
01 Sep 2024

Price Escalation in Construction Projects: Examining National and International Contracts

Bahaa Chammout

Islam H. El-Adaway

Missouri University of Science and Technology, eladaway@mst.edu

Mohammad Abdul Nabi

Rayan H. Assaad

Follow this and additional works at: https://scholarsmine.mst.edu/civarc_enveng_facwork



Part of the [Construction Engineering and Management Commons](#)

Recommended Citation

B. Chammout et al., "Price Escalation in Construction Projects: Examining National and International Contracts," *Journal of Construction Engineering and Management*, vol. 150, no. 9, article no. 04024109, American Society of Civil Engineers, Sep 2024.

The definitive version is available at <https://doi.org/10.1061/JCEMD4.COENG-13918>

This Article - Journal is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in Civil, Architectural and Environmental Engineering Faculty Research & Creative Works by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact scholarsmine@mst.edu.



Price Escalation in Construction Projects: Examining National and International Contracts

Bahaa Chammout, S.M.ASCE¹; Islam H. El-adaway, F.ASCE²;
Mohammad Abdul Nabi, Aff.M.ASCE³; and Rayan H. Assaad, A.M.ASCE⁴

Abstract: The construction industry has witnessed unprecedented disruptions in the supply chain (SC) over the past four years due to the consecutive impacts of the 2018 steel and aluminum tariffs, the COVID-19 pandemic, and the Russian–Ukrainian war. SC disruptions have been linked to price escalations, the management of which varies across different construction contracts. Thus, there is a timely need to understand the contractual implications of price escalation clauses. This article fulfills this research requirement by following an interdependent research methodology. First, the authors analyzed and compared price escalation provisions under various US-based, international, and UK-based standard design–bid–build contracts. Second, the authors examined legal cases that have arisen due to disputes over price escalation-related matters. Third, based on the contractual and legal analysis, the authors formulated and proposed a set of contractual considerations that can be used to plan and manage the contractual implications arising from triggering price escalation clauses. The findings indicate substantial variability in contractual provisions addressing price escalation. A predominant approach entails specifying a fixed contract price, often with a general exception permitting adjustments related to legislative changes. Certain standard contracts afford flexibility through the incorporation of supplementary clauses or amendments during the contract formation stage to counteract escalation risks. Further, insights from the legal review show that judicial relief from contractual obligations is typically granted solely in instances of unforeseen and severe economic conditions. This research makes a significant academic contribution by advancing the understanding of contractual obligations concerning price escalation, especially in the context of ongoing market disruptions. Ultimately, the findings of this study will impact the construction industry by promoting more balanced contractual practices regarding price escalations in construction projects.

DOI: [10.1061/JCEMD4.COENG-13918](https://doi.org/10.1061/JCEMD4.COENG-13918). © 2024 American Society of Civil Engineers.

Introduction

Construction contracts delineate exchange of obligations between project parties as well as allocate the associated risks between them (Athnos 2018). Risks are inherent in the construction industry and cannot be entirely eliminated; however, effective management strategies can be employed to mitigate their impact (Kangari 1995). One such risk that construction projects encounter is price escalation, which could occur throughout the construction contract's life cycle (Al-Zarrad et al. 2015). Price escalation in construction projects can

arise due to a variety of reasons, primarily due to market disruptions and changes in laws, both of which can significantly influence the supply chain (SC) (Bloom et al. 2021; Khan et al. 2022; Handfield et al. 2020). Major disruptions in the construction SC began in 2018 when the United States (US) enacted new tariffs on steel and aluminum imports. These tariffs imposed a 10% levy on imported aluminum and a 25% tariff on imported steel (BIS 2018). Consequently, tariffs and SC disruptions increased the cost of construction supplies, which impacted construction enterprises by increasing the overall cost of construction projects (AGC 2019).

Following the disruptions of 2018, the spread of the COVID-19/coronavirus pandemic in 2019–2020 triggered global SC disruptions. The pandemic has caused substantial disruption in normal business operations across all industry sectors, including the construction industry. Although construction projects were regarded as essential functions and thus exempted from several health regulations (Conerly 2020), the pandemic's effects on material and labor shortages, material production reductions, shipping interruptions, and new required health measures affected the construction sector and led to escalated project risks and conflicts (Khalef et al. 2022).

In addition to the tariffs and pandemic disruption, the Russia–Ukraine conflict, which erupted in February 2022, has resulted in substantial economic and financial disturbances, leading to a surge in the prices of energy and raw materials. Diesel prices in the US surged almost immediately after the conflict started (BLS 2022), elevating the operational expenses of construction equipment such as trucks, cranes, and other heavy machinery. Moreover, as Russia and Ukraine are global raw material providers (Boyette 2022; Hanes 2022), and with sanctions and cargo ship diversions being implemented, construction suppliers are being cut off from raw materials, leading to additional disruptions in the SC and a proportional increase in material costs and lead times (Hanes 2022; AGC 2022a).

¹Ph.D. Student, Dept. of Civil, Architectural, and Environmental Engineering, Missouri Univ. of Science and Technology, Rolla, MO 65409. Email: bahaa.chammout@mst.edu

²Associate Dean for Academic Partnerships, Hurst-McCarthy Professor of Construction Engineering and Management, Professor of Civil Engineering, and Founding Director of the Missouri Consortium of Construction Innovation, Dept. of Civil, Architectural, and Environmental Engineering and Dept. of Engineering Management and Systems Engineering, Missouri Univ. of Science and Technology, 228 Butler-Carlton Hall, 1401 N. Pine St., Rolla, MO 65409 (corresponding author). ORCID: <https://orcid.org/0000-0002-7306-6380>. Email: eladaway@mst.edu

³Project Control Analyst, Anser Advisory LLC, 311 W Monroe St., Suite 301-302, Chicago, IL 60607; formerly, Ph.D. Candidate, Dept. of Civil, Architectural, and Environmental Engineering, Missouri Univ. of Science and Technology, Rolla, MO 65409. Email: mah59@umsystem.edu

⁴Assistant Professor of Construction and Civil Infrastructure, Dept. of Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ 07102. Email: rayan.hassane.assaad@njit.edu

Note. This manuscript was submitted on April 20, 2023; approved on April 1, 2024; published online on June 28, 2024. Discussion period open until November 28, 2024; separate discussions must be submitted for individual papers. This paper is part of the *Journal of Construction Engineering and Management*, © ASCE, ISSN 0733-9364.

As a result of the combined impacts of the steel tariffs, the pandemic, and the conflict-induced disruptions, the construction sector in the US has encountered significant challenges, including unprecedented rises in material costs, disruptions in SCs, a constrained labor market, and increased expenses associated with construction equipment for more than four years (AGC 2019, 2022a). This is also reflected by a surge in the producer price index for building materials, which increased by 124% for steel mill products, 68% copper and brass mill forms, and 61% for hardwood and plywood (BLS 2022).

In the context of commercial construction contracts, there has been a longstanding practice of assigning the risk of unexpected increases in material costs to the contractor. Accordingly, the uncertainty in the availability and prices of construction materials can have significant implications for project profitability, as contractors may need to factor in larger contingencies to account for potential pricing fluctuations (Di Stravolo Elliott 2021). Further, the availability of skilled labor and corresponding wage rates are essential factors influencing the cost structure of construction projects. Shortages of experienced labor can result in higher labor costs, thereby increasing the overall project expenditures (Elinwa and Buba 1993). To this end, the instability in the availability and pricing of building supplies/material, labor, and equipment resources necessitates restructuring of the contractual responsibilities and better allocation of liabilities, especially those related to the impacts that could be caused by extreme price fluctuations (Ward et al. 1991). Notably, two of the primary three factors of disputes, claims, and conflicts in construction projects were found to be associated with issues pertaining to contract administration (Arcadis 2019), which is in conformity with the findings of Rauzana (2016) and Assaad et al. (2020a). Accordingly, the recent volatility in the availability and pricing of building supplies, labor, and equipment has highlighted the need to revisit this approach and ensure that contractual responsibilities are properly structured to minimize risk for all parties involved (Cox 2022). Nonetheless, determining the appropriate approach is intricate, as the complete transfer of the cost inflation burden to any of the project parties (being the owner or the contractor) may impose financial strains on the construction industry at large.

Previous Related Studies

Price escalation falls under the broader category of project cost overruns, a common problem observed in the construction sector across various nations and industries (Vamsidhar et al. 2014). Previous studies have primarily focused on examining project cost overruns in the construction sector. In relation to that, the literature highlighted that numerous causes could lead to cost overruns in construction projects, including changes in scope and poor project management (Love et al. 2016; Love and Ahiaga-Dagbui 2018). Additionally, cost overruns could also be attributed to reasons beyond the project environment. Several studies particularly identified the role of inflation in leading to project cost overruns (Rakhra and Wilson 1982; Aljohani et al. 2017; Haslinda et al. 2018). Inflation is generally defined as the rise in the price level of good(s) and/or service(s) (Prichett et al. 2011). Inflation may also have an impact on numerous components of a construction project's cost, including material pricing, labor compensation, and machinery hire rates, which would prompt a yearly review of cost projections (Musarat et al. 2021). As construction materials constitute 35%–60% of the overall construction project budget (Bourne 1986; Windapo and Cattell 2010), the inflation in material prices significantly affects cost overruns. Further, in the presence of inflation rates, clients are required not only to consider the rise in building costs but also to

pay an additional amount on construction prices due to the uncertainty caused by inflation (Shah 2016).

A limited number of studies have been conducted to analyze contractual price escalation systems in various nations throughout the world, which were driven by high inflation rates in the respective countries. For instance, in response to a substantial increase in construction material costs in Korea between 2003 and 2004, Choi et al. (2006) analyzed the price escalation methods employed in building contracts in Korea and the Southeast Asia region. Their findings revealed that a 3% price variation (whether an increase or a drop) must be exceeded for the contract price to be reassessed under applicable Korean legislation, compared with a 1.5% variance threshold in Japan and a 10% rise in the Philippines (Choi et al. 2006). Similarly, in light of several inflationary occurrences in Turkey, Ercan (2017) examined the price escalation structure of public construction contracts in Turkey. Their investigation revealed that multiple governmental agencies in Turkey issued price escalation decrees for their construction contracts; however, the price adjustment mechanism varied among these agencies and failed to accurately reflect the prevailing market conditions, primarily due to the volatile nature of the Turkish currency. This emphasized the critical need to establish a uniform price escalation scheme across all governmental agencies while taking into account the construction project type and incorporating the input of stakeholders from the construction industry (Ercan 2017). Moreover, Hafeez (2011) conducted a study on the impact of price escalation on the construction industry in Pakistan and the Middle East by administering a questionnaire to industry experts. The survey results showed that cash flow problems (74% of respondents) were the most common issues associated with price escalation, followed by project delay (10%), loss of profit (9%), and poor-quality work (7%) (Hafeez 2011). Despite the prevalence of the Fédération Internationale des Ingénieurs-Conseils (FIDIC) contract in the Middle East region, which includes a price adjustment formulation, as discussed in the “Results and Analysis” section of this paper, the survey results indicated that only 42% of respondent contractors possessed adequate knowledge of this clause, with similar results for respondent consultants and project owners (Hafeez 2011). Mekonen et al. (2023) found that including price escalation provisions in the contract agreement was crucial for mitigating price escalation, based on a survey of construction stakeholders who were involved in university campus construction projects. Additionally, subsequent to the implementation of new tender regulations in Egypt in 2018, Abu Helw and Ezeldin (2022) conducted a comparative analysis with other public contracts. Based on their findings, the authors proposed various amendments to the new law, which included the incorporation of preselected work materials that can be subject to price adjustments.

Such comparative insights into the regulatory frameworks of different countries provide valuable perspectives on the challenges and opportunities facing the construction industry, particularly in relation to managing price escalations. Nonetheless, there has been no attempt to comprehensively investigate the price escalation structure under the standard forms of contracts employed in the US and on international scales. This study fills this critically evolving knowledge gap by conducting a comparative assessment of various construction contracts.

Knowledge Gap and Research Questions

The various sets of construction commercial contracts generally vary in their treatment of the exchange of obligations between the contracting parties (Khalef et al. 2022). As mentioned, a limited

number of studies have undertaken the analysis of contractual price escalation systems across different nations, and these studies were primarily motivated by the prevalence of price fluctuations in their respective countries. For instance, Ercan (2017) examined price escalation in Turkish public construction contracts, revealing variations in the mechanisms among governmental agencies, which inadequately reflected market conditions. Conversely, there is a lack of a comprehensive investigation of the commercial construction contracts with regard to price escalation remedies. Alternatively, in the absence of appropriate provisions, the governing law of the construction contract takes precedence. However, construction practitioners often struggle to understand the complexities of legal matters because they lack exposure and experience in laws that intimately affect their trades, such as liability, regulations, and transactions (Assaad and Abdul-Malak 2020a). Further, in the context of the current market disruption, price escalation and SC disruptions have been recognized as the most critical issues in construction contracts in the US in 2022, with the absence of appropriate clauses termed as a “killer clause” for general contractors (AGC 2022b). Similarly, in the European context, contract issues related to addressing escalating prices and SC challenges have been recognized as major deterrents for contractors in new tenders (FIEC 2022). To this end, additional research in this area is necessary to broaden the analysis’ purview and offer insights toward the development of more effective strategies for managing price escalation risks in construction projects. As a result, there is a timely need to investigate the contractual duties and remedies associated with price escalation in construction projects, particularly in light of the present price volatility in the construction SC.

To that end, the goal of this study is to present a comparative analysis of the contractual and legal perspectives for addressing price escalation in construction projects. This will be achieved by reviewing and analyzing the price escalation structure prevalent in widely adopted construction contracts across the US, the United Kingdom (UK), and the international markets. Thus, this study performs a comparative analysis of the different sets of commonly used standard forms of construction contracts to evaluate the price escalation-related clauses stipulated by each standard set of contracts. Additionally, this study offers a legal perspective on the applicable common law doctrines in the events of price escalation by examining relevant judicial cases at both the state and federal levels under common law jurisdiction. The outcomes of this comparative study provide a crucial and comprehensive understanding of the potential contractual remedies, governing law doctrines, and guidance to the contracting parties in the construction industry. This guidance aims to assist parties in negotiating, drafting, and interpreting price escalation clauses with full awareness of their obligations in the event of price escalation. Ultimately, the findings presented in this study can contribute to minimizing claims and disputes related to unbalanced enforcement of price escalation on a contracting party. That said, this comparative study bridges this critical knowledge gap through attempting to answer the following research questions:

1. What are the remedial measures provided in standard contracts to mitigate the adverse effects of price escalation on construction projects? Additionally, what specific price component(s) (if any) are addressed by these measures?
2. What conditions need to be fulfilled in order to trigger price escalation clauses?
3. What are the appropriate considerations required to safeguard the project parties from exorbitant price increases?
4. If a contract does not include provisions relating to price escalation clauses, what are the fundamental legal considerations that can be utilized to tackle the issue of price escalation?

5. What are the prescribed legal provisions for granting contractual relief in the event of a specified increase in project costs?

As such, this study will propose more balanced contractual practices in relation to price escalation provisions, particularly in light of the currently disrupted SCs. This is consistent with existing COVID-19 contractual research work, which highlighted the critical need for future research studies to address, among other factors, the contractual and legal considerations that have emerged due to the pandemic (Assaad and El-adaway 2021).

Methodology

This study employs an interdependent research methodology (Fig. 1). An interdependent methodology denotes a multiphased approach wherein diverse methods or steps are connected and collaboratively conducted to address the research questions (Salehi et al. 2022; Abdul Nabi et al. 2021). Notably, interdependent or mixed-method approaches are frequently favored when several steps are required to accomplish the goals of a research study (Allen et al. 2016). Moreover, many applied research methodologies exhibit interrelatedness and interdependence to varying degrees, stemming from the fundamental concept of a methodology as a structured arrangement of activities (Novikov and Novikov 2013).

Notably, interdependent research methodologies have been employed in analogous contractual studies. Hansen (2020) utilized a two-step interdependent research methodology to assess the consideration of COVID-19 as a force majeure under civil and common law jurisdictions. Fawzy et al. (2018) adopted an interdependent research methodology in their investigation of termination for convenience under common and civil law. Khalef et al. (2022) employed a six-step interdependent methodology to investigate the contractual implications and remedies associated with the COVID-19 pandemic. Assaad et al. (2020c) utilized an interdependent research methodology to conduct a comparative analysis of the back-to-back relationship between a contractor and a subcontractor under various standard contracts. In alignment with its applicability in analogous comparative contractual studies, this study adopts an interdependent methodology that encompasses three main steps: (1) review of price escalation treatment under standard forms of contracts; (2) legal perspective on the treatment of price escalation; and (3) formulation of contractual considerations. Aligned with this study’s goal of comparatively analyzing extant contractual provisions and providing a legal perspective pertaining to price escalation provisions, the development of contractual considerations to mitigate price escalation risks is rooted in an interdependent analysis encompassing the contractual and legal aspects. Details on each of the methodological steps are provided in the subsequent subsections.

Review of Price Escalation Treatment under Standard Forms of Contracts

First, and to derive an understanding of the contractual treatment of price escalation, the study involved an analysis of price escalation provisions in standard contract forms commonly employed in the US. In relation to that, the authors conducted a desktop analysis of the contract forms produced by ConsensusDocs, the American Institute of Architects (AIA), and the Engineers Joint Contract Documents Committee (EJCDC). Further, price escalation provisions in international contract agreements such as the FIDIC Red Book (FIDIC 2017) as well as UK-based contracts such as the New Engineering Contract (NEC) and the Joint Contracts Tribunal (JCT) were examined, analyzed, and compared with those used in the US. The analysis of the contractual treatment was based on a careful reading and examination of the terms and conditions present in

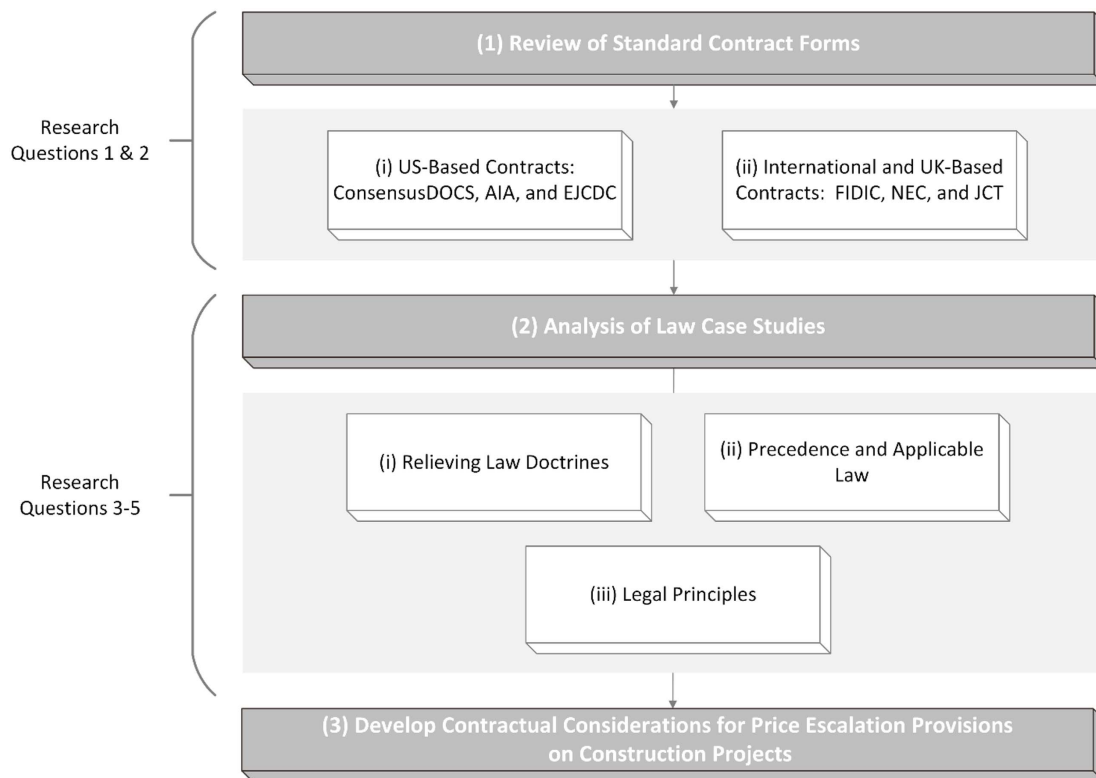


Fig. 1. Research methodology.

the clauses pertinent discussed under the standard contract forms. This procedure facilitates the comprehension of the prevailing risk allocation and remedial procedures concerning price escalation under each standard form of contract. Additionally, it allows for a comparative assessment of the standard terms adopted by the respective contracts in relation to price escalation.

Consequently, this investigation offers a comprehensive elucidation of the contractual entitlements and duties of the project stakeholders concerning the specified provisions and conditions articulated within the price escalation clauses. The authors obtained the results to align with the methodological steps by presenting information pertaining to the analysis conducted on the following key contractual stipulations:

- The contract explicitly or implicitly specified default assumptions concerning price and/or time adjustments in response to price escalation occurrences resulting from changes in law, market fluctuations/disruptions, delivery delays, and currency fluctuations.
- The contract outlined risk responses in relation to price and/or time adjustments for instances of price escalation due to changes in law, market fluctuations/disruptions, delivery delays, and currency changes. These risk responses delineated how the contractual parties handle the identified risks, the method of price adjustment, the relevant conditions precedent, and the specific price components considered (such as material, labor, equipment, etc.).

The authors' approach of presenting the results in this manner ensures the replicability of the research by other interested scholars by accessing the contractual documents, which are available through the AIA, ConsensusDocs, EJCDC, FIDIC, NEC, and JCT references. In addition, the authors have provided all details on the performed review and analysis of the specified price escalation clauses, including specific references to paragraph, subarticle, or subclause numbers. This allows other experts in the field to reproduce the research accurately.

Additionally, it is noteworthy that previous research works have employed analogous contractual analysis methodologies, yielding impactful findings through the examination and analysis of contractual language in various standard contract forms. For instance, Abdul-Malak and Khalife (2020) conducted a study on the risks associated with sustainable building project certification under three standard contract forms, resulting in the proposal of a framework that sustainable building project owners can employ to address sustainability certification-failure risks. Assaad and Abdul-Malak (2020a) conducted a comparative analysis to study the treatment of liquidated damages and penalty clauses under three various legal jurisdictions. Assaad and Abdul-Malak (2020b) conducted an analysis and comparative examination of the timing of liquidated damages recovery and associated liability matters within national and international standard contract forms. Khalef et al. (2021) conducted a comparative investigation that centered on the allocation of risks within exculpatory clauses and their respective legal treatment. Ahmed et al. (2021) performed a comparative analysis to examine the contractual handling of a specific set of identified issues related to integrated project delivery under national contract arrangements. Shafik et al. (2016) conducted a study examining the application of FIDIC contracts under Egyptian law, entailing a comparative analysis of contracting issues with the corresponding set of governing contracts to elucidate administrative procedures for contract management under these circumstances.

Legal Perspective on the Treatment of Price Escalation

Following a comprehensive analysis of the standard contract agreements, legal forums were reviewed to stipulate the legal aspects governing price escalation, particularly when they are not addressed in the contract. Specifically, court cases were studied and compared under the respective legal doctrines to offer a practical perspective on court remedies. This step involved an examination of the legal

treatment of price escalation remedies when relevant clauses were not adhered to in the contract. The main legal jurisdictions encompass civil law, common law, and Islamic law (Al-Humaidi 2014; Yates and Smith 2007; El-adaway et al. 2018). This study focused on legal cases falling within the common law jurisdiction, which serves as the legal authority in the US. This choice was due to the fact that common law, unlike other legal jurisdictions, operates based on legislative decisions rather than a comprehensive set of rules (Stokes 1978). Thus, analyzing cases from common law jurisdictions provides a comprehensive legal perspective, and decisions made in such cases, considering the specific factors involved, can serve as guiding precedents for future stakeholders.

In the context of the absence of appropriate contract clauses, the governing law of the project country assumes primacy, typically specified in the construction contract. Consequently, this study delves into the examination of pertinent legal doctrines, as presented in the “Results and Analysis” section of this paper, to explore their applicability in situations where price escalation clauses are lacking. Further, the study investigates the remedies awarded by the court, achieved through a thorough analysis of relevant legal cases that pertain to these doctrines.

Moreover, it is worth noting that prior research endeavors have utilized similar legal analysis methodologies, resulting in significant insights through the scrutiny and analysis of common law judicial decisions when contractual conditions are not entirely observed. For instance, Khalef et al. (2022) investigated the relevant legal doctrines and principles applicable in cases where the COVID-19 pandemic was not addressed within the contract. Assaad et al. (2021) conducted a study focused on court decisions in disputes related to green construction matters, specifically in situations where contract clauses were found insufficient. Assaad and Abdul-Malak (2020a) undertook a comparative analysis to explore the legal principles governing the treatment and enforcement of liquidated damages and delay penalties across diverse legal jurisdictions. Fawzy and El-adaway (2015) conducted an examination of the legal principles governing global claims within the common law legal system. Demachkieh et al. (2020) synthesized success and failure criteria for global claims by systematically reviewing legal cases, analyzing the interaction of factors, and identifying emerging trends that influence the legal admissibility and success prerequisites of such claims.

Formulation of Contractual Considerations

Ultimately, based on the performed comparative contractual analysis and the legal analysis of the applicable legal doctrines and precedent cases, the authors formulated practical contractual considerations to enhance contract management and decision-making processes. These considerations encompass two main aspects. First, the authors highlight the inclusion and observation of condition precedents in the relevant standard form of contract. By doing so, the contractual parties can ensure the proper application of price escalation clauses provided by the respective standard form of contract. This proactive approach aims to mitigate potential disputes and uncertainties regarding price adjustments, thereby fostering a more stable and transparent contractual framework. Second, the authors propose themes of contractual clauses that the contracting parties should collectively agree upon, taking into consideration the project’s best interests rather than focusing solely on the perspective of individual contracting parties. This emphasis on mutual agreement seeks to promote a cooperative and balanced contractual environment, aligning the interests of all stakeholders and fostering long-term project success. Such contractual considerations can help enhance contract clarity, minimize potential conflicts, and foster a

more cooperative and harmonious contractual relationship between parties, ultimately contributing to the overall success and efficiency of construction projects.

Numerous prior contractual research studies have put forth contractual and conceptual considerations subsequent to thorough contractual and legal analyses, with the aim of improving contractual practices within the construction industry. For instance, following an analysis of the legal and contractual aspects of employing building information modeling (BIM) in construction projects, Chong et al. (2017) proposed a contractual framework to serve as a comprehensive reference for BIM-based contract formation and administration. Abdul-Malak and Hamie (2019) suggested a contractual framework for interpreting contractual documents after conducting a comparative analysis of interpretation requirements under various standard construction contracts. Gunduz and Elsherbeny (2020) proposed guidelines to support and evaluate the performance of contract administration activities in ongoing construction projects. Assaad et al. (2020b) developed a contractual framework to assist project stakeholders in BIM contractual integration following a review of various contract clauses and legal aspects related to BIM contracting in practice.

Aligned with previous contractual research, this study endeavors to propose contractual considerations with the goal of enhancing contractual practices related to price escalation subjects. The proposed considerations would serve as a valuable resource for practitioners and decision-makers within the construction industry, addressing contractual gaps, particularly amid the current challenges of construction price escalation concerning materials, equipment, and labor.

Results and Analysis

Standard contract forms in construction projects are employed based on the contract type and procurement method. Contracts may take on various forms, such as fixed/lump sum, remeasured, or a combination of the two, such as cost-plus with a guaranteed maximum price. Traditionally, a building project is procured using the design–bid–build (DBB) method following a lump sum price, which engages the contractor following the completion of the design to execute the project on an agreed-upon price basis. This section offers a comprehensive examination of price escalation clauses in DBB contracts across various jurisdictions, including US-, international-, and UK-based contracts. The aim is to analyze the types of clauses commonly used and their effectiveness in managing cost escalation risks in the construction industry. By providing valuable insights related to the legal and practical implications of different price escalation clauses for contractors and project owners, this analysis contributes to the development of more effective and comprehensive contractual considerations for managing cost escalation risks in construction projects.

US-Based Contracts

The subsequent section examines price escalation stipulations by the commonly used standard construction contracts in the US. Within the US construction industry, three primary contract types are widely utilized: ConsensusDocs; AIA; and EJCDC.

ConsensusDocs

A review of the main US construction contract forms indicates that only ConsensusDocs offers a comprehensive price escalation amendment, the ConsensusDocs 200.1 “Potentially Time and Price-Impacted Materials.” ConsensusDocs 200.1 is designed to be used in conjunction with the ConsensusDocs 200 owner–contractor

Table 1. ConsensusDocs relevant provisions

Escalation type	Paragraph	Provision subject	Stipulated contractual provisions
Market price fluctuations	3.1 and 3.2	Price increase and decrease	The materials recognized in the ConsensusDocs 200.1 amendment are subject to price adjustment, either an increase or decrease, based on market inflation or deflation, respectively.
	2, 3, 3.3	Price adjustment mechanism	The process of price adjustment shall be determined by the contracting parties. Nevertheless, they must consider a maximum/minimum allowable percentage of adjustment (relative to the baseline prices), beyond which modifications to the specified materials' prices under this amendment are not allowed. The price adjustment shall exclude the incorporation of any overhead and profit margins.
	2.1	Use of contingency	The remuneration for materials recognized under the ConsensusDocs 200.1 amendment must not be duplicated under any contingency stipulated in the general contract employed.
	3.1 and 3.2	Condition precedent	Solely the materials recognized under this amendment are qualified for price adjustment.
Contract default assumption		If the condition precedent is not met, or if market fluctuations involve materials outside the scope of those recognized under the ConsensusDocs 200.1 amendment, the contract price is deemed fixed.	
SC delivery delays	4	Time and/or price adjustment	In the event of significant delivery delays or market unavailability of the materials specified in the amendment, the contractor is entitled to an EOT and reimbursement of any cost impacts associated with the EOT.
	4	Condition precedent	The EOT and associated price adjustment are only applicable to the delivery delays of materials identified under the ConsensusDocs 200.1 amendment, which may impact the contractor's overall schedule.
	6.3.1	Contract default assumption	If the condition precedent is not fulfilled, or if the delivery delay pertains to materials beyond those explicitly specified under the ConsensusDocs 200.1 amendment, the ConsensusDocs 200 standard owner–contractor agreement's Paragraph 6.3 is applicable. This provision permits the EOT for delays that are outside the contractor's control.
Changes in law	3.17.3	Contract price/and or time adjustment	The ConsensusDocs 200 agreement specifies that the contract price and/or time may be adjusted due to legislative changes, including changes in tax provisions.

Sources: Data from ConsensusDocs (2007a, b).

agreement, particularly when the contract type is a lump sum. The ConsensusDocs 200.1 amendment is composed of multiple provisions summarized in Table 1. The amendment first entails the identification of materials that are susceptible to cost and time adjustments and their inclusion under the contract documents, i.e., a condition precedent for the contract price and/or time adjustment. In other words, only the materials identified under this amendment could be adjusted for price, following market fluctuations. Additionally, the ConsensusDocs amendment necessitates the establishment of baseline prices to serve as a benchmark for price escalation, the mechanism of which should be mutually agreed upon by the contracting parties. It is important to note that overhead and profits are excluded from the price escalation mechanism. Further, the price adjustment mechanism, agreed upon by the contractual parties, should specify the maximum allowable amount or percentage by which the contract value can be adjusted. Beyond this threshold, regardless of market fluctuations, no further price modifications can be effectuated.

In addition, the amendment entitles the contractor to receive an extension of time (EOT) in the event of delays in delivery or the unavailability of potentially time and price-sensitive materials, along with a corresponding adjustment to the contract price as a result of such delays. Therefore, this amendment provides indemnification to the contractor against any liability to the owner, including fees, losses, or damages arising from the delay of a potentially time and cost-sensitive material that is beyond the control of the contractor, its subcontractors, or suppliers. Moreover, the ConsensusDocs 200.1 amendment includes a price decrease provision that grants the owner the eligibility to issue a deductive change order in the case of deflation in material costs, resulting in a decrease in the contract price. This provision serves to mitigate the risk of the owner

incurring excessive costs related to materials, while also allowing the contractual parties to take advantage of any potential cost savings that may arise over the course of the construction project. Additionally, the ConsensusDocs 200 agreement form incorporates a default position, which stipulates the adjustment of the contract price and/or time to reflect changes in the law. This provision is relevant for legislative changes that could affect the cost or timeline of a construction project, including tariffs on materials such as the 2018 steel and aluminum tariffs. Therefore, in the event of such alterations, the ConsensusDocs 200 agreement form offers the necessary framework for adjusting the contract price and time accordingly. Moreover, in the absence of ConsensusDocs 200.1, the default stance of ConsensusDocs 200 allows for EOT for unforeseen delays that are beyond the contractor's control, potentially including material delivery delays and shortages. However, the expenses related to such delays can only be recuperated if the delays are caused by the actions of the owner or the architect/engineer. Consequently, if the amendment is not present, the default contract would solely offer an EOT for disruptions in the delivery of materials, without accounting for the accompanying financial ramifications.

AIA

The AIA A201 owner–contractor agreement is one of the most employed general conditions of the contract in the US construction sector (Glisson and Courtway 2019; El-adaway et al. 2014). Table 2 displays the pertinent provisions concerning price escalation within AIA documents. Notably, the AIA A201-2017 does not contain explicit clauses regarding price escalation, as the responsibility for the costs associated with labor, materials, and equipment for the work falls on the contractor. Additionally, the contract sum is constrained to the agreed-upon figure in the contract agreement unless authorized

Table 2. AIA A201 relevant provisions

Escalation type	Subarticle	Provision subject	Stipulated contractual provisions
Market price fluctuations	3.8.2	Price increase	The parties involved in the contract may include cash allowances for materials and equipment that can be utilized in the event of changes in market prices.
	3.8.2.2 and 3.8.2.3	Price adjustment mechanism	Not stated. However, if the allowances are exceeded due to significant fluctuations, the contract price may be further adjusted through a change order to reflect the difference between the actual costs and the contract-stipulated allowances. It should be noted that the allowances must exclude any overhead and profit amounts, which are considered to be accounted for in the contract price.
	3.8.1	Condition precedent	The materials and equipment specified in the allowances, as well as the inclusion of the allowances in the contractual agreement, shall be outlined.
	9.1.1	Contract default assumption	If the condition precedent is not met, the contract price, unless otherwise specified in the contract, is regarded as fixed.
SC delivery delays	8.3.1 and 8.3.3	Time and/or price adjustment	In the case of delivery delays or market unavailability of materials, the contractor is entitled to an EOT. Furthermore, the contracting parties may seek to recover damages, if applicable.
Changes in law	3.8.2.1	Contract price/and or time adjustment	Changes in law are recoverable if they are accounted for under allowances in the general contract.
	3.8.1	Condition precedent	The incorporation of legal changes within the purview of allowances under the contractual agreement.
	9.1.1	Contract default assumption	If the condition precedent is not met, the contract price, unless otherwise specified in the contract, is regarded as fixed.

Sources: Data from AIA (2017, 2019).

adjustments have been made. Alternatively, the AIA A201 mandates that the price escalation variability, in terms of materials, equipment, and changes in taxes, must be acknowledged and addressed through contract allowances prior to the contract formation.

To this end, the *AIA Guide for Supplementary Conditions (A-503)* stipulates that contract parties desiring to alleviate the impact of market volatility on price escalation should incorporate them under contract allowances prior to the bid/contract formation (AIA 2019). Accordingly, under an AIA contract, the price escalation must be contemplated for the stated allowance amounts, unless otherwise provided in the contract documents. It is worth noting that the provisional allowances explicitly exclude overhead and profit, which are acknowledged to be incorporated within the fixed contract price. If the price escalation for vulnerable materials specified in the contract exceeds the allowance amounts, the contract price can be amended following a change order to reflect the escalation beyond the stipulated allowances.

In the absence of provisions for allowances under an AIA contract, the contract price would be regarded as fixed by default to any potential price escalation, be it due to market fluctuations or changes in relevant legislation. Nonetheless, in the occurrence of unforeseen and substantial material delivery delays, which fall beyond the purview of the contractor's control, the contractor may

be entitled to an EOT. Further, the contract parties may be eligible to claim compensation for damages sustained as a result of such material delivery delays.

EJCDC

The EJCDC C-700 standard conditions of the building contract and the EJCDC C-520 owner–contractor agreement (lump sum price) comprise the third commonly utilized set of standard construction contracts for DBB projects in the US. Table 3 presents the pertinent EJCDC provisions concerning price escalation. Under an EJCDC contract, the contractor is responsible for providing and assuming full responsibility for all services, including the material, labor, and equipment required for the building project, potentially implying that the contractor is responsible for any subsequent price escalation. The EJCDC also specifies that all expenses, including those for materials, labor, and equipment required to execute the work stated, are observed under the contract price. Consequently, the contractor would not be entitled to request supplementary payments beyond the agreed-upon contract price.

With regard to delivery delays, the EJCDC contract specifies that the contractor may be eligible for an EOT in the event of unanticipated delays beyond their control. These circumstances may encompass substantial delivery delays and shortages of materials,

Table 3. EJCDC relevant provisions

Escalation type	Paragraph	Provision subject	Stipulated contractual provisions
Market price fluctuation	7.03.A, 11.04.A, and 13.02.B.2	Contract default assumption	The contractor bears ultimate responsibility for all the services and expenses pertaining to the work, which includes but is not limited to the materials, labor, and equipment required for the project's delivery.
SC delivery delays	4.05.C	Time adjustment	In the event of unforeseeable delays that lie beyond the contractor's reasonable contemplation, the contractor is eligible to solely receive an EOT.
Changes in law	7.10.C	Contract price/and or time adjustment	In the event that legal changes, including new tax regulations, transpire post the formation of the contract, the contract price and/or time can be suitably adjusted to account for such implications.

Source: Data from EJCDC (2013).

among other unforeseeable events. Nonetheless, the EJCDC contract specifies that the contractor's exclusive remedy for delays is the EOT and, therefore, does not entail compensation for any consequential financial impacts arising from such delays.

Additionally, the EJCDC contract incorporates standard clauses to facilitate adjustments to the contract price and time in response to changes in the law that have an impact on the cost or duration of executing the work, including tax-related changes. Following a change in legislation, the owner or the contractor may issue a notification to the other party regarding legal changes affecting the cost or duration of executing the work and request the respective adjustment to the contract price and/or time. Thus, the EJCDC's default position only allows for modifications to the contract price and schedule in situations where legal changes affect the cost or duration of executing the work. If the parties involved cannot reach an agreement on the entitlement, amount, or scope of any modifications to the contract price and/or time resulting from legal or regulatory changes, the contractor or owner may initiate a change proposal or a claim, respectively. While this provision allows for some degree of adaptability in adjusting the contract price and time, it is restricted to changes in laws and regulations and excludes other types of cost escalation.

International and UK-Based Contracts

The subsequent sections outline the approach to price escalation in standard construction contracts that are commonly used on an international scale as well as in the UK. The FIDIC Red Book, published by the FIDIC, is a widely utilized set of general conditions for construction contracts that are adopted by the World Bank (Baker et al. 2019; Hillig et al. 2010). Additionally, standard sets of contracts that are based in the UK, such as the NEC and JCT, are frequently employed in the construction market outside of the US.

FIDIC

Under FIDIC Red Book 2017 provisions (Table 4), the contractual agreement recognizes the possible market volatility and the inflation in material prices. In addition to addressing material price fluctuations, the FIDIC contract acknowledges the potential impact of changes in the cost of labor and other inputs on construction costs. In this regard, the FIDIC price escalation clause serves as a comprehensive mechanism for price adjustment that takes into account not only inflationary trends in material prices but also corresponding increases in labor costs and, potentially, equipment prices. The price adjustment to reflect market fluctuation should be following a formula based on the schedule of cost indexation, i.e., a condition precedent to enact price adjustment under a FIDIC contract. If the latter condition is not met, the FIDIC contract agreement explicitly assumes that the contingency in the contract price will be utilized to address any price escalation that may arise. It is worth noting that FIDIC defines the cost to comprise the direct cost of a work item, encompassing taxes and overheads, but excluding profit. As a result, the price adjustment for inflation under FIDIC would include the contractor's overheads but exclude their profit margins.

Further, the application of the price adjustment mechanism would extend to each of the currencies for which the contract price is payable, which serves to mitigate certain risks associated with currency fluctuations, particularly in instances where multiple currencies are observed under the contract. Moreover, the FIDIC contract acknowledges that if the contract price is of a cost-plus type, the owner (referred to as "employer" in FIDIC terminology) would undertake provisional liability for any price escalation. This is attributed to basing the project price on actual expenses accrued during the project, as opposed to a predetermined fixed sum for a fixed-price project.

In the event of unusual shortages in materials and labor, the FIDIC agreement entitles the contractor to an EOT to account for the delay. However, the FIDIC contract does not stipulate price adjustment for financial implications associated with such delays.

Table 4. FIDIC relevant provisions

Escalation type	Subclause	Provision subject	Stipulated contractual provisions
Market price fluctuations	8.5.d and 13.6	Price increase and decrease	The contractual agreement acknowledges the potential for market volatility, such as those arising from epidemic outbreaks. Further, it acknowledges the impracticality of holding the contractor accountable for cost escalation resulting from inflation. Consequently, the contract stipulates that the price shall be adjusted commensurate with fluctuations in input costs, including but not limited to labor, materials, and equipment.
	13.7	Price adjustment mechanism	The pricing adjustment must adhere to the prescribed cost indexation schedule(s), encompassing overhead costs while excluding profit margins. Additionally, such adjustments are to be implemented across all currencies in which the contract is payable.
	13.7	Condition precedent	The inclusion of the schedule(s) of cost indexation under the contract document as well as the appropriate formula for price adjustment.
	13.7	Contract default assumption	In the event of the condition precedent remaining unfulfilled, a fixed-price contract would be deemed to have incorporated an adequate contingency for market volatility within its pricing. In contrast, under a cost-plus contract, the owner would bear the financial risks, covering actual costs as they accrue.
SC delivery delays		Time adjustment	Should delivery delays or unavailability of materials in the market occur, the contractor retains the entitlement to receive an EOT.
Changes in law	13.6 and 14.1	Contract price and/or time adjustment	In the event of legislative changes, such as the introduction of new tax regulations, taking effect subsequent to the formation of the contract, the pricing under such contract shall be modified to account for any rise or fall in costs stemming from the aforementioned legislative changes. Further, if such legal changes have an impact on the contractor's schedule, the contractor shall be entitled to an EOT.

Source: Data from FIDIC (2017).

Additionally, if legislative changes take place after the contract formation, the FIDIC stipulates provisions for adjusting the contract price to reflect any price implication as well as an EOT if the legislation has a time impact on the project.

NEC

The NEC released by the Institution of Civil Engineers (ICE) is another standard for construction contracts utilized in construction markets outside of the US. The NEC4 Engineering and Construction Contract (ECC), which governs the contractual relationship between a client (NEC's terminology of "owner/employer") and a contractor, is the most often utilized type of NEC contract, with widespread adoption in the UK and Hong Kong (Evans 2018). According to NEC4 ECC, there are six procurement options available for delivering construction contracts. Options A and B entail projects priced at a lump sum, in which the contractor assumes full financial risk. In contrast, Options C and D are target contracts, with financial risk shared between the client and contractor. Finally, Options E and F are cost-reimbursable contracts, in which the client assumes the financial risk. Fig. 2 provides a representation of the

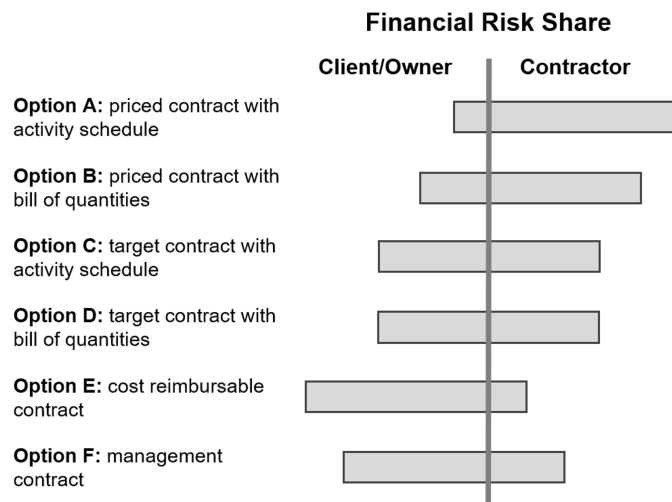


Fig. 2. Financial risk of contract types under NEC. (Adapted from Hughes 2018.)

extent of the financial risks associated with each procurement option under NEC4 ECC.

In accordance with prevalent contract forms for lump sum DBB projects, the NEC4 ECC contract by default features a fixed-price provision for inflation, thereby holding the contractor provisionally liable to inflationary risks. Moreover, the NEC4 ECC contract default also involves fixing the contract price against currency fluctuations and changes in laws. However, the NEC4 ECC, similar to the ConsensusDocs, provides alternative options (Table 5) that, if chosen by the parties involved in the contract, would transfer the risk allocation from the contractor to the client.

As shown in Table 5, the incorporation of Option X1 (price adjustment for inflation) into the contractual agreement would transfer the risk of material price inflation during the contract period from the contractor to the client. In the absence of this option, the contract assumes that the contractor had factored in any potential inflationary impacts on the material costs within the agreed contract price. Additionally, the NEC4 ECC explicitly states that the financial risk of inflation is shifted to the client's obligations under a remeasured contract, as the client is responsible for paying the defined cost at the time it is incurred. Similarly, the presumption under NEC4 ECC is that the contract price will remain fixed in the event of a change in the law. However, should the client and contractor elect to incorporate Option X2 (changes in the law) within the contractual agreement, the contract price might be increased or decreased to reflect changes in the law that may come into effect throughout the contract period. It should be noted that the aforementioned option, as per NEC4 ECC, applies only to legal amendments occurring within the local jurisdiction of the construction site. In the case that materials or supplies are sourced from a foreign country that undergoes legislative changes, the contractor is contractually obliged to assume the financial risks associated with any resulting cost escalations.

Furthermore, the NEC4 ECC allows for Option X3 (multiple currencies), which is applicable to lump sum NEC4 ECC contracts. In the event that resources are procured from a foreign country utilizing a different currency, this supplementary option allows for restricted currency fluctuations and risk restrictions. It is important to note that the implementation of this secondary option necessitates that the exchange rates of the currencies involved as well as the maximum payment amounts per currency are clearly stated in the contract documents. If the prescribed maximum payments in

Table 5. NEC4 ECC contract relevant secondary options

Secondary option	Applicable contracts	Stipulated contractual provisions
Option X1: Price adjustment for inflation	Lump sum and target projects: options A, B, C, and D	The NEC4 ECC's default is a fixed tender price against inflation. This supplementary option allows for the use of a formula to adjust pricing for inflation as the work progresses. The formula's main components are the most recent available index prior to the base date, the most recent available index prior to the evaluation of the interim payment, and the price adjustment factor. This secondary option does not pertain to contract options E and F as, in these cases, the client would pay the actual expenses as they arise.
Option X2: Changes in the law	Any type of contract	By default, NEC4 ECC uses a fixed price mechanism against changes in legislation. If this option is selected, the contract price/schedule can be adjusted upwards or downwards in response to changes in local laws affecting the project. It is important to note that this option only applies to changes in laws in the project's local jurisdiction and does not extend to other countries where materials may be procured.
Option X3: Multiple currencies	Lump sum projects: options A and B	The option allows for work items and activities to be paid in currencies other than the contract currency up to a specific maximum amount, which should be outlined in the contract documents. Once this limit is reached, payments must be made in the contract currency.

Source: Data from Hughes (2018).

the respective currencies are met throughout the contract period, the outstanding payments would be effectuated in the contract currency.

JCT

Another set of internationally used standard sets of contracts is the JCT, which is supported by the British Property Federation, the Royal Institute of British Architects, and the Scottish Building Contract Committee Limited. Table 6 provides a summary of the cost reimbursement mechanisms offered under the *Guide to JCT Intermediate Building Contract 2016 (IC16)* (Lupton 2019).

The JCT contract provides mechanisms for cost reimbursement mechanisms through the loss and expense provisions, which include the possibility of covering additional costs and time resulting from inflation and uneconomic working conditions. The incorporation of a price adjustment mechanism under the contract entails an agreement between the contracting parties regarding the formula to be used. This mechanism extends to labor and material direct costs. Notably, the JCT acknowledges that the lack of provisions for loss and expense fluctuation may result in higher tender prices due to the necessity of incorporating more substantial price contingencies. As a result, the JCT recognizes that employers can integrate fluctuation provisions in the contract, taking provisional responsibility for some of the financial risks typically attributed to contractors under fixed-price contracts, in order to benefit from less inflated tender prices.

Further, in the event of the nonexistence of loss and expense provisions or the presence of no-loss provisions, which explicitly assign the financial risk of inflation to the contractor, Schedule 4 of IC16 of the JCT outlines the default provisions for fluctuations. These provisions enable the contractor to reclaim all fluctuations in the rates of contribution, levy, and tax fluctuations resulting from changes in law. This is the opposite of the base assumption of the other UK-based NEC4 ECC contract, where the default is a fixed price against changes in the law. Thus, in the absence of any other price escalation clauses, the default assumption of the JCT contract permits solely the recovery of changes in law.

Comparative Analysis

Table 7 illustrates the contractual approach to price escalation provisions under the various sets of contracts. Additionally, Fig. 3 illustrates the contractual remedies that are available for addressing price and/or time impacts through the use of price escalation clauses, along with the price components addressed, respectively. The extent of these remedies relies on the presence of pertinent contractual provisions and condition precedent or the relevant default provisions and assumptions otherwise.

As seen in Table 7 and Fig. 3, there are several differences in the treatment of price escalation provisions as specified by each respective contract. While the FIDIC contract explicitly stipulates the provision for a price adjustment to account for inflation, the fluctuation clause falls within the purview of the ConsensusDocs 200.1 amendment when incorporated into a ConsensusDocs contract. Similarly, under an NEC contract, the fluctuation provision is to be observed in accordance with Secondary Option X1 (price adjustment for inflation). Despite the absence of explicit reference to price fluctuations in the AIA, they could be recovered by their incorporation in the allowances provisional sums stipulated in the contract. Alternatively, under UK-based contracts, only the JCT contract addresses price escalation, and such escalations can be recuperated through the implementation of loss and expense provisions.

Additionally, dissimilarities in the price recovery mechanism exist among the utilized contracts. The FIDIC contract outlines the price mechanism through the schedule(s) of cost indexation, i.e., a condition precedent for fluctuations to be recovered under a FIDIC contract, whereas the NEC's Secondary Option X1 specifies that the inflation-based price adjustment will ensue through a price factor adjustment. As both mechanisms base the price adjustment formulation on the defined costs in the contract, this generally includes the overhead costs but excludes the profit component from the price adjustment. Conversely, the ConsensusDocs amendment and the JCT contract mandate that the contractual parties agree upon a formula for the price adjustment, which must be adhered to under the contract. Under ConsensusDocs, any amounts for

Table 6. JCT relevant provisions

Escalation type	Paragraph	Provision subject	Stipulated contractual provisions
Market price fluctuations	6.25, 6.26, and 6.31	Price increase	The contractual agreement recognizes the possibility of price escalation, particularly in light of inflationary pressures, as outlined under the loss and expense provision. Further, the contractual parties are granted the option to incorporate price escalation provisions under the aforementioned loss and expense clause, subject to a mutual agreement on the pertinent clauses.
	6.30 and 6.32	Price adjustment mechanism	The contract parties may elect to utilize the conventional method of accounting for labor and material direct costs, which entails recording full fluctuations, or alternatively, adopt an adjustment formulation.
	6.32	Condition precedent Contract default assumption	The inclusion of loss and expense provisions under the general contract. In the event of nonfulfillment of the condition precedent, the contract price is deemed fixed. However, the standard contract acknowledges that this approach may lead to higher tender figures as contractors would need to factor in larger contingencies.
SC delivery delays	6.30	Time adjustment	The contractual agreement acknowledges the practical correlation between inflation and supply chain disruptions as well as their possible influence on the timeline of the project.
Changes in law	6.32 and 6.33	Contract price adjustment	In the absence of supplementary loss and expense provisions or the incorporation of no-loss provisions, the default fluctuation provisions shall apply. These provisions entail the application of Schedule 4 of the IC16, which allows the adjustment of the contract price to reflect legislative changes that affect the procurement of materials and labor.

Source: Data from Lupton (2019).

Table 7. Treatment of price escalation provisions under the various sets of contracts

Escalation type	US-based contracts				International and UK-based contracts		
	Remedies	ConsensusDocs	AIA	EJCDC	FIDIC	NEC	JCT
Market inflation/deflation	Price increase	Amendment	Allowances	Not stated	Stated provision	Secondary option	Loss and expense provisions
	Price decrease	Amendment owner and contractor's formulation	Not stated	Not stated	Stated provision	Not stated	Not stated
	price adjustment basis	Excluded	Not stated	Not stated	Schedule(s) of cost indexation	Price adjustment factor	Owner and contractor's formulation
	Overhead and profit	Implied default	Excluded	Not stated	Only overhead	Only overhead	Excluded
	Use of contingency	Implied default	Implied default	Implied default	Stipulated default	Stipulated default	Implied default
Market and SC delivery disruptions	Time adjustment	EOT under amendment and contract default	EOT for unforeseen delays	EOT for unforeseen delays	EOT for unforeseen shortages	Not stated	EOT correlated with loss and expense
	Price adjustment	Only under amendment	Not stated	Excluded	Not stated	Not stated	Not stated
Currency fluctuations	Price adjustment	Not stated	Not stated	Not stated	Stated provision	Secondary option	Not stated
Changes in law	Price and time adjustment	Price and/or time adjustment	Allowances; fixed contract otherwise	Price and/or time adjustment	Price and/or time adjustment	Secondary option; fixed contract otherwise	Price adjustment

overhead and profits are explicitly excluded from the price adjustment mechanism as stipulated. The AIA A201 does not prescribe a particular approach for the price adjustment, as fluctuations are generally recovered through allowances, which explicitly exclude the contractor's overhead and profit. Similarly, the JCT assigns the responsibility for establishing the price adjustment mechanism to the contractual parties. However, such a mechanism may fall under the loss and expense provisions, enabling the recovery of direct expenses incurred, while excluding overhead and profit amounts. Correspondingly, the EJCDC does not provide price adjustment formulations, as it does not encompass any provisions for price fluctuations.

In the event that the condition precedent for the fluctuation provisions is not observed under the respective contracts, the contractor's contingency will be the default for any price fluctuations, excluding changes in the law under most contracts. For instance, the FIDIC contract explicitly stipulates that if the schedule of cost indexation is not included in the contract documents, the contract price is deemed to have incorporated sufficient contingency for any fluctuations in costs. Similarly, in the absence of the secondary options, the NEC contract is explicit in assuming a fixed price against inflation, currency changes, and changes in law, thus making the contractor's contingency the default option to absorb any fluctuations. The presumption of utilizing the contractor's contingency is also inferred in the AIA, EJCDC, and ConsensusDocs contracts. Specifically, the AIA contract defaults to a fixed contract price in the absence of cash allowance provisions, implying the reliance on contingency against price fluctuations, including those resulting from legislative changes. Similarly, in the absence of the ConsensusDocs 200.1 amendment or in the case of market fluctuations beyond the items covered by the amendment, the contract defaults to a fixed price. This suggests that the contract assumes the use of the contractor's contingency to address price escalation, except for instances arising from changes in the law, for which the ConsensusDocs contract allows recuperation.

In addition, as the EJCDC contract lacks price escalation clauses, the use of contingency is implicitly considered the default option for the contract, except for changes in law, for which the EJCDC contract provides a mechanism for recovery.

Regarding the potential time impact resulting from price inflation, which may arise from various significant SC disruptions, ConsensusDocs, AIA, EJCDC, FIDIC, and JCT contracts contain provisions for associated EOT under the contract. The AIA, EJCDC, and FIDIC contracts prescribe an EOT for unforeseen delays that are beyond the contractor's control, which may include material deliveries, whereas the JCT contract specifies the correlation between an EOT and loss and expense provisions. Additionally, the ConsensusDocs 200.1 amendment incorporates clauses for time adjustment linked with price fluctuations as well as the financial consequences of such delays. Moreover, In the event that the ConsensusDocs 200.1 amendment is not incorporated into the contract, the ConsensusDocs 200 standard contract affords the contractor the entitlement to EOT for delays that are beyond their control, which may encompass delivery delays, albeit lacking associated financial remuneration for such delays. Conversely, the NEC contract does not provide provisions for adjusting time alongside the secondary price fluctuation options or the contract default provisions.

Provisions for currency fluctuation are generally limited across all types of contracts. Only the FIDIC and NEC contracts provide limited recourse for currency fluctuations. With regard to the FIDIC contract, currency fluctuation can be recovered if the affected currencies are included in the contract payable currencies. Similarly, under the NEC contract, the secondary option X3 (multiple

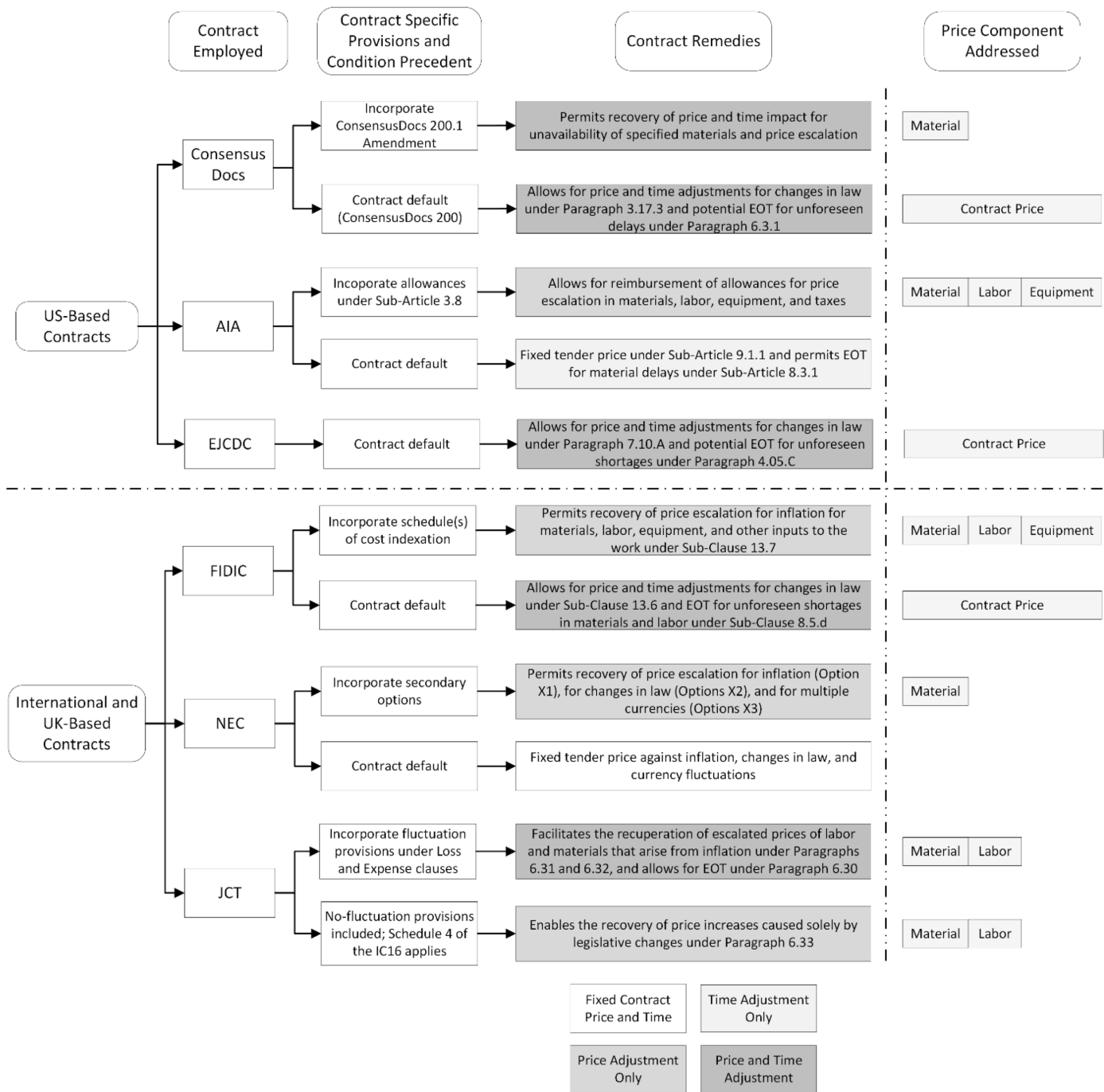


Fig. 3. Price escalation provisions under US-, international-, and UK-based contracts.

currencies) must be observed under the contract for currency fluctuation to be recovered. This option reflects the exchange rates of the currencies involved and the maximum payment amounts per currency, beyond which payments are made in the contract currency.

The general exemption from the default use of contingency is the price escalation that arises from changes in the law. For example, the EJCDC, ConsensusDocs, and FIDIC contracts specify price and/or time adjustments in response to changes in legislation. The JCT contract only includes provisions for price adjustment, with no corresponding provisions for schedule impacts. However, if the contract does not contain explicit provisions or allowances for changes in the law, the AIA contract defaults to a fixed price, whereas an NEC contract defaults to a fixed contract price unless it includes the Secondary Option X2 (changes in the law).

Legal Perspective

In the case of the contract not including a price escalation clause, certain legal doctrines could entitle the contractor to claim relief from the contractual obligations. The notion of *Pacta sunt servanda*, Latin for “agreements must be preserved,” serves as the foundation of contract law in common and international law. When two parties engage in a contract willingly and purposefully, the provisions of the contract must be observed by both parties. However, considering economic conditions might change throughout the course of a construction contract, such as the current significant price fluctuations, most nations recognize one of the legal concepts known as the “circumstance-alteration principle.” In general, this principle allows the contract to be amended if one or more

contract parties are unable to satisfy their contractual commitments due to circumstances beyond their control and/or that were unforeseeable.

Courts may undertake a review of altered circumstances in a contract in certain limited circumstances. An illustration of such circumstances is the invocation of the doctrine of “commercial impracticability” under common law, which is applicable when the performance of a contract can be achieved, albeit at an unjustifiably exorbitant expense. Nonetheless, establishing this principle can be challenging (Declercq 1995; Schwenger 2008). Several other factors, namely unforeseeability, would need to be proved to the court. In the legal case of *Missouri Public Service Company v. Peabody Coal Company* (casetext 1979b), Peabody was involved in a long-term contract to supply coal to Missouri Public Service. Faced with energy cost escalation, which was exacerbated by the Arab oil embargo, the parties involved were unable to come to an agreement on a revised price per ton of coal. Consequently, Peabody indicated its intention to cease shipments, which the public utility service regarded as “anticipatory breach of the contract” and initiated court proceedings to enforce the performance of the contract. The court acknowledged that the Arab oil embargo was a well-known and widely discussed event by the public, and its imposition during the contract period was foreseeable. As a result, since it was not proven that the circumstances were unforeseeable, the defendant (Peabody) was not granted relief under the doctrine of commercial impracticability.

In the legal case of *Iowa Electric Light & Power Co. v. Atlas Corporation* (1979a), Atlas Corporation was a uranium supplier to Iowa Electric Light & Power Company. The defendant (Atlas Corporation) attributed the escalation of costs to a multitude of factors, including the Arab oil embargo, inflation in wages, and specific uranium market conditions, resulting in a cost increase of more than 50%. Consequently, the supplier sought to reform the contract by judicial decree; as to provide a higher price per pound of uranium on the basis of commercial impracticability. The US District Court for the Northern District of Iowa denied Atlas relief from its contractual obligations and dismissed the case. The court noticeably assigned the burden of proof for establishing the constituent elements of impracticability to the party invoking the defense. In the case under consideration, the court determined that the parties to the contract had reasonable grounds to anticipate increasing costs at the time of signing and thus could not claim that such costs were entirely unforeseeable. Accordingly, and in light of the broad acknowledgment of ongoing market disruptions within the construction industry, it is unlikely that a contractor that enters into a contract after the commencement of such disruptions would be able to obtain legal relief from a court. This is attributable to the considerable challenge of demonstrating that the disruptions were unforeseeable and resulted in commercial impracticability.

Further, contractors may assert the common law doctrine of “impossibility of performance,” which allows a contracting party to be relieved from contractual duties owing to unforeseeable events. Notably, regular/anticipated price increases are not an excuse for performance nor is a market collapse a justification. Comment 4 of the Uniform Commercial Code (1952) (§ 2-615), “Excuse by Failure of Presupposed Conditions,” describes that the scale must be proportionate to unforeseeable events that affect the nature of the performance, such as a significant lack of raw materials. In the legal case of *Moyer v. City of Little Falls* (casetext 1986), the contractor (Moyer) experienced a price increase of 666% as a consequence of a decree by the New York State Department of Environmental Conservation (DEC), which was issued after the contract formation. Consequently, the plaintiff (Moyer) attempted to obtain relief from performance-based impossibility of performance. In this case, The

Herkimer County Supreme Court, which is a state court in New York, recognized that courts could allow exemption from performance in cases where government action or unforeseeable circumstances lead to a significantly inequitable situation that was entirely beyond the parties’ initial contemplation. Accordingly, the court awarded the plaintiff’s request for relief, releasing the contractor from further obligations, on account of the escalation in costs that was deemed to be disproportionate and beyond the scope of the parties’ original understanding. Similarly, in the legal case of *Aluminum Co. of Am. v. Essex Grp., Inc.* (1980), the implementation of new environmental control regulations augmented the expenses for the supplier, resulting in anticipated losses exceeding \$75 million throughout the duration of the contract that was yet to be fulfilled. The US District Court for the Western District of Pennsylvania, which is a federal court, recognized that the case involved a challenge regarding the legal response to inflation. The court recommended that, when deciding to modify a contract due to inflation, four factors should be considered: the parties’ anticipation and allocation of risks; the risk mitigation efforts; the severity of financial losses; and the relevant industry-commensurate practice. Thus, in this legal dispute, the court determined that the significant regulatory alterations, coupled with the substantial financial losses, were unforeseeable to the contracting parties and, consequently, granted relief to the seller by establishing that fulfilling its obligations had become commercially impracticable.

Other comparable doctrines, such as the “frustration of purpose” doctrine, have been employed to justify the parties’ incapacity to execute their duties as a result of circumstances that are unforeseen to the contract parties and which disrupt the central purpose of the contract formation. In a recent decision in the legal case of *CAI Rail, Inc. v. Badger Mining Corp* (2021), the US District Court for the Southern District of New York affirmed that the doctrine of frustration of purpose only applies when the frustration is significant, and a party cannot use it to excuse a contract solely because the transaction has become less profitable or resulted in a loss, even if this is due to changes in market conditions. In this legal case, the plaintiff (CAI Rail) contended that the pandemic and economic impact made the contract less profitable than expected when it was signed. The plaintiff further stated that the economic losses are the result of government regulations but failed to provide the court with the legislation. The court decided that, in the absence of governmental legislation rendering the transaction impossible, the contract only became unprofitable for the plaintiff, which was not sufficient to establish frustration of purpose. In consequence, the plaintiff was not awarded relief and was found in breach of contract for failing to deliver on its contractual obligations.

Apart from contractual relief, there exist limited circumstances in which a contractor may be entitled to claim cost escalation. For example, Johnson (2022) illustrates that if the cost escalation would not have been materialized unless for an owner-caused hindrance in the work, such as the delay of site access, the contractor could recover the cost escalation that was experienced due to the employer’s breach of contract. This was the case in the legal case of *S. Leo Harmony, Inc. v. Binks Mfg. Co.* (1984), in which the contractor incurred losses as a result of the owner’s delays, resulting from failure to provide design drawings in a timely manner. On this project, the contractor incurred a 12% increase in price as a direct result of the owner’s breach, in addition to other losses. Following a determination by the court that the defendant (Binks Mfg.) had breached the terms of the contract, the contractor was awarded reimbursement for all damages incurred, including the full value of the price escalation.

Table 8 contrasts the important features of the judicial cases presented. In the instances outlined, a contractor must have experienced

Table 8. Summary of price escalation US court cases

Doctrine	Court case	Sector	Court	Severe economic losses	Unforeseeability Proven	Losses are consequences of Government actions	Court decision
Commercial impracticability	<i>Mo. Public Service Co. v. Peabody Coal Co.</i> (1979)	Energy	State	Yes	No ^a	No	No relief from contract
	<i>Iowa Elec. Light & Power Co. v. Atlas Corp.</i> (1979)	Energy	State	Yes	No ^a	No	No relief from contract
Impossibility to perform	<i>Moyer v. City of Little Falls</i> (1986)	Environmental Services	State	Yes	Yes	Yes	Relief from contract
	<i>Aluminum Co. of America v. Essex Group, Inc.</i> (ALCOA and Essex 1980)	Energy	Federal	Yes	Yes	Yes	Relief from contract
Frustration of purpose	<i>CAI Rail, Inc. v. Badger Mining Corp.</i> (casetext 2020)	Transportation	State	No ^a	Yes	Yes, but failed to substantiate ^a	No relief; in breach of contract
-(disputes)	<i>S. Leo Harmonay, Inc. v. Binks Mfg. Co.</i> (JUSTIA US LAW 1984)	Construction	State	No ^b	No	No; a consequence of the owner's breach	Awarded the losses including the price escalation

^aDetrimental factor in the rejection of the relief.

^bContractor experienced industry-commensurate losses on the project.

severe economic losses as a result of unanticipated occurrences and/or governmental rules to be eligible for contract relief owing to unbearable price increases. Normally, courts do not recuperate financial losses resulting from price increases, except under specific circumstances, such as their probable avoidance unless for an owner's breach of contract.

Proposed Contractual Considerations and Research Summary

Based on the comparative analysis and the legal perspective presented in the previous sections, it could be concluded that, if the contract lacks price escalation clauses and extreme price variations occur on the project, the contractor has limited circumstances to be reimbursed for the price escalation. Alternatively, to be relieved of the contract under the respective legal principles, a contractor must first incur significant economic losses. The courts do not uphold *commercial impracticability* or *frustration of purpose* for contracts that become unprofitable. Further, the high economic losses must be the result of unforeseeable occurrences and/or government policies. Given that the COVID-19 pandemic, the Russia–Ukraine conflict, the oil market disruption, and the escalation of the building materials market are all currently public knowledge, a contractor is unlikely to be relieved of the contract in court if the contract was recently signed or will be signed in the future, as the conditions would not be considered as “unforeseen.” The optimal course to ensure successful project progress in light of construction materials, labor, and equipment price inflation is to stipulate price escalation provisions in the construction contract. As a result, contract price escalation clauses should be reorganized systemically to account for the rapid price fluctuations. Given the variability of price escalation provisions among the respective standard forms of contract, Fig. 4 provides proposed contractual considerations for balanced price escalation clauses in the contract.

While these proposed considerations are generic in nature to be employed under various contracts and jurisdictions, the contractual parties are still required to closely follow the contract conditions and applicable laws for their projects. As illustrated in Fig. 4, if the contract follows a reimbursable structure, such as a cost-plus contract, the financial risk is shifted to the owner. Conversely, in a

lump sum/GMP contract, the contractor predominantly bears the financial risk. To prevent an uneven distribution of financial risks, especially concerning price escalation, it is imperative for contractual parties to institute price escalation provisions. This ensures the establishment of balanced conditions that prevent either party from assuming complete financial risks under both contract pricing models. To address this, contractual parties can refer to the proposed considerations in Fig. 4 in drafting the contractual provisions. The recommendations include subjects of contractual clauses that can be supplemented depending on the standard form of contract employed and the conditions provided therein.

First, under fixed-price contracts, where contractors assume heightened financial risks, it is advisable for contractual parties to integrate the applicable price escalation provisions, which may vary across standard contracts. For instance, if the governing contract is the FIDIC contract, project parties should include the schedule(s) of cost indexation, serving as the condition precedent to ensure the provisional application of price escalation clauses under FIDIC. Alternatively, if utilizing the ConsensusDocs contract, project parties should incorporate the ConsensusDocs 200.1 amendment, clearly specifying the covered material items and the method of price recuperation. Similarly, under the NEC4 ECC contract, parties should consider incorporating secondary options (Options X1, X2, and X3) to guard against price escalation due to inflation, changes in law, and currency fluctuations, respectively. This also requires agreement on the covered items and the formulation of price adjustments. Conversely, when employing contracts such as AIA, which solely permits the inclusion of cash allowances for price fluctuations, EJCDC, lacking a price escalation provision, or JCT, allowing for the incorporation of loss and expense provisions, it is advisable for the project parties to supplement these contracts with robust price escalation provisions. These provisions should encompass the price escalation method, the notice and time-frame process related to such a method, and the treatment of the temporal implications associated with price escalation.

Second, under both contract pricing frameworks, it is advisable for the contracting parties to augment contracts with supplementary provisions to mitigate complete financial exposure for either party and to minimize the occurrence of claims and disputes. Given the variability in the scope of coverage of price escalation provisions

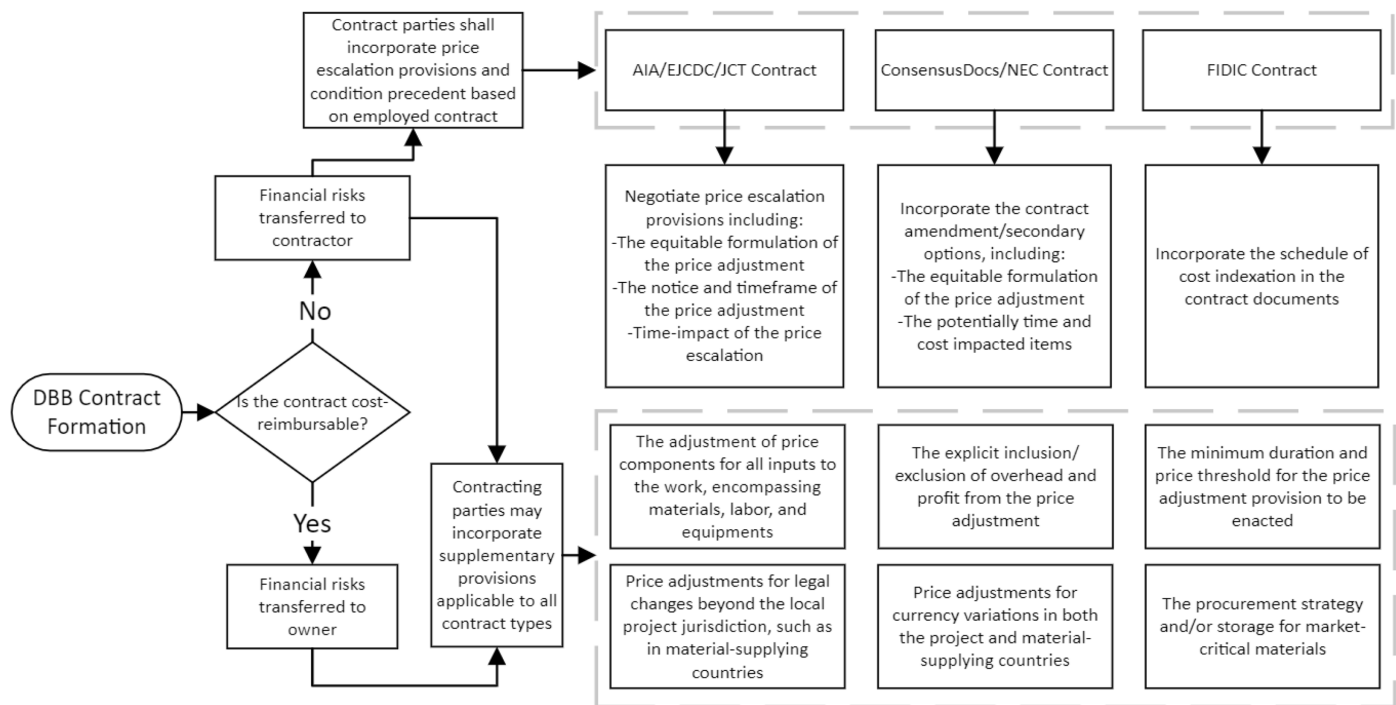


Fig. 4. Outline of the proposed contractual guidelines to include balanced price escalation provisions on the construction contract.

among standard contracts (Fig. 3), contract parties are encouraged to explicitly and mutually define the scope of price adjustment, particularly concerning inputs such as materials, labor, and equipment, the consideration of overhead and profits, and the price and duration thresholds to enact such provisions. Moreover, considering that most contracts delineate price and/or time adjustments for legal changes within the project's location, it is advised that contractual parties stipulate the approach to price and/or time adjustment for legal changes arising in foreign jurisdictions that may exert an influence on the project, particularly in countries contributing to the project's material supply. Similarly, contractual parties are recommended to define the treatment of price adjustment resulting from currency changes, both in the project's local currency and foreign currencies relevant to the project. Additionally, it is imperative for owners and contractors, as well as contractors and their subcontractors, to prioritize procurement strategies that mitigate market volatility. To achieve this, contractual parties should engage in agreements concerning procurement and storage strategies. These strategies would protect the contractor and the owner from financial risks, considering various lead times and early procurement arrangements for materials, labor, and equipment sensitive to fluctuations at the project's outset.

In addition, Table 9 summarizes the study's findings in conjunction with the research questions addressed.

Conclusion, Contributions, and Limitations

This paper addressed one of the most significant price-related components of construction contract formation and administration, i.e., price escalation provisions. The 2018 steel and aluminum tariffs, coupled with the COVID-19 pandemic, have adversely affected the global economy, causing disruptions to the SC of construction materials, labor, and equipment supply. The Russia-Ukraine conflict created continual disruption in the SC of construction supplies as well as a significant increase in

energy prices. As a result, owners and contractors must have appropriate balanced contractual measures in place to address price escalation on their projects. An analysis of the standard forms of construction contracts established that the US-based contracts differ in their approach to price escalation as a result of market fluctuations and changes in the laws, with the ConsensusDocs providing the most thorough amendment for potentially time and price-impacted material. When compared with the FIDIC Red Book 2017 and the UK-based JCT and NEC contracts, the US-based contracts lack numerous price escalation provisions. Further, several elements are missing from price escalation provisions in most contract forms, such as the explicit inclusion/exclusion of overhead and profit in the price adjustment, currency fluctuations in countries where materials are procured from, procurement strategies for market-sensitive materials, labor, and equipment, and the equitable formulation of price adjustment.

This study contributes to the existing scholarly literature and the construction industry by: (1) providing a comprehensive comparative analysis of the treatment of price escalation under the various construction commercial contracts; (2) examining the applicable legal doctrines that come into effect in the absence of appropriate contractual provisions; and (3) proposing contractual considerations for identifying and incorporating various price escalation provisions in the respective standard sets of contracts used in national and international construction projects. These findings are essential to address the impacts of price fluctuations, such as inflation, changes in the law, and changes in currency exchange rates, which need to be appropriately included in and observed under the contract in order to ensure the economic interests of the various construction stakeholders from the market volatility. This should provide a solid foundation for project parties to engage in better review, analysis, mitigation, and management of the financial risk pertinent to price escalation.

Ultimately, these findings enable proactive assessment and management of contractual risks, leading to more secure and successful construction projects. It is important that the associated parties to a

Table 9. Summary of key findings

Research question	General key research findings
1. What are the remedial measures provided for in certain contracts to mitigate the adverse effects of price escalation on construction projects? Additionally, what specific price component(s) (if any) are addressed by these measures?	There is variation in the remedies provided by standard forms of contract, with most contracts assuming a fixed price against inflation but generally allowing for price adjustment in response to changes in the law. Certain contract forms offer optional/additional provisions for price escalation. The price escalation provisions of standard construction contracts differ in terms of the specific price component addressed, with certain contracts only addressing changes in material prices, while others, such as the FIDIC, encompass fluctuations in labor costs and other input factors of the work.
2. What conditions need to be fulfilled in order to trigger price escalation clauses?	The inclusion of price escalation clauses in the contract, as well as fulfillment of the appropriate conditions precedent. For example, only the items specified in ConsensusDocs 200.1 could be price-adjusted under a ConsensusDocs contract.
3. What are the appropriate considerations required to safeguard the project parties from exorbitant price increases?	Under fixed-price contracts, the contractual parties can consider: (1) agreeing on equitable price adjustment formulations in the contract; (2) excluding aspects from price adjustment provisions that, in lump sum contracts, could be managed under the contractor's contingency; and (3) incorporating de-escalation pricing clauses and formulations into the contract. Under reimbursable contracts, the owner is responsible for the financial risks, unless the contract includes additional provisions to allocate/restrict these risks to other parties involved in the project.
4. If a contract does not include provisions relating to price escalation clauses, what are the fundamental legal considerations that can be utilized to tackle the issue of price escalation?	Relief may be granted by the courts under common law doctrines of impossibility, commercial impracticability, and/or frustration of purpose. Courts may also grant reimbursement in certain dispute cases, namely when the losses could have been prevented were it not for the owner's breach/hindrance of the works.
5. What are the prescribed legal provisions for granting contractual relief in the event of a specified increase in project costs?	If the contractor can demonstrate serious economic damages as a result of unforeseeable situations and/or unforeseen governmental acts, the court may provide relief.

contract establish price escalation clauses in good faith and incorporate balanced conditions that return the advantage of lower tender prices to owners while reducing the severe financial risks on contractors. Also, they should integrate procurement plans that prioritize price and time-sensitive materials, labor, and equipment on the project to proactively regulate against price inflation.

Nevertheless, as with any research endeavor, this study is not without limitations. Primarily, this study has limitations inherent to its contractual focus and extensive analysis of national and international contracts related to diverse aspects of price escalation, which led to a comprehensive exploration of present contractual provisions. Due to space constraints, the study did not delve into the relevant contractual tools, such as notice procedures, event documentation, and claims, which are essential in proper contract administration. Therefore, future research concentrating on specific standard contract forms for distinct types of price escalation could provide targeted insights into applicable contractual tools, thus enhancing guided contract administration. Additionally, while the contractual comparative analysis and the proposed contractual considerations are the outcomes of the dual interrelated analysis of standard contract forms and legal cases, it is important to acknowledge that they have a limitation in terms of not being tested to evaluate their value. In contrast with quantitative modeling and simulation-based research, which can be validated and verified using collected data sets or statistically generated data sets through multiple what-if scenarios, qualitative contractual-based research faces challenges in assessing its application in real-life construction projects. Testing the considerations provided in this study on actual projects may be beyond the researchers' control or require a considerable amount of time to yield meaningful results. Accordingly, it is recommended to test the different findings of this study on future construction projects, namely, in the presently disrupted construction SC, and report about their advantages and disadvantages in future publications.

Further, while this study examined the contractual aspects of price escalation, there is also a notable lack of quantitative models that address the issue of price escalation within the construction SC. To address this gap, future research endeavors could extend their investigation by incorporating the influence of inflationary trends within the construction SC. Similarly, in accordance with the observations made in this study regarding the pervasive challenge of cost overruns in the global construction industry, current price escalations introduce additional complexities to the conventional practices of cost estimation. Consequently, forthcoming research works could be directed toward the development of novel approaches aimed at forecasting shifts and uncertainties in construction material costs, particularly in response to recent market fluctuations. Such works hold the potential to enable construction practitioners to optimize their procurement strategies and formulate well-informed decision-making financial frameworks in light of SC volatility.

Data Availability Statement

All data, models, and code generated or used during the study appear in the published article.

Acknowledgments

The authors would like to thank the construction group at Greensfelder Law Firm as represented by Chantal Mehill for providing constructive insights and suggestions that positively contributed to this manuscript. It is worth noting that any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of Greensfelder.

References

- Abdul-Malak, M. A. U., and J. M. Hamie. 2019. "Proposed framework for the rendering of construction contract document interpretations by engineering professionals." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 11 (3): 04519016. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000305](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000305).
- Abdul-Malak, M. A. U., and F. G. Khalife. 2020. "Managing the risks of third-party sustainability certification failures." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 12 (3): 04520027. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.000040](https://doi.org/10.1061/(ASCE)LA.1943-4170.000040).
- Abdul Nabi, M., I. H. El-adaway, R. Assaad, and M. O. Ahmed. 2021. "Prioritization of project factors affecting the use of modular construction: Comparison between the perspectives of industry and literature." In *Proc., Canadian Society of Civil Engineering Annual Conf.*, 569–582. Singapore: Springer.
- Abu Helw, A., and A. S. Ezeldin. 2022. "Framework for enhanced applicability of the public procurement law to international administrative construction contracts." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 14 (2): 04522004. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000537](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000537).
- AGC (Associated General Contractors). 2019. "2018-2019 trade action affecting the construction industry." Accessed October 19, 2022. https://www.agc.org/sites/default/files/Primer-%202018-19%20Trade%20Action%20Affecting%20Const.%20Industry_Draft_May2019.pdf.
- AGC (Associated General Contractors). 2022a. "AGC construction inflation alert." Accessed July 25, 2023. <https://www.agc.org/learn/construction-data/agc-construction-inflation-alert>.
- AGC (Associated General Contractors). 2022b. "Price escalation continues to be the top issue in construction contracts but some success stories can now be shared." Accessed July 25, 2023. <https://www.agc.org/news/2022/10/10/price-escalation-continues-be-top-issue-construction-contracts-some-success-stories-can-now-be>.
- Ahmed, M. O., M. Abdul Nabi, I. H. El-adaway, D. Caranci, J. Eberle, Z. Hawkins, and R. Sparrow. 2021. "Contractual guidelines for promoting integrated project delivery." *J. Constr. Eng. Manage.* 147 (11): 05021008. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0002173](https://doi.org/10.1061/(ASCE)CO.1943-7862.0002173).
- AIA (American Institute of Architects). 2017. *American institute of architects document A201: General conditions of the contract for construction*. Washington, DC: AIA.
- AIA (American Institute of Architects). 2019. *American Institute of Architects document A503: Guide for supplementary conditions, including amendments to AIA documents A201, the 2017 owner-contractor agreements, and the 2019 owner-construction manager as constructor agreements*. Washington, DC: AIA.
- ALCOA and Essex. 1980. "Aluminum Co. of America v. Essex Group, Inc. 499 F. Supp. 53 (W.D. Pa. 1980)." Accessed April 7, 1980. <https://law.justia.com/cases/federal/district-courts/FSupp/499/53/1871367/>.
- Al-Humaidi, H. M. 2014. "Arbitration in Kuwait: Study of current practices and suggestions for improvements." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 6 (1): 03013001. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000128](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000128).
- Aljohani, A., D. Ahiaga-Dagbui, and D. Moore. 2017. "Construction projects cost overrun: What does the literature tell us?" *Int. J. Innovation Manage. Technol.* 8 (2): 137. <https://doi.org/10.18178/ijimt.2017.8.2.717>.
- Allen, N. E., A. L. Walden, E. R. Dworkin, and S. H. A. B. N. A. M. Javdani. 2016. "Mixed methodology in multilevel, multisetting inquiry." In *Handbook of methodological approaches to community based research: Qualitative, quantitative, and mixed methods*, 335–343. Oxford, UK: Oxford University Press.
- Al-Zarrad, M. A., G. P. Moynihan, and S. C. Vereen. 2015. *Guideline to apply hedging to mitigate the risk of construction materials price escalation*. Surrey, BC, Canada: Canadian Society of Civil Engineering.
- Arcadis. 2019. "Global construction disputes report, laying the foundation for success." Accessed April 10, 2023. https://images.arcadis.com/media/5/D/1/%7B5D16141D-B883-4398-BB35-218023E1F4F6%7DRP_GCDR_AL20190620_Final.pdf?_ga=2.259975178.1280885210.1580924143-615783635.1580924143.
- Assaad, R., and M. A. Abdul-Malak. 2020a. "Legal perspective on treatment of delay liquidated damages and penalty clauses by different jurisdictions: Comparative analysis." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 12 (2): 04520013. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000387](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000387).
- Assaad, R., and M. A. Abdul-Malak. 2020b. "Timing of liquidated damages recovery and related liability issues." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 12 (2): 04520015. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000390](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000390).
- Assaad, R., and I. H. El-adaway. 2021. "Guidelines for responding to COVID-19 pandemic: Best practices, impacts, and future research directions." *J. Manage. Eng.* 37 (3): 06021001. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000906](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000906).
- Assaad, R., I. H. El-adaway, and I. S. Abotaleb. 2020a. "Predicting project performance in the construction industry." *J. Constr. Eng. Manage.* 146 (5): 04020030. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001797](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001797).
- Assaad, R., I. H. El-adaway, K. Baxmeyer, M. Harman, L. Job, and H. Lashley. 2021. "Allocation of risks and responsibilities in green and sustainable buildings." *J. Archit. Eng.* 27 (2): 04021002. [https://doi.org/10.1061/\(ASCE\)AE.1943-5568.0000458](https://doi.org/10.1061/(ASCE)AE.1943-5568.0000458).
- Assaad, R., I. H. El-adaway, A. H. El Hakea, M. J. Parker, T. I. Henderson, C. R. Salvo, and M. O. Ahmed. 2020b. "Contractual perspective for BIM utilization in US construction projects." *J. Constr. Eng. Manage.* 146 (12): 04020128. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001927](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001927).
- Assaad, R., A. Elsayegh, G. Ali, M. Abdul Nabi, and I. H. El-adaway. 2020c. "Back-to-back relationship under standard subcontract agreements: Comparative study." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 12 (3): 04520020. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000406](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000406).
- Athnos, L. 2018. "Risks in construction contracts." Accessed July 25, 2023. https://scm.ncsu.edu/wp-content/uploads/2018/04/Risks-in-Construction-Contracts_Lu-Athnos.pdf.
- Baker, E., A. Lavers, and R. Major. 2019. "Introduction to the FIDIC suite of contracts." In *The guide to construction arbitration*, edited by S. D. B. Brekoulakis and D. B. Thomas. London: Law Business Research.
- BIS (Bureau of Industry and Security). 2018. "Section 232 National Security investigation of steel imports: Information on the exclusion process." Accessed October 21, 2022. <https://www.bis.doc.gov/index.php/232-steel>.
- Bloom, M. A., A. Ross, and V. F. Wiener. 2021. "Managing risk: Supply chain disruptions and market price volatility in the construction industry." Accessed October 19, 2022. <https://www.afslaw.com/perspectives/alerts/managing-risk-supply-chain-disruptions-and-market-price-volatility-the>.
- BLS (Bureau of Labor Statistics). 2022. "Producer price index—December 2022." Accessed September 28, 2022. <https://www.bls.gov/ppi/>.
- Bourne, L. S. 1986. "The geography of housing." *Real Estate Econ.* 14 (1): 173–174. <https://doi.org/10.1111/1540-6229.00380>.
- Boyette, K. A. 2022. "How the Russia-Ukraine war could impact the construction industry. Roofing." Accessed October 19, 2022. <https://roofingmagazine.com/how-the-russia-ukraine-war-could-impact-the-construction-industry/>.
- casetext. 1979a. "Iowa Elec. Light & Power Co. v. Atlas Corp., 603 F.2d 1301 (8th Cir. 1979)." Accessed January 1, 2024. <https://casetext.com/case/iowa-electric-light-and-power-v-atlas-corp>.
- casetext. 1979b. "Mo. Public Service Co v. Peabody Coal Co., 583 S.W.2d 721 (Mo. Ct. App. 1979)." Accessed January 1, 2024. <https://casetext.com/case/mo-public-service-v-peabody-coal-co>.
- casetext. 1986. "Moyer v. City of Little Falls. 134 Misc. 2d 299, 510 N.Y.S.2d 813 (NY: Supreme Court, Herkimer 1986)." Accessed January 1, 2024. <https://casetext.com/case/moyer-v-city-of-little-falls>.
- casetext. 2020. "CAI RAIL, Inc. 2020. v. BADGER Mining Corporation, No. 20 Civ. 4644 1361 (LGS) (S.D.N.Y. Aug. 27, 2020)." Accessed February 22, 2021. <https://casetext.com/case/cai-rail-inc-v-badger-mining-corp>.
- Choi, M., J. Kim, and M. Kim. 2006. "A study on the price escalation system in a construction contract." *KSCCE J. Civ. Eng.* 10 (4): 227–232. <https://doi.org/10.1007/BF02830776>.
- Chong, H. Y., S. L. Fan, M. Sutrisna, S. H. Hsieh, and C. M. Tsai. 2017. "Preliminary contractual framework for BIM-enabled projects." *J. Constr.*

- Eng. Manage.* 143 (7): 04017025. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001278](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001278).
- Conerly, B. 2020. "What is essential business in a COVID-19 shelter-in-place order?" Accessed September 28, 2022. <https://www.forbes.com/sites/billconerly/2020/03/24/what-is-essential-business-in-a-covid-19-shelter-in-place-order/?sh=73d51faa5467>.
- ConsensusDocs. 2007a. *Amendment No. 1 potentially time and price-impacted materials*. Arlington, VA: ConsensusDocs.
- ConsensusDocs. 2007b. *Standard agreement and general conditions between owner and constructor (lump sum)*. Arlington, VA: ConsensusDocs.
- Cox, M. 2022. "Anticipating material supply chain issues in construction projects." Accessed October 21, 2022. <https://www.smithcurrie.com/publications/common-sense-contract-law/material-cost-escalation/>.
- Declercq, P. J. 1995. "Modern analysis of the legal effect of force majeure clauses in situations of commercial impracticability." *J. Law Commerce* 15: 213.
- Demachkieh, F., S. Khalife, M. A. Abdul-Malak, and F. Hamzeh. 2020. "Considerations for filing global construction claims: Legal perspective." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 12 (3): 05020003. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000393](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000393).
- Di Stravolo Elliott, M. 2021. "Can I use a price escalation clause in my construction contract? Barley Snyder." Accessed September 28, 2022. <https://www.barley.com/can-i-use-a-price-escalation-clause-in-my-construction-contract/>.
- EJCDC (Engineers Joint Contract Documents Committee). 2013. *Standard general conditions of the construction contract*. EJCDC C-700. Alexandria, VA: EJCDC.
- El-adaway, I. H., I. S. Abotaleb, M. S. Eid, S. May, L. Netherton, and J. Vest. 2018. "Contract administration guidelines for public infrastructure projects in the United States and Saudi Arabia: Comparative analysis approach." *J. Constr. Eng. Manage.* 144 (6): 04018031. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001472](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001472).
- El-adaway, I. H., S. A. Fawzy, K. Cody, S. Fast, G. Spencer, D. Bond, D. Cushman, and T. Stieffel. 2014. "Contract administration guidelines for contractors working under AIA A201-2007 contract for construction." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 6 (1): 03013002. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000131](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000131).
- Elinwa, A. U., and S. A. Buba. 1993. "Construction cost factors in Nigeria." *J. Constr. Eng. Manage.* 119 (4): 698–713. [https://doi.org/10.1061/\(ASCE\)0733-9364\(1993\)119:4\(698\)](https://doi.org/10.1061/(ASCE)0733-9364(1993)119:4(698)).
- Ercan, M. 2017. *A study on the price escalation system in public construction contracts in Turkey*. Ankara, Turkey: Middle East Technical Univ.
- Evans, S. C. 2018. "Why Australia needs the NEC—Queensland major contractors association." Accessed September 18, 2022. <https://qmca.com.au/wp-content/uploads/2018/11/NEC-Contract.pdf>.
- Fawzy, S. A., and I. H. El-adaway. 2015. "Global total cost claims within common law legal systems: Application to the World Bank contract." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 7 (2): 04514005. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000155](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000155).
- Fawzy, S. A., I. H. El-Adaway, L. Perreau-Saussine, M. S. Abdel Wahab, and T. H. Hamed. 2018. "Analyzing termination for convenience provisions under common law FIDIC using a civil law perspective." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 10 (4): 06518003. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000279](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000279).
- FIDIC (Fédération Internationale des Ingénieurs-Conseils). 2017. *Conditions of Contract for Construction*. Geneva: FIDIC.
- FIEC (European Construction Industry Federation). 2022. "Construction industry hit hard by war in Ukraine." Accessed July 25, 2023. https://www.fiec.eu/application/files/2816/6195/4482/2022-June-FIEC_article-Construction_industry_hit_hard_by_war_in_Ukraine-KHL.pdf
https://www.fiec.eu/application/files/2816/6195/4482/2022-June-FIEC_article-Construction_industry_hit_hard_by_war_in_Ukraine-KHL.pdf.
- Glisson, J. D., and J. Courtway. 2019. "Delay provisions in the AIA and ConsensusDocs form contracts." *Saint Louis Bar J.* 66 (1): 4–10.
- Gunduz, M., and H. A. Elsherbeny. 2020. "Operational framework for managing construction-contract administration practitioners' perspective through modified Delphi method." *J. Constr. Eng. Manage.* 146 (3): 04019110. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0001768](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001768).
- Hafeez, K. 2011. "Comparative study of price adjustment formula and its implications in construction contracts." Doctoral dissertation, Dept. of Construction Engineering and Management, National Univ. of Sciences and Technology Islamabad.
- Handfield, R. B., G. Graham, and L. Burns. 2020. "Corona virus, tariffs, trade wars and supply chain evolutionary design." *Int. J. Oper. Prod. Manage.* 40 (10): 1649–1660. <https://doi.org/10.1108/IJOPM-03-2020-0171>.
- Hanes, C. 2022. "Effects of the Russia-Ukraine conflict on construction supply chains." Accessed October 15, 2022. <https://www.irmi.com/articles/expert-commentary/effects-of-the-russia-ukraine-conflict-on-construction-supply-chains>.
- Hansen, S. 2020. "Does the COVID-19 outbreak constitute a force majeure event? A pandemic impact on construction contracts." *J. Civ. Eng. Forum* 6 (1): 201–214.
- Haslinda, A. N., T. W. Xian, K. Norfarahayu, R. M. Hanafi, and H. M. Fikri. 2018. "Investigation on the factors influencing construction time and cost overrun for high-rise building projects in Penang." *J. Phys. Conf. Ser.* 995 (1): 012043. <https://doi.org/10.1088/1742-6596/995/1/012043>.
- Hillig, J. B., D. Dan-Asabe, S. Donyavi, O. Dursun, and A. Thampuratty. 2010. "FIDIC's red Book 1999 edition: A study review." *Proc. Inst. Civ. Eng. Manage. Procure. Law* 163 (3): 129–133. <https://doi.org/10.1680/jmpal.2010.163.3.129>.
- Hughes, K. 2018. *Understanding the NEC4 ECC contract: A practical handbook*. Boca Raton, FL: CRC Press. <https://doi.org/10.1201/9781351014359>.
- Johnson, A. 2022. "Tackling cost escalation in international construction and engineering projects." Accessed October 19, 2022. <https://www.lexology.com/library/detail.aspx?g=4d0bc80b-3ef1-444c-a93b-c61e7c1cfa20>.
- JUSTIA US LAW. 1984. "S. Leo Harmonay, Inc. v. Binks Mfg. Co., 597 F. Supp. 1014 (S.D.N.Y. 1984)." Accessed October 26, 1984. <https://law.justia.com/cases/federal/district-courts/FSupp/597/1014/1437536/>.
- Kangari, R. 1995. "Risk management perceptions and trends of US construction." *J. Constr. Eng. Manage.* 121 (4): 422–429. [https://doi.org/10.1061/\(ASCE\)0733-9364\(1995\)121:4\(422\)](https://doi.org/10.1061/(ASCE)0733-9364(1995)121:4(422)).
- Khalef, R., G. G. Ali, I. H. El-adaway, and G. M. Gad. 2022. "Managing construction projects impacted by the COVID-19 pandemic: A contractual perspective." *Construct. Manage. Econ.* 40 (4): 313–330. <https://doi.org/10.1080/01446193.2022.2031238>.
- Khalef, R., I. H. El-adaway, R. Assaad, and N. Kieta. 2021. "Contract risk management: A comparative study of risk allocation in exculpatory clauses and their legal treatment." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 13 (1): 04520036. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000430](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000430).
- Khan, J., A. Ishizaka, and S. K. Mangla. 2022. "Assessing risk of supply chain disruption due to COVID-19 with fuzzy VIKORSort." *Ann. Oper. Res.* 1–26. <https://doi.org/10.1007/s10479-022-04940-9>.
- Love, P. E., and D. D. Ahiaga-Dagbui. 2018. "Debunking fake news in a post-truth era: The plausible untruths of cost underestimation in transport infrastructure projects." *Transp. Res. Part A: Policy Pract.* 113 (Apr): 357–368. <https://doi.org/10.1016/j.tra.2018.04.019>.
- Love, P. E., D. D. Ahiaga-Dagbui, and Z. Irani. 2016. "Cost overruns in transportation infrastructure projects: Sowing the seeds for a probabilistic theory of causation." *Transp. Res. Part A: Policy Pract.* 92 (Jun): 184–194. <https://doi.org/10.1016/j.tra.2016.08.007>.
- Lupton, S. 2019. *Guide to JCT intermediate building contract 2016: JCT intermediate building contract (IC), JCT intermediate building contract with contractor's design (ICD)*. London: RIBA. <https://doi.org/10.4324/9780429346040>.
- Mekonen, H., A. M. Legesse, and F. M. Ameya. 2023. "Investigation of price escalation and its mitigation mechanisms on selected building construction projects of Jimma University." *Jordan J. Civ. Eng.* 17 (2). <https://doi.org/10.14525/JJCE.v17i2.03>.
- Musarat, M. A., W. S. Alaloul, and M. S. Liew. 2021. "Impact of inflation rate on construction projects budget: A review." *Ain Shams Eng. J.* 12 (1): 407–414. <https://doi.org/10.1016/j.asej.2020.04.009>.
- Novikov, A. M., and D. A. Novikov. 2013. Vol. 2 of *Research methodology: From philosophy of science to research design*. Boca Raton, FL: CRC Press.

- Prichett, M. B., P. W. Griesmyer, D. F. McDonald, V. G. Venters, and L. R. Dysert. 2011. *AACE international certified cost technician primer*. Morgantown, WV: AACE International.
- Rakhra, A. S., and A. J. Wilson. 1982. *Inflation, budgeting and construction costs*. Ottawa: National Research Council Canada.
- Rauzana, A. 2016. "Causes of conflicts and disputes in construction projects." *IOSR J. Mech. Civ. Eng.* 13 (5): 44–48. <https://doi.org/10.9790/1684-1305064448>.
- Salehi, F., S. M. J. M. Al-e, and S. M. M. Hussein. 2022. "A 2-phase interdependent methodology for sustainable project portfolio planning in the pharmaceutical industry." *Comput. Ind. Eng.* 174 (Jun): 108794. <https://doi.org/10.1016/j.cie.2022.108794>.
- Schwenzer, I. 2008. "Force majeure and hardship in international sales contracts." *Victoria U. Wellington L. Rev.* 39 (4): 709. <https://doi.org/10.26686/vuwl.v39i4.5487>.
- Shafik, N., S. Qodsi, E. Serag, and M. Helmi. 2016. "Application of FIDIC contracts under the Egyptian civil code." *J. Leg. Aff. Dispute Resolut. Eng. Constr.* 8 (3): 04516004. [https://doi.org/10.1061/\(ASCE\)LA.1943-4170.0000193](https://doi.org/10.1061/(ASCE)LA.1943-4170.0000193).
- Shah, R. K. 2016. "An exploration of causes for delay and cost overrun in construction projects: A case study of Australia, Malaysia & Ghana." *J. Adv. College Eng. Manage.* 2 (1): 41–55. <https://doi.org/10.3126/jacem.v2i0.16097>.
- Stokes, M. 1978. *International construction contracts*. New York: McGraw-Hill.
- Uniform Commercial Code. 1952. "(§ 2-615) excuse by failure of presupposed conditions, comment 4." Accessed January 1, 2024. <https://www.law.cornell.edu/ucc/2/2-615>.
- Vamsidhar, K., D. A. Eshwarswaroop, K. Ayyappapreamkrishna, and R. Gopinath. 2014. "Study and rate analysis of escalation in construction industry." *IOSR J. Mech. Civ. Eng.* 11 (2): 14–25. <https://doi.org/10.9790/1684-11251425>.
- Ward, S. C., C. B. Chapman, and B. Curtis. 1991. "On the allocation of risk in construction projects." *Int. J. Project Manage.* 9 (3): 140–147. [https://doi.org/10.1016/0263-7863\(91\)90038-W](https://doi.org/10.1016/0263-7863(91)90038-W).
- Windapo, A. O., and K. Cattell. 2010. "Perceptions of key construction and development challenges facing the construction industry in South Africa." In *Proc., Association of Schools of Construction of Southern Africa ASOCSA, Fifth Built Environment Conf. Gqebera, South Africa: Association of Schools of Construction of Southern Africa*.
- Yates, J. K., and J. A. Smith. 2007. "Global legal issues for engineers and constructors." *J. Civ. Eng. Educ.* 133 (3): 199–209. [https://doi.org/10.1061/\(ASCE\)1052-3928\(2007\)133:3\(199\)](https://doi.org/10.1061/(ASCE)1052-3928(2007)133:3(199)).