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Perception of various performance criteria by stakeholders in the construction sector in Hong Kong

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All construction projects in Hong Kong have in common a cast of key contract participants, consisting of clients, consultants (designers) and contractors. The aim of this research is to examine, from different points of view, these practitioners in regard to the importance of perceived performance criteria and their respective performance outcomes in a construction project. A research model is structured based on nine performance criteria and their respective performances. The data were collected from 324 practitioners who have participated in construction projects in Hong Kong. One-way analysis of variance (ANOVA) and repeated measures ANOVA are used to analyse the data. The relative importance of nine performance criteria and their performances are measured. Timely completion of the project is the most important performance criterion, followed by profit, environmental protection and quality. There are differences in the importance of the performance criteria with respect to performance. The differences in the perceptions of performance that are identified are: (i) among different practitioners in a construction project; (ii) due to different project types; and (iii) between different functional roles in the partnering organizations. In order to further understand the importance of the performance criteria with respect to performance, the status quo of project partnering and congeniality problems in the construction industry is reviewed. It is intended to stimulate interest in the further exploration of solutions to improve the overall performance of the construction industry in Hong Kong.

Keywords: Performance improvement, performance evaluation, partnering, supplier relationship, performance criteria.

Introduction

At the beginning of construction projects, various targets are set as 'performance criteria' to be achieved among the key contract participants, consisting of clients, consultants (designers) and contractors. However, different participants have their own perceptions of various performance criteria, and they perform differently according to their perceptions. The aim of this study is to examine, from different points of view, these participants in regard to the importance of the perceived performance criteria and their respective performance outcomes in a construction project. The differences between the levels of importance of the performance criteria and their respective performance outcomes represent areas for the improvement of performance, which these participants should address.

In the present study, nine specific performance criteria are used; they are: (1) profit; (2) time; (3) no claims or contractual disputes; (4) job satisfaction; (5) quality; (6) safety; (7) environment; (8) generation of innovative ideas; and (9) effectiveness. A research model was formulated to test the significant difference between these performance criteria with respect to their performance. There are also tests available to assess the performance of these performance criteria from the perspective of the respondents in different roles (i.e. clients, consultants and main contractors); the types of construction projects (i.e. government, public/private utility and private development); and different functional roles of the staff within the organization (i.e. managerial, frontline supervisory and consultancy staff). This research was conducted through a questionnaire survey with construction practitioners in

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Hong Kong. The overall discussion that follows is based on the results of the statistical analysis of the performance criteria and their respective performances as well as the major differences between the different perspectives of the participants. There are significant differences between the performance criteria with respect to performance, and conclusions are drawn from patterns noted in these results. This study indicates some areas for the improvement of performance. The limitations of this research and further research opportunities will be identified.

Theoretical background

Definition of performance criteria

'Performance criteria' are commonly shared mechanisms for monitoring and demonstrating project success (Krima *et al.*, 2007). Their use allows practitioners to understand their competitive position better and potentially to improve their performance (El-Mashaleh *et al.*, 2001). By looking at the deviations between the levels of importance of the performance criteria and performance outcomes, practitioners can review whether certain criteria underperform or overperform (Soetanto *et al.*, 2001). Ideally, performance outcomes of the performance criteria should be on a par with their normal performance, or, even better, their so-called 'optimum performance', which are satisfactory to practitioners.

Performance criteria of a construction project

Atkinson (1999) stated that time, cost and quality make up the 'iron triangle' for project success. Loosemore *et al.* (2003) highlighted the importance of job satisfaction for the well-being of the construction industry. Fenn (2006) listed the typical performance criteria of commercial projects: time, cost, quality, project delays, delay claims, scheduling, monitoring and control. Lam and Wong (2009) argued that safety is a measure of project performance, as well as time, cost and quality. After reviewing the literature, nine performance criteria were selected:

(1) *Profit*. Norris (1990) measured profit as the increment by which revenues exceed cost. Profit in terms of cost benefits has been identified as a key performance indicator (KPI) (Beatham *et al.*, 2004). Cost benefits can typically be achieved by savings and the early completion of projects (Soetanto *et al.*, 2001).

(2) *Time*. Time refers to the duration for completing a project (Chan and Chan, 2004). Time, cost and quality are the key factors a project team considers to be relevant in the pursuit of successful project delivery (Swan and Khalfan, 2007). Construction delays not only result in cost overruns and poor quality, but lead to increased disputes (Al-Khalil and Al-Ghafly, 1999). Odeh and Battaineh (2002) observed that most claims cases are related to the time of the project delivery.

(3) *No claims or contractual disputes*. It has been observed that the adaptive ability to manage changes without unnecessary claims is often critical in the routine assessment of subcontractors' performance (Mbachu, 2008). The absence of claims or contractual disputes is a fair indicator of project success (Chan and Chan, 2004).

(4) *Job satisfaction*. Job satisfaction refers to the extent to which persons gain enjoyment or satisfaction from their efforts at work (Fogarty, 1994). It is a 'soft' measure, and has often been benchmarked with a company's performance (Beatham *et al.*, 2004). Pinto and Pinto (1991) advocated that measures for project success should include project psychosocial outcomes, which refer to the satisfaction of interpersonal relations among project team members.

(5) *Quality*. Quality is defined as the degree to which general conditions promote meeting the project's established requirements for materials and workmanship (Bubshait and Almohawis, 1994). The improvement of quality can reduce the resources and costs that must be devoted to reworking, which, when reduced, increases profitability (Ling *et al.*, 2009). The costs of rectifying defects and reworking have been estimated to be as high as 6.2% and 12%, respectively, of the profit for a construction project (Thomas *et al.*, 2002).

(6) *Safety*. Safety is defined as the degree to which general conditions promote the completion of a project without major accidents or injuries (Bubshait and Almohawis, 1994). Accidents during a project can be detrimental to the project in terms of time, costs and the reputation of the company (Chan and Chan, 2004).

(7) *Environment*. Environmental issues, such as waste management and public nuisance, have been regarded as negative environmental impacts on construction (Shen *et al.*, 2000). Considerable attention has been directed towards finding out how to minimize construction waste and restrict environmental nuisance (Wong and Chan, 2000). Companies invest in the improvement of environmental protection because of cost factors (Tam *et al.*, 2001; Shen

and Tam, 2002). For example, energy-efficient design allows *both* environmental friendliness and cost effectiveness across the project life cycle (Yao *et al.*, 2006).

(8) *Generation of innovative ideas*. Innovation is the actual novel use of a non-trivial change and improvement in a process, product or system (Slaughter, 1998). Innovation in construction leads to the improvement of working conditions, lowering construction costs, and decreasing construction time (Eaton *et al.*, 2006) so as to improve efficiency in the industry (Egbu, 2004).

(9) *Effectiveness*. Effectiveness is a characteristic of the overall performance of a project, in terms of whether it is being carried out within the budget, performed on schedule, and maintaining quality (Love *et al.*, 2004). Project effectiveness is dependent on conceptual level, skills and communicative abilities (Goodwin, 1993), which are important factors that affect project success (Krima *et al.*, 2007). Practitioners always intend to *continually* improve the effectiveness of the work process (Naoum, 2003).

Research method

Research model and research questions

A research model is developed to examine, from different practitioners' points of view, the levels of importance of the performance criteria and their respective performance outcomes in a construction project in Hong Kong (as shown in Figure 1).

In this study, three questions were addressed about the life of a construction project:

(1) What are the relative levels of importance of the performance criteria from the practitioners' perspectives?

(2) What are the differences between the levels of importance of the performance criteria and their respective performance?

(3) What are the differences in the perception of performance from the practitioners' perspectives?

Research hypotheses

The following hypotheses are formulated based on two variables: the importance of the performance criteria and their respective performance outcomes. Owing to the different dimensions of business-driven benefits and the degree of objective alignment (Thompson and Sanders, 1998), the levels of importance of the performance criteria may be different.

H1: There are significant differences within the importance of the performance criteria.

There are always levels of difference in the performance elements for construction (Soetanto *et al.*, 2001). The levels of importance of the performance criteria may vary with respect to their performance outcomes.

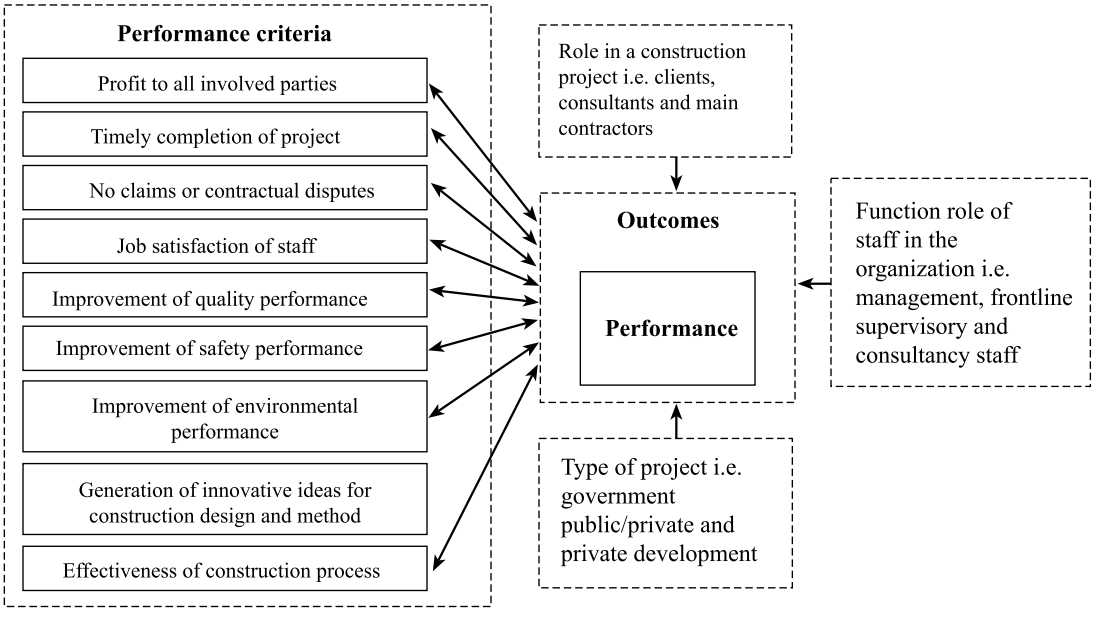

Figure 1 A research model of importance of the performance criteria and their performance outcomes

H2: There are significant differences between the importance of the performance criteria and their performance.

Different stakeholders have different views and expectations of performance in a construction project (Newcombe, 2003). Different roles (i.e. clients, consultants, and main contractors) in a construction project may have different views on the same performance.

H3: There are significant differences among incumbents in different roles in a construction project in the perception of performance among partners.

There are differences between government and private projects in the respective business procurement and the relationship with contractors (Burnes and Coram, 1999). Different types of construction projects (i.e. government projects, public/private utility and private development) may require different types of performances.

H4: There are significant differences in the perception of performance due to different types of construction projects.

Partnering involves teamwork and collaborative activities for achieving goals and resolving problems (Pheng and Hong, 2005; Ingirige and Sexton, 2006). Staff in different functional roles (i.e. managerial, frontline supervisory and consultancy staff) may have different views on performance.

H5: There are significant differences among staff in different functional roles in the partnering organizations in the perception of performance.

Sampling method

In Hong Kong, more than 500 construction companies are certificated with ISO 9001 (HKQAA, 2007). Because of the large number and different types of construction firms, the different sizes and types of construction works that are undertaken and the constraints of time and resources for the research, purposive sampling (Sekaran, 1996) is used to focus on the respondents who have participated in a partnering project. Contractors, consulting firms, government departments and private developers who are active participants in the construction market in Hong Kong are selected. Government departments and private developers are classified as clients of the construction projects. There are three types of project: a government project is a public project that is initiated from a government department such as the Housing Authority; a public/private utility project is usually an infrastructure project, for example, one initiated by a mass transportation services provider, such as Mass Transit Railway Corporation Limited; and a private development project may include something like a residential development project. The respondents include a staff of clients, architectural and engineering consultants who represent clients, and main contractors. The respondents are also classified into three functional roles (i.e. managerial, frontline supervisory and consultancy staff). This study only focuses on the performance of the key contract participants—neither suppliers nor subcontractors are included in this survey.

Questionnaire development and administration

A questionnaire is designed to gather information from people engaged in partnering projects in Hong Kong. A pre-test of the questionnaire was conducted in July 2006 with academics and construction practitioners in order to confirm the general validity and reliability. After the initial pre-test, a further pilot test was undertaken to check the suitability and appropriateness. The final questionnaire consists of two sections. Section 1 is about the background of the respondents and Section 2 is concerned with the views of the respondents on the levels of importance of the performance criteria of the project and on their performance outcomes. Respondents are asked to pick a rating using a five-point Likert scale, ranging from '1' (the least important, or very unsatisfied) to '5' (the most important, or very satisfied) in respect of the criteria and the outcomes. A total of 850 questionnaires were distributed in person to the respondents in August 2006. From the 209 questionnaires that were collected, 71.8% were from the main contractors during the first three months. Thereafter, another 100 questionnaires were distributed only to accessible clients and consultants in October 2006. Statistical analyses are conducted using the Statistical Package for Social Sciences (SPSS) 12.00 software package.

Performance criteria of the construction project

Research samples

Over the six months prior to March 2007, 950 sets of questionnaires were distributed, from which a total of 324 were collected. The response rate is 34.1%. The backgrounds of the respondents are shown in Table 1.

Statistical analysis

Repeated measures analysis of variance (ANOVA) can be used when sample members have been matched

Table 1 The background of the respondents

	Numbers of response	Percentage
Role in a construction project		
Clients	123	38.0
Consultants	51	15.7
Main contractors	149	46.0
Others	1	0.3
Total	324	100
Type of construction project		
Government projects	112	34.6
Public/private utilities	121	37.3
Private development	87	26.9
Others	4	1.2
Total	324	100
Functional role in the organization		
Managerial	131	40.4
Frontline supervisory	157	48.5
Consultancy	21	6.5
Others	15	4.6
Total	324	100

Table 2 The rating of performance criteria

Rank	Performance criteria	Mean	Std. deviation
1	Timely completion of project	4.2778	0.65127
2	Profit to all involved parties	4.2037	0.69174
3	Improvement of environmental protection	4.1265	0.60904
4	Improvement of quality	4.1173	0.61846
5	Improvement of safety	4.1019	0.60350
6	Effectiveness of the construction process	3.9105	0.72634
7	No claims or contractual disputes	3.8920	0.74903
8	Job satisfaction of staff	3.8395	0.68068
9	Generation of innovative ideas for construction design and method	3.7747	0.74350

according to some important characteristic (ACITS, 1997). In this study, sample members are matched, and measurements across conditions are treated like repeated measures. Therefore, repeated measures ANOVA is used to find the rating among the performance criteria. Table A1 in the Appendix shows Mauchly's test of sphericity. This is a test of compound symmetry or the homogeneity of covariance, an important assumption for this statistical test. If the test of sphericity is significant (i.e., p-value < 0.05), then the assumption H0 is met. Consequently, the univariate (more powerful) output (Tests of Within-Subject Effects) can be used. In this test, the p-value is less than 0.05 and H1 is therefore accepted. This means that there are significant differences in the performance criteria. In order to elucidate the differences between them, Bonferroni's test (see Table A2 in Appendix) is applied. The relative rating of the performance criteria is shown in Table 2 where time has the highest mean score, followed by profit, environment, quality, safety, effectiveness, no claims, job satisfaction, and the generation of innovative ideas.

An individual paired-samples T-test is used to determine whether there are significant differences among the levels of importance of the performance criteria and their respective performances. The mean scores and standard deviations of the importance of the performance criteria and their performance outcomes are reported in Table 3. It shows that all of the factors have significant differences. The p-value is less than 0.05. Therefore, H2 is accepted. Time has the highest positive paired mean difference, suggesting that the timely completion of a project, among the other performance criteria, seriously underperforms.

One-way ANOVA is used to determine whether, among partners in different roles in a construction project (i.e. clients, consultants and main contractors), there are significant differences in the perception of performance. Table 4 indicates that there are significant differences in the perception of performance—with the exception of quality—among the three groups. The p-values for all of the factors (except for quality) are less than 0.05. Therefore, H3 is accepted. The comparisons of the different groups are made using *post hoc* tests, after an overall significant difference has been obtained. The Tukey HSD table (Table 5) compares each group with every other group to determine the significance of the difference.

Table 6 indicates that there is no significant difference (p-value > 0.05) in the perception of performance due to the types of projects and between staff in different functional roles in the partnering organizations. Therefore, H4 and H5 are rejected.

Discussion

The levels of importance of the performance criteria

The relative ratings for the highest levels of importance of the performance criteria are: (1) time; (2) profit; (3) environment; (4) quality; (5) safety; (6) effectiveness; (7) no claims or contractual disputes; (8) job satisfaction; and (9) generation of innovative ideas. Time, cost

Table 3 Mean scores and paired-samples t-test for the levels of importance of the performance criteria and their performance outcomes

		Mean scores and standard deviations (N = 324)			Paired-samples t-test (df = 323)				
		Mean	Std. deviation	Std. error mean	Paired differences			t	Sig. (2-tailed)
					Mean	Std. deviation	Std. error mean		
Pair 1	Profit to all involved parties	4.2037	0.69174	0.03843	0.7469	0.94631	0.05257	14.207	0.000
	Profit to all involved parties with good performance	3.4568	0.70028	0.03890					
Pair 2	Timely completion of project	4.2778	0.65127	0.03618	0.8210	0.91024	0.05057	16.235	0.000
	Timely completion of project with good performance	3.4568	0.81091	0.04505					
Pair 3	No claims or contractual disputes	3.8920	0.74903	0.04161	0.5803	0.90221	0.05012	11.577	0.000
	No claims or contractual disputes with good performance	3.3117	0.72870	0.04048					
Pair 4	Job satisfaction of staff	3.8395	0.68068	0.03782	0.6173	0.81500	0.04528	13.633	0.000
	Job satisfaction of staff with good performance	3.2222	0.69049	0.03836					
Pair 5	Improvement of quality	4.1173	0.61846	0.03436	0.6574	0.81201	0.04511	14.573	0.000
	Improvement of quality with good performance	3.4599	0.65003	0.03611					
Pair 6	Improvement of safety	4.1019	0.60350	0.03353	0.6636	0.77566	0.04309	15.399	0.000
	Improvement of safety with good performance	3.4383	0.65781	0.03654					
Pair 7	Improvement of environmental protection	4.1265	0.60904	0.03384	0.6698	0.82841	0.04602	14.553	0.000
	Improvement of environmental protection with good performance	3.4568	0.72204	0.04011					
Pair 8	Generation of innovative ideas for construction design and method	3.7747	0.74350	0.04131	0.5617	0.94388	0.05244	10.712	0.000
	Generation of innovative ideas for construction design and method with good performance	3.2130	0.71755	0.03986					
Pair 9	Effectiveness of the construction process	3.9105	0.72634	0.04035	0.6204	0.93157	0.05175	11.987	0.000
	Effectiveness of the construction process with good performance	3.2901	0.76843	0.04269					

Table 4 One-way ANOVA on significant differences in perception of performance among participants in different roles in a construction project

Performance criteria	Total	Client	Consultant	Main contractor	F-statistic	p-value
Profit to all involved parties	3.4582	3.5772	3.5098	3.3423	4.024	0.019
Timely completion of project	3.4551	3.6423	3.4706	3.2953	6.374	0.002
No claims or contractual disputes	3.3127	3.4715	3.4510	3.1342	8.684	0.000
Job satisfaction of staff	3.2198	3.4228	3.0588	3.1074	9.120	0.000
Improvement of quality	3.4582	3.5203	3.3137	3.4564	1.830	0.162
Improvement of safety	3.4365	3.5691	3.0980	3.4430	9.752	0.000
Improvement of environmental protection	3.4551	3.6098	3.1961	3.4161	6.529	0.002
Generation of innovative ideas for construction design and method	3.2105	3.3415	2.9216	3.2013	6.408	0.002
Effectiveness of the construction process	3.2879	3.4797	3.0000	3.2282	8.208	0.000

Table 5 The Tukey HSD table of the post hoc tests on the performance among participants in different roles in a construction project

Performance criteria	(I) Your role in the construction project	(J) Your role in the construction project	Mean difference (I – J)	Sig.
Profit to all involved parties	Client	Main contractor	0.23495*	0.016
Timely completion of project	Client	Main contractor	0.34697*	0.001
No claims or contractual disputes	Client	Main contractor	0.33732*	0.000
	Consultant	Main contractor	0.31675*	0.018
Job satisfaction of staff	Client	Consultant	0.36394*	0.004
	Client	Main contractor	0.31538*	0.000
Improvement of safety	Client	Consultant	0.47107*	0.000
	Consultant	Main contractor	–0.34491*	0.003
Improvement of environmental protection	Client	Consultant	0.41368*	0.002
Generation of innovative ideas for construction design and method	Client	Consultant	0.41989*	0.001
	Consultant	Main contractor	–0.27977*	0.040
Effectiveness of the construction process	Client	Consultant	0.47967*	0.000
	Client	Main contractor	0.25149*	0.018

Note: * The mean difference is significant at the 0.05 level.

and quality are always described as the 'holy trinity' (Swan and Khalfan, 2007). Krima *et al.* (2007) also noted that the importance of time performance is widely accepted. Most construction projects in Hong Kong are developed on a fast track schedule, completed in two to three years (Chan, 1999). The top concern in the construction industry in Hong Kong is always time. Profit generated from partnering normally derives from cost savings and incentives (Soetanto *et al.*, 2001). Incentives are normally introduced by offering a bonus to contractors achieving the KPIs set for the project (Swan and Khalfan, 2007). Moreover, profit sharing is very popular in construction projects.

It is surprising that the improvement of environmental performance is the third most important performance criterion. Zhang and Shen (2000) observed that clients are often concerned with immediate or short-term results and care little about the potential benefits of improving environmental performance. This finding directly contradicts a previous study performed by Swan and Khalfan (2007), who found that time, cost and quality are the key elements for a successful project. Although the improvement of environmental performance is an important performance criterion, compared with the improvement of quality, this finding still needs to be clarified by further studies.

The improvement of quality is always referred to in terms of less re-working or no abortive work (Thomas *et al.*, 2002). Quality is also defined as conformity and client satisfaction (Soetanto *et al.*, 2001). It is always among the top priorities in construction. Safety has always been an issue in construction because of the routinely high accident rate involving deaths and property damage. The creation of the built environment in

Table 6 One-way ANOVA on significant differences of performance due to the types of project and between those staff in different functional roles in the partnering organizations

Performance criteria		Due to the types of project					Between those staff in different functional roles in the partnering organizations				
		Sum of squares	df	Mean square	F	Sig.	Sum of squares	df	Mean square	F	Sig.
Profit to all involved parties with good performance	Between groups	0.113	2	0.056	0.119	0.887	1.560	2	0.78	1.642	0.195
	Within groups	149.634	317	0.472			145.333	306	0.475		
	Total	149.747	319				146.893	308			
Timely completion of project with good performance	Between groups	0.161	2	0.080	0.124	0.883	0.697	2	0.349	0.529	0.590
	Within groups	205.389	317	0.648			201.872	306	0.660		
	Total	205.550	319				202.570	308			
No claims or contractual disputes with good performance	Between groups	0.174	2	0.087	0.162	0.851	1.234	2	0.617	1.163	0.314
	Within groups	170.198	317	0.537			162.403	306	0.531		
	Total	170.372	319				163.638	308			
Job satisfaction of staff with good performance	Between groups	1.053	2	0.527	1.118	0.328	1.972	2	0.986	2.109	0.123
	Within groups	149.294	317	0.471			143.064	306	0.468		
	Total	150.347	319				145.036	308			
Improvement of quality with good performance	Between groups	2.098	2	1.049	2.528	0.081	0.254	2	0.127	0.299	0.742
	Within groups	131.524	317	0.415			129.889	306	0.424		
	Total	133.622	319				130.142	308			
Improvement of safety with good performance	Between groups	1.819	2	0.909	2.133	0.120	1.522	2	0.761	1.797	0.168
	Within groups	135.169	317	0.426			129.623	306	0.424		
	Total	136.987	319				131.146	308			
Improvement of environmental protection with good performance	Between groups	1.456	2	0.728	1.407	0.246	0.309	2	0.155	0.296	0.744
	Within groups	164.094	317	0.518			159.710	306			
	Total	165.550	319				160.019	308	0.522		
Generation of innovative ideas for construction design and method with good performance	Between groups	1.021	2	0.511	1.001	0.369	1.166	2	0.583	1.122	0.327
	Within groups	161.666	317	0.510			158.989	306			
	Total	162.688	319				160.155	308	0.520		
Effectiveness of the construction process with good performance	Between groups	0.595	2	0.297	0.507	0.603	1.295	2	0.648	1.084	0.339
	Within groups	185.793	317	0.586			182.770	306	0.597		
	Total	186.388	319				184.065	308			

2003 in Hong Kong involved 18% of the total injuries of employees among all industries (OSHC, 2003). Policy makers and the general public always pay great heed to construction safety (Teo *et al.*, 2005).

Effectiveness in construction has received negative commentary (CIRC, 2001). A rating solely on effectiveness itself is taken ordinarily to be insufficient and does not usually prevail. Claims in a project can involve extension of time (EOT), for example, because of inclement weather, or a variation order (VO), for example because of changes of design (Yeo and Ning, 2002). Contractors lose out from not being granted a claim.

Although some previous studies suggest that job satisfaction is a measure of project success (Beatham *et al.*, 2004; Swan and Khalfan, 2007), an analysis of the data fails to find evidence suggesting job satisfaction is a priority in a construction project. Innovative ideas can contribute to cost savings and process expediting, and generating them should be encouraged through reimbursement or benefits sharing (Naoum, 2003). Nevertheless, innovative ideas about construction design and method are very rarely implemented in a construction project because of the relatively short timeline for completion.

The differences of performance outcomes with respect to importance

The relative ratings for the highest difference in performance with respect to the importance of the performance criteria are: (1) time; (2) safety; (3) quality; (4) environment; (5) profit; (6) job satisfaction; (7) effectiveness; (8) no claims or contractual disputes; and (9) generation of innovative ideas. All of the performance criteria clearly underperform.

Timely completion of the project displays the highest difference. To a project owner, delay means loss of revenue due to slackened production and rentable space. To a consultant, delay means either the failure of progress monitoring of contractors or faulty design, or both. To a contractor, delay means penalties and higher overhead costs. It is thus very worthwhile to investigate the cause of delay, the parties who are responsible, and the preventive measures for avoiding it (Assaf and Al-Hejji, 2006).

Owing to stringent legal and contractual requirements in Hong Kong, there are ever-increasing demands, expectations and emphasis on safety, quality and environmental protection. Naoum (2003) has argued that there should be a comprehensive incentive scheme to simulate the overall site performance in these categories. Profit is a basic goal for running a business, but in a project, it is always governed by the traditional re-measured contract at a fixed price. Participants in a construction project can only benefit from cost savings or bonuses awarded by accelerating the process for early completion (Tam, 2002). Job satisfaction is among the performance criteria displaying a low performance outcome. Not only are staff members not happy about job satisfaction, but this variable is also in fact rated as the second least important performance criterion (see Table 2).

The effectiveness of a construction process needs both good planning and coordination. Given the inherently fragmented nature of construction, work is always accomplished in sequential and unique stages handled by different contractors. Since the design and building processes are normally divided between consultants and contractors (Naoum, 2003), the original designers would thus not help the performance outcome or effectiveness of the construction process once it is underway.

No claims or contractual disputes are part of the second-lowest performance outcome. Claims or contractual disputes in a project are very often raised among clients and contractors (Yeo and Ning, 2002). The generation of innovative ideas for construction design and method received the lowest rating concerning performance outcome. In fact, adopting new ideas in construction is always inhibited by the fact that there are always prior specifications governing construction activities (Naoum, 2003). Winch (2003) noted that construction is commonly characterized as a 'backward industry', that is, one that fails to innovate in comparison to other sectors. The strong categorical division of responsibility for design and building worsens this situation.

The performance perceived by practitioners in different roles in a construction project

Profit

There are significant differences between clients and the main contractors in the perception of the performance of profit. Clients are more satisfied than are the main contractors (see Table 5). Clients typically set out the budget for a project at the beginning of project planning, whereas contractors concentrate on cost savings (e.g. reducing the opportunity for claims).

Time

There are significant differences between clients and main contractors in the perception of performance for the timely completion of projects. Clients are more satisfied than are main contractors (see Table 5). They are normally proactive and generally push for timely completion. Main contractors prefer a contract designed with a reasonable duration for the construction

time and fair treatment of claims for EOT (Assaf and Al-Hejji, 2006). Any completion delay for a project will be the subject of a penalty for liquidated damages to a contractor (PAH, 2008). In general, clients would consider an incentive bonus for the contractor who completes the project on time or ahead of schedule (Naoum, 2003). Contractors prefer these bonuses as an incentive for finishing on time or early.

No claims or contractual disputes

There are significant differences between clients, consultants and main contractors in the perception of the performance of no claims or contractual disputes. Clients and consultants are more satisfied than are main contractors (see Table 5). When initiating a contract, clients normally would have a contingency plan to provide additional money for any claim, for a delay in the project or for a change of design. In general, clients and main contractors take a different stand on claims. Clients suffer from claims, while the main contractors benefit. Traditionally, clients are perceived as distrustful and suspicious, while the main contractors are perceived as opportunistic and greedy (Kadefors, 2004). Consultants tend to have a passive attitude to claims, and do not like to see any claims or contractual disputes, as they might be taken to reveal their own faulty design or their failure to perform their duty of supervising the main contractors' performance.

Job satisfaction

There are significant differences between clients, consultants and main contractors in the perception of the performance of the job satisfaction of staff. Staff members, as consultants and main contractors, are less satisfied than are clients (see Table 5). Staff from clients may participate in the partnering projects more than do the staff from consultants and main contractors. Since the levels of participation for different parties are different, they show differences in regard to this issue.

Quality

There is no significant difference between clients, consultants and main contractors in the perception of the performance of quality. This seems to illustrate that all partners in the construction project hold consistent views on the performance of quality.

Safety

There are significant differences between clients, consultants and main contractors in the perception of the performance of safety. Consultants are less satisfied than are clients and main contractors (see Table 5). Clients simply do not like to see any accidents. The responsibility for onsite safety is therefore ascribed to the consultants and the contractors (Teo *et al.*, 2005). Consultants take a passive role in safety during the operations (Teo *et al.*, 2005); they like to have sufficient planning and budgets for the design of safety at the beginning of a project (Wong and Chan, 2000). The main contractors bear most of the legal liability for safety performance (Chan and Chan, 2004); they commit to ensuring safety under a contractual requirement.

Environment

There are significant differences between clients and consultants in the perception of the accomplishment of environmental performance. Consultants are generally less satisfied than are clients (see Table 5), who showed less concern in improving environmental performance. This empirical finding agrees with Yao *et al.*'s (2006) basic argument. The design of environmentally friendly projects involves reduced use of natural resources, recycling of construction waste, and the avoidance of being a nuisance in the neighbourhood (Tam *et al.*, 2004). The green construction concept demands that, at the inception of a project, approval is sought from the client. Although consultants are reactive on this specific issue, they can propose some guidelines for administering a contract's environmental requirements (e.g. contractors should prepare a comprehensive onsite waste management plan). Clients should consider covering all of the costs incurred in those contract specifications satisfying these environmental requirements. On the other hand, contractors do not totally disagree with this concept and are usually willing to follow some guidelines, such as avoiding environmental hazards and following safety procedures. Indeed, clients should regularly take the initiative to monitor and closely inspect contractors' performance of environmental management.

Generation of innovative ideas

There are significant differences between clients, consultants and main contractors in how they perceive the accomplishment of innovative ideas about the construction design and method. Consultants are less satisfied than are clients and main contractors (see Table 5). In general, consultants play a significant role in generating new ideas about the construction method and the design (Bresnen and Marshall, 2000). The main contractors usually do not put too much effort into promoting innovative ideas unless it is a design-and-build project. However, consultants are reluctant to accept a contractor's design proposal (Bresnen and Marshall, 2000). In fact, the best innovative ideas for construction design and method should be developed by consultants during the planning phase. However,

given the zero-growth budgets and tight schedules for construction projects, consultants seldom take the initiative to generate innovative ideas even though they should.

Effectiveness

There are significant differences between clients, consultants and main contractors in the perception of the relative effectiveness of a construction process. Clients are more satisfied than are consultants and main contractors (see Table 5). Consultants, as designers, play an important role by providing good, reliable and complete designs that are buildable. Main contractors play an active role in the construction process (Arobos, 2002; Errasti *et al.*, 2007), dealing with most of the problems raised during the construction stage along with the consultants. Most of the problems generated at the site level and the effective solutions do not involve the clients.

The performance of important aspects of different types of construction project

There is no significant difference between the three groups in the perception of the performance of government project, public/private utility and private development. This means that there appears to be no relationship between performance outcomes and the types of projects.

The performance perceived among staff in different functional roles in partnering organizations

There is no significant difference between the three staff groups: managerial, frontline supervisory and consultancy, in terms of the perception of performance. This means that there is no relationship between the performance outcomes and the staff in different functional roles in the partnering organizations.

Implications, limitations and further research

Implications

The present results reveal that, in order to achieve optimum performance, a company should improve its operations by managing the presence of the nine performance criteria. The differences in the perceptions of performance among the key contract participants in a construction project reveal the congeniality problems in the construction industry. The rule of the contract game, or that the lowest price wins, still very much dominates the final decision on the selection of contractors. The division of roles between designing and building, and the distinct roles of consultants for and management of, a project, exacerbate the adverse effects of the fragmented nature of construction. There are many methods for trying and overcoming the barriers to optimum performance. For example, the ideas of the public–private partnership (PPP) and the private finance initiative (PFI) projects, which create a favourable partnering atmosphere between clients and the main contractors (Li *et al.*, 2005), could help diminish the abovementioned problems. PPP and PFI embrace all of the elements in a successful construction project of design, build and finance, which means a longer project timeframe and a contract sum sufficiently large so as to sustain the partnering atmosphere. Other methods, such as awarding contracts based on quality bids, as well as prices and partnering frameworks, are also recommended.

Limitations

Owing to the large numbers of the sample size and frame and the limited time and resources available, the selection of questionnaire respondents was based on the rationale of purposive sampling, aiming to select some specific categories in the populations. This may cause bias and error. The collected data were mainly from the main contractors and clients (84% of the total respondents) and may have led to biases that render the result inaccurate. A holistic supply chain must be expansive, embracing the vertical networks of subcontractors and suppliers for better partnering. There were also geographical limitations in this study. The survey was only carried out in Hong Kong. It would be beneficial to have the opportunity to test the theory elsewhere.

Further research opportunities

The results indicate that timely completion of a project is both the most important performance criterion and the highest in terms of the difference in the outcome of the performance with respect to importance. Future studies should seek to elaborate on this factor, exploring how to improve the time factor in a construction project. A new research tradition can be built on a more detailed model that specifies not only the relationships between the independent and dependent variables, but also the relationships between the independent variables. This means an investigation of the correlation between the factors of two variables as well as within the factors. In such a study, there should be a deeper focus on the correlation among the performance criteria. Regarding the significant difference from the perspectives of clients, consultants and main contractors about the performance outcomes, further additional research is necessary in order to elaborate on the

more subtle rationale of these differences. A more qualitative data collection method through intensive interviews with participants would provide richer and more in-depth data.

Conclusions

Here, we rate the performance criteria in a construction project in Hong Kong. The order of importance of the performance criteria is: (1) time; (2) profit; (3) environment; (4) quality; (5) safety; (6) effectiveness; (7) no claims or contractual disputes; (8) job satisfaction; and (9) generation of innovative ideas. There are differences among the levels of importance of the performance criteria with respect to performance. The positive differences between the levels of importance of the performance criteria and their performance outcomes indicate a common pattern: all of the performance criteria underperform. The results of the greatest differences are, in order, (1) time; (2) safety; (3) quality; (4) environment; (5) profit; (6) job satisfaction; (7) effectiveness; (8) no claims or contractual disputes; and (9) generation of innovative ideas. Timely completion of the project is the most important performance criterion, but it displays the highest deviation of its performance when compared with its importance. This implies that time management is the most critical factor for the performance of a construction project. In Hong Kong, events pertaining to quality, safety and environmental issues during construction always generate a great deal of publicity. In fact, there are quite regular incidents regarding substandard work, serious accidents on construction sites, and complaints regarding pollution and nuisance generated from construction activities. The performance of these three performance criteria can be improved by providing a greater budget during the planning of the project, or by allowing a larger budget for design and incentives to achieve good performance. Most clients are satisfied with the performance of profit, although the main contractors are less happy, reflecting the fact that, with the prevailing lowest-price-wins and the procurement practice in construction, the main contractor still stands to lose. In general, most respondents are not satisfied with job satisfaction. The job satisfaction of staff should be enhanced through personal development, job security and encouragement from colleagues and superiors. Most clients are satisfied with the performance of the effectiveness of the construction process. Consultants should strive to improve the effectiveness of the construction process early in the design stage of a project and should suggest adopting more design-and-build types of contracts. Clients are satisfied with fewer claims and contractual disputes. However, contractors would like to be treated more fairly when claims are made. Practitioners have less concern about the generation of innovative ideas for a construction method and design that make least deviations from performance. Finally, there is no difference in the perception of performance due to the types of projects, or between those staff in different functional roles in the partnering organizations.

This study in Hong Kong examined, from the points of view of practitioners, the levels of importance of the performance criteria and their respective performance in construction projects. The research reviews the status quo of partnering and the congeniality problems in the industry, and it is intended to stimulate interest in Hong Kong for further exploration of solutions for improving the overall performance of the construction industry.

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Appendix

Table A1 Mauchly's test of sphericity[b]

Within Subjects Effect	Mauchly's W	Approx. chi-square	df	Sig.	Epsilon [a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Factor	0.049	966.660	35	0.000	0.682	0.695	0.125

Notes: Test the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

[a] May be used to adjust the degrees of freedom for the averaged tests of significance.

[b] Design: Intercept Within Subjects Design: factor.

Table A2 Bonferroni test on rating of performance criteria (pairwise comparisons)

(I) factor	(J) factor	Mean difference (I – J)	Std. error	Sig. [a]	95% confidence interval for difference[a]	
					Lower bound	Upper bound
1	2	–0.074	0.033	0.969	–0.182	0.033
	3	0.312*	0.050	0.000	0.150	0.474
	4	0.364*	0.044	0.000	0.221	0.507
	5	0.086	0.044	10.000	–0.054	0.227
	6	0.102	0.044	0.731	–0.039	0.243
	7	0.077	0.044	10.000	–0.065	0.219
	8	0.429*	0.048	0.000	0.275	0.583
	9	0.293*	0.046	0.000	0.145	0.441
2	3	0.386*	0.046	0.000	0.238	0.534
	4	0.438*	0.043	0.000	0.300	0.576
	5	0.160*	0.037	0.001	0.040	0.281
	6	0.176*	0.038	0.000	0.052	0.300
	7	0.151*	0.039	0.005	0.025	0.278
	8	0.503*	0.049	0.000	0.345	0.661
	9	0.367*	0.042	0.000	0.232	0.502
3	4	0.052	0.048	10.000	–0.101	0.206
	5	–0.225*	0.048	0.000	–0.381	–0.070
	6	–0.210*	0.049	0.001	–0.368	–0.052
	7	–0.235*	0.050	0.000	–0.396	–0.073
	8	0.117	0.050	0.705	–0.044	0.279
	9	–0.019	0.049	10.000	–0.177	0.140
4	5	–0.278*	0.041	0.000	–0.410	–0.146
	6	–0.262*	0.042	0.000	–0.399	–0.125
	7	–0.287*	0.044	0.000	–0.430	–0.145
	8	0.065	0.041	10.000	–0.069	0.198
	9	–0.071	0.043	10.000	–0.211	0.069
5	6	0.015	0.018	10.000	–0.042	0.073
	7	–0.009	0.022	10.000	–0.079	0.061
	8	0.343*	0.043	0.000	0.204	0.481
	9	0.207*	0.040	0.000	0.076	0.337
6	7	–0.025	0.014	1.000	–0.069	0.020
	8	0.327*	0.044	0.000	0.184	0.470
	9	0.191*	0.043	0.000	0.053	0.330
7	8	0.352*	0.045	0.000	0.206	0.498
	9	0.216*	0.043	0.000	0.077	0.355
8	9	–0.136*	0.038	0.017	–0.260	–0.012

Notes: Based on estimated marginal means.

* The mean difference is significant at the 0.05 level.

[a] Adjustment for multiple comparisons: Bonferroni.