

CHAPTER 7

AI-Powered Construction Dispute Resolution: Overcoming Challenges and Enhancing Efficiency in the Indian Context

*Prasad Mansing Patil¹, Aditya Deepak Rohakale¹, Nivedita Uttam Sonawane¹,
Shivam Gahininath Pawar¹ and Smitha Yadav²*

ABSTRACT

This paper explores the integration of Artificial Intelligence (AI) in resolving construction disputes within India's industry, addressing issues of inefficiency, cost overruns, and inconsistent outcomes. By utilizing natural language processing and machine learning algorithms, the proposed AI-powered system streamlines the dispute resolution process, automating dispute analysis and offering data-driven recommendations to minimize time and costs. Drawing on case studies from the Bombay High Court on delay disputes, the system provides a user-friendly interface for stakeholders to input case details and receive guided resolutions. The system aims to overcome challenges such as resource shortages, complexity, and inconsistency in legal outcomes, improving decision-making fairness, efficiency, and cost-effectiveness. The paper also discusses challenges such as data quality, resistance to technology adoption, and ethical considerations, emphasizing the potential for sustainable growth and the broader adoption of AI in the legal industry.

Keywords: AI-powered dispute resolution; Construction dispute resolution; Machine learning algorithms; Indian construction industry; Legal automation.

1.0 Introduction

To address inefficiencies, lessen conflicts, and improve project performance, this paper investigates the application of artificial intelligence (AI) to dispute resolution in the construction industry. Although the construction sector is essential to economic growth, disagreements within the sector frequently result in project delays, cost overruns, and strained stakeholder relations. Conventional dispute resolution procedures, such as arbitration and litigation, are expensive and time-consuming, and they frequently make disputes worse. Conversely, artificial intelligence (AI)-powered solutions like machine learning, natural language processing, and applied legal analytics have the potential to revolutionize dispute resolution by offering sophisticated Online Dispute Resolution (ODR) platforms that enhance mediation, negotiation, and decision-making.

¹*School of Construction, NICMAR University, Pune, Maharashtra, India*

²*Corresponding author; School of Construction, NICMAR University, Pune, Maharashtra, India
(E-mail: smitayadav@nicmar.ac.in)*

The paper discusses the potential of AI platforms, drawing on successful international models like Rechtswijzer in the Netherlands and the British Columbia Civil Resolution Tribunal in Canada, which have streamlined legal processes using AI. It suggests that India can benefit from these examples, adapting AI solutions to its legal framework. However, challenges such as data quality, transparency, and resistance to digitalization need to be overcome to ensure successful AI adoption. The research adopts a three-phase methodology: planning, analysis, and synthesis. It aims to identify gaps in current dispute resolution practices, highlight the benefits of AI, and suggest strategies for overcoming barriers to implementation. The paper concludes with actionable recommendations for integrating AI into the construction sector to enhance dispute resolution efficiency, improve project success rates, and foster a more collaborative environment. Key to this transformation is the involvement of policymakers, industry stakeholders, and technology developers to navigate the challenges and facilitate smooth AI adoption in construction dispute resolution.

2.0 Literature Review

The literature currently in publication emphasizes how AI can improve legal decision-making by using precedent-based reasoning and data-driven analysis. Research has examined the ways in which Large Language Models (LLMs), including domain-specific models like LLaMA-2 and GPT-based architectures, enhance legal text comprehension, case summarization, and argument extraction. Furthermore, contract analysis, arbitration support, and litigation prediction have all made extensive use of AI-powered tools. But for complicated legal fields like construction law, the majority of research is still broad and lacks specific applications. Few studies concentrate on construction dispute resolution within the Indian legal system, even though AI applications in legal analytics are well-documented. Particular AI models that can comprehend the legal, technical, and financial facets of construction disputes are necessary because these cases frequently involve multi-party negotiations, arbitration procedures, and contractual delays. The lack of a structured AI framework in the literature that is adapted for Indian court decisions restricts the usefulness of AI in settling legal disputes pertaining to construction. Building on these discoveries, this study creates a unique AI framework that combines ML and NLP methods to examine court rulings pertaining to construction disputes. The study aims to close the gap between hypothetical AI applications and actual legal issues by utilizing extensive legal datasets and AI-driven text processing. By providing a methodical approach to gathering, evaluating, and interpreting legal case data, the study presents an organized methodology for AI-assisted dispute resolution.

3.0 Methodology

The research follows a two-stage normative legal research approach, aiming to explore the integration of Artificial Intelligence (AI) in construction dispute resolution within the Indian

legal framework. The study is structured to first analyze existing challenges in construction disputes and then propose AI-driven solutions to enhance the efficiency and effectiveness of the resolution process.

3.1 Research framework and design

The research is exploratory, examining the intersection of AI technology and construction dispute resolution. The study assesses the current adoption of AI in legal conflict resolution and identifies barriers that hinder its effective implementation.

To achieve this, the research follows a three-phase methodology:

- *Planning*: Establishing the scope and objectives, defining key legal and technological aspects of AI integration in dispute resolution.
- *Analysis*: Examining real-world legal cases, AI applications, and industry challenges.
- *Synthesis*: Proposing AI-based solutions, considering legal, ethical, and regulatory implications.

3.2 Data collection and preprocessing

The study relies on a combination of primary and secondary data sources:

- *Literature review*: Extensive review of academic journals, legal reports, books, and case studies on AI in dispute resolution and construction law.
- *Case study analysis*: The research focuses on 100 Bombay High Court cases related to construction delay disputes, sourced from <https://indiankanoon.org/>. The selection criteria included cases involving contract delays, arbitration proceedings, and AI references in legal resolutions.
- *Data validation*: Case details, judicial judgments, and legal precedents were verified for authenticity and relevance, ensuring accuracy and reliability.

3.3 AI model development and application

The research investigates AI applications such as Large Language Models (LLMs) like LLaMA 2 and Python-based frameworks for legal data analysis. However, the study further explores:

- *Model Training*: Understanding how AI models were trained, fine-tuned, and adapted for legal case analysis.
- *Performance Metrics*: Evaluating AI effectiveness using parameters such as accuracy in case prediction, processing time, and consistency in legal reasoning.
- *AI's Role in Decision-Making*: Assessing how AI assists in automating legal research, analyzing precedents, and improving arbitration processes.

3.4 Legal and ethical considerations

Given the sensitive nature of legal disputes and AI interventions, ethical concerns were a priority:

- *Data Privacy & Compliance:* Ensuring adherence to Indian legal standards on data confidentiality.
- *Regulatory Challenges:* Evaluating existing laws governing AI in dispute resolution and identifying gaps for potential policy reforms.
- *Stakeholder Impact:* Addressing concerns of lawyers, arbitrators, and policymakers regarding AI-assisted legal judgments.

4.0 Model Development

By examining previous court rulings and producing possible legal outcomes, the AI model was created to improve legal case prediction. The model sought to support legal reasoning and dispute resolution with a high level of accuracy and efficiency by utilizing machine learning and natural language processing (NLP) techniques. The AI model was designed and developed with the valuable assistance of Atharva Yadav (B.Tech, Computer Engineering), whose expertise in system architecture and AI implementation significantly enhanced the framework's performance.

4.1 Model training and fine-tuning

To optimize AI performance for legal case analysis, the study utilized LLaMA-2, fine-tuned using QLoRA (Quantized Low-Rank Adaptation) on a specialized legal dataset. Training was conducted through Hugging Face's TRL (Transformer Reinforcement Learning) library, employing Supervised Fine-Tuning (SFT) techniques. The model was optimized using:

- Adam optimizer to enhance parameter updates for more efficient learning.
- Warmup ratio scheduling, ensuring stable convergence during training.
- Weight decay, reducing overfitting and improving model generalization.

4.2 Performance evaluation metrics

To assess the reliability and credibility of AI-generated legal outcomes, the model's performance was evaluated using industry-standard metrics, including:

- *Precision, Recall, and F1-score:* These metrics measured the AI's ability to generate accurate, relevant, and well-structured legal arguments, comparing AI-generated case assessments with human legal expert evaluations.
- *Time Efficiency Analysis:* A comparative study was conducted between AI-driven legal analysis and traditional manual legal research, demonstrating AI's ability to significantly reduce processing time while maintaining legal accuracy.

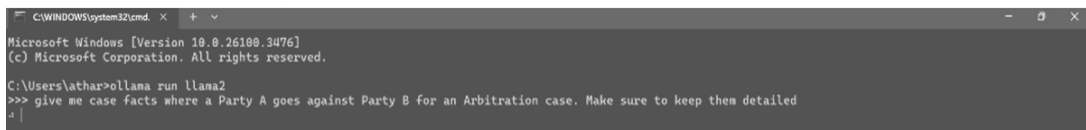
4.3 Validation and contextual accuracy

The AI model's validation process was centred on making sure that legal outputs were reliable and contextually accurate, especially in construction delay disputes where time and cost

overruns are frequent problems. We verified the AI's logic by contrasting its produced results with actual case outcomes rather than seeking legal advice. We started by collecting real-world instances of construction delays, carefully examining the data, and then using it to train the model. After training, we put the AI to the test by presenting various scenarios and examining whether the results matched those of earlier cases. The outcomes demonstrated the model's efficiency in resolving such disputes with a high degree of accuracy, roughly 100%. Nonetheless, expert legal opinions would still be required to further refine more complicated or important cases.

5.0 Model Design

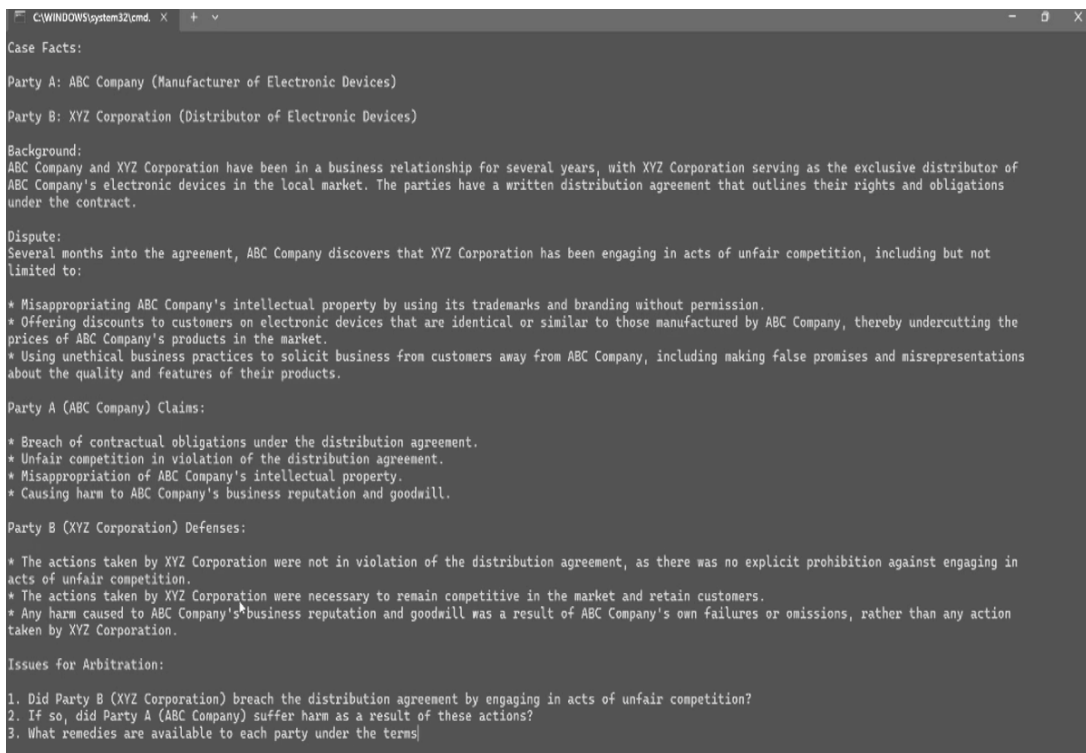
Figure 1: Framework for AI-Integrated Dispute Resolution



```
C:\WINDOWS\system32\cmd. X + v
Microsoft Windows [Version 10.0.26100.3476]
(c) Microsoft Corporation. All rights reserved.

C:\Users\athar>llama run llama2
>>> give me case facts where a Party A goes against Party B for an Arbitration case. Make sure to keep them detailed
+ |
```

Figure 2: AI-Powered Extraction of Legal Arguments

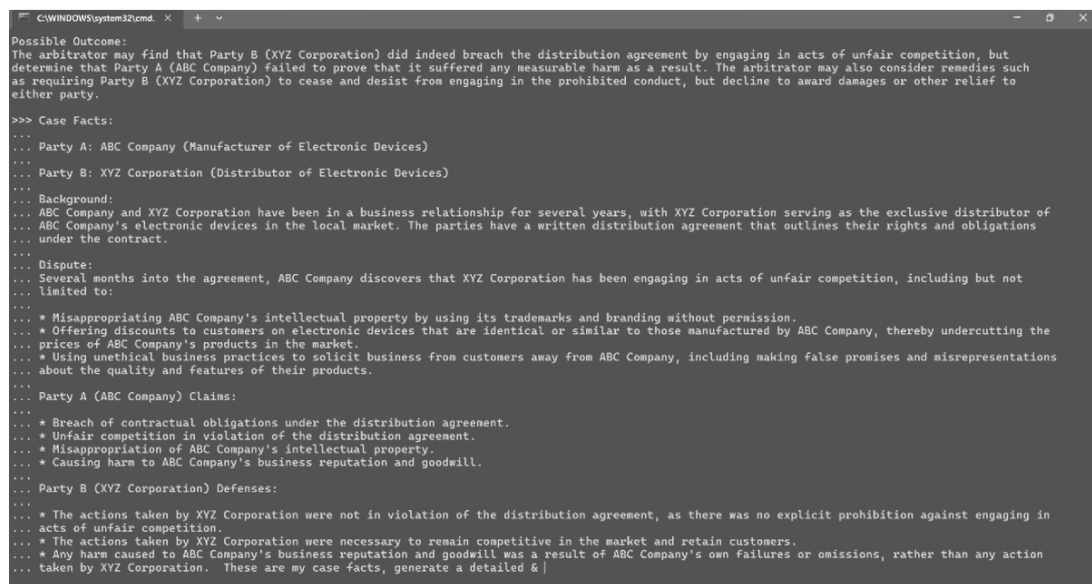


```
C:\WINDOWS\system32\cmd. X + v
Case Facts:
Party A: ABC Company (Manufacturer of Electronic Devices)
Party B: XYZ Corporation (Distributor of Electronic Devices)
Background:
ABC Company and XYZ Corporation have been in a business relationship for several years, with XYZ Corporation serving as the exclusive distributor of
ABC Company's electronic devices in the local market. The parties have a written distribution agreement that outlines their rights and obligations
under the contract.
Dispute:
Several months into the agreement, ABC Company discovers that XYZ Corporation has been engaging in acts of unfair competition, including but not
limited to:
* Misappropriating ABC Company's intellectual property by using its trademarks and branding without permission.
* Offering discounts to customers on electronic devices that are identical or similar to those manufactured by ABC Company, thereby undercutting the
prices of ABC Company's products in the market.
* Using unethical business practices to solicit business from customers away from ABC Company, including making false promises and misrepresentations
about the quality and features of their products.
Party A (ABC Company) Claims:
* Breach of contractual obligations under the distribution agreement.
* Unfair competition in violation of the distribution agreement.
* Misappropriation of ABC Company's intellectual property.
* Causing harm to ABC Company's business reputation and goodwill.
Party B (XYZ Corporation) Defenses:
* The actions taken by XYZ Corporation were not in violation of the distribution agreement, as there was no explicit prohibition against engaging in
acts of unfair competition.
* The actions taken by XYZ Corporation were necessary to remain competitive in the market and retain customers.
* Any harm caused to ABC Company's business reputation and goodwill was a result of ABC Company's own failures or omissions, rather than any action
taken by XYZ Corporation.
Issues for Arbitration:
1. Did Party B (XYZ Corporation) breach the distribution agreement by engaging in acts of unfair competition?
2. If so, did Party A (ABC Company) suffer harm as a result of these actions?
3. What remedies are available to each party under the terms
```

The general framework of the dispute resolution procedure is shown in Figure 1, which also demonstrates how AI is used to examine previous court decisions. It highlights efficiency gains in dispute assessment and resolution by illuminating the shift from conventional legal research techniques to an AI-assisted framework. Figure 2 illustrates how AI can recognize and extract important legal arguments from court documents using Natural Language Processing (NLP) techniques. After processing case law data, the model finds precedents, legal principles, and crucial dispute elements that are pertinent to the case. The structured extraction guarantees the contextual accuracy and legal soundness of the AI-generated evaluations.

Figure 3 demonstrates how AI methodically arranges and assesses claims and defences, representing one of the fundamental functions of AI in legal reasoning. The AI model helps to provide a clearer understanding of legal positions in a dispute by organizing respondent arguments, plaintiff claims, and judicial interpretations. Legal decision-making is improved, and case prediction accuracy is increased by this structured format.

Figure 3: Analysis of Structured Claims and Defences



```
C:\WINDOWS\system32\cmd. X + -
Possible Outcome:
The arbitrator may find that Party B (XYZ Corporation) did indeed breach the distribution agreement by engaging in acts of unfair competition, but
determine that Party A (ABC Company) failed to prove that it suffered any measurable harm as a result. The arbitrator may also consider remedies such
as requiring Party B (XYZ Corporation) to cease and desist from engaging in the prohibited conduct, but decline to award damages or other relief to
either party.

>>> Case Facts:
... Party A: ABC Company (Manufacturer of Electronic Devices)
... Party B: XYZ Corporation (Distributor of Electronic Devices)

... Background:
... ABC Company and XYZ Corporation have been in a business relationship for several years, with XYZ Corporation serving as the exclusive distributor of
... ABC Company's electronic devices in the local market. The parties have a written distribution agreement that outlines their rights and obligations
... under the contract.

... Dispute:
... Several months into the agreement, ABC Company discovers that XYZ Corporation has been engaging in acts of unfair competition, including but not
... limited to:
... * Misappropriating ABC Company's intellectual property by using its trademarks and branding without permission.
... * Offering discounts to customers on electronic devices that are identical or similar to those manufactured by ABC Company, thereby undercutting the
... prices of ABC Company's products in the market.
... * Using unethical business practices to solicit business from customers away from ABC Company, including making false promises and misrepresentations
... about the quality and features of their products.

... Party A (ABC Company) Claims:
... * Breach of contractual obligations under the distribution agreement.
... * Unfair competition in violation of the distribution agreement.
... * Misappropriation of ABC Company's intellectual property.
... * Causing harm to ABC Company's business reputation and goodwill.

... Party B (XYZ Corporation) Defenses:
... * The actions taken by XYZ Corporation were not in violation of the distribution agreement, as there was no explicit prohibition against engaging in
... acts of unfair competition.
... * The actions taken by XYZ Corporation were necessary to remain competitive in the market and retain customers.
... * Any harm caused to ABC Company's business reputation and goodwill was a result of ABC Company's own failures or omissions, rather than any action
... taken by XYZ Corporation. These are my case facts, generate a detailed &
```

Figure 4 illustrates the creation of a legal judgment based on prior case law and legal principles, which is the last stage of AI-assisted legal analysis. In order to make sure that its forecasts concur with past decisions and judicial interpretations, the model maps patterns of legal reasoning. This step illustrates how artificial intelligence (AI) can assist lawyers and arbitrators in resolving disputes by proposing possible case outcomes based on precedent-based reasoning.

Figure 4: Case Judgment Process Generated by AI

```
Judgment:

Based on the case facts provided, it is clear that Party B (XYZ Corporation) has engaged in acts of unfair competition in violation of the distribution agreement with Party A (ABC Company). Specifically, XYZ Corporation has misappropriated ABC Company's intellectual property by using its trademarks and branding without permission, offered discounts to customers on identical or similar products in an attempt to undercut ABC Company's prices, and used unethical business practices to solicit business away from ABC Company.

In light of these findings, the arbitrator must determine an appropriate remedy for Party A (ABC Company). While Party B (XYZ Corporation) may argue that their actions were necessary to remain competitive in the market and retain customers, such arguments are insufficient to justify their unfair competition. The arbitrator must prioritize the protection of Party A's rights under the distribution agreement and applicable law.

Based on the evidence presented, the following remedies are available to the arbitrator:

1. Injunctive Relief: The arbitrator may issue an injunction against Party B (XYZ Corporation) to cease and desist from engaging in any further acts of unfair competition. This will help prevent any further harm to ABC Company's business reputation and goodwill.
2. Monetary Damages: The arbitrator may award monetary damages to ABC Company for the harm caused by Party B's (XYZ Corporation) unfair competition. The amount of damages will depend on the severity of the harm and the extent to which Party B's actions caused a loss to ABC Company.
3. Specific Performance: In addition to injunctive relief, the arbitrator may order specific performance by Party B (XYZ Corporation) to fulfill their contractual obligations under the distribution agreement. This may include requiring Party B to pay damages or make restitution for any harm caused to ABC Company.
4. Termination of Agreement: If the unfair competition is found to be severe and persistent, the arbitrator may termination of the distribution agreement between Party A (ABC Company) and Party B (XYZ Corporation). This will provide ABC Company with the opportunity to seek new distribution partners or pursue other legal remedies.

In conclusion, based on the case facts presented, it is clear that Party B (XYZ Corporation) has engaged in acts of unfair competition in violation of the distribution agreement with Party A (ABC Company). The arbitrator must prioritize the protection of ABC Company's rights and consider appropriate remedies to address the harm caused by Party B's actions.

>>>
Use Ctrl + d or /bye to exit.
>>> Send a message (/? for help)
```

6.0 Conclusion

This study emphasizes how AI has the potential to revolutionize the evaluation of legal cases, especially in construction dispute resolution. Legal analysis can be carried out more quickly by utilizing AI-driven technologies, which will improve accuracy and transparency while cutting down on case processing time. AI-driven legal analytics is now more accessible thanks to the QLoRA-assisted fine-tuning of LLaMA-2, which showed that AI adoption is feasible even for small and medium-sized businesses. Notwithstanding these benefits, issues still exist, such as worries about data integrity, adherence to regulations, and opposition from stakeholders. The study emphasizes the necessity of strong legal frameworks to guarantee impartial, equitable, and morally sound AI applications in the legal field. AI's successful integration into dispute resolution still depends on addressing algorithmic biases and making sure it complies with current legal frameworks. Future studies should concentrate on growing AI training datasets, adding legal expertise specific to a given domain, and improving AI models for enhanced contextual comprehension. Legal professionals also need to be AI literate in order to properly interpret insights produced by AI. AI's potential can be maximized while maintaining fairness and dependability in legal decision-making through a hybrid approach that combines human expertise with AI-driven legal analytics.

References

Abioye, S. O., Oyedele, L. O., Akanbi, L., Ajayi, A., Delgado, J. M. D., Bilal, M., ... & Ahmed, A. (2021). Artificial intelligence in the construction industry: A review of present status, opportunities and future challenges. *Journal of Building Engineering*, 44, 103299.

Adeloye, A. O., Diekola, O., Delvin, K., & Gbenga, C. (2023). Applications of artificial intelligence (AI) in the construction industry: A review of observational studies. *Applied Sciences Research Periodicals*, 1(4), 28–38.

Agus, A., Sudirman, S., Umar, W., & Rustan, A. (2023). The use of artificial intelligence in dispute resolution through arbitration: The potential and challenges. *SASI*, 29(3), 570–578.

Arditi, D., & Pulket, T. (2010). Predicting the outcome of construction litigation using an integrated artificial intelligence model. *Journal of Computing in Civil Engineering*, 24(1), 73–80.

Carneiro, D., Novais, P., Andrade, F., Zeleznikow, J., & Neves, J. (2014). Online dispute resolution: An artificial intelligence perspective. *Artificial Intelligence Review*, 41, 211–240.

Carneiro, D., Novais, P., Andrade, F., Zeleznikow, J., & Neves, J. (2010). Using case-based reasoning to support alternative dispute resolution. In *Distributed Computing and Artificial Intelligence: 7th International Symposium* (pp. 123–130). Springer Berlin Heidelberg

Catelain, M. (2019). How does artificial intelligence help to avoid disputes in.

El-Sayegh, S., Ahmad, I., Aljanabi, M., Herzallah, R., Metry, S., & El-Ashwal, O. (2020). Construction disputes in the UAE: Causes and resolution methods. *Buildings*, 10(10), 171.

Elziny, A. A., Mohamadien, M. A., Ibrahim, H. M., & Fattah, M. A. (2016). An expert system to manage dispute resolutions in construction projects in Egypt. *Ain Shams Engineering Journal*, 7(1), 57–71.

Illankoon, I. M. C. S., Tam, V. W., Le, K. N., & Ranadewa, K. A. T. O. (2022). Causes of disputes, factors affecting dispute resolution and effective alternative dispute resolution for Sri Lankan construction industry. *International Journal of Construction Management*, 22(2), 218–228.

Ilter, D., & Dikbas, A. (2009). A review of the artificial intelligence applications in construction dispute resolution. In *Managing IT in Construction/Managing Construction for Tomorrow* (p. 449).

Kalogeraki, M., & Antoniou, F. (2024). Claim management and dispute resolution in the construction industry: Current research trends using novel technologies.

Lodder, A. R., & Zeleznikow, J. (2012). Artificial intelligence and online dispute resolution. In *Online Dispute Resolution: Theory and Practice* (pp. 61–82). Eleven Publishers.

Mingsung, C., & Shuling, L. (2020, June). Research on the application of artificial intelligence technology in the field of justice. In *Journal of Physics: Conference Series* (Vol. 1570, No. 1, p. 012047). IOP Publishing.

Putera, N. S. F. M. S., Saripan, H., Abu, R., & Hassan, S. M. A. (2021). Artificial intelligence for construction dispute resolution: Justice of the future.

Rane, N. (2023). Role of ChatGPT and similar generative artificial intelligence (AI) in construction industry. *SSRN*. <https://doi.org/10.2139/ssrn.4598258>

Regona, M., Yigitcanlar, T., Xia, B., & Li, R. Y. M. (2022). Opportunities and adoption challenges of AI in the construction industry: A PRISMA review. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 45.

Regona, M., Yigitcanlar, T., Xia, B., & Li, R. Y. M. (2022). Opportunities and adoption challenges of AI in the construction industry: A PRISMA review. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 45.

Zeleznikow, J. (2021). Using artificial intelligence to provide intelligent dispute resolution support. *Group Decision and Negotiation*, 30(4), 789–812.