

Biases in construction project dispute resolution

Biases
in CPDR

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Abstract

Purpose – This study aims to propose a framework of bias in construction project dispute resolution (CPDR hereafter).

Design/methodology/approach – With reference to the literatures on effects of bias, manifestations of bias in CPDR were developed. Based on data obtained from construction professionals about their frequency of having these bias manifestations, the underlying constructs of biased behaviors were explored by a principal component factor analysis. A confirmatory factor analysis was further conducted to validate the framework of bias in CPDR.

Findings – Four types of bias were identified as the constructs that underlie biased behaviors in CPDR. These four biases were included in the bias framework proposed: preconception, self-affirmation, optimism and interest-oriented. The potency of these types of bias was also evaluated.

Practical implications – First, the findings inform that the existence of bias in CPDR is real. Early detection allows management to intervene and steer CPDR team back to rational courses. Second, this study suggests optimizing CPDR procedures to diminish the chance of bias occurring.

Originality/value – Bias is almost an uncharted area in CPDR. The study fills this research gap by conceptualizing the underlying constructs of biased behaviors. The findings inform construction professionals of the likelihood of practicing biased behaviors in CPDR. Repeated dispute decisions in the commonly used multi-tiered dispute resolution process would enable the creeping in of biases.

Keywords Bias, Construction project dispute resolution, Multi-tiered dispute resolution, Rational decisions

Paper type Research paper

Received 12 March 2018

Revised 17 May 2018

3 July 2018

Accepted 30 July 2018

1. Introduction

The growth of world population has led to extensive urbanization and infrastructural developments. The complexity nature of construction project requires the collaboration of project participants from different construction sectors, professional background or even cultural background. Diversities in construction project bring management with technical and contractual challenges. Unfortunately, many projects ended with substantial disputes that took years to get settled (Kumaraswamy, 1997; Flyvbjerg, 2017; Lu *et al.*, 2017). Davis and Pharro (2003) and Meng and Boyd (2017) highlighted that people and working relationships were the foci of construction project management. It has also been well documented that conflicts among project participants underpin disputes (Cheung and Yiu, 2006). In terms of dispute resolution, it is not uncommon to find disputants missing the chance of capturing win-win options even when these are notable (Lobel, 1994). Human factor, therefore is one of the deciding factors in construction dispute resolution (Chinyio and Taiwo, 2016; Eriksson and Kadefors, 2017).

It is generally believed that rational evaluation underpins quality decisions. Most negotiation studies assume that decision makers are rational and able to make sense of the available information and select the most appropriate options (Conlisk, 1996; Bromiley and Papenhausen, 2003; Binmore, 2009; Bendle and Cotte, 2016). However, humans are not always rational (Ariely, 2008; Cusick, 2009). Simon (1955) proposed the concept of bounded rationality in describing cognitive limitations in human judgments. Bromiley and Papenhausen (2003) commented that assuming absolute rationality in human decisions



Engineering, Construction and
Architectural Management
Vol. 26 No. 2, 2019
pp. 321-348

© Emerald Publishing Limited
0969-9988

DOI 10.1108/ECAM-03-2018-0109

The work reported in this paper was fully supported by CityU SRG projects (number 7004624, 7004870) and HKSAR GRF (11209118).

is unrealistic. Instead, heuristics are commonly applied by decision makers to simplify problems so that quick decisions can be made (Simon, 1979; Kahneman, 2003). Tversky and Kahneman (1974) further claimed that systematic and predictable errors arose from over-reliance on heuristics. In fact, it has been reported that application of unconscious heuristics could lead to bias (Barnes, 1984; Keren and Teigen, 2004; Eriksson and Kadefors, 2017). In this regard, Stingl and Gerdali (2017) found that biased decisions threatened construction project success and triggered escalation of commitment (Alvarez *et al.*, 2011; Wang *et al.*, 2017), ineffective risk management system (Kutsch and Hall, 2005, 2010), suboptimal project plan (Flyvbjerg, 2006; Pinto, 2013) and failure to respond to early warnings in projects (Haji-Kazemi *et al.*, 2015). Though in construction projects bias was found not uncommon, study of bias in CPDR is an almost uncharted area. Notably, identifying bias in CPDR is considered the first step to alleviate biased behaviors and thereby enhance the possibility of achieving successful dispute settlement. Efficiency will be improved when valuable resources are not wasted in protracted dispute resolution processes.

This study posits to address the following questions. Are construction disputing parties rational as assumed in most negotiation studies? Do biases affect their decisions? If biases do exist, what are the underlying constructs of biased behaviors that would hinder amicable dispute resolution? These questions are to be discussed in this study. This study aims to fulfill the research gap by conceptualizing bias in CPDR. A bias framework is proposed.

Admission of bias is not likely for disputants, however, their dispute resolution behaviors might suggest otherwise. Drawing from literatures on bias effects in decision making, a list of possible manifestations of bias in CPDR context was assembled. This study aims to conceptualize bias in CPDR by examining the underlying constructs of biased behaviors. In these regards, an empirical survey was conducted in Hong Kong to track the tendency of construction project disputants having the above manifestations. A conceptual framework of bias in CPDR was developed and further validated with data collected from practicing construction professionals. The study is reported in seven parts: first, manifestations of bias in CPDR; second, data collection; third, data analysis; fourth, findings; fifth, implications on construction project dispute management; sixth limitations and future direction; and seventh concluding remarks. Figure 1 shows the research plan of the study.

2. Manifestations of bias in CPDR

This study draws from literatures on bias effect to develop artifacts of bias. As indicated in Table I, anchoring effect (AE), overconfidence effect (OE), self-serving effect (SE), hindsight effect (HE) and confirmation effect (CE) are found to be five most ubiquitous and frequently cited bias effects that have been used to demonstrate irrational human decisions (Li and Cheung, 2016). Therefore, further deliberation of these five types of bias effect are provided seriatim.

2.1 Anchoring

As the name aptly describes, AE on decision making refers to the impression derived from the first set of information received (Sherif and Hovland, 1961; Mussweiler *et al.*, 2004; Mochon and Frederick, 2013; Meub and Proeger, 2015). Decision makers rely too much on these impressions (Tversky and Kahneman, 1974; Chapman and Johnson, 1999; Furnham and Boo, 2011). It is quite natural that people make decisions with due reference to previously available information. However, experiments conducted by Strack and Mussweiler (1997) and Mussweiler *et al.* (2004) found that anchors derived from previously received information could, however, be irrelevant, uninformative, implausibly extreme or even self-generated. In the study of Tversky and Kahneman (1974), the subjects' estimation about the percentage of African countries in the United Nations were under the

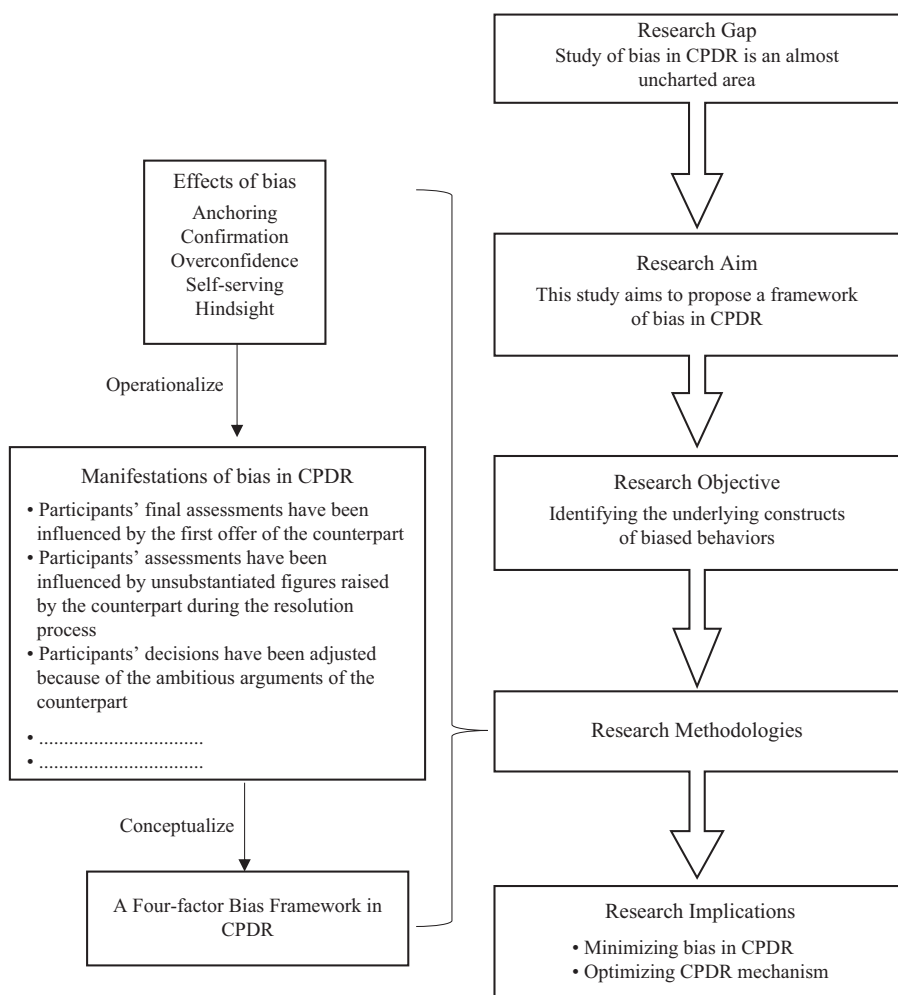


Figure 1.
Research plan
of the study

influence of the anchors which were selected randomly by spinning a wheel of fortune in the subjects' presence. In the experiment conducted by Russo and Shoemaker (1989), the subjects estimated the date that Attila the Hun was defeated in Europe under the influence of irrelevant telephone numbers as anchors. In Chapman and Johnson (1999), subjects decided their minimum selling price for a lottery and the winning probability of a republican candidate in the US presidential election under the influence of social security number as anchor. In these experiments, most of the subjects used the information provided as anchors for their own evaluations without challenging its accuracy and reliability.

Prior research studies offered the following explanations for AE. The first is insufficient adjustment. People make estimation starting from the first available set of information. Subsequent decisions are made through adjustments there-from (Tversky and Kahneman, 1974). These adjustments are typically not thorough and terminate prematurely and stop when reaching a region of acceptable answers where-from the first acceptable value is usually chosen (Chapman and Johnson, 2002; Mussweiler *et al.*, 2004; Epley and Gilovich, 2006).

Table I.
Key references of
the five types
of effect of bias

| Authors | AE | OE | SE | HE | CE | Authors | AE | OE | SE | HE | CE |
|---|----|----|----|----|----|--|----|----|----|----|----|
| Harvey (1997) | * | * | | | | Bjork <i>et al.</i> (2013) | | | | | * |
| Arkes (1991) | * | * | | * | * | Roese and Vohs (2012) | | * | * | * | * |
| Hawkins and Hastie (1990) | * | * | | * | | Hardt <i>et al.</i> (2010) | * | | | * | |
| Miller and Ross (1975) | | | * | | | Blank <i>et al.</i> (2008) | * | | | * | |
| Hilbert (2012) | * | * | | | | Pohl and Hell (1996) | * | | | * | |
| Morewedge and Kahneman (2010) | * | | * | * | * | McCray <i>et al.</i> (2002) | * | * | | * | |
| Epley and Gilovich (2006) | * | | * | | * | Koriat <i>et al.</i> (2000) | | | | | * |
| Galinsky and Mussweiler (2001) | * | | | * | * | Christensen-Szalanski and Willham (1991) | | * | | * | |
| Epley and Gilovich (2001) | * | | * | | | Pronin (2007) | * | | * | * | |
| Chapman and Johnson (1999) | * | * | | * | * | Bazerman <i>et al.</i> (2000) | * | * | * | * | |
| Kahneman (1992) | * | | * | | | Babcock and Loewenstein (1997) | | * | * | * | |
| Kassin <i>et al.</i> (2013) | | * | * | | * | Babcock <i>et al.</i> (1995) | | | * | | |
| Jonas <i>et al.</i> (2001) | | | | | * | Wang <i>et al.</i> (2017) | | * | | | |
| Wood (2000) | * | | | | * | Thompson and Loewenstein (1992) | | * | * | | |
| Nickerson (1998) | | * | * | | * | Gelfand and Christakopoulou (1999) | | | * | | |
| MacCoun (1998) | * | | * | * | * | Neale and Bazerman (1992) | * | * | | | |
| Klayman (1995) | | * | | * | * | Strack and Mussweiler (1997) | * | | | | * |
| Klayman and Ha (1987) | | | | | * | Kramer <i>et al.</i> (1993) | | * | * | | |
| Juslin <i>et al.</i> (2000) | * | * | * | | * | Chase <i>et al.</i> (1998) | | * | | | |
| Klayman <i>et al.</i> (1999) | | * | | * | * | Diener <i>et al.</i> (2003) | | | * | | |
| Gigerenzer <i>et al.</i> (1991) | | * | | * | * | Pronin <i>et al.</i> (2002) | | | * | | |
| Shore (2008) | | * | | | | Tversky and Kahneman (1974) | * | | | | |
| Breaugh (2013) | | | | | * | Arkes <i>et al.</i> (1988) | | | | | * |
| Haji-Kazemi <i>et al.</i> (2015) | | * | | | | Bukszar and Connolly (1988) | | | | * | |
| Libby and Rennekamp (2012) | | * | * | | | Stallard and Worthington (1998) | | | | * | |
| Notes: AE, anchoring effect; OE, overconfidence effect; SE, self-serving effect; HE, hindsight effect; CE, confirmation effect | | | | | | | | | | | |

Therefore, with insufficient adjustments, the final estimation would arrive at the vicinity of the anchors and likely to be suboptimal. Mussweiler (1997) explained AE as a selective accessibility process whereby decision makers estimate the target with the hypothesis that target is similar or close to the anchor (Strack and Mussweiler, 1997; Mussweiler and Strack, 1999; Mussweiler *et al.*, 2004; Chaxel, 2014; Strack *et al.*, 2016). Chapman and Johnson (1999) proposed that anchor-influenced judgment by changing the availability, construction or retrieval of the deciding factors. The features of the target that are common to the anchor are activated while those features that are different from the anchor are overlooked (Chapman and Johnson, 2002). Bergman *et al.* (2010) demonstrated that AE could be reduced with greater cognitive skills. Furnham and Boo (2011) and Furnham *et al.* (2012) further explained that human factors, such as mood, knowledge and personality would influence the strength of AE. Besides, computer-based training programs have been experimented to be effective in mitigating AE (Mullinix *et al.*, 2013; Dunbar *et al.*, 2014; Clegg *et al.*, 2015; Adame, 2016).

2.2 Overconfidence

Many studies have found that decision makers with high confidence are likely to overestimate the accuracy of their judgment – a phenomenon called overconfidence (Lichtenstein *et al.*, 1977; Doherty *et al.*, 1979; Harvey, 1997; Klayman *et al.*, 1999; Fellner and Krügel, 2012; Fellner-Röhling and Krügel, 2014; Thunström *et al.*, 2015; Merkle, 2017). Moore and Healy (2008) and Bazerman and Moore (2008) found three principal forms of overconfidence: over-estimation of one’s actual performance; over-placement of one’s performance compared to others’; and over-precision about the accuracy of one’s judgment. Klayman *et al.* (1999) and Tsai *et al.* (2008) added that level of confidence is also dependent

on the way a problem is put forward, the field to which the judgment problem belonged, and people making the estimation. Prior researchers also explored the relationship between confidence and difficulty (Lichtenstein *et al.*, 1977; Suantak *et al.*, 1996; Juslin *et al.*, 2000). The more difficult the problem is, the more confidence people have. With easier problems, less confidence is displayed (Pulford and Colman, 1997; Tsai *et al.*, 2008; Bordley *et al.*, 2017). Overlooking new information while sticking with previous knowledge is one of the causes of overconfidence (Tversky and Kahneman, 1974; Soll, 1996; Tsai *et al.*, 2008). Besides, imperfect information of their own and others' performance can also lead to overconfidence (Erev *et al.*, 1994; Moore and Healy, 2008). Klayman *et al.* (1999) proposed that inherent judgmental error might be another source of overconfidence. One possible source of inherent judgmental error is inappropriate assessment of the validity of the information collected and people's imperfect adjustment of subjective feeling of confidence (Erev *et al.*, 1994; Ferrell, 1994; Soll, 1996; Klayman *et al.*, 1999). This judgmental error is akin to the concept of cognitive limitation that people are not good at employing additional information to improve the accuracy of their judgment (Tsai *et al.*, 2008). Likewise, Radzevick and Moore (2009) proposed that objective circumstances, like social pressure could also exacerbate overconfidence. Bazerman and Moore (2008) demonstrated that being overconfident, decision makers relieved internal dissonance and tension about uncertain decisions. Besides, negative relationship between skill and overconfidence was found: lower-skilled subjects show higher level of overconfidence (Dunning, 2011; Feld *et al.*, 2017).

2.3 Self-serving

SE is a kind of cognitive discourse whereby people tend to claim contribution to positive outcomes and attribute negative outcomes to either external factors like the environment or the behaviors of others (Miller and Ross, 1975; Campbell and Sedikides, 1999; Libby and Rennekamp, 2012; Deffains *et al.*, 2016; Newey, 2016). Other research studies further demonstrated that self-serving tendency was a manifestation of self-protection whereby self-esteem is maintained by shifting the responsibility of negative outcomes (Zuckerman, 1979; Sedikides *et al.*, 1998). Miller and Ross (1975) examined the relationship between optimistic attitude and self-serving tendency. They identified that behavior of self-serving was related to subjects' over-optimistic predictions and expectations (Tamborski *et al.*, 2012). Motivated reasoning and the desire to seek, protect and enhance positive self-image can also explain SE. Self-esteem is thus the main self-serving motivator (Bradley, 1978; Coleman, 2011). Lerner and Keltner (2000) and Coleman (2011) believed that emotion can play an influencing role on self-serving. Baumgardner and Arkin (1988) further claimed that positive emotions and bright self-image made people more susceptible to SE than negative emotions. Campbell and Sedikides (1999) proposed a self-threat model that suggests pessimism would generate detrimental negative effects on one's self-image and self-concept. Therefore, when they encounter the unfavorable feelings of self-threat like being challenged, questioned, blamed or despised, they would switch on the self-serving mode with the aim of shedding responsibility for the negative outcomes. Besides, self-serving biased decision makers were found to have misunderstanding about equity, they subconsciously take actions that are most beneficial to them and consider this is not unfair to the other stakeholders (Kriss *et al.*, 2011; Otto and Bolle, 2015; Newey, 2016).

2.4 Hindsight

HE means people over claim their ability to estimate happening likelihood of an event after knowing the outcome (Fischhoff, 1975; Pezzo, 2011; Peer and Gamliel, 2013; Chelley-Steeley *et al.*, 2015; Bhattacharya and Jasper, 2018). Hindsight explains the influence of outcome knowledge on judgment under uncertainty. The tendency to perceive reported outcomes as being inevitable is also known as "creeping determinism" and "knew it all along"

(Wood, 1978; Hoffrage and Pohl, 2003; Bernstein *et al.*, 2011; Roes and Vohs, 2012). Hawkins and Hastie (1990) further demonstrated that creeping determinism stemmed from simultaneous and automatic integration of the outcome information into a person's initial knowledge of an event. What is more, people are usually not aware of the influence of HE (Fischhoff, 1975; Pohl, 2007). One explanation of the effect of outcome knowledge is assimilation (Fischhoff, 1975). Subjects assimilate the already known outcome with what are already in their mind about the issue. Assimilation of outcome knowledge raises the perceived match level between the known outcome and 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 (Hawkins and Hastie, 1990; Blank and Nestler, 2007; Roes and Vohs, 2012). Fischhoff (1975) and Connolly and Bukszar (1990) claimed that HE occurs because of the cognitive activities of information integration and retrieval. In simple terms, it means the tendency to simplify cause and effect. Hindsight helps one to develop stories that incorporate the happening of events according to the known outcomes (Kruglanski, 1989; Lombrozo and Carey, 2006). The better a person can make sense of the story and inject meaning into the past, the greater is the HE (Hawkins and Hastie, 1990; Blank and Nestler, 2007; Roes and Vohs, 2012).

2.5 Confirmation

CE describes the tendency that people search or interpret information to confirm existing beliefs, hypotheses and assumptions (Koriat *et al.* 1980; Nickerson 1998; Villarroel *et al.*, 2016). Klayman (1995) added that CE is the inclination to retain or reluctance to abandon a currently favored position. When one takes on a position or forms an opinion on an issue, the subsequent search of information becomes highly selective and aims mostly to defend or justify that position or opinion (Koriat *et al.*, 1980; Nickerson, 1998; Peer and Gamliel, 2013). Characteristics of CE include: only focusing on favored hypothesis and neglecting alternatives; giving greater weight to evidence supporting existing beliefs while overlooking information on the opposite side; testing only cases that fit the hypotheses; and interpreting information into patterns that one is looking for (Millward and Spoehr, 1973; Fischhoff and Beyth-Marom, 1983; Nickerson, 1998; Hernandez and Preston, 2013; Charness and Dave, 2017). With the inclination toward confirming existing hypotheses, decision makers would give unjustified weights to information that supports the same and neglect those dissenting (Koriat *et al.*, 1980; Nickerson, 1998; Schwind and Buder, 2012). Millward and Spoehr (1973) also found that decision makers were inclined to only test cases or examples that were within the implications of the hypotheses and the items they expected would fit the hypotheses (Taplin, 1975; Evans, 2008). Nickerson (1998) demonstrated CE 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 the cases with the hypothesized features of small, red and circular. It is obvious that this approach would fail to unveil the small circle concept because the CE would exclude other qualifying examples like small yellow circle.

Developed from the afore-mentioned deliberations on bias effects in decision making, a list of possible manifestations of bias in CPDR context was assembled and summarized in Table II.

3. Data collection

The construction professionals in Hong Kong are the targeted respondents of this study. To obtain the frequency of construction project participants having the above biased behaviors, these bias manifestations were operationalized into first person narration and organized as a data collection questionnaire. 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

| Manifestations | References |
|--|---|
| 1. Participants' final assessments have been influenced by the first offer of the counterpart (Anchoring) | Chertkoff and Conley (1967), Galinsky and Mussweiler (2001) and Thompson (2008) |
| 2. Participants' assessments have been influenced by unsubstantiated figures raised by the counterpart during the resolution process (Anchoring) | Neale and Bazerman (1992), Tversky and Kahneman (1974) and Huber and Neale (1986) |
| 3. Participants' decisions have been adjusted because of the ambitious arguments of the counterpart (Anchoring) | Chapman and Bornstein (1996), Malouff and Schutte (1989), Marti and Wissler (2000) and Englich <i>et al.</i> (2006) |
| 4. Participants cannot get away with the assessments made at prior round of dispute negotiations (Anchoring) | Englich and Mussweiler (2001), Englich <i>et al.</i> (2006) and Wilson <i>et al.</i> (1996) |
| 5. Participants become immune to alternative reasonable assessments after forming their first assessments about the dispute (Confirmation) | Klayman (1995), Doherty <i>et al.</i> (1979), Nickerson (1998) and Fischhoff and Beyth-Marom (1983) |
| 6. Participants have paid more attention to the information which is consistent with their prior knowledge of the dispute (Confirmation) | Pennington and Hastie (1993) and Peer and Gamliel (2013) |
| 7. Participants incline to interpret further information as evidences to justify their assessments (Confirmation) | Troutman and Shanteau (1977), Holstein (1985) and Hendry and Shaffer (1989) |
| 8. Participants search for information that confirms their assessment (Confirmation) | Nickerson (1998), Koriati <i>et al.</i> (1980), Peer and Gamliel (2013) and Carlson and Russo (2001) |
| 9. Participants consider that their party has contributed more to the positive outcomes of the resolution (Self-serving) | Farnsworth (2003), Campbell and Sedikides (1999) and Greenberg <i>et al.</i> (1982) |
| 10. Participants endorse information that supports their assessments (Confirmation) | Nickerson (1998) and Peer and Gamliel (2013) |
| 11. Participants are very optimistic about the likelihood of winning irrespective of the arguments of the counterpart (Overconfidence) | Samuelson and Bazerman (1985), Neale and Bazerman (1992) and Bazerman and Neale (1982) |
| 12. Participants totally believe that the outcome of the resolution will be good for their party (Overconfidence) | Neale and Bazerman (1992) and Bazerman and Neale (1982) |
| 13. Participants are very confident that their ambitious requests will succeed (Overconfidence) | Thompson and Loewenstein (1992), Bazerman and Neale (1982) and Kramer <i>et al.</i> (1993) |
| 14. Participants believe that their party is able to avoid bias (Overconfidence and Self-serving) | Pronin <i>et al.</i> (2002) and Mezulis <i>et al.</i> (2004) |
| 15. At the conclusion of the dispute, participants feel "I know the outcome all along" (Overconfidence and Hindsight) | Roese and Vohs (2012), Hoffrage and Pohl (2003) and Wood (1978) |
| 16. Participants think that the counterpart is having bias (Self-serving) | Pronin <i>et al.</i> (2002) and Brown and Rogers (1991) |
| 17. Participants think the counterpart should take greater responsibility to the negative outcomes of the resolution (Self-serving) | Farnsworth (2003), Greenberg <i>et al.</i> (1982) and Sedikides <i>et al.</i> (1998) |
| 18. Participants stick to the arguments that are beneficial to their party (Self-serving) | Kramer <i>et al.</i> (1993), Thompson and Loewenstein (1992), Farnsworth (2003) and Babcock <i>et al.</i> (1995) |
| 19. After knowing the negative outcome of the resolution, participants consider the demands of the counterpart during the dispute as unreasonable (Self-serving and Hindsight) | Smith and Greene (2005) and Stallard and Worthington (1998) |
| 20. At the conclusion of the dispute, participants consider the failure to settle as inevitable because of the negative attitude of counterpart (Self-serving and Hindsight) | Harley (2007), Peer and Gamliel (2013) and Fischhoff (1975) |

Table II.
Manifestations of
bias in CPDR

survey includes two parts. Part A collected the demographic information of the respondents. In Part B, the respondents were asked to indicate the pattern of their behavior in CPDR against a six-point Likert scale of frequency level from 0 (not at all) to 6 (always) for each of the measurement statements. The sectors likely to have dispute resolution experience

are contractor, client and consultant. The electronic-version questionnaires were sent online with a cover letter that introduces the basic background information about the study. To encourage honest responses (Paulhus and Vazire, 2007), assurance of anonymity and confidentiality were emphasized. 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. Paper-version questionnaires were distributed in learned societies' seminars and workshops. In total, 347 questionnaires were distributed and 134 full responses were considered as valid data, representing a satisfactory response rate of 38.6 percent (Barlett *et al.*, 2001; Adebayo and Osmond, 2011). The organization, professional background, years of experience of the respondents as well as the dispute types they were involved are shown in Table III.

4. Data analysis

4.1 Bias framework development

The respondents were separated according to different professional groups: contractor group ($n = 40$), client group ($n = 33$) and consultant group ($n = 61$). The results are shown in Table IV. Items1–20 are the 20 manifestations in sequence as shown in Table II. In each professional group, the mean response of each manifestation was calculated as the mean score. Standard deviation was also calculated to indicate the dispersion of the responses. The manifestations with higher occurrence evaluations are considered as of higher potency. To this end, relative rankings were calculated in the descending sequence of mean scores of the 20 measurement statements. Item8 “I search for information that confirms their assessments” and item10 “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 (Kaiser, 1958). Kaiser–Meyer–Olkin and Bartlett’s test of sphericity were performed to test the sampling adequacy and suitability of the data (Cerny and Kaiser, 1977). The results are satisfactory

Table III.
Profile of respondents

| <i>Profession</i> | <i>Percentage</i> | <i>Organization</i> | <i>Percentage</i> |
|------------------------------------|-------------------|---------------------------------|-------------------|
| 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 | | |
| <i>Years of experience (years)</i> | <i>Percentage</i> | <i>Dispute types</i> | <i>Percentage</i> |
| Below 5 | 28.4 | Building services installations | 16.4 |
| 5–10 | 27.6 | Building work | 37.3 |
| 10–15 | 11.2 | Civil engineering work | 36.6 |
| 15–20 | 7.4 | Maintenance work | 6.0 |
| Above 20 | 25.4 | Others | 3.7 |
| Total | 100.0 | Total | 100.0 |

Table IV.
Relative importance
ranking of the items

| Item | Client (<i>n</i> = 33) | | | Consultant (<i>n</i> = 61) | | | Contractor (<i>n</i> = 40) | | |
|--------|-------------------------|-------|---------|-----------------------------|-------|---------|-----------------------------|-------|---------|
| | Mean score | SD | Ranking | Mean score | SD | Ranking | Mean score | SD | Ranking |
| Item1 | 3.30 | 0.728 | 18 | 3.10 | 0.768 | 16 | 3.28 | 0.816 | 17 |
| Item2 | 3.30 | 0.728 | 17 | 2.64 | 0.895 | 18 | 3.20 | 0.758 | 19 |
| Item3 | 3.94 | 0.496 | 6 | 2.64 | 0.984 | 19 | 3.15 | 0.622 | 20 |
| Item4 | 3.30 | 0.684 | 16 | 3.08 | 0.802 | 17 | 3.25 | 0.707 | 18 |
| Item5 | 3.18 | 0.983 | 20 | 2.64 | 0.753 | 20 | 3.38 | 0.868 | 14 |
| Item6 | 3.94 | 0.966 | 5 | 3.90 | 1.012 | 3 | 4.08 | 0.997 | 2 |
| Item7 | 4.03 | 1.185 | 3 | 3.56 | 1.009 | 5 | 3.65 | 0.893 | 7 |
| Item8 | 4.42 | 1.032 | 1 | 4.02 | 1.057 | 2 | 4.30 | 1.091 | 1 |
| Item9 | 3.70 | 1.015 | 10 | 3.36 | 0.913 | 9 | 3.70 | 0.823 | 4 |
| Item10 | 4.30 | 1.045 | 2 | 4.03 | 0.983 | 1 | 3.98 | 1.025 | 3 |
| Item11 | 3.48 | 0.755 | 15 | 3.21 | 0.839 | 13 | 3.40 | 0.900 | 12 |
| Item12 | 3.97 | 0.810 | 4 | 3.49 | 0.977 | 7 | 3.53 | 1.062 | 9 |
| Item13 | 3.70 | 0.984 | 9 | 3.18 | 0.847 | 15 | 3.40 | 0.928 | 13 |
| Item14 | 3.76 | 1.119 | 7 | 3.52 | 1.010 | 6 | 3.65 | 0.975 | 6 |
| Item15 | 3.55 | 0.833 | 13 | 3.26 | 0.854 | 10 | 3.48 | 0.847 | 10 |
| Item16 | 3.55 | 1.252 | 14 | 3.25 | 0.767 | 11 | 3.58 | 0.844 | 8 |
| Item17 | 3.73 | 1.039 | 8 | 3.23 | 0.783 | 12 | 3.38 | 0.838 | 16 |
| Item18 | 3.64 | 1.025 | 12 | 3.75 | 1.059 | 4 | 3.68 | 1.023 | 5 |
| Item19 | 3.24 | 0.936 | 19 | 3.18 | 0.847 | 14 | 3.38 | 0.952 | 15 |
| Item20 | 3.64 | 0.859 | 11 | 3.41 | 0.990 | 8 | 3.40 | 0.928 | 11 |

and shown in Table V (Kaiser, 1974). Hair *et al.* (1998) recommended that only factors with eigenvalue greater than 1 are to be considered as significant and this was applied accordingly. Factor loadings stand for the correlation between the items and the factors, the larger the factor loading, the item is more representative of the factor (Hair *et al.*, 1998). According to Hair *et al.* (1998), a factor loading of 0.5 can be considered as significant both statistically ($\alpha = 0.05$) and practically for a sample of 134 in this study. Therefore, only items with factor loadings no less than 0.5 were kept under each factor. As a result, four factors each with five items without cross loading were extracted. For this study, the PCFA factor structure shown in Table VI therefore is the most representative, parsimonious and theoretically meaningful.

The PCFA suggested a four-factor framework. Upon examining the grouping of the measurement statements, it was found that manifestations under the same factor were having a common enabler. In this regard, four factors were extracted as four constructs of biased behaviors in CPDR. With reference to the meaning, nature and underpinning theories of manifestations under each construct, four constructs stand for four types of bias that explain biased behaviors in CPDR. The four types of bias were identified as: preconception bias, self-affirmation bias, optimism bias and interest-oriented bias, respectively. Identifying bias constructs in CPDR is the first step to alleviate biased behaviors.

Reliabilities of measurement statements and correlation coefficients of the four types of bias are shown in Table VII. From Table VII, it can be seen that measurement statements

Table V.
Measures of sampling
adequacy and
suitability

| KMO | Bartlett's test of sphericity | | | | Factor | | | |
|-------|-------------------------------|-----|-------|---------------|--------|-------|-------|-------|
| | χ^2 | 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 |

Notes: KMO, Kaiser–Meyer–Olkin measure of sampling adequacy; df, degree of freedom; Sig., significance

Table VI.
Factor matrix of
bias in CPDR

| | Factor | | | |
|--|--------|-------|---|-------|
| | 1 | 2 | 3 | 4 |
| Manifestations in CPDR | | | | |
| <i>Preconception bias</i> | | | | |
| 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 |
| <i>Self-affirmation bias</i> | | | | |
| 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 evidences to justify my assessments | | 0.567 | | |
| 8. I search for information that confirms my assessments | | 0.743 | | |
| 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 | | |
| <i>Optimism bias</i> | | | | |
| 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 | | | |
| <i>Interest-oriented bias</i> | | | | |
| 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 |

Table VII.
Reliabilities and
correlation coefficients
of the four
biases in CPDR

| Factor | Cronbach's α | 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 (two-tailed) | | | | | |

under each factor have satisfactory internal consistency, with Cronbach's α values larger than 0.70, the rule of thumb value suggested by Nunnally and Bernstein (1994). Besides, the significant correlation in Table VII indicates interrelatedness of the four biases. The bias framework in CPDR is shown in Figure 2. The five generic effects of bias on decisions are

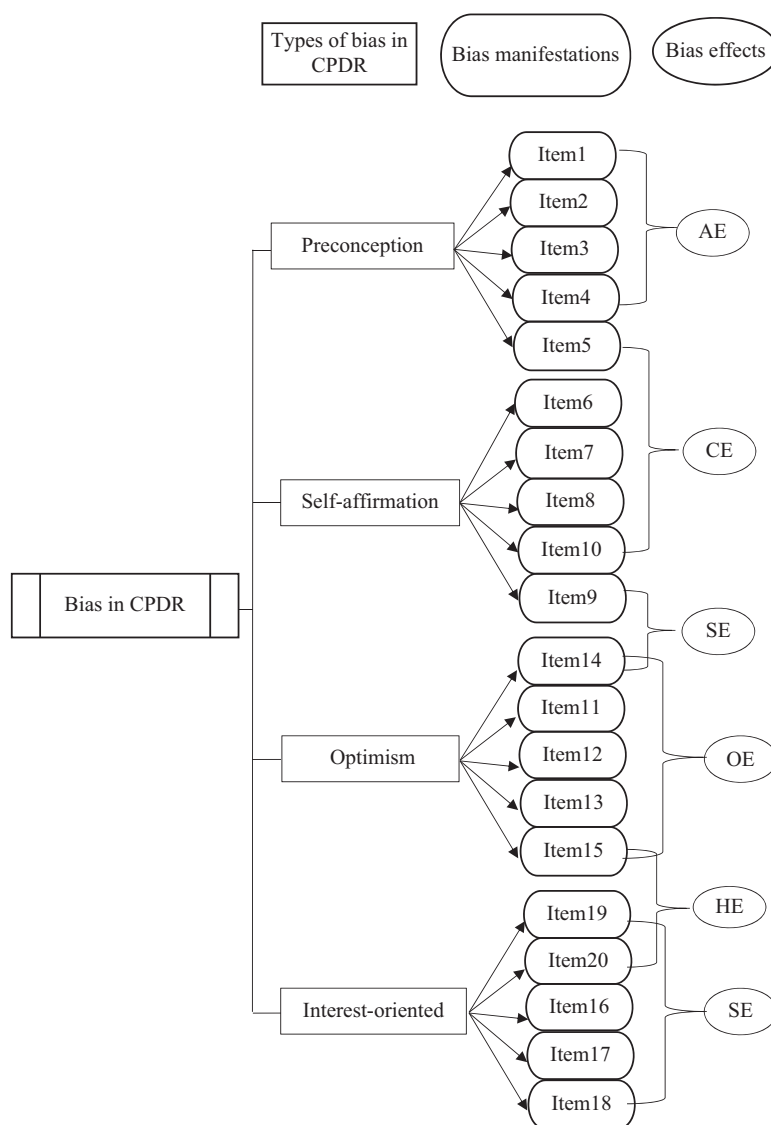


Figure 2.
A framework of
bias in CPDR

AE, OE, SE, HE and CE. These effects were used to develop bias manifestations in CPDR. This study conceptualized the 20 bias manifestations by examining the underlying constructs that explain biased behaviors in CPDR. Four constructs were identified as: preconception bias, self-affirmation bias, optimism bias and interest-oriented bias.

Factor score of each factor was then calculated as the average of item scores under each factor. For example, the factor score of preconception bias is the average of scores of item1, item2, item3, item4 and item5. Analysis of variance (ANOVA) multiple comparison was conducted for different background groups to test whether there was significant difference among factor scores of different factors. The results are shown in Table VIII. The results of

Table VIII.
ANOVA multiple
comparisons

| Factor (<i>I</i>) | Factor (<i>J</i>) | Mean difference (<i>I</i> – <i>J</i>) | SE | Sig. | 95% confidence interval | |
|----------------------------|---------------------|---|---------|-------|-------------------------|-------------|
| | | | | | Lower bound | Upper bound |
| <i>Client (n = 33)</i> | | | | | | |
| 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 |
| <i>Contractor (n = 40)</i> | | | | | | |
| 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 |
| <i>Consultant (n = 61)</i> | | | | | | |
| Preconception | Self-affirmation | –0.95410* | 0.11681 | 0.000 | –10.1842 | –0.7240 |
| | Optimism | –0.51475* | 0.11681 | 0.000 | –0.7449 | –0.2847 |
| | 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

ANOVA multiple comparisons indicate that in all the professional groups, the mean factor score of self-affirmation bias is the largest at the 0.05 level. That suggests that the professionals in all three groups are very likely to have self-affirmation bias behavior in dispute resolution. While in the consultant group, the mean factor score of preconception bias is the lowest. In this regard, consultants are relatively less prone to have preconception bias than the other three types of biases.

4.2 Validation

The proposed bias framework is further validated by a confirmatory factor analysis (CFA). The CFA model was built according to the factor structure obtained from the PCFA. 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 (Fornell and Larcker, 1981). These include measurement errors in observed variables and residuals in latent variables (Schumacker and Lomax, 2016). The CFA model shown in Figure 3 was assessed by goodness-of-fit (GOF) measures including absolute fit indices, incremental fit indices and parsimonious fit indices. The absolute fit indices measure discrepancy between the proposed model and the original sample set, indicating the fitness of the proposed model to the practical scenario (McDonald and Ho, 2002). The absolute fit indices include comparative Chi-square/df (χ^2/df), goodness-of-fit index, adjusted goodness-of-fit index and root mean square error of approximation. The incremental fit indices indicate the result of comparison with a

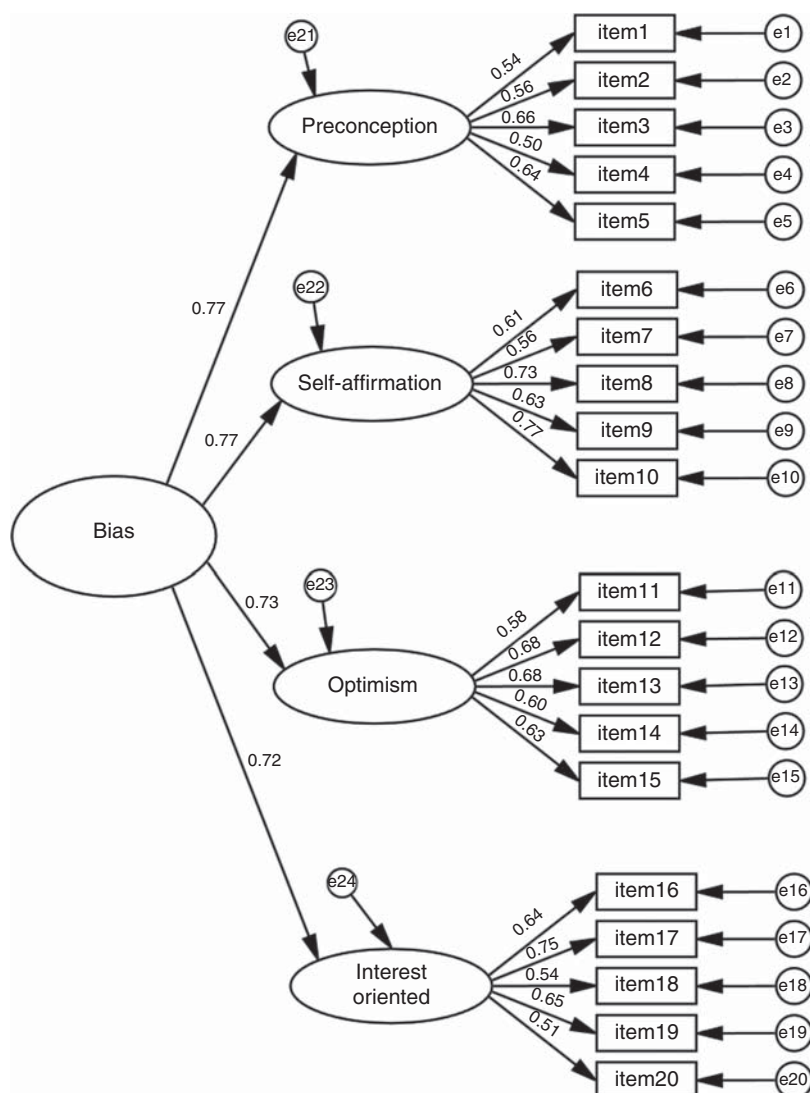


Figure 3.
CFA of bias in CPDR

baseline model (Leung *et al.*, 2005). The incremental fit indices include comparative fit index, Tucker–Lewis Index. Parsimonious fit indices assess the level of parsimony of the proposed model (Hair *et al.*, 1998; Xiong *et al.*, 2015). These indices include the parsimony normed-fit index and parsimony comparative fit index. The results of the GOF indices are shown in Table IX.

Since the sample size of this study is below 200, bootstrapping was conducted to augment the reliability and increase the accuracy of the results of CFA (Kline, 1998; Sadler-Smith and Smith, 2004; Ozorhon *et al.*, 2008; Paiva *et al.*, 2008). Bootstrapping procedure was conducted to create a new data set by resampling, iterating and replacing random selection of observations from the original data set (Paiva *et al.*, 2008; Chow *et al.*, 2012). When conducting Bollen–Stine bootstrap, the *p*-value result of 0.337 (> 0.05) supports the null hypothesis that the model is correct. Bootstrapping allows the testing of the significance of parameter estimates by comparing the parameters resulted from original data set and bootstrapped estimates (Janz and Prasarnphanich, 2009; Chow *et al.*, 2012). Both the regression weights resulted from original sample set and 1,000 replications bootstrapped estimates are shown in Table X. It can be seen from Table X 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 (Ho, 2013). These results collectively indicate that the parameter estimates obtained from the CFA analysis are statistically significant. CFA was conducted using IBM SPSS Amos version 23.0.

5. Findings

A bias framework is developed and includes four types of bias in CPDR. The types of bias are, respectively, called preconception bias, self-affirmation bias, optimism bias and interest-oriented bias. The bias framework has also been validated by a satisfactory CFA.

For preconception bias, item 3 (0.685), item 5 (0.646), item 2 (0.626), item 1 (0.607) and item 4 (0.578) are representative in descending order of factor loadings. In CPDR, ambitious arguments of the counterpart precipitate as anchors based on which disputants develop preconception about the dispute. Project disputants may believe that the counterpart dares to

| Fit index | Desired levels | Model results |
|--------------------------------|----------------------------|--|
| <i>Absolute fit indices</i> | | |
| 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 ^c | 0.831 (recommended fit) ^e |
| RMSEA | 0.06 or below ^f | 0.049 (excellent fit) ^g |
| <i>Incremental fit indices</i> | | |
| CFI | 0.8 or above ^c | 0.927 (good fit) ^c |
| TLI | 0.8 or above ^c | 0.917 (good fit) ^a |
| <i>Parsimonious fit</i> | | |
| PNFI | 0.5 or above ^h | 0.663 (good fit) ^h |
| PCFI | 0.5 or above ^h | 0.810 (good fit) ^h |

Notes: GOF, goodness-of-fit indexes; χ^2/df , chi square/degree of freedom; GFI, good-ness-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. ^aHair *et al.* (1998, 2006); ^bXiong *et al.* (2015); ^cMaskarinec *et al.* (2000); ^dWong *et al.* (2008); ^eGefen (2000); ^fHu and Bentler (1999); ^gMarsh and Hau (1996); ^hChen and Fong (2012)

Table IX.
GOF indices results

Table X.
Standardized
regression weights
and 1,000 sample
bootstrapped
estimates

| Parameter | Estimate* | Mean (Bootstrapped) | SE (Bootstrapped) | Lower | Upper | p |
|---------------------------------------|---------------|---------------------|-------------------|-------|-------|-------|
| Preconception \leftarrow F1 | 0.771** | 0.763 | 0.091 | 0.576 | 0.946 | 0.001 |
| Self-affirmation \leftarrow F1 | 0.772 (3.891) | 0.783 | 0.085 | 0.575 | 0.923 | 0.005 |
| Optimism \leftarrow F1 | 0.725 (3.673) | 0.71 | 0.111 | 0.498 | 0.928 | 0.001 |
| Interest oriented \leftarrow F1 | 0.717 (3.805) | 0.713 | 0.103 | 0.483 | 0.894 | 0.002 |
| Item1 \leftarrow Preconception | 0.541** | 0.543 | 0.081 | 0.354 | 0.692 | 0.003 |
| Item2 \leftarrow Preconception | 0.56 (4.562) | 0.549 | 0.089 | 0.364 | 0.719 | 0.001 |
| Item3 \leftarrow Preconception | 0.664 (4.948) | 0.663 | 0.063 | 0.542 | 0.783 | 0.002 |
| Item4 \leftarrow Preconception | 0.502 (4.176) | 0.503 | 0.09 | 0.307 | 0.655 | 0.003 |
| Item5 \leftarrow Preconception | 0.639 (4.945) | 0.635 | 0.069 | 0.48 | 0.753 | 0.002 |
| Item6 \leftarrow Self-affirmation | 0.609** | 0.606 | 0.075 | 0.451 | 0.733 | 0.002 |
| Item7 \leftarrow Self-affirmation | 0.555 (5.191) | 0.55 | 0.077 | 0.39 | 0.692 | 0.002 |
| Item8 \leftarrow Self-affirmation | 0.726 (6.321) | 0.723 | 0.061 | 0.578 | 0.824 | 0.003 |
| Item9 \leftarrow Self-affirmation | 0.63 (5.609) | 0.631 | 0.07 | 0.474 | 0.749 | 0.003 |
| Item10 \leftarrow Self-affirmation | 0.768 (6.443) | 0.77 | 0.06 | 0.618 | 0.864 | 0.004 |
| Item11 \leftarrow Optimism | 0.583** | 0.588 | 0.076 | 0.409 | 0.706 | 0.004 |
| Item12 \leftarrow Optimism | 0.683 (5.616) | 0.678 | 0.065 | 0.548 | 0.806 | 0.001 |
| Item13 \leftarrow Optimism | 0.681 (5.558) | 0.675 | 0.072 | 0.514 | 0.802 | 0.002 |
| Item14 \leftarrow Optimism | 0.601 (5.168) | 0.603 | 0.094 | 0.378 | 0.754 | 0.004 |
| Item15 \leftarrow Optimism | 0.626 (5.204) | 0.624 | 0.073 | 0.447 | 0.739 | 0.003 |
| Item16 \leftarrow Interest-oriented | 0.637** | 0.639 | 0.069 | 0.487 | 0.766 | 0.003 |
| Item17 \leftarrow Interest-oriented | 0.751 (6.583) | 0.741 | 0.076 | 0.579 | 0.873 | 0.002 |
| Item18 \leftarrow Interest-oriented | 0.541 (4.857) | 0.547 | 0.086 | 0.349 | 0.698 | 0.004 |
| Item19 \leftarrow Interest-oriented | 0.649 (5.643) | 0.65 | 0.069 | 0.492 | 0.769 | 0.003 |
| Item20 \leftarrow Interest-oriented | 0.507 (4.697) | 0.498 | 0.086 | 0.316 | 0.657 | 0.002 |

Notes: SE, 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

make ambitious arguments because they are righteous. The preconception renders participants to make compromise in their first responses. The preconception can make either way and hence making the first offer at the right time would bring strategic advantage. High first offer serving as an anchor may give preconception on the counterpart that there are good reasons to support the offer. The preconception would steer subsequent resolution process. In the experiment of Galinsky and Mussweiler (2001), during negotiation first offers had strong correlation with the final agreed price. Thus, the party making the first offer in general derives more benefit. In CPDR, the amount the contractor claims due to culpable acts of the client may influence the final number 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 (1996) described this phenomenon as first offer advantage: the more you ask for, the more you get. Besides, early decisions made at prior stage give project disputants 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. These five items' regression weights in CFA also support the influence of self-affirmation. Project disputants 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 to 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 in descending order of factor loadings. Project disputants who are having optimism bias have the following behavior patterns. They overestimate their ability in assessing the dispute. They raise ambitious requests and are overly confident that would be met by the counterparts. During the whole process, no matter how the counterparts defend, it cannot alleviate their optimistic attitudes about winning and the overconfidence about positive outcome. Upon completion of the dispute resolution process, under the influence of HE, 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 CPDR, when disputants are under the influence of interest-oriented bias, maximizing self-interest characterizes whatever they do and, however, they behave. When the dispute failed to reach an amicable settlement, interest-biased disputants would claim that this outcome is inevitable. With no rethink of their insistence on pursuing their interests that had led to the impasse, they would attribute the failure to settle as responsibility of the counterparts. They believe the counterpart is having bias and their demands during resolution process are unreasonable. They would flee away from their responsibility of settlement failure by attributing negative outcome to the counterpart. During a dispute resolution process, they would only take note of arguments that favor them.

The potency of the biases can also be assessed by path coefficients in CFA. The path coefficients represent the relative strength of the four biases. The path coefficients of preconception bias, self-affirmation bias, optimism bias and interest-oriented bias are 0.77, 0.77, 0.73 and 0.72, respectively (Figure 3 refers). Self-affirmation bias has the highest path coefficients. In this regard, self-affirmation bias has greater potency to creep in CPDR. It echoes with the results of ANOVA multiple comparisons in Table VIII. Self-affirmation bias has the largest mean factor score for all the professional groups and thus suggesting higher potency. Preconception bias has the same path coefficient as self-affirmation bias in CFA. 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 VII) suggest the interrelatedness of these four biases.

6. Implications on construction project dispute management

With extensive urbanization and infrastructural developments, globalization and international collaboration become the mainstream trend in completing grandiose projects. Working with project participants of different disciplines, cultural background and management styles can be a great challenge (Meng and Boyd, 2017; Stingl and Gerald, 2017). The existence of bias stifles rational decision making with the results of having suboptimal solutions. If biased decision making could be diminished, efficiency will be greatly improved and vast resources will be saved in these international grandiose projects.

Furthermore, use of multi-tiered dispute resolution process (MTDR) incorporating alternative dispute resolution (ADR) as intermediate step before arbitration has been the predominant approach for settling disputes (Chong and Mohamad Zin, 2012; Chen *et al.*, 2014; Lee *et al.*, 2016). The characterizing feature of MTDR approach is that a dispute will be evaluated repeatedly from negotiation, mediation to adjudication and arbitration (Li and Cheung, 2016). 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 equips project managers (PMs) with practical measures to address these biases. Early awareness of bias allows PMs to conduct timely intervention to steer the dispute resolution team back to

rational courses. Besides, this study suggests the optimization of CPDR procedures as well, which would diminish the chance of bias occurring. Therefore, this study has great contribution to international dispute management in promoting effective dispute resolution and saving resources.

6.1 *Minimizing bias in CPDR*

As international collaboration brings diversities to construction project, human factor becomes an important inducer of construction disputes. PM plays a vital role in ensuring that project participants think and behave in a rational manner in these international projects (Müller and Turner, 2010; Sommerville *et al.*, 2010; Wu *et al.*, 2017). PM should be mindful and can use the framework proposed in the study as a checklist of biased behaviors. Identifying the underlying bias constructs provides the prerequisites for devising and applying corresponding bias mitigation measures.

The results of this study demonstrate that self-affirmation bias has the highest chance to creep in irrespective of professional background. Therefore, PM should note whether himself/herself and the project team members are keen to confirm themselves and seek positive self-images during CPDR, which are the potential traps of self-affirmation bias. In this regard, PM should be calm and guide the team members to search full and complete information about the dispute, not only the supporting evidences to their own arguments; be open to alternatives irrespective of the assessment already made; and carefully consider the rationality of counterpart's arguments and evidences.

Preconception bias has the path coefficient (0.77) same as self-affirmation bias in CFA. Therefore, before entering CPDR, PM should remind the team members to forget about their previous preconception about the counterpart and reconstruct their assessment about the dispute matter. When receiving aggressive offers from counterpart, PM should lead the team to carefully consider counterpart's reservation price based on the current project. When given ambitious arguments and unsubstantiated figures from 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 analyzed.

The framework indicates that disputants in CPDR are likely to be optimistic. In this regard, after being diagnosed with optimistic tendency by the bias framework, construction professional should be reminded about the chance of settlement failure. There is no substitute of prudent action in considering and analyzing the reasons and evidences raised by the counterparts. It is also quite normal that disputants focus on self-interest during dispute resolution processes 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 a win-win result and lubricate the communication between the inter-organizational relationships referring to prior successful experience. Management should also remind the resolution team members to respectfully listen to both side's grievances, control their emotions and express their opinions in a decent manner. When settlement fails, resolution team should review what had gone wrong and learn from the failure. In this study, the mean factor score of preconception bias is the lowest for the consultant group (see in Table VIII), suggesting that consultants are less prone to or more prepared to deal with preconception bias. It maybe the result of the professional training consultants have received. Professionally, as the neutral third 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 for construction professionals to minimize preconception bias.

6.2 Optimizing the CPDR mechanism

The study also has implications in optimizing CPDR mechanism. Major industry reviews have called for innovative CPDR (CIRC, 2001). Use of MTDR process incorporating ADR as intermediate step has been the predominant response (Chong and Mohamad Zin, 2012; Chen *et al.*, 2014; Lee *et al.*, 2016). The characterizing feature of MTDR is that disputes will be evaluated repeatedly at each tier (Li and Cheung, 2016). In extreme cases, the same issue may have to be reviewed at every tier. Would this arrangement improve the chance of settlement? Precisely this is the anticipated benefit 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 form preconception and impede rational re-assessments in subsequent resolution processes; the way of disputants collecting and interpreting information could be biased toward justifying themselves under the influence of self-affirmation bias; before entering a new tier of resolution, disputants could be optimistic about the winning likelihood therefore refuse to compromise under the influence of optimism bias; at the end of resolution, under the influence of interest-oriented bias, disputants could attribute the undesirable resolution outcome and expensive cost to the counterparts' unwillingness to settle in prior tiers. The study contributes to CPDR study domain in bringing out the downsides of having convoluted repeated evaluations in MTDR. Dispute resolution procedure with extended tiers may not serve the intended outcome due to the possibility of bias creeping in. In these regards, this study suggests moving the focus back to negotiation mechanism. More resources, energy and inputs are encouraged to resolve disputes in the negotiation stage and better not resort to protracted tiers, where positions would become hardened and inflexible.

Besides, although the data were collected in Hong Kong, Hong Kong construction industry is quite international with many international firms and professionals. Also the theoretical bases of the study have no geographical specificity. Therefore, the findings and recommendations provided in this study should have good applications beyond Hong Kong.

7. Limitations and future direction

One of the limitations of this study is the social desirability bias, which means respondents tend to reply survey questions in a way to make them look more favorable (Nederhof, 1985; Furnham, 1986). People may reluctant to admit that they practice bias. Therefore they may lower their ratings on the frequency of biased behaviors in the questionnaire. Measures to alleviate social desirability bias have been employed in this study. Assurance of anonymity and confidentiality was emphasized in the covering letter, which was distributed together with the data collection questionnaire to encourage honest responses (Paulhus and Vazire, 2007). This limitation leads to future direction of following studies. Observations from the "lookers-on" in CPDR, maybe third party neutrals, representatives, consultants could be the factual sources to witness existence of disputants' biased behaviors. Future work will be conducted to solicit the observations of third parties in CPDR about their witness of bias.

8. Concluding remarks

Negotiation studies have largely assumed decision makers to be competent and rational. However, this is far from the reality as decision makers are subject to bias (Ariely, 2008; Cusick, 2009). In these regards, this study posits to conceptualize bias in CPDR by proposing a bias framework. Manifestations of bias were operationalized from literatures on effects of biases. Data were then collected from construction professionals on their pattern of behaving these manifestations. With the assistance of a PCFA and with reference to the nature of the bias constructs, a four-factor bias framework was developed. Four types of biases were included in the framework: preconception bias, self-affirmation bias, optimism

bias and interest-oriented bias. The framework was validated by a CFA. The findings inform construction professionals of the likelihood of practicing biased behaviors in CPDR. In addition, practical measures to minimize biases in CPDR are also offered. The irrationality of human decisions as a result of bias is highlighted in this study. This study also timely reminds the caveats in employing MTDR in construction as repeated dispute evaluations therein create the platform for biases to creep in. It suggests that more resources and energy should be put to resolve disputes at the early negotiation stage instead of reverting to protracted tiers of resolution where positions might become hardened and not responding to changes in circumstances.

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