The Happening of Bias in Construction Dispute Negotiation

Sai On Cheung and Keyao Li

Introduction

As the world population grows, rapid urbanization has been the key form of development across the world. Naturally, infrastructural facilities are major parts of urbanization. In addition to the ever-growing in scale, construction projects have also become more and more complex and sophisticated. Close collaboration among technically and commercially specialized professionals is needed for the delivery of these projects. Very often, these professionals are coming from different organizations and even from different countries. The inevitable differences in organizational and personal interests add further managerial complexity for decision makers. In fact, it has been reported that many major construction projects did end with substantial disputes that took years to resolve [73, 116, 126]. Davis and Pharro [52] and Meng and Boyd [133] further found that human factor is one of the key barriers against dispute settlement. It has also been well documented that conflicts among project participants underpin disputes [42]. In construction dispute resolution, it is not uncommon to find parties involved overlooking notable chances of settlement, in extreme situations even win–win options are forsaken [124]. Therefore, addressing human factor is pivotal in settling construction dispute negotiation [43, 63].

Rational evaluation is considered to be the prerequisite of quality decisions. On this basis, negotiation studies are mostly conducted with this assumption whereby decision makers are rational and able to make sense of the available information and select the most appropriate options [15, 19, 26, 49]. As a matter of fact, human

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decisions are not always made through deliberate analysis [4, 51]. The limitation of human decisions was pinpointed by Simon [174] whose concept of bounded rationality remains one of the key theories on cognitive human judgments. In this regard, Bromiley and Papenhausen [26] echoed that complete rational human decisions cannot be expected. In reality, many decisions are made by applying heuristics for the ease to achieve direct and quicker decisions. For this purpose, the problems are typically simplified with the application of heuristics [102, 175]. Moreover, Tversky and Kahneman [191] commented that systematic and predictable errors could arise if heuristics are used too grossly. It has been further reported that application of unconscious heuristics could lead to bias [10, 63, 106]. Specifically in construction, Stingl and Geraldi [180] reported that project success could be compromised by biased decisions [3, 193]. Other undesirable impacts include ineffective risk management [117, 118], suboptimal project planning [72, 158] and failure to respond to failing signals [85]. Notwithstanding the well documented influence of biases on decisions, study on bias in construction decisions is very limited and particularly in construction dispute negotiations (CDN hereafter) is almost uncharted. Notably, conceptualizing bias in CDN would be instrumental in detecting biased behaviors during dispute negotiations. Minimizing biased decisions is no doubt an effective way to improve the possibility of achieving successful dispute settlement. Efficiency will be enhanced when valuable resources are directed appropriately with more rational decisions. Against these backgrounds, the following questions are addressed in this study: (i) are construction disputing parties rational as assumed in most negotiation studies? (ii) do biases affect their decisions? (iii) if biases do exist, what are the underlying constructs of biased behaviours that would hinder amicable dispute negotiation? This study therefore fulfills the research gap of biases in CDN by proposing a bias conceptualization framework.

Admission of bias is not likely for dispute decision makers; however, their dispute negotiation behaviours might present evidence. Drawing from literatures on effects of bias in decision-making, a list of possible manifestations of bias in CDN was assembled. To conceptualize bias in CDN, the underlying constructs of biased behaviours are first explored. In these regards, an empirical survey was conducted in Hong Kong to study the propensity of construction project disputants of practicing biased manifestations. A conceptual framework of bias in CDN (the Framework hereafter) was proposed. With data collected from professional construction practitioners, the Framework was validated. The study is reported in seven parts: (i) Manifestations of bias in CDN; (ii) Data collection; (iii) Data analysis; (iv) Findings; (v) Implications on construction project dispute management; (vi) Limitations and future direction and (vii) Concluding remarks. Figure 1 shows the research plan of the study.

Manifestations of Bias in CDN

The artifacts of bias are drawn from literature. As indicated in Table 1, anchoring effect (AE), overconfidence effect (OE), self-serving effect (SE), hindsight effect

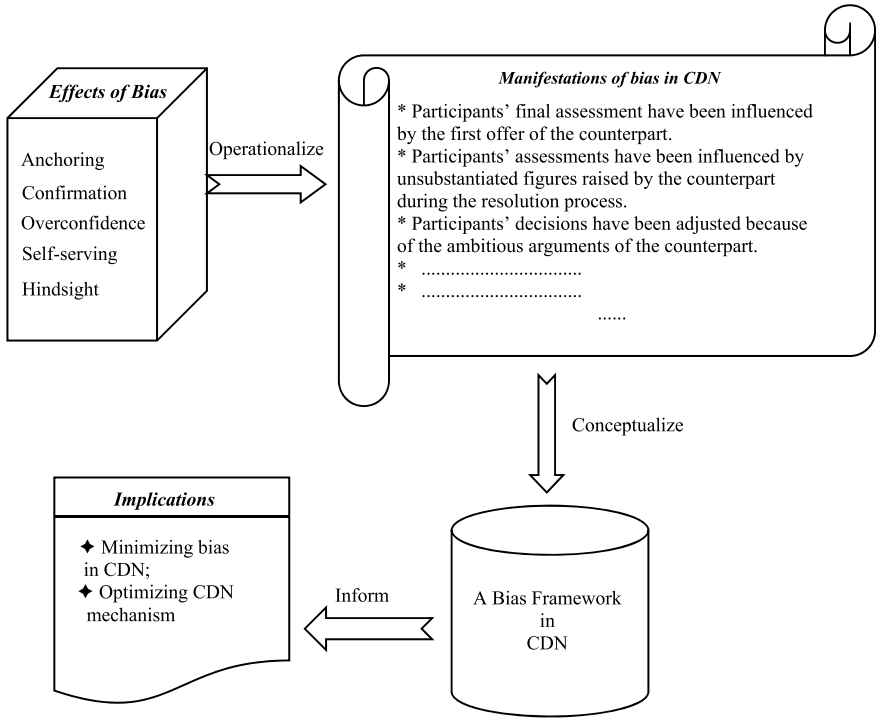

Fig. 1 Research plan of the study

(HE) and confirmation effect (CE) are found to be the mostly reported bias effects. The respective impacts on irrational human decisions have been summarized by Li and Cheung [121]. These five types of bias effect are discussed seriatim.

Anchoring

Anchoring effect describes the lasting impression derived from the first set of information uptake [135, 139, 145, 172]. It means that once an impression was made based on the first received information, it becomes anchor for any further decisions to be made. In construction dispute negotiation context, disputants under anchoring effect would rely on information received at the earlier negotiation stage without validating their applicability [33, 76, 191]. As a matter of fact, it is quite natural for people to analyze their problem at hand with reference to previously accepted information. However, Strack and Mussweiler [182] and Mussweiler et al. [145] found that influencing anchors derived from previously received information could surprisingly be irrelevant, uninformative, implausibly extreme or even self-generated. Tversky and Kahneman [191] demonstrated that even estimation about the percentage of African

Table 1 Key references of the five types of effect of bias

Authors	AE	OE	SE	HE	CE	Authors	AE	OE	SE	HE	CE
[88]	*	*				[20]				*	
[5]		*		*	*	[165]		*	*	*	
[89]	*	*		*		[86]	*			*	
[137]			*			[22]	*			*	
[92]	*	*				[160]	*			*	
[141]	*		*	*	*	[132]	*	*		*	
[61]	*		*		*	[111]				*	
[78]	*			*	*	[46]		*		*	
[60]	*		*			[161]	*		*	*	
[33]	*	*		*	*	[12]	*	*	*		
[101]	*		*			[7]		*	*	*	
[105]		*	*		*	[8]			*		
[99]					*	[193]		*			
[197]	*				*	[186]		*	*		
[150]		*	*		*	[80]			*		
[127]	*			*	*	[147]	*	*			
[107]		*		*	*	[182]	*				*
[108]					*	[113]		*	*		
[100]	*	*	*		*	[36]		*			
[109]		*			*	[54]			*		
[81]		*			*	[162]			*		
[173]		*				[191]	*				
[25]					*	[6]				*	
[85]		*				[28]				*	
[122]		*	*			[179]				*	

Notes Anchoring effect (AE); Overconfidence effect (OE); Self-serving effect (SE); Hindsight effect (HE); Confirmation effect (CE)

countries in the United Nations were affected by the anchors randomly selected by spinning a wheel of fortune in the subjects' presence. Russo and Shoemaker [166] also experimented that the estimates on the date when Attila the Hun was defeated in Europe had been impacted by anchors like irrelevant telephone numbers. Apparently in these experiments, subjects used the information provided by the researchers as anchors for their evaluations without challenging their relevancy and reliability. One possible explanation is that people start analyzing a problem with the first set of available information and subsequent decisions are then made through adjustments there-from Tversky and Kahneman [191]. These adjustments are typically not thorough and terminate prematurely when reaching a region of acceptable answers [34, 61, 145]. Therefore, with insufficient adjustments, the final estimation would be

close to the anchors and likely to be suboptimal. Mussweiler [144] provided another explanation of anchoring effect with a selective accessibility process whereby decision makers estimate a target with the hypothesis that the target is similar or close to the anchor [37, 143, 145, 182, 181]. Further, Chapman and Johnson [33] proposed that under anchoring biases, factors that are common to the anchor are considered during decision making while the others are ignored [34]. Besides, Bergman et al. [16] demonstrated that anchoring effect could be reduced with greater cognitive skills. Furnham and Boo [76] and Furnham et al. [77] further argued that human attributes, such as mood, knowledge and personality would influence the strength of anchoring effect. Moreover, computer-based training programs have been found to be effective in mitigating anchoring effect [1, 47, 56, 142].

Overconfidence

Previous studies have found that decision makers with high confidence are likely to overestimate the accuracy of their judgment—a phenomenon called overconfidence [55, 67, 68, 88, 109, 123, 134, 188]. Moore and Healy [140] and Bazerman and Moore [13] described three principal forms of overconfidence: (i) over-estimation of one's actual performance, (ii) over-placement of one's performance compared to others'; and (iii) over-judgment of the accuracy of one's assessment. Klayman et al. [109] and Tsai [190] added that confidence level is idiosyncratic and varies with the way a problem is presented and the reference knowledge domain. Prior researchers also explored the relationship between confidence and difficulty [100, 123, 183]. The more difficult the problem is, the more confident one tends to be. Whereas easier problems are likely to acquire lower confidence [23, 163, 190]. Overlooking new information while sticking with previous knowledge is another manifestation of overconfidence [177, 190, 191]. Interestingly, Klayman et al. [109] proposed that overconfidence can stem from inherent judgmental error. To this end, one possible source of inherent judgmental error is inappropriate assessment of the validity of the collected information [62, 69, 109, 177]. This judgmental error is akin to the concept of cognitive limitation whereby people are not good at interpreting additional information to verify the accuracy of their judgment [190]. Furthermore, Radzevick and Moore [164] proposed that objective circumstances, like social pressure could also exacerbate overconfidence. Bazerman and Moore [13] demonstrated that decision makers may use overconfidence to relieve internal dissonance and tension when faced with tough decisions. More recently, Dunning [57] and Feld [66] found that lower-skilled subjects are showing higher level of overconfidence.

Self-serving

Self-serving effect is a kind of cognitive discourse whereby an individual is inclined to claim contribution for achievement of positive outcomes. However, if the outcome is negative, one would either blame the counterpart or take external factors as excuses [29, 53, 122, 137, 149]. Furthermore, self-serving tendency was found to be a type of self-protection mechanism to maintain self-esteem by denying the responsibility of negative outcomes [171, 200]. Campbell and Sedikides [29] described a self-threat model—when one encounters unfavorable feelings of self-threat such as being challenged, questioned, blamed or despised, one would leverage self-serving mode with the aim of shedding responsibility of the negative results and protecting self-image. Miller and Ross [137] examined the relationship between optimistic attitude and self-serving tendency, they claimed that self-serving behaviors are underpinned by over-optimistic predictions and expectations [184]. Similarly, self-serving behaviors are backed by the desire to protect and enhance positive self-image. Thus, it can be summarized that self-esteem is the prime motivator of self-serving acts [24, 48]. From another perspective, Lerner and Keltner [120] and Coleman [48] found that emotion also matters. For example, Baumgardner and Arkin [11] identified positive emotions and bright self-image made one more likely to bring about self-serving effect than negative emotion. In addition, pessimism would generate detrimental effects on one's self-image and self-concept. In negotiation context, decision makers under the impact of self-serving bias only take actions that are beneficial to themselves and believe that this is not unfair to the other stakeholders [114, 149, 152].

Hindsight

Hindsight effect describes that people over claim their estimation of happening likelihood of an event after knowing the outcome [18, 38, 70, 155, 157]. Hindsight explains the influence of outcome knowledge on judgment under uncertainty. The phenomenon of claiming known outcomes as being inevitable is known as "creeping determinism" [17, 94, 165, 196]. Hawkins and Hastie [89] further demonstrated that creeping determinism is the result of instantaneous integration of outcome information into the knowledge frame of an event. One explanation of the effect of outcome knowledge is assimilation [70]. Subjects assimilate the already known outcome into their memory about the issue. Assimilating outcome knowledge to match with the event background, thus making the outcome appears more likely to happen right at the outset. The effect of hindsight is also called knowledge updating [21, 89, 165].

Fischhoff [70] opined that one is typically not aware of the influence of hindsight effect [159]. It is because hindsight effect occurs as the cognitive activities of information integration, resulting in the simplification of cause and effect [50]. As a result, known happenings are then incorporated into memories that are taken as background

information of the event [115, 125]. The better one makes sense of the stories by injecting meaning into the past, the stronger is the hindsight effect [21, 89, 165].

Confirmation

Confirmation effect describes one's tendency to search for and interpret information therefrom to confirm existing beliefs and assumptions [112, 150, 192]. Klayman [107] added that confirmation effect can be in the forms of inclination to retain or reluctance to abandon a favored position. When one takes on a position or forms an opinion on an issue, the subsequent information search becomes highly selective and aims mostly to defend the previous position [112, 150, 155]. Characteristics of confirmation effect include: (i) focusing only on favored assumptions while neglecting alternatives, (ii) giving greater weight to evidence that support existing beliefs and undermining those that suggest otherwise; (iii) testing only cases that fit the hypotheses; and (iv) interpreting information into the way that one is looking for [35, 71, 91, 138, 150]. With the wishes to confirm existing assumptions, one would render unwarranted weights to information that supports the same [112, 150, 170]. Millward and Spoehr [138] also found that decision makers were inclined to only test cases that they expected would tie with the hypotheses [64, 185]. Nickerson [150] demonstrated confirmation effect by the following example: suppose the concept to be discovered is small circle, if the subject's hypothesis is small red circle, he would then only test those cases with the hypothesized features of small, red, and circular. It is obvious that this approach would not unveil the small circle concept because the confirmation effect would exclude other qualifying examples like small yellow circle.

With the afore-mentioned deliberations on bias effects, a list of manifestations of bias in CDN was developed and summarized in Table 2.

Data Collection

The study requires data on the frequency of construction dispute negotiators practicing biased behaviours. Measurement statements were developed from bias manifestations summarized from the aforementioned literature. For example, "Participants' final assessments have been influenced by the first offer of the counterpart" was changed to "My final assessments have been influenced by the first offer of the counterpart". The data collection survey has two parts. The first part collects personal particulars, including professional background of the respondents. In the second part of the survey, the respondents were asked to evaluate their practice in CDN against a six-point Likert scale of frequency from 0 (not at all) to 6 (always) for each of the measurement statements. The Hong Kong construction professionals with dispute resolution experience are the target, including professionals working in contractor,

Table 2 Manifestations of bias in CDN

Manifestations	References
1. Participants' final assessments have been influenced by the first offer of the counterpart. (Anchoring)	[41, 78, 187]
2. Participants' assessments have been influenced by unsubstantiated figures raised by the counterpart during the resolution process. (Anchoring)	[97, 147, 191]
3. Participants' decisions have been adjusted because of the ambitious arguments of the counterpart. (Anchoring)	[32, 59, 128, 130]
4. Participants cannot get away with the assessments made at prior round of dispute negotiations. (Anchoring)	[58, 59, 194]
5. Participants become immune to alternative reasonable assessments after forming their first assessments about the dispute. (Confirmation)	[55, 71, 107, 150]
6. Participants have paid more attention to the information which is consistent with their prior knowledge of the dispute. (Confirmation)	[155, 156]
7. Participants incline to interpret further information as evidence to justify their assessments. (Confirmation)	[90, 95, 189]
8. Participants search for information that confirms their assessment. (Confirmation)	[30, 112, 150, 155]
9. Participants consider that their party has contributed more to the positive outcomes of the resolution. (Self-serving)	[29, 65, 82]
10. Participants endorse information that supports their assessments. (Confirmation)	[150, 155]
11. Participants are very optimistic about the likelihood of winning irrespective of the arguments of the counterpart. (Overconfidence)	[14, 147, 168]
12. Participants totally believe that the outcome of the resolution will be good for their party. (Overconfidence)	[14, 147]
13. Participants are very confident that their ambitious requests will succeed. (Overconfidence)	[14, 113, 186]
14. Participants believe that their party is able to avoid bias. (Overconfidence & Self-serving)	[136, 162]
15. At the conclusion of the dispute, participants feel "I know the outcome all along". (Overconfidence & Hindsight)	[94, 165, 196]
16. Participants think that the counterpart is having bias. (Self-serving)	[27, 162]
17. Participants think the counterpart should take greater responsibility to the negative outcomes of the resolution. (Self-serving)	[65, 82, 171]
18. Participants stick to the arguments that are beneficial to their party. (Self-serving)	[8, 65, 113, 186]
19. After knowing the negative outcome of the resolution, participants consider the demands of the counterpart during the dispute as unreasonable. (Self-serving & Hindsight)	[176, 179]
20. At the conclusion of the dispute, participants consider the failure to settle as inevitable because of the negative attitude of counterpart. (Self-serving & Hindsight)	[70, 87, 155]

client and consultant. Both on-line and paper-based questionnaires were used. The contacts of respondents were mainly collected from: research networks; websites of government departments including Hong Kong Housing Authority, Buildings Department, Civil Engineering and Development Department and Department of Justice; websites of professional institutes including The Hong Kong Institute of Engineers, The Hong Kong Institute of Architects, The Hong Kong Institute of Surveyors, Institution of Civil Engineers and Hong Kong Institute of Construction Managers. Hard copy of the questionnaire was also distributed at learned societies' seminars and workshops. 347 questionnaires were distributed, and 134 valid responses were obtained, representing a satisfactory response rate of 38.6% [2, 9]. The organization, professional background, years of experience of the respondents as well as the dispute types they were involved are presented in Table 3.

Table 3 Profile of respondents

Profession	Percentage (%)	Organization	Percentage (%)
Architect	3.0	Contractor	29.9
Builder	9.7	Client	24.6
Engineer	48.5	Consultant	45.5
Building surveyor	3.7	Total	100.0
Project manager	12.7		
Quantity surveyor	17.9		
Others	4.5		
Total	100.0		
Years of experience cons	Percentage (%)	Dispute types	Percentage (%)
Below 5 years	28.4%	Building services installations	16.4
5–10 years	27.6%	Building work	37.3
10–15 years	11.2%	Civil engineering work	36.6
15–20 years	7.4%	Maintenance work	6.0
Above 20 years	25.4%	Others	3.7
Total	100.0	Total	100.0

Data Analysis

Bias Framework Development

The respondents were grouped according to different professional background: Contractor group (N = 40), Client group (N = 33) and Consultant group (N = 61). The results are shown in Table 4. Item 1 to Item 20 are the twenty manifestations listed in Table 2. For each professional group, the mean value of the responses of each manifestation was calculated. Standard deviation (S.D.) was also calculated to indicate the dispersion of the responses. The manifestations with higher occurrence evaluations are considered as having higher propensity. Accordingly, relative rankings were calculated in the descending sequence of mean scores of the twenty measurement statements. Item 8 "I search for information that confirms their assessments" and item 10 "I endorse information that supports their assessments" were ranked within top 3 in all the professional groups. To further explore the underlying construct of the measurement statements, principal component factor analysis (PCFA) was conducted using IBM SPSS version 23.0.

Varimax rotation was conducted to achieve a simpler factor structure [103]. Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity were performed to test the sampling adequacy and suitability of the data [31]. The results are satisfactory and summarized in Table 5 [104]. Hair et al. [83] recommended that only factors with eigenvalue greater than one are to be kept. Factor loadings stand for the correlation between the items and the factors, the larger the factor loading, the more representative the item is representing the factor [83]. According to Hair et al. [83], a factor loading of 0.5 is the baseline of significance both statistically (alpha = 0.05) and practically for a sample of 134 and this was applied accordingly. As a result, a four-factor structure without cross loading was extracted and presented in Table 6.

Upon examining the measurement statements under each factor, it was found that manifestations under the same factor sharing a common enabler. In this regard, four factors were extracted as four constructs of biased behaviors in CDN. With reference to the meaning, nature and underpinning theories of manifestations under each construct, four constructs represent four types of biased behaviour in CDN. The four types of bias were identified as: preconception, self-affirmation, optimism and interest-oriented respectively.

The reliability of measurement statements and correlation coefficients of the four types of bias are shown in Table 7. From Table 7, measurement statements under each factor have satisfactory internal consistency, with Cronbach's alpha values larger than baseline of 0.70 as suggested by Nunnally and Bernstein [151]. Besides, the significant correlation in Table 7 indicates interrelatedness of the four biases. The bias framework in CDN is shown in Fig. 2.

Factor score of each type of bias was then calculated by the average of respective item scores. For example, the factor score of preconception bias is the average of the respective score of item1, item2, item3, item4 and item5. Analysis of variance (ANOVA) multiple comparison was conducted for different background groups to

Table 4 Relative importance ranking of the items

Item	Client (N = 33)			Consultant (N = 61)			Contractor (N = 40)		
	Mean score	S. D	Ranking	Mean score	S.D	Ranking	Mean score	S. D	Ranking
Item 1	3.30	0.728	18	3.10	0.768	16	3.28	0.816	17
Item 2	3.30	0.728	17	2.64	0.895	18	3.20	0.758	19
Item 3	3.94	0.496	6	2.64	0.984	19	3.15	0.622	20
Item 4	3.30	0.684	16	3.08	0.802	17	3.25	0.707	18
Item 5	3.18	0.983	20	2.64	0.753	20	3.38	0.868	14
Item 6	3.94	0.966	5	3.90	1.012	3	4.08	0.997	2
Item 7	4.03	1.185	3	3.56	1.009	5	3.65	0.893	7
Item 8	4.42	1.032	1	4.02	1.057	2	4.30	1.091	1
Item 9	3.70	1.015	10	3.36	0.913	9	3.70	0.823	4
Item 10	4.30	1.045	2	4.03	0.983	1	3.98	1.025	3
Item 11	3.48	0.755	15	3.21	0.839	13	3.40	0.900	12
Item 12	3.97	0.810	4	3.49	0.977	7	3.53	1.062	9
Item 13	3.70	0.984	9	3.18	0.847	15	3.40	0.928	13
Item 14	3.76	1.119	7	3.52	1.010	6	3.65	0.975	6
Item 15	3.55	0.833	13	3.26	0.854	10	3.48	0.847	10
Item 16	3.55	1.252	14	3.25	0.767	11	3.58	0.844	8
Item 17	3.73	1.039	8	3.23	0.783	12	3.38	0.838	16
Item 18	3.64	1.025	12	3.75	1.059	4	3.68	1.023	5
Item 19	3.24	0.936	19	3.18	0.847	14	3.38	0.952	15
Item 20	3.64	0.859	11	3.41	0.990	8	3.40	0.928	11

Table 5 Measures of sampling adequacy and suitability

KMO	Bartlett's test of sphericity				Factor			
	Chi-square	DF	Sig		1	2	3	4
0.842	852.973	190	0.000	Eigenvalue	5.922	1.720	1.675	1.456
				% of Variance	29.609	8.602	8.376	7.280

Note KMO = Kaiser–Meyer–Olkin measure of sampling adequacy; DF = degree of freedom; Sig. = significance

Table 6 Factor matrix of bias in CDN

Manifestations in CDN		Factor			
		1	2	3	4
Preconception bias	1. My final assessment has been influenced by the first offer of the counterpart				0.607
	2. My assessments have been influenced by unsubstantiated figures raised by the counterpart during the resolution process				0.626
	3. My decisions have been adjusted because of the ambitious arguments of the counterpart				0.685
	4. I cannot get away with the assessments made at prior round of resolution of the dispute				0.578
	5. I become immune to alternative reasonable assessments after forming my first assessment about the dispute				0.646
Self-affirmation bias	6. I have paid more attention to the information which is consistent with my prior knowledge of the dispute		0.674		
	7. I incline to interpret further information as evidence to justify my assessments		0.567		
	8. I search for information that confirms my assessments		0.743		

(continued)

Table 6 (continued)

Manifestations in CDN		Factor			
		1	2	3	4
	9. I consider that my party has contributed more to the positive outcomes of the resolution		0.520		
	10. I endorse information that supports my assessments		0.793		
Optimism bias	11. I am very optimistic about the likelihood of winning irrespective of the arguments of the counterpart	0.570			
	12. I totally believe that the outcome of the resolution will be good for my party	0.687			
	13. I am very confident that my ambitious requests will succeed	0.775			
	14. I believe that my party is able to avoid bias	0.779			
	15. At the conclusion of the dispute, I feel "I know the outcome all along"	0.540			
Interest-oriented bias	16. I think that the counterpart is having bias			0.609	
	17. I think the counterpart should take greater responsibility to the negative outcomes of the resolution			0.717	
	18. I stick to the arguments that are beneficial to my party			0.607	
	19. After knowing the negative outcome of the resolution, I consider the demands of the counterpart during the dispute as unreasonable			0.672	
	20. At the conclusion of the dispute, I consider the failure to settle as inevitable because of the negative attitude of counterpart			0.721	

test whether there was significant difference among factor scores of different types of bias. The results of ANOVA multiple comparisons in Table 8 show that in all the professional groups, the mean factor score of self-affirmation bias is the highest among the four types of bias. That suggests that professionals from all background groups had higher frequency of practicing self-affirmation bias in their construction

Table 7 Reliabilities and correlation coefficients of the four types of bias

Factor	Cronbach's alpha	Correlation coefficient			
		Preconception bias	Self-affirmation bias	Optimism bias	Interest-oriented bias
Preconception bias	0.718	1.000	0.484*	0.419*	0.382*
Self-affirmation bias	0.789	0.484*	1.000	0.445*	0.445*
Optimism bias	0.770	0.419*	0.445*	1.000	0.389*
Interest-oriented bias	0.750	0.382*	0.445*	0.389*	1.000

Note *Correlation is significant at the 0.01 level (2-tailed)

dispute negotiation process. Specifically, for the consultant group, the mean factor score of preconception bias is significantly lower than other types of bias, suggesting that consultants are relatively less prone to have preconception bias among the four types of biases.

Validation

To validate the proposed CDN bias framework, the PCFA factor structure was tested by the confirmatory factor analysis (CFA) (Fig. 3). Error terms were included in the CFA model to represent the proportion of the variance in the variable that is not explained by the factors [74]. These include measurement errors in observed variables and residuals in latent variables [169]. The statistical significance of the CFA model was assessed by goodness-of-fit (GOF) measures, including comparative Chi-square/df (χ^2/df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), root mean square error of approximation (RMSEA). comparative fit index (CFI), Tucker–Lewis Index (TLI), parsimony normed-fit index (PNFI) and parsimony comparative fit index (PCFI). The results of the GOF indices are shown in Table 9.

Bootstrapping was conducted to augment the reliability of CFA results in this study [110, 153, 154, 167]. Bootstrapping allows the testing of the significance of parameter estimates by comparing the results from original data set with the bootstrapped estimates [45, 98]. It can be seen from Table 10 that the regression weights generated from the original data set were within the upper and lower bounds generated from bootstrapped data set at 95% confidence level. Besides, all estimates have critical ratio values >1.96, indicating their statistical significance at 95% confidence level [93]. These results collectively indicate that the parameter estimates obtained from the CFA analysis are statistically significant. Confirmatory factor analysis (CFA) was conducted using IBM SPSS Amos version 23.0.

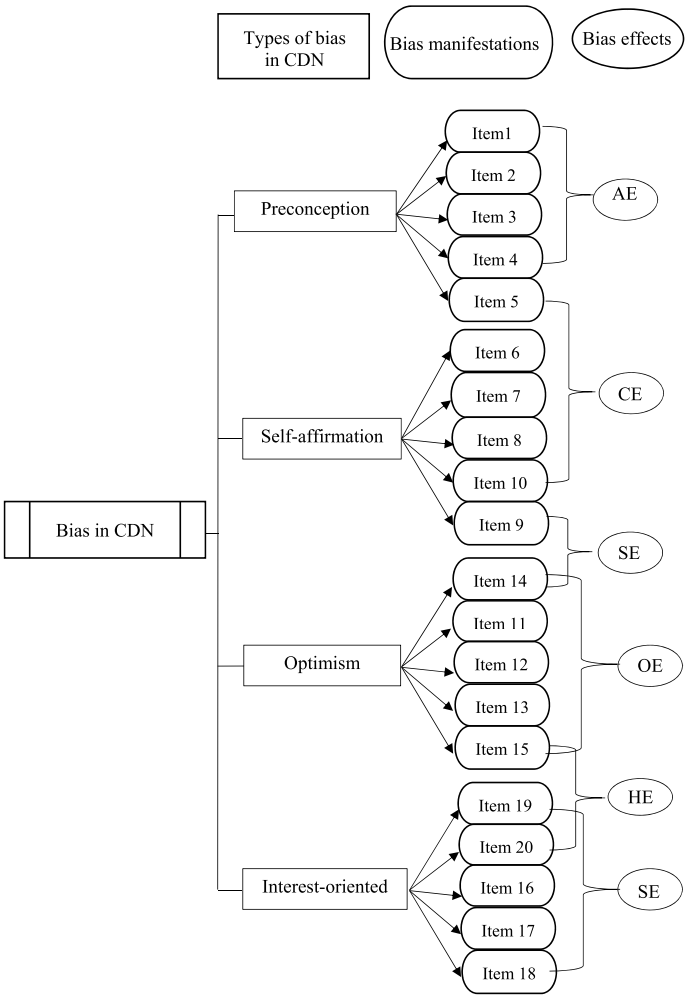

Fig. 2 A framework of bias in CDN

Findings

A CDN bias framework is developed with four types of bias: preconception, self-affirmation, optimism and interest-oriented. The bias framework has also been validated by a statistical-significant CFA.

Under preconception bias, item 3 (0.685), item 5 (0.646), item 2 (0.626), item 1 (0.607), item 4 (0.578) are included and presented in descending order of factor loadings. In CDN, aggressive arguments of a counterpart precipitate as anchors from where a disputing party may develop preconception of the dispute. The preconception renders the disputing party to make compromise to the first offer received.

Table 8 ANOVA multiple comparisons

Client (N = 33)

Factor (I)	Factor (J)	Mean difference (I-J)	Standard error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Preconception	Self-affirmation	−0.67273*	0.17048	0.000	−1.0101	−0.3354
	Optimism	−0.28485	0.17048	0.097	−0.6222	0.0525
	Interest-oriented	−0.15152	0.17048	0.376	−0.4888	0.1858
Self-affirmation	Preconception	0.67273*	0.17048	0.000	0.3354	1.0101
	Optimism	0.38788*	0.17048	0.025	0.0506	0.7252
	Interest-oriented	0.52121*	0.17048	0.003	0.1839	0.8585
Optimism	Preconception	0.28485	0.17048	0.097	−0.0525	0.6222
	Self-affirmation	−0.38788*	0.17048	0.025	−0.7252	−0.0506
	Interest-oriented	0.13333	0.17048	0.436	−0.2040	0.4707
Interest-oriented	Preconception	0.15152	0.17048	0.376	−0.1858	0.4888
	Self-affirmation	−0.52121*	0.17048	0.003	−0.8585	−0.1839
	Optimism	−0.13333	0.17048	0.436	−0.4707	0.2040

Contractor (N = 40)

Factor (I)	Factor (J)	Mean difference (I-J)	Standard Error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Preconception	Self-affirmation	−0.69000*	0.13939	0.000	−0.9653	−0.4147
	Optimism	−0.24000	0.13939	0.087	−0.5153	0.0353
	Interest-oriented	−0.23000	0.13939	0.101	−0.5053	0.0453
Self-affirmation	Preconception	0.69000*	0.13939	0.000	0.4147	0.9653
	Optimism	0.45000*	0.13939	0.002	0.1747	0.7253
	Interest-oriented	0.46000*	0.13939	0.001	0.1847	0.7353
Optimism	Preconception	0.24000	0.13939	0.087	−0.0353	0.5153
	Self-affirmation	−0.45000*	0.13939	0.002	−0.7253	−0.1747
	Interest-oriented	0.01000	0.13939	0.943	−0.2653	0.2853
Interest-oriented	Preconception	0.23000	0.13939	0.101	−0.0453	0.5053
	Self-affirmation	−0.46000*	0.13939	0.001	−0.7353	−0.1847
	Optimism	−0.01000	0.13939	0.943	−0.2853	0.2653

Consultant (N = 61)

Factor (I)	Factor (J)	Mean difference (I-J)	Standard error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Preconception	Self-affirmation	−0.95410*	0.11681	0.000	−1.1842	−0.7240
	Optimism	−0.51475*	0.11681	0.000	−0.7449	−0.2847

(continued)

Table 8 (continued)

	Interest-oriented	−0.54426*	0.11681	0.000	−0.7744	−0.3142
Self-affirmation	Preconception	0.95410*	0.11681	0.000	0.7240	1.1842
	Optimism	0.43934*	0.11681	0.000	0.2092	0.6694
	Interest-oriented	0.40984*	0.11681	0.001	0.1797	0.6399
Optimism	Preconception	0.51475*	0.11681	0.000	0.2847	0.7449
	Self-affirmation	−0.43934*	0.11681	0.000	−0.6694	−0.2092
	Interest-oriented	−0.02951	0.11681	0.801	−0.2596	0.2006
Interest-oriented	Preconception	0.54426*	0.11681	0.000	0.3142	0.7744
	Self-affirmation	−0.40984*	0.11681	0.001	−0.6399	−0.1797
	Optimism	0.02951	0.11681	0.801	−0.2006	0.2596

Note *The mean difference is significant at the 0.05 level

This preconception can thus bring strategic advantage should this perception works favourably to one disputing party and intimidates the counterpart. Thus, offering a high demanding first offer serves as an anchor that may give preconception on the counterpart that there are good reasons to support the offer. The preconception would steer subsequent resolution process as well. In the experiment of Galinsky and Mussweiler [78], it was found that first offer had strong correlation with the final agreed price. Thus, the party making the first offer in general derives more benefits. In CDN, the amount the contractor claims due to culpable acts of the client may influence the final quantum they get in the end. However, the situation may reverse if the client chooses to make a settlement offer first. Very often, disputants choose to ignore rational analysis of evidence and legal opinions in making a first offer with the aim of building room for negotiation. Chapman and Bornstein [32] described this phenomenon as first offer advantage: the more you ask for, the more you get. Besides, early decisions made at prior stage could also give dispute negotiators a stable preconception about the situation, therefore they have the tendency to retain and defend the early assessment.

Self-affirmation bias is represented by item 10 (0.793), item 8 (0.743), item 6 (0.674), item 7 (0.567) and item 9 (0.520) in descending order of factor loadings. Dispute negotiators like to affirm themselves through seeking a positive self-image. Thus, it is quite natural for them to endorse information that supports their assessments. In fact, strong self-affirming disputants would even search for and interpret information that reinforce prior assessments. As a result, greater attention has been paid to information that is consistent with prior knowledge or assessment. In addition, they would amplify their contribution to the successful outcomes of the settlement to affirm self-worth.

Item 14 (0.779), item 13 (0.775), item 12 (0.687), item 11 (0.570) and item 15 (0.540) represent the optimism bias factor. Construction dispute negotiators who are having optimism bias have the following behaviour patterns: they overestimate their ability in assessing the dispute; they raise ambitious requests and are unwarrantedly confident that the same would be met by the counterparts. During dispute negotiation,

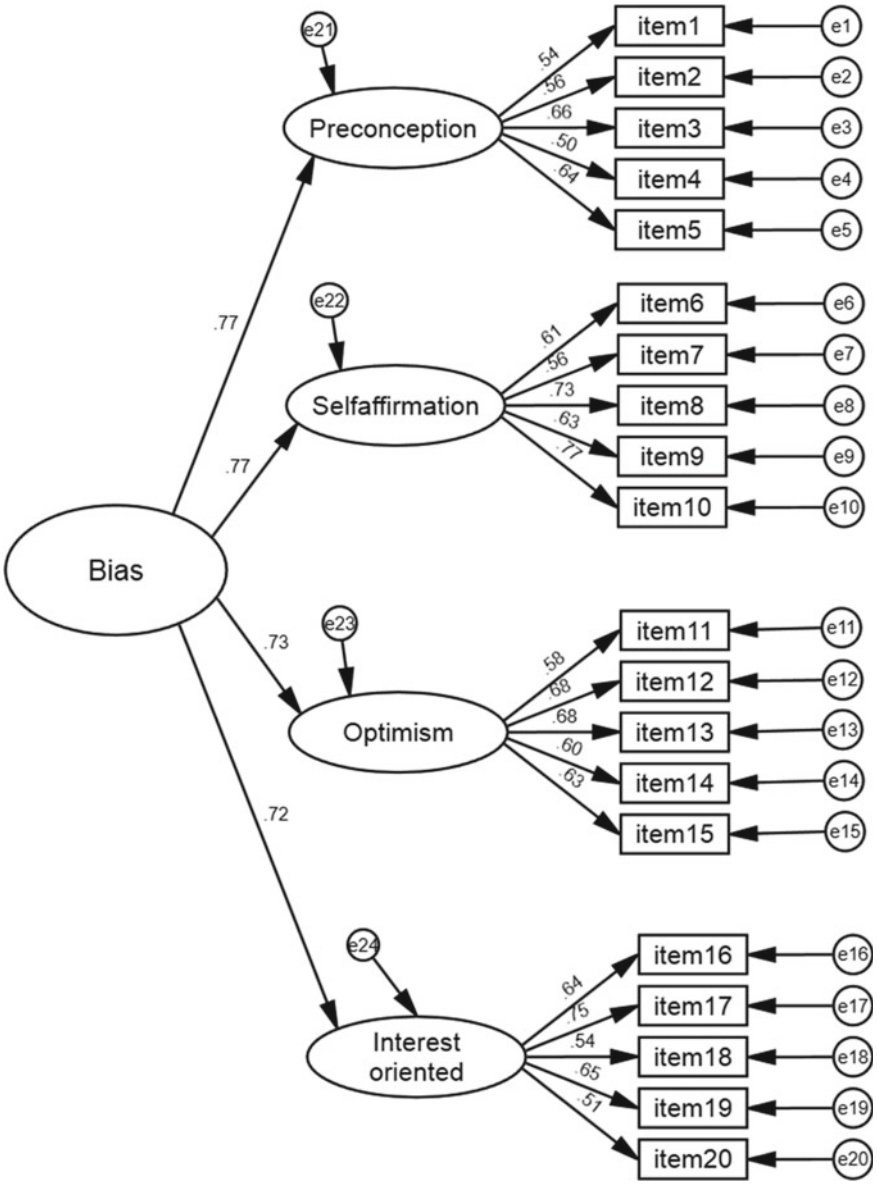

Fig. 3 CFA of bias in CPDR

Table 9 GOF indices results

Fit index	Desired levels	Model results
Absolute fit indices		
χ^2/df	2 or below[a]	1.314 (sufficiently good fit)[b]
GFI	0.8 or above[c]	0.867 (good fit)[d]
AGFI	0.8 or above[e]	0.831 (recommended fit)[e]
RMSEA	0.06 or below[f]	0.049 (excellent fit)[g]
Incremental fit indices		
CFI	0.8 or above[c]	0.927 (good fit)[c]
TLI	0.8 or above[c]	0.917 (good fit)[a]
Parsimonious fit		
PNFI	0.5 or above[h]	0.663 (good fit)[h]
PCFI	0.5 or above[h]	0.810 (good fit)[h]

Note: GOF = goodness-of-fit indexes; χ^2/df = chi square/degree of freedom; GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; PNFI = parsimony normed-fit index; PCFI = parsimony comparative fit index

[a]Hair et al. [83, 84], [b]Xiong et al. [199], [c]Maskarinec et al. [131], [d]Wong et al. [195], [e]Gefen [79], [f]Hu and Bentler [96], [g]Marsh and Hau [129], [h]Chen and Fong [39]

no matter how the counterparts defend, it cannot alleviate the disputing parties' optimistic attitudes about winning and the overconfidence about their requests. Upon completion of the dispute negotiation, under the influence of hindsight effect, they feel they know the outcome all along, which further reinforces their optimism.

Item 20 (0.721), item 17 (0.717), item 19 (0.672), item 16 (0.609) and item 18 (0.607) represent interest-oriented bias. In CDN, when disputants are under the influence of interest-oriented bias, maximizing self-interest characterizes their actions and behaviors. When the negotiation failed to reach an amicable settlement, interest-oriented biased disputants would claim that this outcome is inevitable. With no rethink of their insistence in pursuing their interests that had led to the impasse, they would attribute the failure to settle as the responsibility of the counterparts. They believe the counterpart is having bias and their demands during negotiation are unreasonable. They would flee away from their responsibility of settlement failure by attributing all negative outcomes to the counterpart. In addition, during the negotiation, they would only take note of the arguments that favour them.

The propensity of the biases can also be assessed by the path coefficients of CFA model. The path coefficients represent the relative strength of the four biases. The path coefficients of preconception bias, self-affirmation bias, optimism bias and

Table 10 Standardized regression weights and 1000 sample bootstrapped estimates

Parameter	Estimate*	Mean (bootstrapped)	S.E. (bootstrapped)	Lower	Upper	P
Preconception ← F1	0.771**	0.763	0.091	0.576	0.946	0.001
Self-affirmation ← F1	0.772 (3.891)	0.783	0.085	0.575	0.923	0.005
Optimism ← F1	0.725 (3.673)	0.71	0.111	0.498	0.928	0.001
Interest-oriented ← F1	0.717 (3.805)	0.713	0.103	0.483	0.894	0.002
Item 1 ← Preconception	0.541**	0.543	0.081	0.354	0.692	0.003
Item 2 ← Preconception	0.56 (4.562)	0.549	0.089	0.364	0.719	0.001
Item 3 ← Preconception	0.664 (4.948)	0.663	0.063	0.542	0.783	0.002
Item 4 ← Preconception	0.502 (4.176)	0.503	0.09	0.307	0.655	0.003
Item 5 ← Preconception	0.639 (4.945)	0.635	0.069	0.48	0.753	0.002
Item 6 ← Self-affirmation	0.609**	0.606	0.075	0.451	0.733	0.002
Item 7 ← Self-affirmation	0.555 (5.191)	0.55	0.077	0.39	0.692	0.002
Item 8 ← Self-affirmation	0.726 (6.321)	0.723	0.061	0.578	0.824	0.003
Item 9 ← Self-affirmation	0.63 (5.609)	0.631	0.07	0.474	0.749	0.003
Item 10 ← Self-affirmation	0.768 (6.443)	0.77	0.06	0.618	0.864	0.004
Item 11 ← Optimism	0.583**	0.588	0.076	0.409	0.706	0.004
Item 12 ← Optimism	0.683 (5.616)	0.678	0.065	0.548	0.806	0.001
Item 13 ← Optimism	0.681 (5.558)	0.675	0.072	0.514	0.802	0.002
Item 14 ← Optimism	0.601 (5.168)	0.603	0.094	0.378	0.754	0.004
Item 15 ← Optimism	0.626 (5.204)	0.624	0.073	0.447	0.739	0.003
Item 16 ← Interest-oriented	0.637**	0.639	0.069	0.487	0.766	0.003
Item 17 ← Interest-oriented	0.751 (6.583)	0.741	0.076	0.579	0.873	0.002
Item 18 ← Interest-oriented	0.541 (4.857)	0.547	0.086	0.349	0.698	0.004

(continued)

Table 10 (continued)

Parameter	Estimate*	Mean (bootstrapped)	S.E. (bootstrapped)	Lower	Upper	P
Item 19 ← Interest-oriented	0.649 (5.643)	0.65	0.069	0.492	0.769	0.003
Item 20 ← Interest-oriented	0.507 (4.697)	0.498	0.086	0.316	0.657	0.002

Note S.E.: standard error
*Figures in parentheses are critical ratios from the unstandardized solutions
**The critical ratio is not available, because the regression weight is fixed at 1

interest-oriented bias are 0.77, 0.77, 0.73 and 0.72 respectively (Fig. 3 refers). Self-affirmation bias has the highest path coefficients. In this regard, self-affirmation bias has greater propensity to creep in construction dispute negotiation. It echoes the results of ANOVA multiple comparisons in Table 8. Self-affirmation bias has the highest mean factor score for all the professional groups and thus suggesting higher propensity. Preconception bias has the same path coefficient as self-affirmation bias in the CFA model. The early assessments made by the participants may serve as the preconception influencing their subsequent decisions. The small differences of four biases' path coefficients in CFA together with significant correlation coefficients (see in Table 7) suggest the interrelatedness of these four biases.

Implications on Construction Project Dispute Management

With extensive urbanization and infrastructural developments, globalization and international collaboration become the commonly accepted norm to deliver mega projects. It can be very challenging to work with project participants from different disciplines and cultural background [133, 180]. The existence of bias stifles rational analyses resulting in suboptimal decisions. If biased decisions are minimized, negotiation efficiency would be greatly improved thus saving vast resources.

Furthermore, use of multi-tiered dispute resolution process (MTDR) incorporating alternative dispute resolution (ADR) before arbitration has been the predominant dispute resolution approach [40, 44, 119]. The characterizing feature of MTDR approach is that a dispute will be evaluated repeatedly from negotiation, mediation to adjudication and arbitration [121]. Repeated dispute evaluations might allow the creeping in of all four types of bias. This study posits to raise the awareness of bias and further suggests practical measures to address these biases.

Minimizing Bias in CDN: The Important Role of Project Manager

Project manager (PM) plays a vital role in ensuring that dispute negotiators think and behave in a rational manner [146, 178, 198]. PM should be mindful of the existence of biases when settling construction disputes. In this regard, this bias framework can be used as a checklist of biased behaviors. Self-affirmation bias has been identified with the highest chance to creep in construction dispute negotiation irrespective of the professional background of the negotiators. Therefore, PM should note whether the project team members are keen to confirm themselves and seek positive self-images during construction dispute negotiation, which are the potential traps of self-affirmation bias. In this regard, PM should guide the team members to (i) search complete information about the dispute, not only the supporting evidence to their own arguments, (ii) be open to alternatives irrespective of the assessment already made; (iii) carefully consider the rationality of counterpart's arguments and evidences.

In order to minimize preconception bias, before commencing construction dispute negotiation, PM should remind the team members to forget about their previous preconception about the counterpart and review their assessment about the dispute. When aggressive offers are received from the counterpart, PM should lead the team to carefully consider the counterpart's reservation price based on the conditions of the project. In response to the ambitious arguments and unsubstantiated figures presented by the counterpart, PM should encourage the team to carefully re-estimate the project matter and check the objectivity of the arguments from counterpart. PM should always keep the team alert and re-assess the dispute matter when more and more information is collected and analysed.

To alleviate optimism bias, construction professionals should be reminded of settlement failure. There is no substitute of prudent action in carefully analysing the evidence raised by the counterparts. It is also quite normal for the disputants to focus on their self-interest during dispute negotiations when huge money is at stake. Hence, it is suggested that possibility of future collaboration and a long-term relationship between the project parties should be taken into consideration. Disputants should aim at achieving win–win result through seamless communication. PM should also remind the negotiation team to respectfully listen to both side's grievances, control their emotions and express their opinions in a decent manner. When settlement is not achieved, the team should review what had gone wrong. Besides, in the consultant group it has been found that preconception bias has the lowest mean factor score than other biases (see in Table 8), suggesting that consultants are less prone to or more prepared to deal with preconception bias. It may be the result of the professional training that consultants have received. Professionally, as the neutral 3rd parties between client and contractor, consultants should not have pre-disposition to their own impression or preconception of the situation. Therefore, receiving de-biasing training before commencing dispute resolution process would be helpful to minimize preconception bias.

Optimizing the CDN Mechanism

The study also contributes to the design of construction dispute negotiation procedure. Major industry reviews have called for innovative dispute resolution (CIRC 2001). Use of multi-tiered dispute resolution process (MTDR) incorporating alternative dispute resolution (ADR) is now the mainstream approach [40, 44, 119]. The characterizing feature of MTDR is that disputes will be evaluated repeatedly at each of the tiers [121]. Would this arrangement improve the chance of settlement? This is perhaps the good wish of a MTDR design. However, the issue of bias would aggregate if the same individual or group is doing the repeated evaluations. Under the influence of preconception bias, information collected, or decisions made in the prior tier may become preconception that impedes further rational analysis of the dispute. The way the disputants collect and interpret information could also be biased towards justifying themselves—a form of self-affirmation bias. In entering a new tier of resolution, disputants could be optimistic about the chance of winning thereby refuse to compromise under the influence of optimism bias. Under the influence of interest-oriented bias, should settlement be not achieved, disputants could attribute the undesirable resolution outcome and expensive cost to the counterparts' unwillingness to settle in prior tiers. The study contributes to CDN study by challenging the use of MTDR design because of the happening of biases. Dispute resolution procedure with extended tiers may not materialize the intended outcome due to the creeping in of bias. Thus, this study suggests directing more resources, energy and inputs to resolve disputes in the negotiation stage.

Moreover, it is prudent to be aware of the limitations of this study. The most notable is the social desirability bias, which means respondents tend to reply survey questions in a way to make them look more favourable [75, 148]. People may be loath to admit their practice of bias. Therefore, they may lower their ratings on the frequency of biased behaviours in the questionnaire. Measures to alleviate social desirability bias have been employed in this study.

Summary

Negotiation studies have largely been developed based on the assumption of rational analyses and free-will bargain. However, negotiators are human, and bias appears inevitable [4, 51]. This study conceptualizes bias in CDN by proposing a bias framework. Manifestations of bias in CDN were operationalized after summarising effects of bias from literature. Construction professionals were invited to provide data on their negotiation behaviours. A PCFA further suggested a four-factor bias framework. The four types of bias are preconception, self-affirmation, optimism and interest-oriented. The framework was validated by a CFA. The findings inform construction professionals that the practice of biased behaviours in CDN is real. The irrationality of human decisions as a result of bias is thus highlighted in this study. Practical

measures to minimize biases in CDN are proposed. In terms of construction dispute resolution process design, this study timely reminds the caveats in employing MTDR. Repeated dispute evaluations allow biases to creep in. More resources and energy should therefore be deployed to enhance the settlement of dispute through negotiation before embarking on convoluted multi-tiered procedures. Repeated evaluations of a dispute may bring unintended outcomes of hardening of positions and uncompromising attitude.

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