

Article

Perceptive Biases in Construction Mediation: Evidence and Application of Artificial Intelligence

Nan Cao ^{1,*}, Sai-On Cheung ¹  and Keyao Li ²

¹ Construction Dispute Resolution Research Unit, Department of Architecture and Civil Engineering, City University of Hong Kong, Hong Kong 999077, China; saion.cheung@cityu.edu.hk

² Future of Work Institute, Curtin University, Perth 6102, Australia; keyao.li@curtin.edu.au

* Correspondence: nora.cao06@gmail.com; Tel.: +852-95086151

Abstract: In light of advancements in big data analysis and artificial intelligence (AI), there are emerging opportunities to harness these technologies to address perceptive biases. This study examines the potential perceptive biases that may arise when construction mediation is quasi-imposed on the disputing parties. This can happen when mediation attempts are stipulated in the construction contract or court-directed. It is argued that, under such circumstances, a negative perception might arise over whether a bona fide mediation can be realised. Concerns include the fairness and timeliness of the process, as well as the practice of opportunistic mediating behaviours. With data collected from practising construction mediation practitioners in Hong Kong, the constructs of Perceptions of Bona Fide Mediation, Quasi-Imposition, and Positive Mediation Outcomes were first developed. Applying partial least square structural equation modelling to the relationship frameworks of the constructs, it was found that quasi-imposition is not as damaging as envisaged as far as having a bona fide mediation and attaining positive mediation outcomes are concerned. Moreover, a negative perception of the fairness and timeliness of the quasi-imposed mediation would jeopardise the integrity of a bona fide mediation. In this regard, utilizing NLP and machine learning algorithms offers a pioneering AI-driven approach to informing mediating parties, as well as reminding mediators to uphold the fairness and timeliness of the process for the purposes of reaching positive mediation outcomes.

Keywords: quasi-imposition; perceptions; bona fide mediation; perceptive bias; opportunism; Construction Industry 4.0; artificial intelligence



Citation: Cao, N.; Cheung, S.-O.; Li, K. Perceptive Biases in Construction Mediation: Evidence and Application of Artificial Intelligence. *Buildings* **2023**, *13*, 2460. <https://doi.org/10.3390/buildings13102460>

Academic Editor: Antonio Caggiano

Received: 12 September 2023

Revised: 22 September 2023

Accepted: 26 September 2023

Published: 27 September 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

As the construction industry ventures into the era of 4.0, there will be a profound paradigm shift steered by the integration of smart technology, automation, and data analytics [1–3]. This evolution necessitates a robust framework for real-time data collection through IoT, advanced analytics via AI, and transparent, data-driven decision-making mechanisms [4–8]. This integration trend has not only transformed how projects are executed but also the way that disputes might arise and be resolved [9,10]. Novel challenges emerge as technological complexities introduce new origins for disputes, such as disputes around data breaches, technology malfunctions and model discrepancies. It is essential for traditional dispute-resolution methods to adapt to the technological advancements and evolving dynamics of the construction industry.

Mediation has been used as an alternative to arbitration and litigation as it is believed that this private, speedy, and economical proceeding is attractive to disputing parties. The spirit of mediation is to allow the disputing parties the widest flexibility and freedom to negotiate a settlement with the facilitation of the mediators. Thus, bona fide mediation is characterised by voluntary participation that embraces process autonomy and the parties' commitment. In the last two decades, the use of mediation has been promoted through contractual use or court-directed.

In fact, it is now a more or less standard practice to contractually require participation in mediation before a construction dispute can be referred to arbitration [11,12]. In Hong Kong, for cases reaching the Hong Kong High Court Construction and Arbitration list, parties can refer the dispute to mediation [13]. A party unreasonably refusing to mediate may face an adverse costs order. These practices are described as quasi-imposition. While quasi-imposition can facilitate the use of mediation, the disputing parties may not feel that the mediation is bona fide. This concern can just be a matter of perception. In this study, this form of concern is identified as a perceptive bias in a bona fide mediation. Specifically, the concerns include fairness, opportunism, and timeliness. As such, the practice of construction mediation is not so voluntary as it is supposed to be. It is further acknowledged that humans are rationally bounded and psychological biases can happen unknowingly [14,15]. With the quasi-imposition approach, would disputing parties' perceptive biases compromise the intended benefits of bona fide mediation? This study posits to examine this proposition.

The digital era emphasizes the effective use of data. More specifically, the surging use of big data and artificial intelligence (AI hereafter) in recent years have offered a window opportunity to reshape how disputes are resolved [10]. This study has two main research objectives: (1) To investigate the often-neglected aspect of quasi-imposition and its impact on mediation. By exploring perceptive biases in a bona fide mediation, this study offers insights into the ways in which quasi-imposition shapes the final mediation outcome. (2) To explore the possibility of using AI to reduce perceptive biases in the mediation process.

Industry 4.0 envisions the use of AI and information technologies to transform construction processes, including mediation. These tools can enhance objectivity, improve time-efficiency, and minimise decision-making biases [16–18]. Our exploration into the potential of AI in reducing perceptive biases in mediation can contribute to more amicable mediation outcomes, fostering a harmonious and sustainable work environment for the construction industry. This also provides insights into the development of a healthy work environment where humans and technology work more closely to achieve optimised goals in construction projects. This study paves the groundwork for future research into the integration of new technologies within the realm of construction mediation research.

This identified research gap is twofold:

- Understanding the impact of quasi-imposition on the practice of mediation: The evolution of the construction industry has led to a shift from purely voluntary mediation processes to quasi-imposed ones. Yet, there is limited knowledge as to how these evolving dynamics, particularly in an industry that has been laden with disputes, handle parties' perceptions of the mediation's genuineness and fairness.
- Exploring AI's Role in Mediation: As AI and big data increasingly permeate every sector, their potential role in reshaping how disputes are resolved in the construction industry remains largely unexplored. There is a pressing need to understand how AI can be harnessed to address the challenges arising from the aforementioned shift in mediation processes.
- Given the identified research gap, our study aims to:
- Investigate the often-neglected aspect of quasi-imposition and its impact on mediation in the context of Construction Industry 4.0.
- Identify Perceptive Biases: To unveil the potential perceptive biases arising during quasi-imposed mediation processes. Specifically, biases related to fairness, opportunism, and timeliness are examined.
- Examine the potential of AI in reducing the perceptive biases that might arise during these mediation processes. This exploration seeks to offer a forward-looking agenda of how technology can be used to enhance the effectiveness and fairness of dispute mediation in the construction sector.

By addressing these issues, our study contributes to a deeper understanding of the challenges and opportunities presented by Construction 4.0 in the realm of construction dispute mediation.

2. The Conceptual Bases of the Study

Figure 1 presents the propositions of the study. The conceptual bases are discussed seriatim.

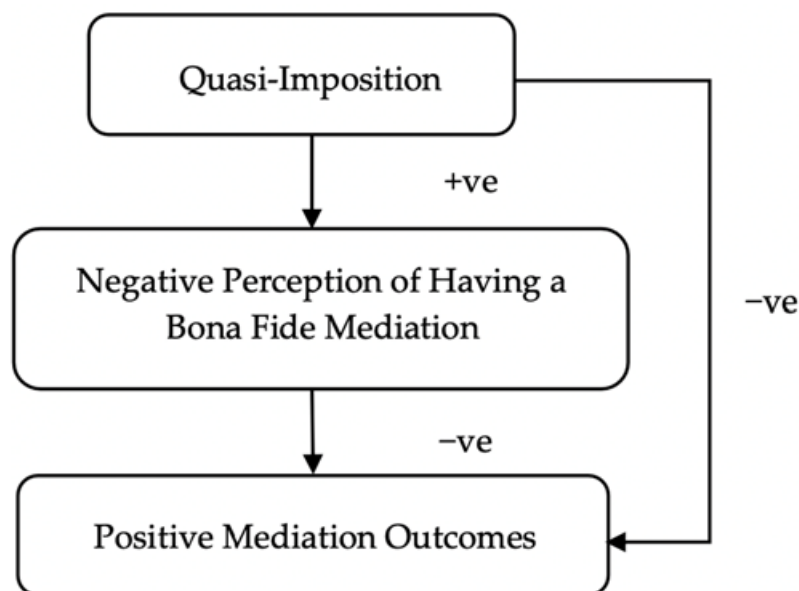


Figure 1. Propositions of the Study.

2.1. Quasi-Imposition

Quasi-imposition (QI hereafter) happens when a disputing party is obligated to mediate. Advocates of quasi-imposition [19–21] contend that it facilitates a more time-efficient and economical dispute resolution. For some disputing parties, hesitation may hinder voluntary engagement, and quasi-imposition could overcome this inertia. From a broader perspective, QI might alleviate court congestion and lighten the workload of the judiciary. Conversely, critics argue that quasi-imposition risks undermining the voluntariness of mediation. Studies by Boettger, Ross and Conlon [21,22] have explored quasi-imposition's effect on voluntary mediation participation and revealed the potential of subduing motivation and commitment to the mediation. Quasi-imposition in mediation can be a contentious issue, although it has been used extensively for construction disputes. As its prevalence may expand, comprehending its impact on bona fide mediation has both theoretical and practical significance. Should parties perceive coercion into mediation, their genuine engagement or good-faith negotiations may wane, resulting in suboptimal outcomes and potential mediation breakdown. This argument suggests that quasi-imposition could undermine the voluntary nature of mediation.

Hypothesis 1 (H1). *Quasi-Imposition has negative impacts on the perception of Bona Fide Mediation*

2.2. Bona Fide Mediation

It is posited that mediation can be portrayed as a bona fide negotiation that is idiosyncratic to the parties involved. Thus, bona fide mediation encompasses the exchange of proposals prepared by collaborating disputing parties. Putnam et al. and Liao et al. [23,24] demonstrated that bona fide mediation is perceived by the parties as fair, timely and free of tactics. The expectation of having a bona fide mediation should foster a collaborative type of negotiation. Conversely, perceptions of inequity may hamper chances of having a bona fide mediation. Three dimensions are associated with a bona fide mediation: fair process, absence of opportunism and timely execution.

2.3. Fairness

Fairness Heuristics Theory [25] offers a theoretical explanation for how perceived fairness might influence the voluntariness to mediate. This theory posits that social interaction inherently creates a “fundamental social dilemma,” stemming from the uncertainty involved in dealing with an entity, such as an individual, group, or organisation. While mediation may help in achieving the desired outcomes (e.g., financial rewards, enhanced identity), it also carries the risk of rejection or exploitation. Fairness Heuristics Theory emphasises the human need to alleviate this uncertainty, using fairness as an heuristic to build confidence in the decision to engage with a group or organization [26]. This principle applies to the trust in the mediation process. In this connection, Gilliland’s framework of fairness in selection has become one of the most influential models in explaining the individual’s perceptions of selection [27]. The expectation of fairness has received substantial backing in job acceptance and organisational attractiveness [17,26,28,29].

Perceived fairness refers to an individual’s subjective assessment of a situation or outcome’s fairness. In construction dispute resolution, fairness can be perceived when disputants feel their interests have been acknowledged, and the outcome is reasonable and equitable. Conversely, the process may be seen as unfair if one’s interests are ignored or outcomes are biased.

The perception of fairness greatly influences mediation outcomes. If perceived as fair, disputants are more willing to engage in mediation, believing in an equitable consideration of their interests and a fair outcome [29,30]. This enhances positive perception and collaboration, fostering successful dispute resolution. Conversely, greater willingness to engage likely reflects a perception of fairness, as disputants feel their interests are prioritised, thus promoting successful dispute resolution through heightened levels of perceived fairness.

Hypothesis 2 (H2). *Disputants’ perception of fairness has positive impacts on achieving a positive mediation outcome.*

2.4. Opportunism

Opportunism is characterised by manipulative behaviours. Opportunism leverages tactics for personal gain, necessitating organisational vigilance to counteract their influence. In construction dispute mediation, opportunistic attempts to induce unwarranted information disclosure can destabilise the power balance, triggering retaliation responses. For instance, revealing sensitive negotiation details can allow an opponent to gain an advantage, impeding the possibility of a mediated settlement.

The practice of opportunism, therefore, may lower an individual’s enthusiasm to partake in the mediation processes. Opportunism involves manipulating others for personal gain, often against others’ self-interest [31]. Fulmer et al. discovered that opportunists are less cooperative, more competitive, and frequently employ deceptive tactics to achieve objectives [32]. Several scholars emphasised that opportunists are highly adaptable, and can forge alliances [33,34], and lack ethics [35]. Within dispute resolution, individuals displaying high opportunistic levels may shy away from bona fide mediation, opting to wield their power and influence for their own advantage.

Hypothesis 3 (H3). *Disputants’ perception of opportunism has negative impacts on achieving positive mediation outcomes.*

2.5. Timeliness

Timeliness is defined as the extent to which procedures are triggered at the appropriate time. Along with fairness, expediency constitutes a vital aspect of effective mediation. Timeliness may resonate with disputants as it often reflects process transparency and respect for fairness. It is advocated that timeliness is likely to influence disputants’ attitudes and behaviours. Ge et al. found that timeliness often works hand in hand with fairness [36]. According to equity theory, fairness in outcomes is evaluated in the light of

the timing in achieving that outcome [37]. Studies on timeliness [27,38] also claimed that those who voluntarily partook in mediation perceived the process as more timely than the mandated procedure. This perception might be reinforced by the enhanced control and lowering of flexibility associated with quasi-imposition. Collectively, the existing literature implies that quasi-imposition can negatively affect the perceived timeliness of the mediation. Those voluntarily involved may view the procedure as more timely than quasi-imposed participants.

The efficacy of construction dispute mediation hinges on timely intervention. Prompt resolution positively correlates with settlement, while delays risk eroding relationships and trust. Adversarial tactics may prevail in the absence of bona fide mediation. Conversely, timely mediation can forestall dispute escalation, cultivating a collaborative environment and enhancing the likelihood of success. It also minimises adverse effects on the project, such as unnecessary delays.

Hypothesis 4 (H4). *Disputants' perception of timeliness has positive impacts on achieving positive mediation outcomes.*

2.6. Positive Mediation Outcomes

Positive Mediation Outcomes (PMO hereafter) can be identified as “voluntary, personalised agreements negotiated between disputing parties with due regard to the benefits of each party” [39]. In fact, Liao et al. stated that bona fide mediation encourages idiosyncratic negotiation that aims for mutual benefit [24].

Nevertheless, PMO can have various forms [24] and embrace flexibility, development, workload reduction, task adjustment, and financial aspects [24,40]. In construction mediation, four forms are prevalent: Flexible, Developmental, Task, and Financial Positive Mediation Outcomes. Flexible Positive Mediation Outcomes enable scheduling to accommodate needs, Developmental Positive Mediation Outcomes foster cooperative relationships, Task Positive Mediation Outcomes allow work content adjustment, and Financial Positive Mediation Outcomes offer customised compensation. While these can be examined separately, they collectively capture the extent to which disputants have negotiated special arrangements.

Reported studies reveal that various work-related perceptions, attitudes, and behaviours influence Positive Mediation Outcomes. They are found to correlate positively with organisational commitment [40] and work engagement [39], and negatively with the inclination to quit [41]. This study explores the impact of disputants' perceptions and behaviours when pursuing Positive Mediation Outcomes.

Hypothesis 5 (H5). *Quasi-Imposition has negative impacts on achieving positive mediation outcomes.*

Figure 2 presents the relationship framework, depicting the hypotheses developed from the aforementioned conceptual bases. Specifically, we aim to delineate the complexities and challenges emanating from the perception of quasi-imposed mediation (whether this will be bona fide?), understanding how these dynamics can be strategically managed to augment the mediation's effectiveness. Our framework incorporates the interplay between opportunism, timeliness, and fairness arising from quasi-imposition and elucidates the impacts of negative perceptions of having a bona fide mediation on positive mediation outcomes.

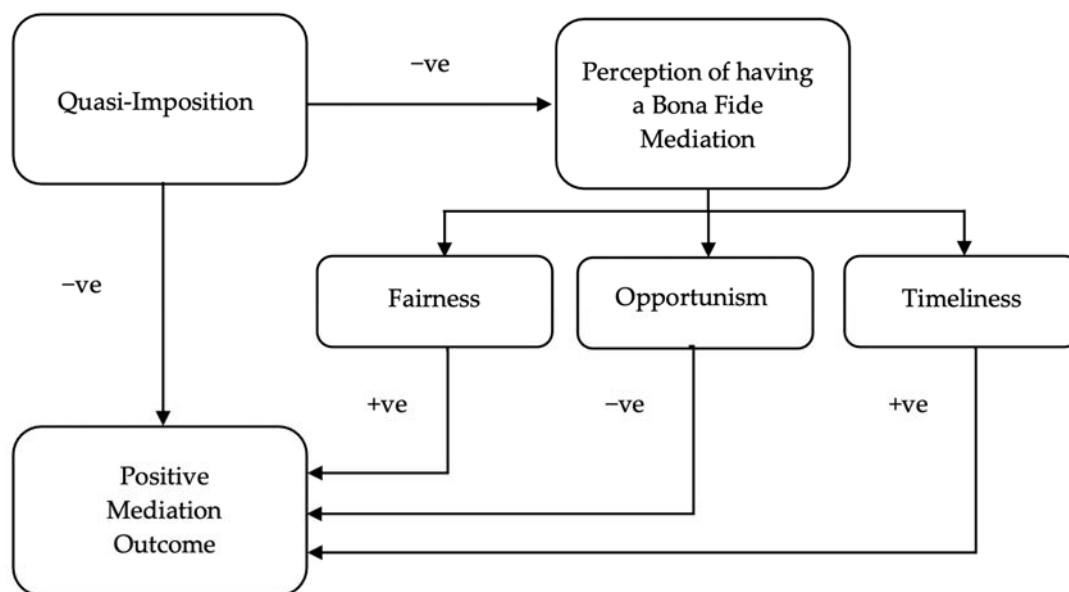


Figure 2. Relationship Framework of the Study.

3. The Study

Before finalising the questionnaire, we consulted with a panel of experts in the field of construction mediation, to ensure the content and face validity. This panel comprised experienced professionals and academic researchers. The panellists were asked to review the questionnaire items to ensure they were comprehensive, relevant, and appropriate to the study's objectives. Based on their feedback, some items were revised, while others were either added or removed to ensure the questionnaire accurately captured the constructs of interest. Beyond the content, it was crucial to ensure that the questionnaire was clear and easily understood by the respondents. For this, we conducted a pilot study with a smaller group of participants from our target audience. After completing the questionnaire, participants were interviewed about their experience, including whether they found any questions confusing, ambiguous, or difficult to answer. Their feedback provided valuable insights, leading to further refinements in the questionnaire's phrasing and structure.

Our study specifically targets professionals with experience in dispute mediation within the construction industry for the questionnaire sample. This ensured the relevance of our sample to the research objectives. Therefore, this study adopted the nonprobability sampling approach, which has been often recommended by the construction management literature [42,43], especially in cases where the population of the subject group is not available. In line with this approach, we selected professionals primarily from consultants, contractors, employers, and mediators.

After that, two stages of work were conducted. First, the constructs for the study were developed. Second, the relationship framework was tested by partial least square structural equation modelling. Data were collected for the implementation of two stages of work.

3.1. Data Collection

To validate the proposed constructs and their identifications, a data collection questionnaire was developed. This questionnaire has six sections. Section A inquires about personal particulars; Section B requests information on a single completed construction dispute mediation in which respondents have been involved, along with some organisational particulars; Sections D through F contain questions about Perception of Bona Fide Mediation (Fairness, Opportunism, Timeliness), Positive Mediation Outcome and Quasi-Imposition, respectively. All identifications were contextualized for construction dispute mediation. Respondents were asked to indicate their agreement on a Likert Scale (1–7) for each description of the identifications. For Section F, respondents were asked

to indicate the extent to which the statements represented the party's participation in mediation. Data were collected from experienced construction project management professionals and construction dispute mediators, primarily from the following associations and government departments:

- Government staff involved in construction projects from works departments;
- The Hong Kong Institute of Engineers (HKIE);
- The Hong Kong Institute of Surveyors (HKIS);
- The Hong Kong Institute of Architects (HKIA);
- The Hong Kong International Arbitration Centre (HKIAC);
- The Hong Kong Mediation Accreditation Association Limited (HKMAAL);
- The Chartered Institute of Arbitrators (CIArb).

3.1.1. Personal Particulars

Response rates can vary significantly among different research methods. Unlike experiments or in-person, face-to-face interviews, mail-out/mail-back surveys in the construction industry often have very low response rates [44]. This study solely utilised email to solicit responses during the COVID-19 pandemic, and the response rate was represented by the percentage of valid responses to emails that were opened. We have double-checked our dataset, avoiding response bias, missing values, etc, and deleted related responses. Of the 248 questionnaires that were opened, as shown in the collector, 133 were valid responses, resulting in a response rate of 53.63%. This rate is considered acceptable, especially given that the average response rate for data collected from organisations in 1607 academic studies was 35.7% [45]. Table 1 provides details about the respondents.

Table 1. Particulars of the Respondents.

No. Description (Number, %) (Sum = 133, 100%)		
A1 Professional background/practice (the most relevant to this study)		
Architect (5, 4%)	Arbitrator (11, 8%)	Building surveyor (7, 5%)
Barrister (12, 9%)	Builder (11, 8%)	Building services engineer (9, 7%)
Mediator (15, 11%)	Claim consultant (6, 5%)	Civil engineer (23, 17%)
Solicitor (3, 2%)	Quantity surveyor (17, 13%)	Project manager (3, 2%)
Others (8, 6%)	Structural engineer (3, 2%)	
A2 Years of experience in the construction industry		
Below 5 years (4, 3%)	5–10 years (12, 9%)	11–15 years (16, 12%)
16–20 years (15, 11%)	Above 20 years (98, 74%)	
A.3 Years of experience in construction dispute resolution		
Below 3 years (29, 22%)	3–6 years (12, 9%)	7–10 years (16, 12%)
11–15 years (16, 12%)	16–20 years (15, 11%)	Above 20 years (45, 34%)

Table 1 reveals that the respondents include key stakeholders in construction projects at either a managerial or professional level. Regarding their professional background, 23% of respondents are civil engineers, and many have both legal and construction expertise. In terms of industry working experience, 74% of the respondents have more than 20 years of working experience in construction. Moreover, 45% have more than 20 years of experience in construction dispute resolution.

3.1.2. Particulars of the Mediation Cases

Table 2 illustrates the distribution of various organisations among different disputing parties in the construction industry. The respondents encompass a broad spectrum of stakeholder groups, thereby ensuring a fair representation. Specifically, the organisational

distribution for claimants includes 44% main contractors, 12% subcontractors, and 11% private developers. Conversely, among respondents, the distribution comprises 50% main contractors, 18% subcontractors, and 14% private developers. Notably, the percentages differ between the organisations representing the respondent and claimant sides.

Table 2. Particulars of the Mediation Cases.

No. Description (Number, %) (Sum = 133, 100%)			
B1 The role of survey respondent in the Mediation:			
Claim Consultant (9, 7%)	Claimant (24, 18%)	Respondent (24, 18%)	Mediator (49, 37%)
Legal representative of one of the disputing parties (12, 9%)		Expert Witness (15, 11%)	
B2 The organisation of the claimant			
Domestic subcontractor (16, 12%)	Engineering consultant (5, 4%)		
Government department (14, 11%)	Incorporated owners (5, 4%)	Main contractor (44, 33%)	
Nominated subcontractor (9, 6%)	Private developer (11, 8%)		
Professional consultant (9, 6%)	Quantity surveying consultant (4, 3%)		
Specialist contractor (6, 5%)	Others (10, 8%)		
B3 The organisation of the respondent			
Domestic subcontractor (10, 8%)	Engineering consultant (6, 5%)		
Government department (16, 12%)	Incorporated owners (4, 3%)	Main contractor (50, 37%)	
Nominated subcontractor (5, 4%)	Private developer (19, 14%)		
Professional consultant (5, 4%)	Quasi government organisation (6, 4%)		
Specialist contractor (3, 2%)	Others (9, 7%)		

3.1.3. Particulars of the Mediated Disputes

Table 3 summarises the contract and dispute values of the mediations involved in the study. Specifically, 40% of the projects have a contract value below 50 million, while 26% have a contract value exceeding 500 million. Similarly, 62% of the disputes fall below 50 million, and 15% are valued above 500 million.

Table 3. Particulars of the Mediated Disputes.

No. Description (Number, %) (Sum = 133, 100%)		
B.3 The contract value (HKD) of the concerned project		
Below 50 million (53, 40%)	50–200 million (27, 20%)	
200–500 million (15, 11%)	Above 500 million (34, 26%)	N/A (4, 3%)
B.4 The quantum of dispute(s) that was subject to the Mediation		
Below 50 million (82, 62%)	50–200 million (24, 18%)	
200–500 million (9, 7%)	Above 500 million (15, 11%)	N/A (3, 2%)

3.2. Stage I: Development of Constructs for the Study

All the identifications for Quasi-Imposition (QI), perception of a bona fide mediation (Fairness, Opportunism, Timeliness), and positive mediation outcomes (PMO) were operationalised into measurement statements. Tables 4–6 list these statements along with their descriptive statistics. To determine if the indicators meet the required normality, measures of kurtosis and skewness are utilised [46]. Kurtosis measures help in identifying the shape of a curve. If a curve is leptokurtic, it is highly arched at the mean with short tails, whereas platykurtic curves are flatter with a lower peak and longer tails. A positively

skewed curve means most scores fall below the mean, while a negatively skewed curve means most scores are above it. Both skewness and kurtosis create asymmetrical normal curves and can be analysed through descriptive statistics. Acceptable values for skewness range between -3 and $+3$, and for kurtosis between -10 and $+10$ when utilising Structural Equation Modelling (SEM) [47].

Table 4. Data Description of Perception of Bona Fide Mediation (Fairness, Opportunism, Timeliness).

Forms	Items	Mean	Std.	Skew	Kurt
Fairness	D1 The Party had been able to express their views and feelings.	4.73	1.69	0.46	0.59
	D2 The Party considered the outcome to reflect the effort.	4.35	1.59	0.37	0.54
	D3 The Party considered the counterpart had refrained from improper remarks/comments.	4.21	1.45	0.06	0.53
	D4 The Party considered the counterpart had been candid in communicating with them.	4.00	1.55	0.06	0.65
Opportunism	D5 The Party only talked to the counterpart to get information for their benefit.	3.53	1.61	0.25	0.72
	D6 The Party enjoyed being able to exercise control over the proceeding.	3.71	1.61	0.33	0.46
	D7 The Party was more concerned about winning than achieving a win-win outcome.	4.01	1.61	0.25	0.76
	D8 The Party dislikes committing to the counterpart because they didn't trust them.	3.52	1.47	0.20	0.57
Timeliness	D9 The Party considered the Mediation had been initiated at an appropriate time.	4.55	1.57	0.18	0.48
	D10 The Party considered the Mediation caucuses had been organized in a timely manner.	4.76	1.55	0.34	0.17
	D11 The Party considered the overall Mediation had been carried out within an acceptable time frame.	4.64	1.66	0.33	0.43
	D12 The Party considered they had timely feedback from me.	4.89	1.55	0.38	0.43

3.2.1. Perception of Bona Fide Mediation

Part D explores the disputants' perceptions regarding fairness, opportunism, and timeliness. The scores for all items relating to fairness and timeliness range between 4 (Neutral) and 5 (Slightly Agree), whereas the scores for items under opportunism fluctuate between 3.5 and 4.0. This pattern essentially suggests that the disputing parties perceive the mediation process as fair and timely, but opportunistic behaviour may be either insignificant or mitigated during the mediation process. The three highest scores among these sections are D1 (4.73), "The Party had been able to express their views and feelings"; D7 (4.01), "The Party was more concerned about winning than achieving a win-win outcome"; and D12 (4.89), "The Party considered they had timely feedback from me." These scores reflect that respondents tend to place a higher value on perceived fairness and timeliness from their counterparts. The absolute values of the coefficients of skewness fall below 0.5, indicative of a symmetrical distribution to the responses [48].

Table 5. Data Description of Positive Mediation Outcomes.

Forms	Items	Mean	Std.	Skew	Kurt
Positive Mediation Outcomes	E1 The work arrangement of the agreed outcome met their needs.	4.37	1.59	0.21	0.50
	E2 The schedule arrangement of the agreed outcome met their needs.	4.45	1.58	0.18	0.51
	E3 The compensation arrangement of the agreed outcome met their needs.	4.11	1.54	0.04	0.39
	E4 Issues in dispute were narrowed down.	4.80	1.65	0.34	0.63
	E5 Full settlement was achieved.	4.33	1.84	0.25	0.75
	E6 No change to our positions.	4.27	1.56	0.05	0.48

Table 6. Data Description of Quasi-Imposition.

Forms	Items	Mean	Std.	Skew	Kurt
Quasi-Imposition	F1 Participation because of contractual requirement.	4.49	1.95	0.47	0.88
	F2 Participation because of court directive.	2.89	1.78	0.65	0.35
	F3 Participation because of incentive provided by the Mediation initiator.	3.04	1.68	0.36	0.70
	F4 Participation to avoid adverse publicity.	3.74	1.84	0.13	0.98
	F5 Participation irrespective of all the above.	3.87	1.64	0.19	0.38

3.2.2. Positive Mediation Outcomes

Part E focuses on the distribution of positive mediation outcomes. The mean scores for all the questions are above 4 (Neutral), indicating that all disputes utilising mediation have achieved positive mediation outcomes. The highest mean score is attributed to E.4 (4.80), which corresponds to the statement “Issues in dispute were narrowed down.” This suggests that respondents commonly recognise that narrowing down specific issues during the negotiation process is a likely achievement in a bona fide mediation. The absolute value of the coefficient of skewness falls below 0.5, signifying a symmetrical distribution to the responses [48].

3.2.3. Quasi-Imposition

Part F concerns the quasi-imposition of the mediation. The findings indicate that most mean scores fall below 4 (Neutral), apart from F1 (4.49), “Participation because of contractual requirement,” which stands above 4. The lowest mean score is F2 (2.89), “Participation because of court directive.” Consequently, it appears that most disputing parties engaged in mediation due to contractual obligations rather than court encouragement or other incentives. The absolute value of the coefficient of skewness is below 1, reflecting a moderately skewed distribution of responses [48].

3.2.4. Reliability Analysis

Table 7 displays the Cronbach’s Alpha values for various variables, including autonomy (0.704), commitment (0.875), perception of fairness (0.89), perception of opportunism (0.74), perception of timeliness (0.897), Bona Fide Mediation (0.848), and Quasi-Imposition (0.63). Since all these values are greater than the threshold of 0.6, it suggests that the

variables exhibit good internal consistency reliability. As for the Corrected Item-Total Correlation (CITC), values between 0.00 and 0.19 may imply that a question is not discriminating well; values between 0.20 and 0.39 indicate good discrimination, while values of 0.4 and above are indicative of very good discrimination [49,50].

Table 7. Reliability Analysis of the Scales.

		Corrected Item-Total Correlation (CITC)	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
Perception of Bona Fide Mediation	Fairness	D1	0.613	0.890
		D2	0.688	
		D3	0.624	
		D4	0.694	
	Opportunism	D5	0.443	0.740
		D6	0.550	
		D7	0.254	
		D8	0.338	
	Timeliness	D9	0.628	0.897
		D10	0.626	
		D11	0.658	
		D12	0.628	
Positive Mediation Outcome		E1	0.812	0.848
		E2	0.809	
		E3	0.761	
		E4	0.672	
		E5	0.627	
		E6	0.171	
Quasi-Imposition		F1	0.149	0.630
		F2	0.431	
		F3	0.541	
		F4	0.580	
		F5	0.277	

3.2.5. Validity Analysis

When the Kaiser–Meyer–Olkin (KMO) measure is greater than 0.7, and Bartlett's Test of Sphericity is significant ($p < 0.05$), the data satisfy the prerequisite requirements for factor analysis [51]. In this study, Principal Component Factor Analysis is employed for factor extraction, with common factors extracted having an eigenvalue greater than 1. The varimax method is utilised for rotation [52]. Both Kaiser's criterion and the Scree test guide the determination of the number of initial unrotated factors to be extracted. The eigenvalue linked with each factor signifies the variance explained by those linear components. With primary factor loadings of each measurement item greater than 0.6, and cross loadings less than 0.45, the measurement demonstrates good structural validity [53]. In addition, all the items displayed communality values above 0.5, indicating that over half of their variance is explained by the extracted factors. The results of the rotated component matrix are presented in Table 8 below.

Table 8. Rotated Component Matrix of Perception of Bona Fide Mediation.

Manifestation of Perception of Bona Fide Mediation		Component		
		1	2	3
Fairness	D1 <i>The Party</i> had been able to express their views and feelings.	0.804	0.235	0.082
	D2 <i>The Party</i> considered the outcome to reflect the effort.	0.77	0.309	0.172
	D3 <i>The Party</i> considered the counterpart had refrained from improper remarks/comments.	0.818	0.239	0.073
	D4 <i>The Party</i> considered the counterpart had been candid in communicating with them.	0.871	0.232	0.155
Opportunism	D5 <i>The Party</i> only talked to the counterpart to get information for their benefit.	0.264	0.015	0.776
	D6 <i>The Party</i> enjoyed being able to control over the proceeding.	0.334	0.209	0.647
	D7 <i>The Party</i> was more concerned about winning than achieving a win-win outcome.	−0.079	0.083	0.727
	D8 <i>The Party</i> dislikes committing to the counterpart because they didn't trust them.	0.05	0.06	0.769
Timeliness	D9 <i>The Party</i> considered the <i>Mediation</i> had been initiated at an appropriate time.	0.25	0.825	0.094
	D10 <i>The Party</i> considered the <i>Mediation</i> caucuses had been organised in a timely manner.	0.198	0.899	0.056
	D11 <i>The Party</i> considered the overall <i>Mediation</i> had been carried out within an acceptable time frame.	0.228	0.88	0.106
	D12 <i>The Party</i> considered they had timely feedback from me.	0.327	0.717	0.133

3.3. Stage II: Testing of the Hypothesised Relationships between the Constructs

For the measurement of the structural model, the assessment procedure, as suggested by Hair et al. [54], includes two main steps:

1. Assessing the structural model for potential collinearity issues;
2. Evaluating the significance and relevance of the relationships within the structural model.

The four hypotheses of the study are developed from theories and can neatly be presented as structural frameworks [54,55]. For this study, partial least squares structural equation modelling (PLS-SEM hereafter) is used to analyse these relationship frameworks [56]. This method has been widely used in marketing [54], business [57], construction [58] and psychology [59] due to its versatility in handling complex model structures and its ability to work with relatively smaller samples (less than 300). Smart PLS 3 [60] is used to analyse the relationship frameworks developed from the four hypotheses. The PLS-SEM results are used to support or contradict the hypotheses.

3.3.1. Assess the Structural Model for Collinearity Issues

A related measure of collinearity is the Variance Inflation Factor (VIF). A VIF value of five or higher typically indicates a potential collinearity problem [54]. Table 9 displays the VIF index for all the indicators. Notably, the VIF of E1, “The work arrangement of the agreed outcome met their needs,” and E2, “The schedule arrangement of the agreed outcome met their needs,” exceed the threshold of five. Since the term ‘work’ in the description

could encompass both time and workload, an outer VIF of less than 10 is considered acceptable [61]. Thus, no collinearity issues were detected for the entire structure.

Table 9. The Variance Inflation Factor (VIF) of All the Indicators.

Indicator	VIF	Indicator	VIF
D1	2.496	E1	5.914
D2	2.458	E2	5.965
D3	2.979	E3	2.456
D4	3.634	E4	2.04
D5	2.04	E5	1.748
D6	2.192	E6	1.051
D7	1.391	F1	1.063
D8	1.508	F2	1.352
D9	2.806	F3	1.524
D10	4.095	F4	1.689
D11	3.86	F5	1.143
D12	2.202		

3.3.2. Assess the Significance and Relevance of the Relationships Framework

The figures below illustrate the path coefficients and significances of the models after applying the PLS algorithm. Figure 3 shows the measurement model of the perception of bona fide mediation. The path coefficients (t-values for direct effects) of the overall framework, with bootstrapping applied to 5000 subsamples, are summarised in Tables 10–13.

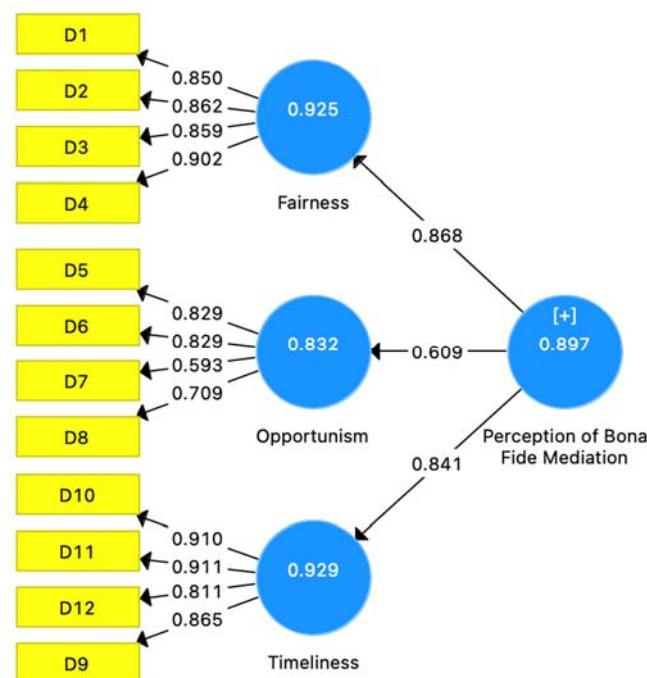


Figure 3. The Measures of Perception of Bona Fide Mediation.

An Hierarchical Component Model (HCM) was used to validate the structure of the key construct: Perception of Bona Fide Mediation. The Lower Order Components (LOCs) are selectively measured constructs that do not share a common cause, but rather form a general concept that fully mediates the impact on subsequent endogenous variables [62]. The findings are summarised as follows: The three LOCs exhibit notable differentiation. The path coefficients of Fairness (0.868) and Timeliness (0.841) are quite similar and both are essential contributors to perception. In contrast, Opportunism (0.609) is found to be the least contributing among the three dimensions of perception.

Table 10. Path Coefficients of H1 and Significance of the Key Constructs.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p Values
Perception of Bona Fide Mediation → Fairness	0.865	0.866	0.029	29.835	0
Perception of Bona Fide Mediation → Opportunism	0.622	0.621	0.084	7.381	0
Perception of Bona Fide Mediation → Timeliness	0.836	0.837	0.033	25.563	0
Quasi-Imposition → Perception of Bona Fide Mediation	0.341	0.365	0.077	4.453	0

Table 11. Path Coefficients of H2–H4 and Significance of the Key Constructs.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p Values
Fairness_ → Positive Mediation Outcomes	0.349	0.353	0.107	3.274	0.001
Opportunism → Positive Mediation Outcomes	0.224	0.227	0.089	2.521	0.012
Timeliness → Positive Mediation Outcomes	0.348	0.349	0.094	3.7	0

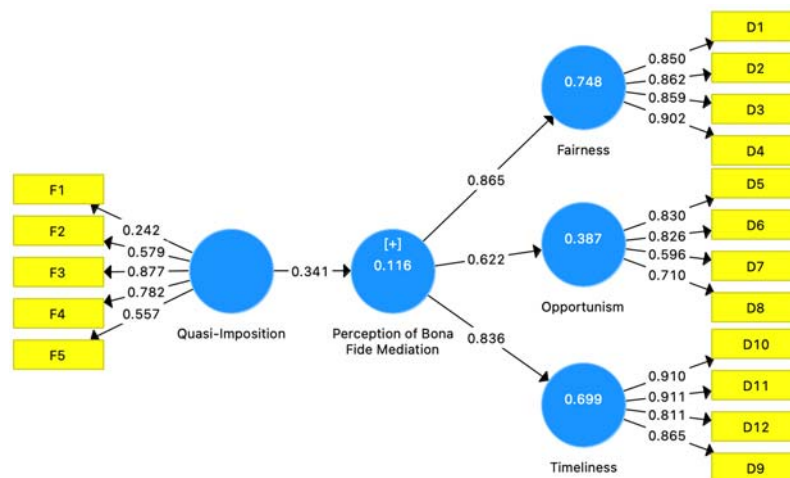
Table 12. Path Coefficients and Significance of Overall Framework.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	p Values
Perception of Bona Fide Mediation → Fairness	0.865	0.865	0.03	29.177	0
Perception of Bona Fide Mediation → Opportunism	0.618	0.62	0.08	7.729	0
Perception of Bona Fide Mediation → Positive Mediation Outcomes	0.687	0.686	0.055	12.427	0
Perception of Bona Fide Mediation → Timeliness	0.838	0.839	0.031	26.638	0
Quasi-Imposition → Perception of Bona Fide Mediation	0.33	0.35	0.08	4.14	0
Quasi-Imposition → Positive Mediation Outcomes	0.122	0.132	0.077	1.579	0.114

Table 13. Summary of Tested Hypothesis.

Hypotheses	PLS-SEM Analysis Results	Findings
H1: <i>Quasi-Imposition has negative impacts on the perception of bona fide mediation.</i>	Positively correlated	Not supported.
H2: <i>Disputants' perception of fairness has positive impacts on achieving positive mediation outcomes.</i>	Positively correlated	Supported
H3: <i>Disputants' perception of opportunism has negative impacts on achieving positive mediation outcomes</i>	Insignificant correlation	Not supported.
H4: <i>Disputants' perception of timeliness has positive impacts on achieving positive mediation outcomes.</i>	Positively correlated	Supported.
H5: <i>Quasi-Imposition has negative impacts on achieving positive mediation outcomes.</i>	Insignificant correlation	Not supported.

Figures 4–6 show the path coefficients and significances obtained through the PLS algorithm, while Tables 10–12 summarise the PLS results, with bootstrapping applied for 5000 subsamples. These results reveal that all standard path coefficients are statistically significant. Specifically, Figure 4 and Table 10 report a positive correlation between Quasi-Imposition and Perception of Bona Fide Mediation. The corresponding p -value is less than 0.001 (precisely, it is 0.000, but not exactly 0), indicating that the positive impact of Quasi-Imposition on the Perception of Bona Fide Mediation is statistically significant. Consequently, as the findings run contrary to a negative impact, Hypothesis 1 (H1) is not supported.

**Figure 4.** PLS-SEM Analysis Results of H1.

Hypothesis 1 (H1). *Quasi-Imposition has negative impacts on the perception of Bona Fide Mediation.*

Figure 5 and Table 11 show a positive correlation between Fairness, Opportunism, Timeliness and Positive Mediation Outcomes. The p -value of Hypothesis 2 (H2) and Hypothesis 4 (H4) are less than 0.001, confirming the statistical significance of the hypothesis. A p -value of Hypotheses 3 (H3) is 0.012, means there is a 1.2% chance of observing the data (or something more extreme) if the null hypothesis were true; null hypothesis typically represents a statement of no effect or no difference. Therefore, fairness and timeliness perceptions are each positively correlated with positive mediation outcomes. Consequently, H2 and H4 are supported, while H3 is not supported.

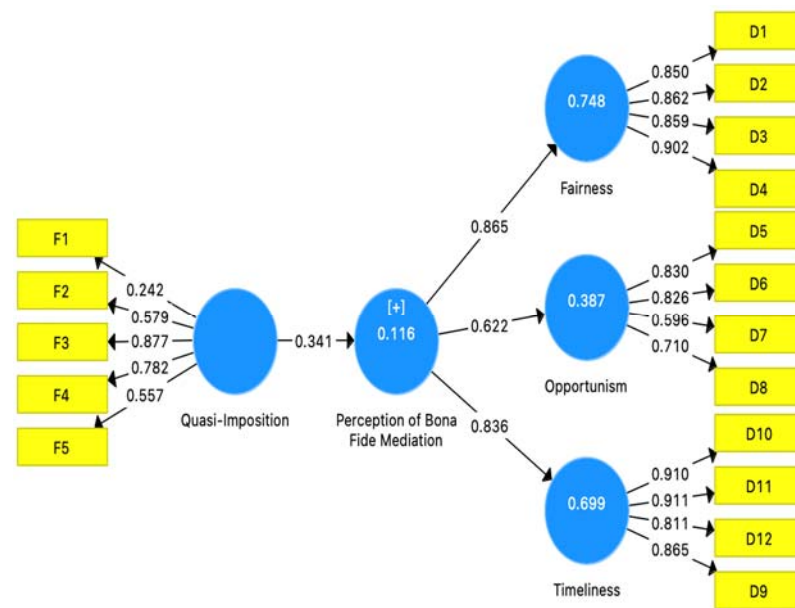


Figure 5. PLS-SEM Analysis Results of H2–H4.

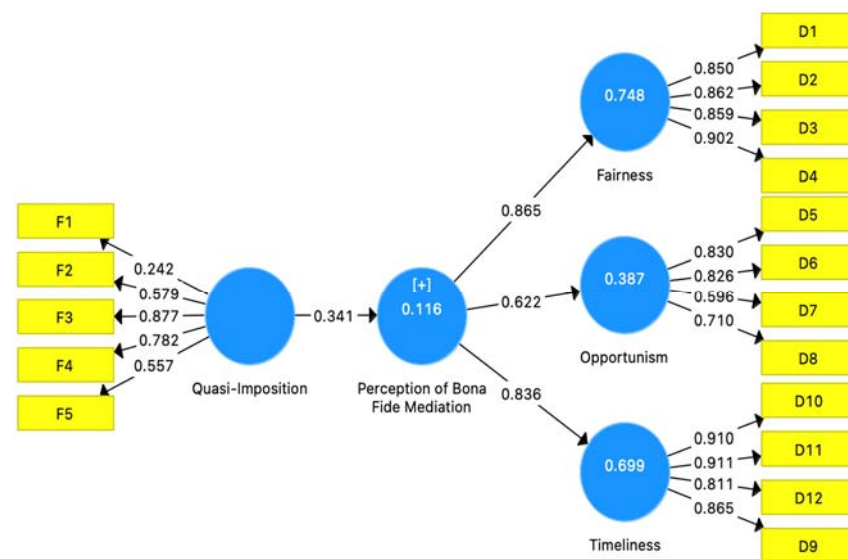


Figure 6. PLS-SEM Analysis Results of Overall Framework.

Hypothesis 2 (H2). Disputants' perception of fairness has positive impacts on achieving positive mediation outcomes.

Hypothesis 3 (H3). Disputants' perception of opportunism has negative impacts on achieving positive mediation outcomes.

Hypothesis 4 (H4). Disputants' perception of timeliness has positive impacts on achieving positive mediation outcomes.

3.3.3. The Complete Relationship Framework

The path coefficients (t-values for direct effects) of the overall framework are summarised in Table 12. Using a 5% significance level, most relationships within the structural model are positively correlated and statistically significant (p -value < 0.05). The empirical results underline the support for the perception of Bona Fide Mediation through mediation

is identified as the starting point and serves as a significant primer that warrants careful consideration. Conversely, Quasi-Imposition exhibits a positive correlation with the disputants' perception of Bona Fide Mediation through mediation (H1) is not supported; and Quasi-Imposition has an insignificant correlation with Positive Mediation Outcomes (H5) is not supported.

Hypothesis 5 (H5). *Quasi-Imposition has negative impacts on achieving Positive Mediation Outcomes.*

Table 13 summarises all the hypotheses and their PLS-SEM analysis results.

4. Discussion and Recommendations

The findings are first discussed, then followed by a review of the potential use of artificial intelligence to manage potential perceptive biases in quasi-imposed construction mediation.

First, key components of the constructs were identified. These include quasi-imposition (QI), bona fide mediation (BFM) and positive mediation outcomes (PMO). For bona fide mediation, fairness and timeliness were found to be main contributors to a positive perception. Accordingly, mediation processes should be designed to ensure these qualities are kept. This can be achieved by incorporating these in the mediation rules. For positive mediation outcomes, attending to substantive issues is the key. For quasi-imposition, the highest path loading was related to the contractual use of mediation. This result suggests that private proceedings and avoiding adverse publicity may not be that effective compared to contractual use of mediation. Second, through analysing of the relationships between key constructs, it was found that QI does not hinder the disputant's perception of bona fide mediation. Thus, the practice of QI remains an acceptable approach to promote wider use of construction mediation [63]. In this regard, this study affirms the value of quasi-imposition. With reference to the wide range of contract values, and the positive attitude among contractors toward resolving disputes through contractually stipulated mediation, quasi-imposition may as well be accepted as a new normal. The quasi-imposition of mediation, carefully implemented, promotes the use of construction dispute mediation. Nevertheless, QI should be used in parallel with flexible procedures [64]. Mediators are also reminded to adhere to the parties' expectations of fairness, timeliness and good faith mediating behaviours.

This study also highlights the backlash from negative perceptions of fairness and timeliness because of quasi-imposition. These negative impacts may just be psychological. Jussim suggested that these perceptions often have the potential to derail rational judgment and action, potentially leading to suboptimal decisions [65]. Perceptive bias is used to describe these negative perceptions. The emergence of artificial intelligence has prompted new opportunities for problem solvers in this area.

The role of AI in legal settings has been extensively studied, offering insights on its capabilities and limitations. Surden explored how AI can replicate complex legal reasoning [9], while Ashley investigated the benefits and risks of using AI in legal judgments [66]. Marrow et al. provided an extensive analysis of the incorporation of AI in arbitration [67], suggesting that while it is in its nascent stages, there is substantial potential for AI to offer unbiased advice in arbitration. However, the use of AI to mitigate biases is not without its ethical concerns. Cath et al. underlined that, while AI may help in reducing human biases [68], it brings about its own set of ethical dilemmas, such as transparency, accountability, and potential misuse. This necessitates the need for stringent guidelines when deploying AI for sensitive tasks like mediation. The ability of AI to process vast quantities of data without emotional or cognitive biases offers it a unique position to enhance decision-making processes. Dignum argued that AI systems could be programmed to operate on strict data-driven logic [69], offering potential avenues for unbiased analysis. Raji et al. demonstrated how AI can be trained specifically to recognise and mitigate biases [70],

turning them into powerful tools to maintain rationality. While the integration of AI to reduce perception bias in mediation processes is still an evolving field, the current literature indicates a cautiously optimistic trajectory. The following studies introduce AI use cases that have potential implications in the construction mediation domain.

Surden provided an exploration of the interactions between machine learning and legal practice [9]: (1) For information extraction from legal documents, the paper emphasises how machine learning can help in extracting and categorising information from large sets of legal documents. Algorithms can be trained to recognise patterns, such as specific types of clauses in contracts or patterns indicative of legal relevance. (2) For predictive analytics, machine learning has the potential to forecast legal outcomes based on historical data. By analysing previous case outcomes, algorithms can predict the likely outcome of new, similar cases, thereby assisting lawyers in formulating strategies or advising clients. (3) For automation of routine tasks, machine learning can facilitate the automation of routine legal tasks, such as document review. This not only saves time but also reduces the chances of human oversight or error.

Drawing inferences from the aforementioned studies, machine learning can potentially assist in the mediation context by: (1) Neutral Data Analysis: Machine learning tools can provide an unbiased analysis of facts, helping parties in mediation see a neutral perspective. For instance, an algorithm might analyse similar contracts and disputes in a contract dispute to provide insights about industry norms and likely interpretations. (2) Case Analysis: Just as machine learning can predict legal outcomes based on historical data, it could potentially predict the outcome of mediation processes. This could assist mediators in understanding the probable outcomes and formulating strategies accordingly. (3) Facilitation: Advanced AI could facilitate conversations, ensuring that all parties get equal time to speak or identifying moments of heightened tension and suggesting breaks or interventions. Ensuring a consistent and systematic review of information and texts, predictive analysis tools and virtual mediation assistants can help maintain a rational perspective on fairness. Furthermore, with regard to timeliness, machine learning can optimize mediation processes, ensuring that proceedings advance efficiently and within expected timeframes, thereby enhancing the parties' confidence in the process.

Marrow et al. delved into the feasibility and challenges of AI incorporation in the arbitration process, discussing the theoretical and legal ramifications of AI as an arbitrator [67]. While this study centres on arbitration, the principles can be extrapolated to mediation, where an AI mediator could not only facilitate discussions but also offer probable resolutions. Bellamy et al. launched a toolkit targeting AI bias issues [71]. This toolkit's pivotal use is in ensuring AI fairness, especially if deployed in mediation. It is paramount that any AI application in mediation ensures fairness as the cardinal objective. Utilising such toolkits can certify that AI algorithms employed in mediation remain bias-free, ensuring equitable outcomes.

For future applications of AI in mediation, it is prudent to emphasise that ensuring fairness remains a top priority in the mediation process. The integration of AI trends and the insights from this study suggest key implications for reducing perceptual bias in mediation. With AI's NLP capabilities, mediators have an opportunity to analyse linguistic patterns and detect biases, ensuring a more equitable conversation. The role of AI in real-time bias detection offers a proactive approach to heighten a mediation's credibility. Emphasising prompt and unbiased AI-driven interventions resonates with the proven positive impact of timeliness on mediation results. Neural network models, combined with data-driven feedback, can enrich the mediators' comprehension of ongoing dynamics, ensuring a more balanced and timely mediation process. Yet, AI's capacity to understand emotions and intricate interpersonal nuances remains a challenge. Table 14 lists the potential uses of AI to reduce perceptual biases in mediation.

Table 14. Summary of the Potential Use of AI to Reduce Perceptive Biases in Mediation.

Use of AI	Potential Impact on Perception Bias in Mediation	Hypotheses Correlation with AI's Role	Findings	Usage	References
Neural Network Models	Predict potential bias patterns from historical mediation data	H1: <i>Quasi-Imposition has negative impacts on the perception of bona fide mediation</i>	AI can potentially predict the obstacles.	User: Mediator. How: By analysing past mediation cases. Purpose: To understand patterns of bias in historical cases.	Surden [9].
Natural Language Processing (NLP)	Analyses linguistic patterns to determine bias in mediation conversations	H2: <i>Perception of fairness impacts positive outcomes</i>	AI with NLP supports unbiased understanding and enhances fairness.	User: Both. How: By processing transcripts of mediation sessions. Purpose: To detect linguistic indications of bias.	Ashley [66].
Bias Detection Algorithms	Actively detects and highlights potential biases in real-time mediation processes	H3: <i>Perception of opportunism impacts positive outcomes</i>	AI could address but more research required.	User: Mediator. How: By actively monitoring the mediation process. Purpose: To instantly identify and address instances of bias.	Bellamy et al. [71]
AI-Driven Mediation Bots	Provides initial stages of mediation to ensure timely and unbiased handling	H4: <i>Perception of timeliness impacts positive outcomes</i>	AI supports timely mediation processes.	User: Both. How: Virtual sessions conducted before face-to-face mediation. Purpose: To quickly address easily solvable issues.	Gregory et al. [72]
Data-Driven Feedback	Uses data analytics to give feedback on mediation process and potential bias	H5: <i>Quasi-Imposition impacts positive outcomes</i>	AI can offer insights but direct correlation not evident.	User: Mediator. How: Post-session analysis for improvement. Purpose: Continuous refinement of the mediation process based on data.	Chouldechova and Roth [73]

Mediation professionals should consider deploying AI tools like natural language processing (NLP) and neural network models into their practices. By focusing on the perceptive biases of fairness and timeliness, AI can be employed in bias detection, time tracking, etc. By using NLP, an AI system can analyse the content of speech during mediation sessions to detect potential biases or triggers that could lead to perceptions of unfairness. This could include biased language, overt favouritism, or even microaggressions. Advanced neural networks can go beyond mere word recognition to understand the sentiment and emotions behind spoken words. This can help mediators identify when a party feels they are being treated unfairly, even if they have not voiced it explicitly.

In addition, neural networks can use past mediation data to predict when discussions may veer off-topic or stall, enabling the mediator to steer the conversation back to its resolution in a timely manner. Technologies such as time-tracking tools and priority analysis can be employed to ensure that each party is given equal time to voice their concerns and viewpoints. If one party is dominating the conversation, the system can alert the mediator.

While AI integration offers many benefits, it is crucial to understand its potential risks and ethical implications. Continued research is recommended to enhance the understanding of AI algorithms and ensure they address the specific nuances and challenges of mediation. Mediators should create an iterative feedback loop where findings from AI insights are constantly integrated into the mediation process. By eliminating human

biases and prejudices, AI systems can help to ensure fair treatment for all parties in the mediation process.

5. Conclusions

Technological advancements, such as artificial intelligence and learning algorithms, have brought unprecedented opportunities to transform dispute management methods in construction. This study discusses the potential use of AI in reducing perceptive biases in construction mediations. Mediation has been used as a popular alternative to arbitration and litigation because it offers a private, fast, and cost-effective process. Despite the intended benefits, the practice of quasi-imposition may cause disputing parties to have concerns over whether the quasi-imposed mediation is bona fide. In this study, these forms of concern are identified as perceptive biases in a bona fide mediation and include fairness, opportunism and timeliness. With views and observations from practising construction professionals to develop the constructs for this study, it was found that the disputing parties' perceptive biases caused by quasi-imposed mediation could compromise the outcomes of a bona fide mediation. In this regard, the applications of AI and algorithms, such as NLP for sentiment analysis and machine learning algorithms for predictive time management, are recommended to reduce perceptive biases and improve amicable settlements in construction mediation.

Contributions:

- **To Theory:** This research expanded the theoretical perspective of construction mediation by incorporating the impact of Industry 4.0 advancements. It enriched the literature by introducing the concept of perceptive biases arising from quasi-imposition and the potential of AI in alleviating these biases.
- **To Practice:** The findings highlight the caveats of perceptive biases and their detrimental effects on having a bona fide negotiation. A clearer understanding of perceptive biases can guide disputing parties towards more objective and fruitful discussions. Professionals in the construction industry can leverage our findings to adopt more cost-effective and time-efficient dispute-resolution methods. By addressing these biases, parties can approach mediation in good faith, which may lead to better outcomes and reduced disputes. In addition, this study suggests the potential of AI use to reduce biases in construction mediation, pointing to ways to leverage Construction 4.0 in improving the construction mediation process.
- **To Policy:** Our findings offer insightful comments for policymakers in the construction sector. First, the necessity of acknowledging and confronting potential biases is raised. Recognising these biases is paramount, as it paves the way for the development and implementation of strategies that can neutralise them. Second, mediation, whether it is court-encouraged, contractually stipulated or court-directed, remains a meaningful method to resolve construction disputes. This is even more crucial in light of the growing incorporation of technology within the construction industry.

Limitation:

- **Sample Size and Diversity:** One limitation of our study is the sample size and its potential lack of diversity. However, the sample size was statistically adequate and we mitigated this limitation by ensuring rigorous data quality checks.
- **Temporal Nature:** Our study is cross-sectional, meaning it captures a snapshot in time. Longitudinal studies could provide more insights into how perceptions and outcomes evolve over time.
- **Common Source Bias:** The data collected for this study originate from a singular source, raising concerns related to common source bias. While efforts were made to minimize this bias, the potential for its presence remains. This limitation could result in inflated relationships between variables, and readers should interpret the findings with this consideration in mind [43,74].
- **Causality and SEM:** Although structural equation modelling (SEM) was employed to analyse the relationships among the study's variables, it is important to emphasise

that SEM, in the context of this research, does not establish causality. The current study is correlational in nature, and, as such, any observed relationships should not be interpreted as definitive evidence of cause and effect. Future experimental or longitudinal designs are required to provide clearer insights into causal links among the constructs of interest [75].

Future Studies:

- Longitudinal Examination: Future research could adopt a longitudinal approach to investigate the evolution of perceptive biases and the long-term effectiveness of AI-mediated interventions.
- Expanded Sample Diversity: Further studies could focus on expanding the sample pool across different geographical regions, ensuring an holistic understanding of the phenomenon.
- Integration of Additional Technologies: As Industry 4.0 encompasses various technologies beyond AI, future studies could explore the impact of other technological integrations, like Blockchain or Augmented Reality, on mediation processes in the construction industry.

Author Contributions: Conceptualisation, S.-O.C. and N.C.; methodology, N.C.; software, N.C.; validation, N.C.; formal analysis, N.C.; writing—original draft preparation, N.C. and S.-O.C.; writing—review and editing, S.-O.C., K.L. and N.C.; supervision, S.-O.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: All data generated or analysed during the study are included in the published paper.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bilal, M.; Oyedele, L.O.; Qadir, J.; Munir, K.; Ajayi, S.O.; Akinade, O.O.; Owolabi, H.A.; Alaka, H.A.; Pasha, M. Big Data in the Construction Industry: A Review of Present Status, Opportunities, and Future Trends. *Adv. Eng. Inform.* **2016**, *30*, 500–521. [\[CrossRef\]](#)
2. Wang, J.; Wu, P.; Wang, X.; Shou, W. The Outlook of Blockchain Technology for Construction Engineering Management. *Front. Eng. Manag.* **2017**, *41*, 67–75. [\[CrossRef\]](#)
3. Sivasuriyan, A.; Vijayan, D.S.; Górski, W.; Wodzyński, Ł.; Vaverková, M.D.; Koda, E. Practical Implementation of Structural Health Monitoring in Multi-Story Buildings. *Buildings* **2021**, *11*, 263. [\[CrossRef\]](#)
4. Ahmad, T.; Madonski, R.; Zhang, D.; Huang, C.; Mujeeb, A. Data-Driven Probabilistic Machine Learning in Sustainable Smart Energy/Smart Energy Systems: Key Developments, Challenges, and Future Research Opportunities in the Context of Smart Grid Paradigm. *Renew. Sustain. Energy Rev.* **2022**, *160*, 112128. [\[CrossRef\]](#)
5. Bagherzadeh, F.; Shafighfard, T.; Khan, R.M.A.; Szczuko, P.; Mieloszyk, M. Prediction of Maximum Tensile Stress in Plain-Weave Composite Laminates with Interacting Holes via Stacked Machine Learning Algorithms: A Comparative Study. *Mech. Syst. Signal Process.* **2023**, *195*, 110315. [\[CrossRef\]](#)
6. Moaf, F.O.; Kazemi, F.; Abdelgader, H.S.; Kurpińska, M. Machine Learning-Based Prediction of Preplaced Aggregate Concrete Characteristics. *Eng. Appl. Artif. Intell.* **2023**, *123*, 106387. [\[CrossRef\]](#)
7. Anastasiadou, M.; Santos, V.; Dias, M.S. Machine Learning Techniques Focusing on the Energy Performance of Buildings: A Dimensions and Methods Analysis. *Buildings* **2021**, *12*, 28. [\[CrossRef\]](#)
8. Adibimanesh, B.; Polesek-Karczewska, S.; Bagherzadeh, F.; Szczuko, P.; Shafighfard, T. Energy Consumption Optimization in Wastewater Treatment Plants: Machine Learning for Monitoring Incineration of Sewage Sludge. *Sustain. Energy Technol. Assess.* **2023**, *56*, 103040. [\[CrossRef\]](#)
9. Surden, H. Machine Learning and Law. *Wash. Rev.* **2014**, *89*, 87.
10. Carneiro, D.; Novais, P.; Andrade, F.; Zeleznikow, J.; Neves, J. Online Dispute Resolution: An Artificial Intelligence Perspective. *Artif. Intell. Rev.* **2014**, *41*, 211–240. [\[CrossRef\]](#)
11. Harmon, K.M. Resolution of Construction Disputes: A Review of Current Methodologies. *Leadersh. Manag. Eng.* **2003**, *3*, 187–201. [\[CrossRef\]](#)
12. Cao, N.; Cheung, S.O. The Paradox of Power Asymmetry and Voluntary Participation in Construction Dispute Mediation. *Constr. Dispute Res. Expand.* **2022**, 229–254. [\[CrossRef\]](#)

13. Hong Kong Mediation Ordinance (Cap. 620). 2017. Available online: <https://www.elegislation.gov.hk/hk/cap620> (accessed on 22 September 2023).
14. Li, K.; Cheung, S.O. Unveiling Cognitive Biases in Construction Project Dispute Resolution through the Lenses of Third-Party Neutrals. *J. Constr. Eng. Manag.* **2019**, *145*, 04019070. [\[CrossRef\]](#)
15. Li, K.; Cheung, S.O. Alleviating Bias to Enhance Sustainable Construction Dispute Management. *J. Clean. Prod.* **2020**, *249*, 119311. [\[CrossRef\]](#)
16. Buçinca, Z.; Malaya, M.B.; Gajos, K.Z. To Trust or to Think: Cognitive Forcing Functions Can Reduce Overreliance on AI in AI-Assisted Decision-Making. *Proc. ACM Hum. Comput. Interact.* **2021**, *5*, 1–21. [\[CrossRef\]](#)
17. Köchling, A.; Wehner, M.C. Discriminated by an Algorithm: A Systematic Review of Discrimination and Fairness by Algorithmic Decision-Making in the Context of HR Recruitment and HR Development. *Bus. Res.* **2020**, *13*, 795–848. [\[CrossRef\]](#)
18. Shrestha, Y.R.; Ben-Menahem, S.M.; Von Krogh, G. Organizational Decision-Making Structures in the Age of Artificial Intelligence. *Calif. Manage. Rev.* **2019**, *61*, 66–83. [\[CrossRef\]](#)
19. Pearson, J. An Evaluation of Alternatives to Court Adjudication. *Just. Sys. J.* **1982**, *7*, 420.
20. Winston, D.S. Participation Standards in Mandatory Mediation Statutes: You Can Lead a Horse to Water. *Ohio State J. Disput. Resolut.* **1996**, *11*, 187.
21. Ross, W.H.; Conlon, D.E. Hybrid Forms of Third-Party Dispute Resolution: Theoretical Implications of Combining Mediation and Arbitration. *Acad. Manage. Rev.* **2000**, *25*, 416–427. [\[CrossRef\]](#)
22. Boettger, U. Efficiency versus Party Empowerment-against a Good-Faith Requirement in Mandatory Mediation. *Rev. Litig.* **2004**, *23*, 1.
23. Putnam, L.L.; Myers, K.K.; Gailliard, B.M. Examining the Tensions in Workplace Flexibility and Exploring Options for New Directions. *Hum. Relat.* **2014**, *67*, 413–440. [\[CrossRef\]](#)
24. Liao, C.; Wayne, S.J.; Rousseau, D.M. Idiosyncratic Deals in Contemporary Organizations: A Qualitative and Meta-Analytical Review. *J. Organ. Behav.* **2016**, *37*, S9–S29. [\[CrossRef\]](#)
25. Colquitt, J.A.; Zipay, K.P. Justice, Fairness, and Employee Reactions. *Annu. Rev. Organ. Psychol. Organ. Behav.* **2015**, *2*, 75–99. [\[CrossRef\]](#)
26. Colquitt, J.A.; Greenberg, J.; Zapata-Phelan, C.P. What Is Organizational Justice? A Historical Overview. In *Handbook of Organizational Justice*; Psychology Press: London, UK, 2013; pp. 3–56.
27. Gilliland, S.W. The Perceived Fairness of Selection Systems: An Organizational Justice Perspective. *Acad. Manage. Rev.* **1993**, *18*, 694–734. [\[CrossRef\]](#)
28. Murphy, K.R. Performance Evaluation Will Not Die, but It Should. *Hum. Resour. Manag. J.* **2020**, *30*, 13–31. [\[CrossRef\]](#)
29. Harold, C.M.; Holtz, B.C.; Griepentrog, B.K.; Brewer, L.M.; Marsh, S.M. Investigating the Effects of Applicant Justice Perceptions on Job Offer Acceptance. *Pers. Psychol.* **2016**, *69*, 199–227. [\[CrossRef\]](#)
30. Outlaw, R.; Colquitt, J.A.; Baer, M.D.; Sessions, H. How Fair versus How Long: An Integrative Theory-Based Examination of Procedural Justice and Procedural Timeliness. *Pers. Psychol.* **2019**, *72*, 361–391. [\[CrossRef\]](#)
31. Luthans, F.; Luthans, B.C.; Luthans, K.W. *Organizational Behavior: An Evidence-Based Approach*, 4th ed.; IAP: North Carolina, USA, 2021.
32. Fulmer, I.S.; Barry, B.; Long, D.A. Lying and Smiling: Informational and Emotional Deception in Negotiation. *J. Bus. Ethics* **2009**, *88*, 691–709. [\[CrossRef\]](#)
33. Gulati, R.; Wohlgezogen, F.; Zhelyazkov, P. The Two Facets of Collaboration: Cooperation and Coordination in Strategic Alliances. *Acad. Manage. Ann.* **2012**, *6*, 531–583. [\[CrossRef\]](#)
34. Castañer, X.; Oliveira, N. Collaboration, Coordination, and Cooperation among Organizations: Establishing the Distinctive Meanings of These Terms through a Systematic Literature Review. *J. Manag.* **2020**, *46*, 965–1001. [\[CrossRef\]](#)
35. Dania, W.A.P.; Xing, K.; Amer, Y. Collaboration Behavioural Factors for Sustainable Agri-Food Supply Chains: A Systematic Review. *J. Clean. Prod.* **2018**, *186*, 851–864. [\[CrossRef\]](#)
36. Ge, Y.; Liu, S.; Gao, R.; Xian, Y.; Li, Y.; Zhao, X.; Pei, C.; Sun, F.; Ge, J.; Ou, W. Towards Long-Term Fairness in Recommendation. In Proceedings of the 14th ACM International Conference on Web Search and Data Mining, Online, 8–12 March 2021; pp. 445–453. [\[CrossRef\]](#)
37. Wick, M.; Tristan, J.-B. Unlocking Fairness: A Trade-off Revisited. *Adv. Neural Inf. Process. Syst.* **2019**, *32*, 1–10. Available online: https://proceedings.neurips.cc/paper_files/paper/2019/file/373e4c5d8edfa8b74fd4b6791d0cf6dc-Paper.pdf (accessed on 11 September 2023).
38. Bernerth, J.B.; Feild, H.S.; Giles, W.F.; Cole, M.S. Perceived Fairness in Employee Selection: The Role of Applicant Personality. *J. Bus. Psychol.* **2006**, *20*, 545–563. [\[CrossRef\]](#)
39. Hornung, S.; Rousseau, D.M.; Weigl, M.; Müller, A.; Glaser, J. Redesigning Work through Idiosyncratic Deals. *Eur. J. Work. Organ. Psychol.* **2014**, *23*, 608–626. [\[CrossRef\]](#)
40. Rosen, C.C.; Slater, D.J.; Chang, C.-H.; Johnson, R.E. Let's Make a Deal: Development and Validation of the Ex Post i-Deals Scale. *J. Manag.* **2013**, *39*, 709–742. [\[CrossRef\]](#)
41. Rousseau, D.M.; Ho, V.T.; Greenberg, J. I-Deals: Idiosyncratic Terms in Employment Relationships. *Acad. Manage. Rev.* **2006**, *31*, 977–994. [\[CrossRef\]](#)

42. Xia, N.; Sun, N.; Ding, S. How Psychological Capital Drives the Initiative of Project Managers in the Chinese Construction Industry: The Roles of Work Engagement and Decision Authority. *J. Manag. Eng.* **2022**, *38*, 04022031. [\[CrossRef\]](#)
43. Xie, Q.; Xia, N.; Yang, G. Do Family Affairs Matter? Work–Family Conflict and Safety Behavior of Construction Workers. *J. Manag. Eng.* **2022**, *38*, 04021074. [\[CrossRef\]](#)
44. Abowitz, D.A.; Toole, T.M. Mixed Method Research: Fundamental Issues of Design, Validity, and Reliability in Construction Research. *J. Constr. Eng. Manag.* **2010**, *136*, 108–116. [\[CrossRef\]](#)
45. Baruch, Y.; Holtom, B.C. Survey Response Rate Levels and Trends in Organizational Research. *Hum. Relat.* **2008**, *61*, 1139–1160. [\[CrossRef\]](#)
46. Kline, R.B. *Principles and Practice of Structural Equation Modeling*; Guilford Publications: New York, NY, USA, 2023.
47. Brown, T.A. *Confirmatory Factor Analysis for Applied Research*; Guilford Publications: New York, NY, USA, 2015.
48. Chiou, P.; Miao, W. Predicted Return Level of Annual Maximum Earthquake in Northern California. *Measurements* **2016**, *19*, 22.
49. Prieto, L.; Alonso, J.; Lamarca, R. Classical Test Theory versus Rasch Analysis for Quality of Life Questionnaire Reduction. *Health Qual. Life Outcomes* **2003**, *1*, 1–13.
50. Calders, T.; Verwer, S. Three Naive Bayes Approaches for Discrimination-Free Classification. *Data Min. Knowl. Discov.* **2010**, *21*, 277–292. [\[CrossRef\]](#)
51. Shrestha, N. Factor Analysis as a Tool for Survey Analysis. *Am. J. Appl. Math. Stat.* **2021**, *9*, 4–11. [\[CrossRef\]](#)
52. Huey Yiing, L.; Zaman Bin Ahmad, K. The Moderating Effects of Organizational Culture on the Relationships between Leadership Behaviour and Organizational Commitment and between Organizational Commitment and Job Satisfaction and Performance. *Leadersh. Organ. Dev. J.* **2009**, *30*, 53–86. [\[CrossRef\]](#)
53. Chen, C.-J.; Huang, J.-W. How Organizational Climate and Structure Affect Knowledge Management—The Social Interaction Perspective. *Int. J. Inf. Manag.* **2007**, *27*, 104–118. [\[CrossRef\]](#)
54. Hair Jr, J.F.; Sarstedt, M.; Hopkins, L.; Kuppelwieser, V.G. Partial Least Squares Structural Equation Modeling (PLS-SEM): An Emerging Tool in Business Research. *Eur. Bus. Rev.* **2014**, *26*, 106–121. [\[CrossRef\]](#)
55. Matthews, L.; Hair, J.O.E.; Matthews, R. Pls-Sem: The Holy Grail for Advanced Analysis. *Mark. Manag. J.* **2018**, *28*, 1–13.
56. Hair Jr, J.; Hair Jr, J.F.; Hult, G.T.M.; Ringle, C.M.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*; Sage Publications: Thousand Oaks, CA, USA, 2021.
57. Ringle, C.M.; Sarstedt, M.; Straub, D.W. Editor’s Comments: A Critical Look at the Use of PLS-SEM in “MIS Quarterly”. *MIS Q.* **2012**, *36*, iii–xiv. [\[CrossRef\]](#)
58. Chan, A.P.C.; Darko, A.; Olanipekun, A.O.; Ameyaw, E.E. Critical Barriers to Green Building Technologies Adoption in Developing Countries: The Case of Ghana. *J. Clean. Prod.* **2018**, *172*, 1067–1079. [\[CrossRef\]](#)
59. Willaby, H.W.; Costa, D.S.; Burns, B.D.; MacCann, C.; Roberts, R.D. Testing Complex Models with Small Sample Sizes: A Historical Overview and Empirical Demonstration of What Partial Least Squares (PLS) Can Offer Differential Psychology. *Personal. Individ. Differ.* **2015**, *84*, 73–78. [\[CrossRef\]](#)
60. Ringle, C.M.; Sarstedt, M.; Mitchell, R.; Gudergan, S.P. Partial Least Squares Structural Equation Modeling in HRM Research. *Int. J. Hum. Resour. Manag.* **2020**, *31*, 1617–1643. [\[CrossRef\]](#)
61. Purwanto, A. Partial Least Squares Structural Equation Modeling (PLS-SEM) Analysis for Social and Management Research: A Literature Review. *J. Ind. Eng. Manag. Res.* **2021**.
62. Crocetta, C.; Antonucci, L.; Cataldo, R.; Galasso, R.; Grassia, M.G.; Lauro, C.N.; Marino, M. Higher-Order PLS-PM Approach for Different Types of Constructs. *Soc. Indic. Res.* **2021**, *154*, 725–754. [\[CrossRef\]](#)
63. Cao, N.; Cheung, S.O. Mediators’ View on Voluntary Construction Dispute Mediation. *J. Leg. Aff. Dispute Resolut. Eng. Constr.* **2023**.
64. Cao, N.; Cheung, S.O. The Value of Voluntary Participation in Construction Dispute Mediation. *Eng. Constr. Archit. Manag.* **2023**. *ahead-of-print*. [\[CrossRef\]](#)
65. Jussim, L. *Social Perception and Social Reality: Why Accuracy Dominates Bias and Self-Fulfilling Prophecy*; Oxford University Press: Oxford, UK, 2012.
66. Ashley, K.D. *Artificial Intelligence and Legal Analytics: New Tools for Law Practice in the Digital Age*; Cambridge University Press: Cambridge, UK, 2017.
67. Marrow, P.B.; Karol, M.; Kuyan, S. *Artificial Intelligence and Arbitration: The Computer as an Arbitrator—Are We There Yet?* Lyon & Ross: New York, NY, USA, 2020.
68. Cath, C.; Wachter, S.; Mittelstadt, B.; Taddeo, M.; Floridi, L. Artificial Intelligence and the ‘Good Society’: The US, EU, and UK Approach. *Sci. Eng. Ethics* **2018**, *24*, 505–528.
69. Dignum, V. Ethics in Artificial Intelligence: Introduction to the Special Issue. *Ethics Inf. Technol.* **2018**, *20*, 1–3. [\[CrossRef\]](#)
70. Raji, I.D.; Smart, A.; White, R.N.; Mitchell, M.; Gebru, T.; Hutchinson, B.; Smith-Loud, J.; Theron, D.; Barnes, P. Closing the AI Accountability Gap: Defining an End-to-End Framework for Internal Algorithmic Auditing. In Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency, Barcelona, Spain, 27–30 January 2020; pp. 33–44.
71. Bellamy, R.K.; Dey, K.; Hind, M.; Hoffman, S.C.; Houde, S.; Kannan, K.; Lohia, P.; Martino, J.; Mehta, S.; Mojsilović, A. AI Fairness 360: An Extensible Toolkit for Detecting and Mitigating Algorithmic Bias. *IBM J. Res. Dev.* **2019**, *63*, 4:1–4:15. [\[CrossRef\]](#)
72. Gregory, R.W.; Henfridsson, O.; Kaganer, E.; Kyriakou, H. The Role of Artificial Intelligence and Data Network Effects for Creating User Value. *Acad. Manage. Rev.* **2021**, *46*, 534–551. [\[CrossRef\]](#)

73. Chouldechova, A.; Roth, A. A Snapshot of the Frontiers of Fairness in Machine Learning. *Commun. ACM* **2020**, *63*, 82–89. [\[CrossRef\]](#)
74. Favero, N.; Bullock, J.B. How (Not) to Solve the Problem: An Evaluation of Scholarly Responses to Common Source Bias. *J. Public Adm. Res. Theory* **2015**, *25*, 285–308. [\[CrossRef\]](#)
75. Bullock, H.E.; Harlow, L.L.; Mulaik, S.A. Causation Issues in Structural Equation Modeling Research. *Struct. Equ. Model. Multidiscip. J.* **1994**, *1*, 253–267. [\[CrossRef\]](#)

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.