruptions, and landslides (Widyangga et al., 2024). These recurring events severely disrupt infrastructure projects, causing delays, cost overruns, and contractual disputes (Riefky et al., 2021). Despite these recurring threats, construction contracts in Indonesia typically lack adequate responsiveness to disaster risks. Most existing contractual frameworks rely on general force majeure clauses,

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which often fail to specify the types of disasters, each party's responsibilities, and mechanisms for risk sharing and adaptation. This results in confusion, legal ambiguity, and project inefficiencies during disasters.

Indonesia's regions such as Sumatra, Java, Bali, Nusa Tenggara, and Sulawesi are especially vulnerable due to active tectonic plate boundaries and volcanic belts (Widyangga et al., 2024). Infrastructure projects in these areas frequently face risks of ground shaking, soil liquefaction, and volcanic ash fall, which can lead to structural damage, delays, or even total project shutdowns (Asifah et al., 2023). However, many project stakeholders still underestimate these risks during the planning phase, leading to under-preparedness in contract terms and technical specifications.

In addition to geological hazards, hydro-meteorological disasters such as floods, landslides, and intense rainfall events also pose major challenges. These are especially prevalent in Java and Kalimantan, where deforestation, land-use change, and urban sprawl exacerbate natural vulnerabilities. Construction projects located near rivers, slopes, or low-lying areas are highly susceptible to sudden environmental shifts, which can cause equipment damage, loss of access, or compromised safety. Unfortunately, these seasonal and location-specific risks are often addressed reactively, with little anticipation embedded in construction contracts or project timelines.

Beyond the direct physical impacts of disasters, secondary risks significantly affect project implementation and management. These include disruptions to labor availability and mobility, interruptions in material supply chains, and restricted access to construction sites due to damaged transportation or communication networks. Such indirect impacts are rarely quantified during risk assessments or reflected in contractual provisions, despite their considerable influence on project costs and duration (Mohammadi et al., 2024). Moreover, the cascading effects of disaster-related delays can affect subcontractor relationships, insurance claims, and community engagement, amplifying the risks faced by contractors and project owners.

Despite the regular occurrence of these hazards, disaster risk is not systematically embedded in the majority of infrastructure project contracts in Indonesia (Riefky et al., 2021). Project documentation typically lacks disaster-specific clauses, risk allocation mechanisms, or contingency procedures tailored to local hazard profiles. This oversight reflects a broader gap in integrating disaster risk management into project governance and legal instruments. As a result, when disasters strike, projects are often left exposed to legal uncertainty, financial strain, and fragmented emergency responses. The lack of preparedness at the contractual level significantly hampers Indonesia's ability to build infrastructure that is both resilient and responsive to its unique risk landscape. This paper addresses the urgent need to formulate adaptive construction contract clauses that respond to Indonesia's specific disaster risk profile. It aims to analyze the limitations of current contract models in disaster situations. The second objective is to identify key characteristics for disaster-responsive contract clauses.

Methodology

This study adopts a qualitative research approach, focusing on doctrinal legal research and comparative analysis to explore the adaptability of construction contract clauses in disaster-prone contexts. It investigates normative gaps in existing contract frameworks and identifies key characteristics for disaster-responsive contract clauses. The doctrinal analysis is used to examine primary legal documents, namely the FIDIC Red Book 2017, the Presidential Regulation No. 16/2018 on Government Procurement, and a standard contract template issued by the Ministry of Public Works and Housing (MPWH) through the Ministry Regulation No. 25/2020 on Standards and Guidelines for Procurement of Integrated Design and Build Construction Works Through Providers.

The selection of the three contract models is deliberate. The FIDIC Red Book 2017 represents the most widely adopted international standard form used in Indonesian infrastructure projects, particularly those involving foreign funding. Presidential Regulation No. 16/2018 serves as the primary legal framework governing public procurement in Indonesia. Meanwhile, MPWH Regulation No. 25/2020 provides the operational standard contract template for integrated design-and-build projects under the Ministry of Public Works and Housing. Together, these instruments constitute the dominant contractual and regulatory ecosystem for public construction projects in Indonesia, making them highly relevant for examining the adaptability of disaster-responsive contracts.

The research begins with a document review to assess the extent to which existing contractual models accommodate unforeseen events, force majeure, risk allocation, and recovery mechanisms. To ensure systematic comparison, this study employs a comparative analytical matrix based on predefined resilience-related criteria. The matrix evaluates each contract framework across several dimensions: (1) definition and scope of force majeure, (2) allocation of disaster-related risks, (3) extension of time provisions, (4) variation and adjustment mechanisms, (5) suspension and termination rights, and (6) dispute resolution flexibility. These criteria were derived from disaster resilience theory and construction contract risk management principles.

The doctrinal analysis was conducted using a thematic coding approach. Relevant clauses from each contract model were identified, extracted, and categorized into thematic groups corresponding to the analytical matrix. The coding process was conceptual (Braun & Clarke, 2006), focusing on normative interpretation and legal coherence. This structured comparison allows identification of normative gaps and strengths in accommodating disaster-related disruptions. Then, the study employs a conceptual synthesis of findings to identify the key characteristics of disaster-responsive contract clauses. The outcome is a conceptual basis that can guide future policy and regulatory reforms in Indonesia's construction contract system.

Results and Discussion

Limitations in Existing Contract Models

An in-depth review of standard construction contracts commonly used in Indonesia, such as those

governed by Presidential Regulation No. 16/2018 on Government Procurement, a model contract issued by MPWH (based on MPWH Regulation No. 25/2020), and international forms like FIDIC, reveals significant limitations in addressing disaster risks.

Firstly, most contracts rely heavily on generic force majeure clauses. These typically refer to "natural disasters" or "acts of God" without offering clear definitions, thresholds, or operational procedures. For example, in the Presidential Regulation No. 16/2018 on Government Procurement, Natural disasters are not mentioned under the force majeure section and are not detailed by specific types (e.g., earthquake, flood, volcanic eruption) or geographic relevance. While FIDIC and MPWH Regulation No. 25/2020 mention natural disasters as part of exceptional events (Clause 18.1) and force majeure (S.1.1), these clauses rarely outline what constitutes sufficient evidence to invoke force majeure. This ambiguity leaves contractors and project owners uncertain about their legal standing when disasters occur.

Furthermore, risk allocation mechanisms in these contracts tend to disproportionately burden the contractor, without sufficient flexibility to accommodate the shifting risk landscape presented by disasters. In the FIDIC model, risk remains heavily on the contractor unless explicitly amended, while both the MPWH and Presidential Regulation No. 16/2018 lack proactive clauses for disaster mitigation or equitable risk-sharing. This imbalance can lead to disputes and project delays during post-disaster recovery when contractors face unforeseen conditions without adequate contractual protection.

The variations and claims mechanisms in all three models also exhibit significant rigidity. Although extensions of time are permitted, the processes are bureaucratic, formalistic, and lack the agility required in emergency or disaster conditions. Cost adjustments related to disaster impacts are generally excluded or unclear, leaving contractors unable to recover financial losses unless they engage in time-consuming claims procedures, an impractical route during urgent post-disaster recovery phases.

Additionally, all models fail to include explicit post-disaster recovery provisions. There is no guidance on project re-scoping, redesign, or contract modification after a disaster has occurred. This omission is critical in a country like Indonesia, where construction works often intersect with hazard-prone zones. The lack of recovery mechanisms creates legal and operational uncertainty, delaying reconstruction efforts and increasing public sector vulnerability (Anthopoulos et al., 2013).

In terms of flexibility and adaptability, the FIDIC contract, though internationally standardized, must be substantially adapted to local contexts. The MPWH and Presidential Regulation No. 16/2018, on the other hand, are highly rigid and centralized, requiring high-level approvals for any modification, which slows down response during disasters. The absence of predefined flexibility contradicts the very nature of resilience that should be embedded in disaster-sensitive construction governance (Kalak et al., 2024).

Finally, none of the models adequately integrates local risk profiles. There is a striking absence of clauses that incorporate Indonesia’s disaster risk zoning or regional hazard maps. This disconnect suggests that the legal instruments currently in use are not sufficiently grounded in

spatial risk data or national disaster management strategies. Without integration of local risk parameters, contracts remain reactive rather than proactive, ultimately undermining resilience in infrastructure development.

These limitations collectively contribute to project delays, unbalanced risk distribution, and increased legal disputes after disasters. The current contractual ecosystem in Indonesia lacks structural resilience and does not encourage proactive disaster preparedness. This reactive approach not only affects construction timelines and costs but also undermines long-term infrastructure reliability and investor confidence. Addressing these gaps requires a paradigm shift in how contracts are drafted, reviewed, and enforced. Future contract models must incorporate disaster risk considerations from the outset, through contextual risk mapping, adaptive clause formulation, and clearly defined procedural responses. This is crucial to ensure legal clarity, financial fairness, and operational continuity of construction projects when disasters strike.

Table 1. Comparative analysis of limitations of current contract models in disaster situations

Aspect	FIDIC Red Book 2017	MPWH Contract (Regulation No. 25/2020)	Presidential Regulation No. 16/2018
Force Majeure Definition	Recognizes force majeure, but lacks specific guidance for localized or recurring disasters common in Indonesia	Recognizes force majeure but does not define adaptive procedures or flexible risk-sharing mechanisms	Vague definition, often generic; without procedural detail
Risk Allocation	Places a significant risk on contractors unless otherwise modified; limited flexibility for disaster scenarios	Lacks proactive disaster mitigation clauses	Government retains major control; risk clauses are often general
Variation & Claims Mechanism	Allows claims for time extension but not for additional cost; procedures are formal and lengthy	Bureaucratic process; lacks agility in emergency decision-making for variation approvals	Allows claims for extension; lacks clear procedures for variation due to force majeure
Contract Suspension / Termination	Permits suspension/ termination due to force majeure, but lacks post-disaster recovery mechanisms	Permits suspension/ termination due to force majeure, but lacks post-disaster recovery mechanisms	Termination procedures focus on administrative aspects
Disaster Recovery Provisions	No clear guidance on re-scoping or contract modification post-disaster	No clear clauses to guide recovery or contract modification post-disaster	No specific procedural tools for post-disaster contract adjustments
Flexibility & Adaptability	Standardized globally; requires bespoke adaptation to suit local disaster contexts	Highly rigid and standard; difficult to modify without lengthy approval	Acts as an umbrella regulation; requires interpretation in a bespoke contract
Integration of Local Risk Profile	Not tailored to Indonesia's high-risk geography (volcanic, seismic, floods)	Does not incorporate disaster risk zoning or local risk maps	No explanation regarding the integration of local risk profiles

Identifying Key Characteristics Towards Adaptive and Contextual Contract Clauses

Given Indonesia's high exposure to natural disasters, the development of adaptive contract clauses requires a firm foundation in the local context and risk profiles. The identified limitations in existing contract models reveal a structural imbalance in the legal treatment of disaster risks. The reliance on general force majeure clauses indicates a reactive approach, in which disasters are treated as exceptional interruptions rather than as foreseeable systemic risks in disaster-prone contexts. This normative orientation explains why risk allocation tends to shift disproportionately to contractors, particularly through strict liability for delays and rigid claim documentation requirements.

The rigidity of variation and claim mechanisms further demonstrates that current frameworks are designed for predictable commercial risks rather than cascading disaster impacts. The absence of explicit post-disaster recovery provisions reflects a contractual logic focused on termination or suspension rather than structured recovery and continuity. Moreover, the lack of integration with local disaster risk profiles shows that contracts operate independently from spatial and environmental risk governance systems (Puri et al., 2025).

Each of these normative gaps directly informs the proposed characteristics of adaptive and contextual contract clauses. This begins with contextual grounding, where contract provisions must be based on localized disaster risk data, such as hazard maps from BNPB (National Disaster Management Agency) or BIG (Geospatial Information Agency). Infrastructure projects should incorporate disaster risk assessments at the planning stage, especially in regions known for seismic activity, flooding, or landslides (Hadi, 2020). For example, a dam construction project in the landslide-prone highlands of West Java will require different contract risk clauses than a coastal road project in flood-prone Central Kalimantan. These risk maps and assessments should be embedded within the contract documents or technical appendices to ensure the clauses are not only valid but traceable to factual risk data.

On the dimension of operational feasibility, adaptive clauses must go beyond legal phrasing and offer clear, actionable procedures for emergency conditions (Walls, 2024). Contracts should outline specific response protocols for disaster events, including securing the project site, immediate communication procedures among stakeholders, remote supervision options using drones or IoT systems when site access is restricted, and the roles of emergency responders. For example, the contract could include a disaster response annex that defines who takes command when a project is impacted by an earthquake or flood, how the work is temporarily suspended, and what documentation is needed to resume it. Currently, standard government procurement documents under Presidential Regulation No. 16/2018 and associated technical guidelines do not provide such operational detail, leaving implementing agencies and contractors to improvise in times of crisis.

From a legal soundness perspective, any adaptive clauses must align with existing national regulations, particularly the Procurement Law (Presidential Regulation No. 16/2018), Law No. 2/2017 on Construction Services, and Law No. 24/2007 on Disaster Management. Clauses that allow the temporary suspension of work, the modification of scope, or the release of emergency budgets must refer to acceptable legal instruments and procedures. For instance, a clause may

allow the use of emergency procurement mechanisms, but it must be tied to formal declarations of emergency status by regional or national disaster management agencies. Moreover, the clause should include clear triggers and thresholds, such as disaster intensity level (e.g., BMKG or BNPB alert levels), area affected, or impact duration, that must be met for certain rights and obligations to activate. This ensures that decisions are not arbitrary and can be supported legally if challenged.

Adaptive contracts must also include flexible adjustment mechanisms (Zhang & Xi, 2023), particularly trigger-based clauses that automatically enable suspension, renegotiation, or fast-track approval pathways during disasters. For instance, the contract could stipulate that if a project site is under a 'Disaster Emergency Status' declared by local authorities, then work is suspended without penalty, and a joint reassessment of scope and budget is mandated within 14 days. These clauses should also enable alternative execution modes, such as reallocation of resources, partial completion, or shifting project milestones, to be implemented without initiating a formal contract amendment process, which is typically bureaucratic and slow. These mechanisms are especially important in government projects where rigid administrative layers often delay responsive actions.

Lastly, robust risk-sharing models must be embedded in the contract to clearly define financial and operational responsibilities for disaster-related disruptions. This includes stipulating the party responsible for insurance coverage, types of insurable risks (e.g., site equipment, third-party liability, worker injuries), and processes for damage assessment and claims. Adaptive clauses should also address compensation mechanisms, such as covering standby time, demobilization costs, or reconstruction costs, depending on whether the disaster is classified as force majeure, a foreseeable hazard, or a shared risk.

These proposed adaptive clauses can be integrated into standard bidding documents (*Dokumen Pemilihan Penyedia*) and national model contracts, such as those endorsed by the MPWH. However, before implementation, such clauses must undergo joint review by legal experts, construction professionals, and disaster risk specialists to ensure they are technically sound, enforceable, and tailored to the project's location and type. This collaborative approach allows adaptive contracting to be operationalized within Indonesia's unique socio-environmental context, improving not only resilience but also legal clarity and stakeholder coordination during crises.

Conclusion

Based on the analysis presented, Indonesia's current construction contract frameworks are not adequately equipped to handle the growing frequency and complexity of disaster-related disruptions. Generic force majeure clauses, lack of clear risk-sharing mechanisms, and the absence of adaptive operational procedures create legal uncertainty and project vulnerability. To address these challenges, construction contracts must be reformed to include adaptive and context-specific clauses that reflect localized disaster risks, align with national legal frameworks, and offer flexible, actionable mechanisms for response and recovery. By grounding contract terms in empirical risk data, enabling operational feasibility during emergencies, and establishing fair and transparent risk allocation, Indonesia can enhance the resilience and continuity of its infrastructure projects. These reforms are not only a legal and technical necessity but also a strategic imperative for sustainable

development in one of the world's most disaster-prone nations.

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