Inequity and Dispute

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Introduction

Contracts are used to govern economic exchanges whereby parties to a contract get what they intended. While the principle of freedom of contract is based on the idea that parties to a contract have exercised their free will in concluding the contract, classical contract theory assumes that contracting parties will commit to the terms of the contract that reflects their respective rights and obligations. However, Adam [5] advocated that contracting parties may enter a contract because of necessity, commercial reality and in extreme case under coercion. It is not uncommon to find one-sided contracts are used in construction projects, especially in those highly competitive construction markets where cut-throat pricing is regularly practised. In such circumstance, contractors are entering into contracts that are inequitable as far as ownership of risks and responsibilities are concerned. These disparities between the contracting parties are major departure from the notion of equal footing as assumed in classical contract theory [73]. On critical issue related to dispute is whether inequitable contract provisions would affect the contracting behaviours of the illy-treated party. In fact, Equity Theory [3] projects that whether one will honour the terms of a contract depends not only on what one gets, but also on whether the same is in parity with that to be received by their counterpart. In this study, equity gap (EG hereafter) is used as a collective term to describe such disparities. The effects of EG on contracting behaviours would surface upon commencement of physical works. Unaddressed disparities are often met with retaliatory behaviours

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S. O. Cheung (ed.), *Construction Dispute Research Expanded*, Springer Tracts in Civil Engineering, https://doi.org/10.1007/978-3-030-80256-1_6

such as non-cooperation, procrastination and opportunism [4]. These responses are counterproductive and trigger disputes.

For example, with the shifting of power ex poste, it is also not surprising to find contractors practising opportunism to express their dissatisfaction over the inequitable treatment. Schieg [65] describe this as a principal-agent phenomenon whereby the agent (contractor) leveraging information advantage ex post to exploit the principal. Inequitable contractual arrangements are thus having an enduring negative impact on contracting behaviours that are counterproductive a dispute driven.

Most capital construction projects are of intermediate duration spanning a few years while mega projects may take even longer to complete. Coordinated effort of multi-disciplinary project team is the prerequisite for efficient and effective delivery of the project. Lui and Ngo [56] found that notwithstanding cooperative working among project team members is a necessary condition for successful delivery, this is not always achieved. In fact, the negative impact of non-cooperation caused by inequitable treatments will inevitably undermine project performance. The concept of asset specificity under transaction cost economics theory is central to the practice of opportunism [56, 72]. High asset specificity and interdependency asymmetry also provide the breeding ground of non-cooperative behaviour [17]. Evidently, EG is one of the sources of problematic contracting behaviours that breed disputes [15]. This study examines the elements of EG and proposes measures to address the disparities. The ultimate aim is to make contracting environment less dispute prone. This chapter reports the followings:

1. Identifying elements of EG between developer and contractor;
2. Developing a conceptual framework of EG; and
3. Suggesting measures to alleviate happening of dispute through addressing EG.

Equity Gap in Construction Contracting

This section examines the characteristic of the relationship between developer and contractor and identifies the disparities arising therefrom. These are termed as elements of equity gap that is used as a collective term doer the disparities. The potential damages of EG on contracting behaviours are then summarized.

The Relationship Between Developer and Contractor in Construction Projects

An agency relationship has arisen between two (or more) parties when one, designated as the agent, acts for the other, designated the principal [64]. In construction, the principal is the developer and the agent are the contractor. They are independent commercial entities,they would have their own interests despite joint efforts are

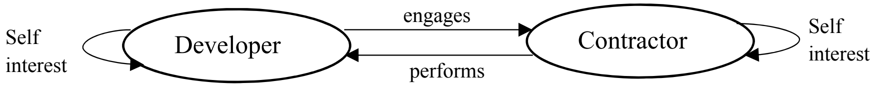

Fig. 1 The project developer-contractor relationship. Adapted from [8]

needed to develop the construction project. Figure 1 presents their interdependent relationship as principal and agent.

What significant issues arise from this interdependency? Smith and Barclay [67] claimed that cooperation is a necessary condition for effective discharge of highly interdependent construction tasks. Moreover, agency theory projects that there is a potential conflict between the principal and the agent because of their self-interest. Williamson [73] offer two important concepts, asset specificity and uncertainty, to explain the practice of opportunism resulting from self-interest.

Williamson [72] identified asset specificity (AS hereafter) as the "durable investments that are undertaken in support of particular transactions, the opportunity cost of which investments is much lower in best alternative uses or by alternative users should the original transaction be prematurely terminated." For construction projects, substantial resources are deployed progressively as the project unfolds. The investments therefore from the contracting parties are in general much higher than typical buyer–seller relationship. In extreme case, contractual determination would bring substantial loss. Thus AS makes it possible for the more flexible party to exploit the less flexible one [23] in practising opportunism [72]. Moreover, in a social context, Liu et al. [57] advocate that under social exchange theory, with relation-specific assets, multiple transactions enhance devotions from both parties and lead to more cooperative behaviour [32]. Accordingly, the practice of opportunism can be restrained when future dealings are anticipated.

Uncertainty is widely recognised as a critical design parameter of contractual governance. Uncertainty can be viewed as a state that ranges from just short of certainty to a complete lack of knowledge about a result [39, 73]. Uncertainty coupled with bounded rationality make contract inevitably incomplete. As not all the events can be predicted, the unplanned impact calls for the use of power to make sure the affected party unhurt as far as possible. Unfortunately, this usually only applies to the principal. Besides, uncertainty is also a trigger of construction disputes [16]. Construction projects are typically unique and involve meticulous coordination. The uncertainties arising from the physical environment can lead to overreactions, unnecessary interventions, second guessing, mistrust, and distorted information flows [39]. Thus, Williamson [73] concluded that the level of uncertainty dictates the type of contractual governance, the more more uncertain the environemnt, the more relational should the governance be [73]. Regretably the actual happening is the opposite.

Another distinctive feature of typical construction projects is the use of project team assembled from particiapting organisations to manage the project [23]. Project teams only function during the project duration and thus often being termed as temporary managemnt organization (TMO) [69]. As the team members are guided primarily by their respective own interest, protective behavior can be expected. Specifically for the contractor, the practice of opportunism to enhnace her interest is often observed if future dealing is not envisaged [62].

Elements of Equity Gap

The elements of the equity gaps are rooted in developer-contractor relationship. Agency Theory predicts that there is imbalance of **information** [64]and **risks** [14] in a principal-agent relationship [4]. The consequent of AS gives rise to **power asymmetry**. Besides, Transaction Cost Theory [73] also suggests that AS renders a less dependent party the power to decide how interests to be distributed, hence the **expected return**.

Information

Principal and agent are having their own goals, risk preferences and information sources [64]. Agency problem arises when (1) the principal cannot verify has the agent had behaved as contracted,and (2) the principal and agent are having different attitudes toward risks. The assumptions are about people (e.g., self-interest, bounded rationality, risk aversion) and organizations (e.g. goal conflict among members), and information (e.g., information is a commodity which can be purchased) [30].

Holmstrom [44] explains that when the principal can only observe the results, the agent may behave in a way that would jeopardise the interest of the principal while the result would appears reasonable [64]. In construction, if the developer cannot monitor the contractor or if he is not able to deduce stringently the quality of his service while work is in progress, an information imbalance in favour of the contractor will result [65]. In this regard, Xiang et al. [75] discussed the information dominance/inferiority between developer and contractor during the bidding and construction stage. Table 1 summarises their findings.

Because of information asymmetry, opportunistic behaviour happens when one party purposely not disclosing information with the belief that the other party may take advantage of the weaknesses to increase his or her own profit. Accordingly, both developer and contractor would withhold certain core information purposely. As such, the transaction becomes less and less transparent with rising suspicions and protectionism. All these would make the exchange less efficient [75]. Ratchet effect is another explanation of why contracting parties are holding back information [36]. When the agent with a high performance today would face higher future demand [52]. Disclosing performance information at is thus not preferred [52].

Table 1 Information asymmetry between developer and contractor

Participants	Bidding stage		Construction stage	
	Dominance	Inferiority	Dominance	Inferiority
Developer	• Construction purpose • Financial strength • Construction project procedures	• Contractor's qualifications • Technological and management ability, performance • Business reputation	• Financial payment capacity • Management ability • Business reputation	• Contractor's management ability • Employee talent • Business reputation • Construction technology, equipment
Contractor	• Quality: • Technology • Equipment • Management, and service	• Developer's construction purpose • Financial payment capacity • Business reputation	• Developer's talent • Construction method and technology • Management ability and instruments, material quality	• Developer's business reputation • Financial payment capacity

Adapted from [75]

Risk

Risk can be viewed as deviation from anticipation [12]. Construction projects are one-off endeavours characterized by extended duration, complicated processes, resources laden and dynamic management [66]. Risks arising from the hostile working environment may materialize at any time of the project. These risks can cause cost inflation, time delay, substandard quality and safety hazard during construction. In some cases, environmental disaster may result [79, 80].

Risks in construction projects can hardly be eliminated. Typically risks are shared or transferred among the contracting parties [1]. Risks can be broadly categorized as environmental and behavioural [77, 80].

Environmental risks refer to those often caused by the changes of the natural, economic, social, legal, and technological environments., like unforeseeable physical conditions and cost fluctuation because of the market. Theoretically, environmental risks should be distributed between and shared by the two parties [34]. Behavioural risks are resulted from the behaviours of the contracting parties [34]. Some examples include delayed payment caused by the developer or delayed information of the project reported by the contractor. Theoretically, each party should take responsibility for the risks caused by themselves respectively.

Equitable risk allocation between construction contract is pivotal in putting parties on a cooperative working platform [14]. Several principles of allocation have been advocated. The most commonly used is the set of principles proposed by Abrahamson [2]. Essentially, risk allocation should observe the principles of foreseeability, manageability and controllability [55]. When faced with uncertainties, developers typically would avoid risk as far as possible by allocating most of the risks to the contractor [14, 76]. Procurement through competitive tendering and the lowest price selection are very common for construction projects. Contractors are therefore often in an ex ante disadvantaged position with little bargaining power over the terms of the contract. However, unilateral risk shifting to contractor occurs in many contracts. Zhang et al. [77] collected data from 284 Chinese project professionals and showed that some environmental risks are indiscriminatingly shifted to the contractor. It was further found that pro-employer contractual terms would backfire when contractor choose to practice opportunism ex post.

Inequitable risk allocation in construction contracts impedes cooperative behaviour and is one of the underlying causes of dispute [13, 14]. Similarly, an investigation of the construction industry in Canada and United States found that one major cause of construction disputes is inappropriate risk allocation [76].

Return on Efforts

Williamson [73] explained that the differential of expected return comes from the dependence asymmetry. Dependence Theory [31] explains that people evaluate outcomes as gains or losses with reference to certain yardsticks. The extent of deviation from the yardstick will affect their devotion to their responsibilities. For example, if the added value is expected to be squeezed from the most contributing party, he or she would choose to take conservative actions to prevent further widening the deviation. AS also has a part to play, the party who is less dependent on the other will have the chance to direct whose interest shall take priority thereby aggregate the imbalance. When the contractor is threatening to suspend work if no extra compensation is provided. The developer would to weight which option will cost more: determine the employment of the contractor and conceding to the demand.

Power

Emerson [31] defined power as the resistance offered by participant A to overcome domination by participant B in a relationship. It can also be characterized as the ability to influence, control or restraint others. Power is an attribute of position in a network and is identified by the participants' behaviour [20]. The presence of asymmetry and imbalance of power is common in contractual relationship [23, 22]. In construction where contracting parties are highly interdependent, the issue of power differential is more acute [32]. Interdependence asymmetry occurs when one party holds power advantage over the counterpart. Inter-organisational power can be unilateral (sanction) or bilateral (bargaining) [38].

a. Sanction Power

Sanction power is used primarily to penalise nonconformance of the specified. Its use serves to influence others by the damage that could be caused by the sanction. In construction contracts, unilateral sanctions are mostly punitive and can be exercised as of right [61]. For the developer, unilateral sanction of levy like damages and contract changes are notable examples of control over the contractor [6]. Moreover, wrongful sanction can be challenged in the form of dispute. The most powerful sanction is determination of employment [18]. At the early phase of a construction project, the developer usually has power advantage as the switching cost is relatively low. With input of contractor increases, the developer becomes less flexible with the increasing transaction costs of re-tendering and the extra costs resulting from removal of a 'defaulting' contractor. As classical example of asset specificity [73] in construction, exercising determination may inflict more harm to the developer especially at the later part of the project [11].

b. Bargaining Power

Bargaining power can expressed by the extent to which one party would inflict concession by the counterpart [10]. Bargaining power is derived from ownership or control of scare resources that the other side needs [20]. In negotiation, bargaining power can be exercised by the ability of depriving the counterpart values that he possesses or by obstructing the attainment of desired values [70]. Bargaining power aims to achieve one's own benefits by exploiting the differentials between [20].

In construction, because of the competitive tendering and lowest bid selection, developer usually has greater bargaining power as compared to the contractor at the bidding stage [49]. In order to obtain the contract, the contractor is willing to compromise in the contract price negotiation. At the construction stage, bargaining power swings towards the contractor as physical work proceeds. Hold-up problem occurs and the developer becomes vulnerable in ordering changes [11]. Capitalising on the sunk cost of re-tendering [73], contactor might exploit the vulnerability of the developer. Winch [74] described this as 'opportunistic margin' for the contractor. If the opportunistic behaviour costs less than the cost of switching, the developer would concede to the demand of the contractor [9]. This situation becomes acute when the project reaches critical stage where delay will hurt the developer dearly [11, 59].

Based on the afore-stated theoretical deliberations, the elements of EG in construction contracting are summarized in Table 2.

The potential effects of EG on contracting performance can be discussed from two perspectives: (1) EG inhibits inter-organizational relationship development; and (2) EG reduces project efficiency. There is a strong preference for fairness in human interaction. People who have experienced unfairness tend to react with anger, resentment and loss of motivation [49]. Achieving fairness is also considered important in developing inter-organizational relationship [58]. If one party takes advantage of the imbalance of status and deliberately widen these gaps, mistrust between them will grow [76]. Das and Teng [24] observed that the weaker party often practices

Table 2 Theoretical bases of EG in construction contracting

	Certainty of risks	Information ownership	Expected return	Power	Key references
Agency theory	√	√			[30]
Prospect theory	√		√		[50]
Transaction cost theory	√		√		[72]
Social exchange theory				√	[32]
Power-dependence theory				√	[31]

opportunism and thereby triggers defensive reaction of the counterpart. All these behaviours would lower the overall project efficiency. Some contractors may build in high risk premium in their bids to insure against potential losses. However, this act may lower their chance of getting the contract. Instead, pursuing post-contract claims to maximise their returns is often adopted. Developers and consultants often find claim conscious contractors offensive. As such, having a harmonious working project team is unlikely. The potential damages due to EG between developer and contractor are summarized in Table 3.

Table 3 The potential damage of EG on construction contracting

Elements of EG	Consequences		References
	Inter-organizational relationship	Project efficiency	
Information	Mistrust Uncertainty of other parties' behaviour	Hamper innovation Cost wastage for information obtainment	[36, 53, 75]
Risk	Mistrust Unwilling to cooperate	Hamper innovation	[28]
		Cost wastage and disputes	[76]
Return on efforts	Less devotion to the project Opportunistic behaviour	Hamper innovation Disputes	[73]
Power	Impede commitment behaviour Withdrawal behaviour	Impede concessions and agreements Disputes	[32] [54]

Conceptualizing EG in Construction Contracting

Key Elements of EG: Empirical Findings for a Pilot Case Study

A pilot case study was first conducted to explore the existence of EG in a real project, the Hong Kong-Zhuhai-Macau Bridge (HZMB hereafter). In this regard, Zhu et al. [78] found that effective management measures by the HZMB Authority can enhance inter-organizatioanl comuunication. This had effectively narrowed information asymmetry created ex ante. Likewise, the HZMB project offereed a valued opportuntity to test the existence of the elements of EG (Table 3).

This pilot case study interviewed 20 senior construction project participants of the HZMB project. Among the 20 interviewees, half worked as developer and the remaining as contractor. A questionnaire was set to collect their viewpoints about EG. The interviewees were asked to indicate their view on the degree of EG in a Likert Scale 1–7. Using the quality risks as an example, template of the questions is listed in Table 4. Two evaluations one at commencemnt and one near the completion were done to identify the changes of asymmetries.

The results of Part one is shown in Table 5. The positive score implies that the Developer had the advantage while negative score means that the interviewees believed that contractor had advantage instead.

Table 4 Questionnaire template to measure the equity gap between developer and contractor

No.	Description	The position of your engaged party	Degree of asymmetry Low–High
A. At the commencement of the project			
A.1	The distribution of the risks		
A.1.3	Quality risks	Advantage/disadvantage/same	0 1 2 3 4 5 6 7

Table 5 The data and the changes of EG

No.	Description	Stage of the project		Ratio (%)
		Commencement	Completion	
A.1	*Risk*	*3.14*	*2.46*	*−22*
A.1.1	Environmental risks	1.36	1.29	*−5*
A.1.2	Behaviour risks	2.79	2.14	−30
A.2	*Power*	*4.93*	*4.18*	*−15*
A.2.1	Sanction power	5.14	4.43	−14
A.2.2	Bargaining power	4.71	3.93	−17
A.3	*Return on efforts*	*2.29*	*3.71*	*+63*
A.4	*Information*	*4.43*	*3.43*	*−23*
	Total			**−**37

Observations from the responses of the interviewees:

(1) It is agreed by all the interviewees that there are disparities between developer and contractor throughout the project duration. The existence of EG elements was basically confirmed.
(2) Comparatively, Developer was in better position than the contractor in terms of risk, power, expected return and information. Power and information asymmetry are more notable. This is not surprising as most construction contract are organised to provide developer these relative advantages.
(3) Sanction and bargaining power have the most notable asymmetry in level of EG through the project. At the beginning of the project, power has the highest asymmetry (4.93) while expected return has the lowest (2.29). Information (−23%) and Risk differential (−22%) present the most significant drop when comparing the evaluations between the commencement and completion stage of the project. The change of power asymmetry takes the second place (−15%). Developer has the dominating power throughout the project. Expected return in efforts is the only element that had increased as the project unfolds. The interviewees explained that it was due to the fact that the developer has dominant sanction power and thus has overwhelming influence over the final payment, thus expected return asymmetry aggregates at completion of contract.

The general view of the interviewees is that they do recognize the existence of EG. The level of disparity does change as the project unfolds. The nature of disparity decides that some had narrowed while others had widened. This phenomenon corresponds to the projection of influence of asset and process specificities under transaction cost economics theory [72]. That means the contractor became more influential with the progress of physical works.

To further analyse the elements of EG, a comprehensive literature review suggested the inclusion of identifications of the EG elements that are summarised in Table 6.

Conceptual Framework of EG

The conceptual framework of EG is then developed in Fig. 2.

Empirical Testing of the Framework

A Partial Least Square-Structural Equitation Modelling (PLS-SEM hereafter) based analysis was conducted to test the robustness of the framework. Data were collected through a questionnaire that has 2 parts. Part 1 is about the personal particulars. In Part 2, the respondents were asked to recall a project they have been involved in for at least 1 year as either Developer or Contractor. All the measurement items developed

Table 6 Identifications of EG elements

1.	Information		
1.1	Project details	In the bidding stage, Developer had more information about project details	[75]
1.2	Adverse selection	In the bidding stage, Developer had an information disadvantage about the contractor's ability	[65, 75]
1.3	Project performances	In the construction stage, Contractor had an information advantage relating to market changes	[75]
1.4	Moral Hazard	In the construction stage, Developer cannot monitor all the detailed Contractor's behaviour relating project performance	[65, 75]
2.	Risks: the allocation of the following risks in contract favour the Developer		
2.1	Environmental risks		[77]
a.	Unforeseeable physical conditions		
b.	Cost fluctuation (inflation of prices)		
c.	Adverse climatic conditions		
2.2	Behaviour risks		
d.	Defective design by owner		
e.	Delayed payment		
f.	Delayed instructions or information		
g.	Access to site		
3.	Return on efforts		
3.1	Unequal sharing of project surplus	At the beginning of the project, the returns or rewards for one party were unfair in view of his contributed resources to the project	[48] [72]
3.2		For this project, one party's profit was squeezed when there are additional profits	[10] [72]
3.3		For this project, one party beard more losses when there are unforeseeable losses	[72] [10]
4.	Power		
4.1	Sanction power		
a.	Asset specificity	The unilateral termination behaviour had more threatens to one of the parties	[11]
b.	Power for project control	For project disputes, for one party, unilateral decisions could serve as weapons against another party to achieve their own goals	[6]

(continued)

Table 6 (continued)

c.	Coordination failure	During construction procedure, one party was unwilling to cooperate for events which are critical to the other party	[37]
4.2	Bargaining power		
a.	Process specificity (ex-ante)	Comparing two parties, in bidding stage, one party used to feel more constrained and sacrificed in negotiation of contract price because of foreseeable losses	[10]
b.	Process specificity (ex-poste)	Comparing two parties, in construction stage, one party used to feel more constrained and sacrificed in renegotiation of contract price and interim payments because of foreseeable losses or disputes	[10] [47]
c.	Hold-up problem	Comparing two parties, one party used to feel pressure to agree a claim value beyond the 'true' cost of the additional change of work	[10]
d.	Time specificity	It is posited that making a compromise in a short time was needed for one party as the time pressure of switching partner and value loss at some critical moment of the project	[59] [10]

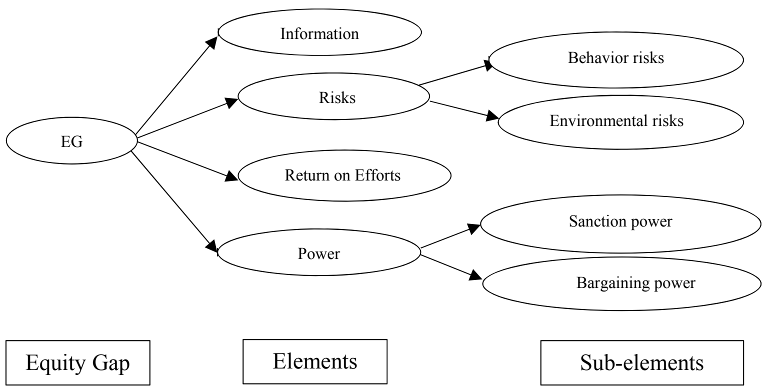

Fig. 2 A conceptual framework of EG in construction contracting

from theories were converted into questions (Table 6). They were asked to indicate in a Likert Scale of 1 (Strongly disagree) to 7 (Strongly agree). Their level of agreement of the statement represent the extent of happening of the EG identifications during the project. Confirmatory Factor Analysis (CFA hereafter) was applied to examine statistically the relationships as shown in Fig. 2.

SEM is a family of statistical models that seek to explain the relationships among multiple variables for CFA. It examines the structure of interrelationships expressed in a series of equations, similar to a series of multiple regression equations [41]. PLS-SEM is applied in this study because it is more flexible on the theoretical bases and also comparatively suitable for small sample size [42].

In view of the complex component structure of the four EG elements, applying hierarchical component model (HCM) is also necessary. Establishing higher-order models or hierarchical component models (HCMs) are usually referred to in the context of PLS-SEM. It is also important to verify the measurement framework first before analysing the relationships between different factors [51]. Testing second-order models that contain two-layer structure of constructs are often involved [71].

There are three main reasons to include HCM in a PLS path model [42]:

a. Reduce the number of relationships in the structural model;
b. Prove valuable if the first-order constructs are highly correlated;
c. Prove valuable if formative indicators exhibit high level of collinearity, and discriminant validity may not be established.

The HCMs are also divided for reflective and formative measurement models. The major difference between these two types is the contributions of the indicators in forming the construct and measures [26]. Reflective indicators can be viewed as representative sample of possible items available within the conceptual domain, which may be relevant with each other. In contrast, formative measurement is based on the assumption that all causal indicators form the construct are interdependent and considered as linear combinations [42]. Research also suggests that formative measurement is not an equal attractive alternative to reflective measurement in developing new measures or choosing among alternative existing measures [46]. In this study, the reflective measurement model is therefore selected.

Data Collection and Analysis

Personal Particulars

Over 300 questionnaires were distributed, and 106 valid responses were received. The response rate is about 30%. It is reasonably close to the median rate (35.7%) of the survey conducted in the United States for 1607 organizational academic studies [29]. The response rate of questionnaire survey is also similar to the relevant studies conducted in the construction industry studies that are usually ranged from 25 to 30% [29]. Therefore, the response rate for this study is considered acceptable. Table 7 summarizes the personal particulars of respondents.

Table 7 shows that the respondents cover the typical roles in construction projects and include management and professional staff. There are about equal number of respondents working in developer and contractor. The data is therefore useful to

Table 7 Personal particulars

No.	Description	Number	%
1.1 Your position			
1	Management staff	34	32
2	Professional staff	72	68
1.2 Working experience			
1	<5 years	22	21
2	5–10 years	28	26
3	11–20 years	36	34
4	>20 years	30	28
1.3 Your organization			
1	Developer	59	56
2	Contractor	47	44
1.4 Your counterpart			
1	Developer	47	44
2	Contractor	59	56

examine if there is any inter group differences. Q1.4 is used to countercheck if the respondents understand the study arrangements. The result shows that all these 106 responses were valid. The result shows that the feedbacks are reasonable.

PLS-SEM Analysis

a. Data Description

The relevant identification items of Table 6 were operationalized as measurement statements. Respondents need to indicate from a Likert Scale of 1 (Strongly disagree) to 7 (Strongly agree) how accurate the statement represent the happening of the project. The descriptive statistics are shown in Table 8.

Table 8 gives the general descriptive statistics of the data. It was found that most of the mean score of information, risk, return on efforts, are above 4 (out of 7). This suggests that the respondents agree in general the existence of the EG identifications in the respective project they have participated. Q2.17 has the lowest mean score (3.74) and it is lower than the neutral score of 4. It means that the respondents tend to agree that contractors are willing to cooperate in the construction period. Because the developer often has the dominant power in many contractual and management procedures, contractors would find opportunities to express their discontent and adopting a cooperative behaviour. Q2.21 has the highest mean score (4.93). Both the developer and contractor groups agree that asset specificity asymmetry is significant at some critical moment during the construction procedure. Furthermore, the K-W test result suggest there is no significant group differences between Developer and Contractor.

Table 8 Measurement statements and descriptive statistics

No	Equity gap		Min	Max	Mean	Std
	Elements/sub-elements	Identifications				
Q2.1	Information	At the bidding stage, the developer had an information advantage about the project details	3	7	4.89	1.05
Q2.2		At the bidding stage, the developer had an information disadvantage about the contractor's ability	1	7	4.08	1.15
Q2.3		At the construction stage, the contractor had an information advantage relating to market changes	3	6	4.62	0.95
Q2.4		At the construction stage, the developer could not monitor comprehensively the Contractor's behaviour relating project performance	1	7	4.05	1.39
	Risks	The allocation of the risks in the contract favoured the developer in terms of				
Q2.5	Risk (environmental risk)	Unforeseeable physical conditions	2	7	4.58	0.98
Q2.6		Cost fluctuation (inflation of prices)	1	7	4.02	1.30
Q2.7		Unforeseeable loss because of adverse climatic conditions	2	6	4.13	0.9
Q2.8	Risk (behaviour risk)	Unforeseeable loss because of defective design	1	7	4.14	1.31
Q2.9		Time for payment	2	6	4.19	0.96
Q2.10		Time for providing information/instructions	1	7	4.32	1.12
Q2.11	Return on efforts	At the bidding stage, price competition was fully leveraged to drive down contractor's profit	2	6	4.59	1.06
Q2.12		The return for one of the parties was not commensurate to his contribution in resources to the project according to the contract	2	6	4.11	0.75

(continued)

Table 8 (continued)

No	Equity gap		Min	Max	Mean	Std
	Elements/sub-elements	Identifications				
Q2.13		At the construction stage, return for changes was not commensurate to his contribution in resources to the project	2	6	4.38	0.90
Q2.14	Sanction power	At the construction stage, unilateral termination by the contractor presented greater threat than the developer	1	6	4.27	1.01
Q2.15		Unilateral decision authority over project dispute had been the major weapon used by the developer to achieve his own goals	1	6	4.24	1.13
Q2.16		At the construction stage, the developer was unwilling to cooperate for events which are critical to the contractor	2	7	4.04	0.84
Q2.17		At the construction stage, the contractor was unwilling to cooperate for events which are critical to the developer	2	6	3.74	0.91
Q2.18	Bargaining power	At the bidding stage, the contractor felt more constrained and sacrificed in negotiating contract terms in relation to compensation for foreseeable losses	3	7	4.47	1.06
Q2.19		At the construction stage, the developer felt more constrained and sacrificed in renegotiation of contract terms in relation to compensation for foreseeable losses or disputes	1	6	4.43	1.05
Q2.20		The developer felt being forced to settle claims below his entitlements for change of work	2	6	4.18	0.85

(continued)

Table 8 (continued)

No	Equity gap		Min	Max	Mean	Std
	Elements/sub-elements	Identifications				
Q2.21		Making compromise was needed for the developer in view of the time pressure in switching contractor	3	6	4.93	0.83

b. PLS-SEM Analysis

SmartPLS3 software was applied to estimate the framework. The evaluation procedure followed the guidelines of PLS-SEM analysis [42]. Applying a 5% significance level the significance of the path coefficients was all tested by bootstrapping with a 5000 subsample. The one-tail t-test was also used to test the hypotheses. For $p > 0.05$, the null hypothesis is rejected. Figure 3 shows the PLS-SEM analysis result.

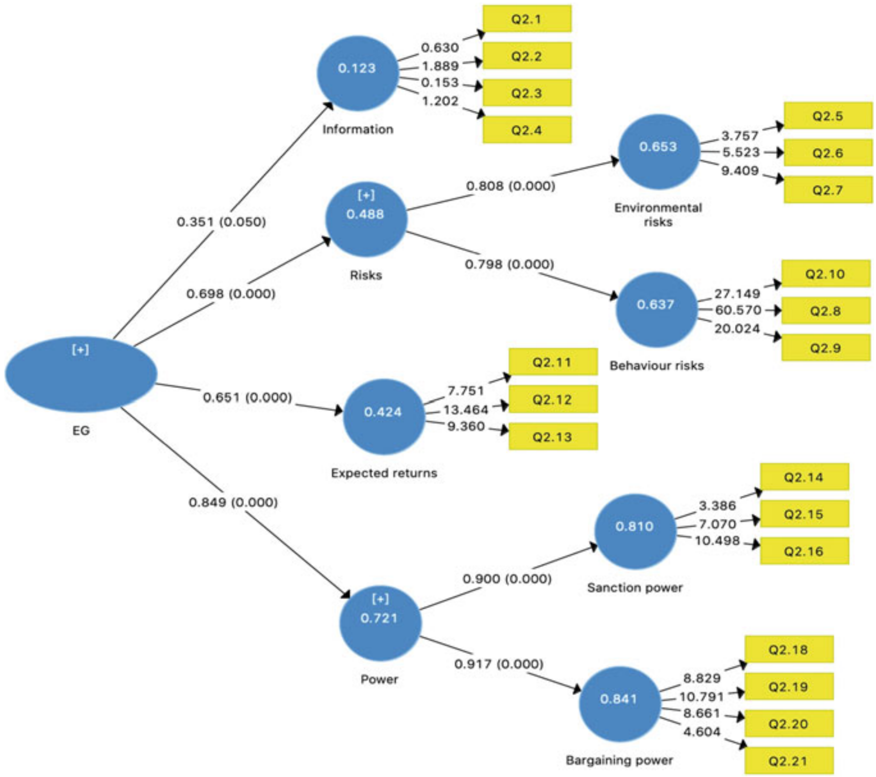

Fig. 3 PLS-SEM analysis of the EG framework

The robustness of the framework is also assessed by examining the criteria of PLS-SEM analysis [42]:

(1) Common Method Variance (CMV). As the measuring constructs were all measured in a one-time questionnaire, common method variance (CMV) problem may exist which could affect the hypothesised relationships in the structural model. It is suggested that CMV exists if a significant factor is found to explain over 50% of the variance for all variables in factor analysis [41]. The results indicate that the factor only explained 21.01% of the variance. The results suggest that CMV unlikely affects model evaluation.

(2) Internal consistency reliability (Composite Reliability) and Average Variance Extracted (AVE). Cronbach's alpha (α) is widely used to assess internal consistency of the construct. Threshold value of 0.7 is suggested by Davcik [25]. For PLS analysis, composite reliability is a more appropriate measure for internal consistency [42]. Composite reliability of all constructs should satisfy the threshold of 0.70 [42] and 0.60 is acceptable [25]. To establish convergent validity, researchers consider the outer loadings of the indicators, as well as the Average Variance Extracted (AVE) [40]. The general acceptable AVE should be higher than 0.5 but 0.4 is still adequate when the composite reliability is higher than 0.7 [35]. The Composite Reliability and AVE are shown in Table 9.

(3) R^2 Value, f^2 Value and predictive relevance Q^2 are the mostly used measures to evaluate the fitness of the structure model. R^2 is a measure of the model's predictive accuracy and is calculated as the squared correlation between a specific endogenous construct's actual and predicted values [42]. Falk and Miller [33] suggested that R^2 and adjusted R^2 values greater than 0.10 are acceptable. Effective size f^2 is used to further evaluate all endogenous constructs. Its objective is to evaluate whether the omitted construct has a substantive impact on the endogenous constructs.

(4) Cohen [19] has suggested the use of Q^2 value of 0.02, 0.15 and 0.35 to indicate weak, medium or strong effects, respectively. Also, to further evaluate

Table 9 Composite reliability and average variance extracted (AVE)

	Cronbach's Alpha	Composite reliability	Average variance extracted (AVE)
Equity gap	0.78	0.82	0.42
Information	0.63	0.63	0.47
risks	0.67	0.79	0.54
Environmental risks	0.59	0.79	0.56
Behaviour risks	0.86	0.91	0.78
Return on efforts	0.81	0.89	0.73
Power	0.75	0.82	0.43
Bargaining power	0.60	0.77	0.46
Sanction power	0.53	0.76	0.53

the magnitude of the R^2 values, the Stone-Geisser's Q^2 value is examined [42]. This value is obtained by means of the blindfolding procedure, estimates the model parameters, and predicts the omitted part by using the previously computed estimates. The smaller the difference between the predicted and the original values, the greater the Q^2 value [63]. Since Q^2 values greater than 0 indicate predictive relevance for a certain endogenous construct, the relevance is considered as small, medium, and when the respective values are 0.02, 0.15 and 0.35. Table 11 shows the predictive relevance Q^2 of the constructs used in this study. The Q^2 value are all acceptable on a reasonable level. Table 10 shows all the analysis results.

(5) Heterogeneity. Heterogeneity occurs when different groups of data show significant differences in terms of model parameters. For example, the Developer and Contractor may hold different view towards different questions. A Multi-Group Analysis (MGA hereafter) is developed to investigate the differences between different observed groups. For the non-parametric data, PLS-MGA is applied [43]. Group analysis between Developer and Contractor was conducted. The results are presented in Table 11. There are no significant differences (p value under 0.05) detected between these two groups.

Discussions and Recommendations

The proposed EG framework (Fig. 2) is supported by the PLS-SEM analysis statistically. As such, the elements of EG are considered well placed. Power (0.849) is the most notable element. Bargaining power (0.917) is having a higher contribution to EG than sanction power (0.900). For bargaining power, the most relevant is Q2.18: "At the bidding stage, the contractor felt more constrained and sacrificed in negotiating contract terms in relation to compensation for foreseeable losses". It shows that at the biding stage, contractor is at an inferior position. Q2.16 is the most influential factor in sanction power: "At the construction stage, the developer was

Table 10 R^2 value, effect size f^2 and blindfolding results

	R^2	R^2Adjusted	f^2	SSO	SSE	Q^2 (=1 − SSE/SSO)
EG				2120	2120	
Information	0.123	0.115	0.141	424	417.61	0.12
Risks	0.488	0.483	0.952	530	426.96	0.19
Environmental risks	0.653	0.65	1.885	318	212.31	0.33
Behaviour risks	0.637	0.633	1.752	318	168.46	0.47
Return on efforts	0.424	0.418	0.735	318	228.82	0.28
Power	0.721	0.718	2.584	742	546.67	0.26
Sanction power	0.841	0.84	4.275	318	189.24	0.41
Bargaining power	0.81	0.809	5.308	424	268.90	0.37

Table 11 The MGA result between developer and contractor

	Path coefficients-diff (Developer − contractor)	t-value (|Developer vs contractor|)	p-value (Developer vs contractor)
EG → Expected returns	−0.011	0.058	0.954
Power → Sanction power	−0.008	0.151	0.881
EG → Risks	−0.097	0.182	0.856
Risks → Environmental risks	−0.04	0.303	0.763
EG → Power	−0.102	0.314	0.755
EG → Information	−0.129	0.52	0.606
Risks → Behaviour risks	0.2	1.241	0.221
Power → Bargaining power	0.063	1.358	0.181

unwilling to cooperate for events which are critical to the contractor". Comparatively, the contractor gradually takes the dominant position at the construction stage.

Return on efforts and risks are also relevant when addressing EG between Developer and Contractor. The unequal distribution of returns is reflected by the responses. For risks, greater influences are found for the differential of environmental (0.808) and behavioural risks (0.798). Comparatively, information asymmetry has the lowest contribution to EG among the four elements.

The PLS-MGA result shows no significant difference between the developer and contractor group. Both groups thus share similar view about the existence of EG elements. As both groups are commercial based, opportunistic behaviours may happen to maximise their own interest should circumstances allow. With EG being one of the contextual enablers, unrestrained opportunistic behavers would lead to serious dispute [16].

The findings of this study also suggested that EG should be addressed to alleviate the chance of happening of dispute during construction. For example, at the contract planning stage, identifying the extent of EG is the first step to devise strategies to install a perception of fairness. Corresponding strategies should be put forward based on different project nature and characteristics. The following possible quasi-contractual arrangements are suggested:

(1) Setting relational incentive to balance power differential

Equity concerns and emergent interpersonal commitments would constrain and impede the use of power [20]. Status recognition was proposed as an effective strategy by Power Dependence theory [31]. To alleviate EG, the party with power advantage should make higher motivational and relational investments towards the party with less power [31]. The recognition including aligned goal commitments [12]; shared relational attitudes [68]; offer mutual support and developing mutual trust [60]. For example, developer can set incentive schemes at the contract planning stage as additional payment to compensate the additional 'risks' the contractor is taking to reach a more balanced risk ownership. Instead of exercising power to suppress potential retaliation, recognising the risks taken by the contractor and with reasonable return on running the risks would prevent further deterioration of their relationship [21].

Furthermore, relational investment aims to let the weaker party to be better recognized and increase the sense of engagement in this relationship. Similarly, offering status cognition is also suggested by Stewardship Theory [27]. The differences between Agency theory and Stewardship Theory is the degree of participation of the agent in decision-making. Stewardship Theory further suggests giving more support and freedom for the agent to manage effectively the transaction [27]. The improved bargaining power should have positive impacts on collaborative working and trust building.

(2) Allowing reallocation of risk and return as deemed necessary and appropriate

Under classical contract theory, contract terms cannot be adjusted unless the parties agree to establish supplemental agreement for the proposed changes. Moreover, when a project is facing great uncertainties, frequent use of supplemental agreement is not efficient. Alternatively three instruments are suggested: establishing common targets, reducing information asymmetries, and reallocating risks [65]. *Ex post* revision in profit sharing is found as an inducer for contractors to align their goals with those of the developer. Allowing reallocation of risks would also change the risk attitude of project participants. In terms of crest for long-term improvement, realignment of innovation risks can be the turning twist to promote creativity [7].

(3) Enhancing tasks programmability for ease of monitoring and evaluation

For information asymmetry, improve observability is one way to reduce moral hazard [30]. Based on Agency theory, tasks should be detailly programmed to facilitate the observability of the agent's compliance or otherwise [44]. It is because the behaviour of agents engaged in more programmed jobs is easier to be observed and thus evaluated. Therefore, the more programmed the tasks, the more attractive are behaviour-based contracting and information about the agent's behaviour is readily determined [30]. Highly programmed tasks can also reduce indeterminacy [45] and increase the accuracy of outcome evaluation [72]. In construction, using more tangible objective targets and milestones are instrumental. In fact, the strategy is commonly used in setting targets of incentive schemes. Hopefully the aligned common interest would encourage the contractor to share progress information. The information exchange is therefore embodied and beneficial for the communication of two parties. Nonetheless, it is admitted that specifying objective standard remains a challenge.

Summary

Contractors often enter into contracts that are notably inequitable in terms of risks and responsibilities. Retaliatory responses are common ex post and, in many instances, have led to dispute [16]. In this study, equity gap (EG) is used to describe the differentials created ex ante between the developer and the contractor. This study contributes to construction dispute research by analysing the roles of EG in cultivating disputes. The objectives of the study include: (i) identifying elements of EG between developer and contractor; (ii) developing a conceptual framework of EG; and (iii) suggesting measures to address EG.

Through literature review, four EG elements in construction projects are identified: information, risk, power and return on efforts. To develop the conceptual framework of EG, a pilot case study of the HZMB project was first conducted. Through structured interview with 20 project participants it was found that developers are in general having the upper hand position for all the four EG elements. The interviewees agreed that all these elements did exist in the HZMB project. The most notable element is power and is represented by sanction and bargaining power. The conceptualisation of EG was systemised by arranging the elements into a framework. This representation enabled statistical testing of the framework. Data were collected from 106 senior project professionals working for developer or contractor. The conceptual framework was validated through PLS-SEM analysis. No significant differences were detected between the developer and contractor group. The strength of the relationship links of the framework inform the respective level of contribution towards EG. With these, the following recommendations are put forward: (a) setting relational incentive to balance power differential; (b) allowing reallocation of risk and return as deemed necessary and appropriate; and (c) enhancing tasks programmability for ease of monitoring and evaluation. Collectively, it is anticipated that by addressing EG, the chance of having disputes arising from retaliatory behaviours of contractors would be reduced.

Acknowledgements The empirical work of this chapter has been reported in a paper entitled "Equity Gap in Construction Contracting: identification and ramifications" of the Journal of Engineering, Construction and Architectural Management. The funding support of a CityU SRG (project no. 7005557) is duly acknowledged.

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