

SEARCH FOR KEY PERFORMANCE INDICATORS (KPIs) FOR TARGET COST CONTRACTS IN HONG KONG

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ABSTRACT

In view of the adversarial working relationships inherent with the traditional procurement method, Target Cost Contracts (TCC) and Guaranteed Maximum Price (GMP) contracts (being a variant of TCC), which align the individual objectives of various contracting parties together, would be appropriate integrated procurement models to cultivate more collaborative working atmosphere and partnering spirit within the construction industry. Different countries have already applied both TCC and GMP (TCC/GMP) schemes for several years. However, there exists a lack of published literature about the performance measurement of TCC/GMP projects worldwide, particularly in the Hong Kong context. In order to fill up this knowledge gap, this paper aims to identify those key performance indicators (KPIs) for TCC/GMP contracts in the construction industry of Hong Kong. Based on a series of various KPIs sought from a comprehensive desktop review, a two-round Delphi survey was launched with 14 industrial practitioners with direct hands-on experience in TCC/GMP construction projects in Hong Kong. A total of seven KPIs were identified in the survey. It was found that time, cost and quality are perceived as the typical KPIs for these kinds of projects. Moreover, the research findings reflected that relationship-based elements are also discerned as significant performance indicators such as mutual trust between project partners and contractor's involvement in project design, which play a vital role in project performance associated with TCC/GMP schemes as well. The identification of those KPIs has enhanced the understanding of project team members in implementing a successful TCC/GMP project.

Keywords: *Delphi Survey Method; Guaranteed Maximum Price Contracts; Hong Kong; Performance Measurement; Target Cost Contracts.*

1. INTRODUCTION

The problems associated with the traditional design-bid-build procurement method are often conducive to the adversarial working relationships (Kaka *et al.*, 2008; Lahdenpera, 2010). Both the Target Cost Contracts (TCC) and Guaranteed Maximum Price (GMP) contracts (being a variant of TCC) are considered to be the preferred options where project risks are taken jointly by the employer and the contractor. Sharing savings and losses depending on the final financial outcome of the projects make the contracting parties consider another side's view better and collaborate more efficiently. TCC and GMP (TCC/GMP) schemes have gained increasing popularity in the construction sector (Meng and Gallagher, 2012) across several countries such as the United States, the United Kingdom, Sweden and Finland for many years. However, an extensive desktop search indicated that there has been a lack of systematic empirical research into the performance measurement of TCC/GMP projects worldwide so far, especially in the Hong Kong context. To fill up this knowledge gap, this paper purports to search for a set of the key performance indicators (KPIs) to measure the performance of these procurement models.

The determination of KPIs for TCC/GMP projects is important in the project management and the continual improvement of performance of those TCC/GMP contracts and in enhancing the cost

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effectiveness of the whole procurement process. The aim of this study is to equip different key project stakeholders, including but not limited to employers, contractors and consultants, with the necessary knowledge and sound understanding about those KPIs inherent with TCC/GMP schemes. This study can also generate more valuable insights by adding to the existing body of knowledge and serving as a solid foundation for further studies on the performance measurement of TCC/GMP projects in future.

2. CONCEPTS OF TCC AND GMP

Twort and Ree (2004) advocated that a target cost contract is a contract in which the contractor shares a proportion of cost saving as a reward if the expenditure is less than the target cost, while he has to bear a proportion of cost overrun if he expends more than the target. Naoum (2003) shared a similar perception that target cost contract is a contract where a target cost is agreed and the contractor is reimbursed the costs, plus a fee. Any overrun or under run is shared in pre-agreed proportion. Wong (2006) proposed a computerized model for cost control of TCC contracts in Hong Kong and opined that TCC is a contract in which the contractor is paid the actual cost for the work done during the construction stage. When the final construction cost, termed the final total cost differs from the initial contract target cost, the difference would be shared between the employer and the contractor based on a pre-determined gain-share/pain-share ratio as stated in the contract. Hughes *et al.* (2011) pointed out that TCC is often referred to as a gain-share/pain-share arrangement in which the contracting parties specify an estimated cost (target cost) and sharing ratio which applies if the actual cost is higher than or lower than the estimated cost. They also advocated that TCC is justified to be used when: (1) the client is incentivised actively to help the contractor to search for cost-efficient solutions; and (2) the client deliberately chooses the same contractor for repeated business.

The American Institute of Architects (AIA) (2001) viewed GMP as a sum established in an agreement between a client and a contractor as the cap of overall project cost to be paid by the client to the contractor for performing specified works on the basis of the cost of labour and materials plus overhead and profit. The contractor receives a prescribed sum, along with a share of any savings to the client under this procurement approach. If the cost of the works exceeds the assured maximum, the contractor bears the excessive costs (Walker *et al.*, 2000). Under this situation, a ceiling price is established, and the contractor is solely responsible for any additional costs (Gould and Joyce, 2003).

In fact, GMP is perceived as a TCC with an additional feature that the maximum amount to be paid to the contractor by the employer is capped (Hughes *et al.*, 2011); and GMP is a variant of TCC according to Masterman (2002). So TCC and GMP are lumped together in previous research studies for analysis (e.g. Chan *et al.*, 2007a, 2007b, 2010). As a result of the similar nature of TCC and GMP contracts and their practices derived from previous research studies, both TCC and GMP are placed together for subsequent analyses and discussions herein.

3. PERFORMANCE OF TCC/GMP CONTRACTS

Scholars have shared mixed views on the effectiveness of TCC/GMP schemes. Hughes *et al.* (2011) opined that the TCC contractual arrangement may not incentivise the contractors to save cost. However, Chan *et al.* (2007b) reported on the key findings of eight face-to-face interviews and concluded that providing financial incentives for the contractors to achieve cost savings and innovate is one of the perceived benefits of TCC/GMP contracts. It would be interesting and essential to look into the actual performance outcomes of TCC/GMP construction projects worldwide. Payment methods in construction contracts can be analysed from the perspective of incentives or disincentives. Cost incentives encourage saving which may be more effective for cost control in practice, while cost disincentives discourages overspending (Meng and Gallagher, 2012). If cost incentives are combined with cost disincentives, the joint effect is remarkable and this may be the main reason for introducing GMP contracts.

In the United Kingdom and the Republic of Ireland, Meng and Gallagher (2012) conducted a questionnaire survey in order to analyse the relationship between the use of incentives and the

performance outcomes of 60 completed construction projects. The study compared the projects under four different payment methods including: (1) fixed-price contracts; (2) target cost contracts; (3) cost-plus-fee contracts; and (4) contracts in which payment is based on final outcomes. The study revealed that target cost contracts performed better than cost-plus-fee contracts and contracts in which payment is based on final outcomes in terms of cost certainty. In terms of cost performance, target cost contracts also performed more favourably than these two kinds of payment methods. According to the statistics of the National Health Service (NHS) (2011), the 97% of the TCC projects under the ProCure 21+ Framework in 2010 achieved the final cost to budget or within budget. In the United States, Rojas and Kell (2008) investigated around 300 school projects located in the Northeast part of the United States. The actual project cost exceeded the GMP value in 75% of the cases. They concluded that GMP may not be an effective guarantor of construction cost in practice. In contrast, Bogus *et al.* (2010) conducted an extensive analysis of the performance data of public water and wastewater facilities in the United States. Their study advocated that contracts using cost-plus-fee method with the GMP arrangement performed better in terms of cost and schedule in comparison with those with lump-sum contracts.

4. DELPHI SURVEY TECHNIQUE

The Delphi survey technique was originally developed by the RAND Corporation for studying the impact of warfare (Hallowell and Gambatese, 2010). According to Hasson *et al.* (2000), a Delphi survey is regarded as a group facilitation technique, designed to transform opinions into group consensus. This technique allows researchers to maintain a significant degree of control over bias in a well-structured academically rigorous process, according to the judgment of qualified experts (Hallowell and Gambatese, 2010). The Delphi method is considered as a highly formalised method of communication that is designed to extract the maximum amount of unbiased information from a panel of experts (Chan *et al.*, 2001). Individual experts are requested to participate in two or more rounds of structured surveys. An anonymous result summary of opinions of the group of experts from the previous round is provided to each of the experts, and they are invited to review the overall group results and consider whether to revise their previous responses or not. The objective of this process is to decrease the variability of the responses and to achieve group consensus and correct value. Delphi method can offer a merit in situation where it is important to define areas of uncertainties or disagreements amongst experts. The Delphi technique is therefore appropriate for obtaining a series of the most important KPIs for evaluating the success of TCC/GMP construction projects (Chan *et al.*, 2001).

5. DEVELOPMENT OF DELPHI SURVEY QUESTIONNAIRE

The questionnaire used in the Delphi survey was developed based on a comprehensive desktop review of the KPIs to evaluate the success of construction projects worldwide. The previous studies on performance measurement in construction were reviewed from contemporary literature (KPI Working Group, 2000; Cox *et al.*, 2003; Swan and Kyng, 2004; Cheung *et al.*, 2004; Menches and Hanna, 2006; Jones and Kaluarachchi, 2007; Lam *et al.*, 2007; Luu *et al.*, 2008; Rojas and Kell, 2008; Tennant and Langford, 2008; De Marco *et al.*, 2009; Toor and Ogunlana, 2009). Finally, a total of 15 KPIs were identified on the survey questionnaire and they are listed below: (1) Time required for the settlement of final project account; (2) Time performance; (3) Mutual trust between project partners; (4) Percentage of contractor's alternative design proposals approved by consultants in first go; (5) Final out-turn cost exceeding the final contract target cost or guaranteed maximum price value or not; (6) Magnitude of disputes and conflicts; (7) Cost per m² of construction floor area (CFA) including foundations; (8) Client's satisfaction on quality of completed work; (9) Contractor's satisfaction on TCC/GMP contractual arrangement; (10) Contractor's involvement in project design; (11) Contractor's feedback on client's decision making process; (12) Design quality; (13) Environmental friendliness; (14) Safety performance; and (15) Time needed from commencement of project design up to contract award. These 15 KPIs elicited on the survey form were then properly verified by some

senior industrial practitioners with extensive hands-on experience in TCC/GMP projects, and they were all confirmed to be sufficient, representative and appropriate for use.

5.1. FORMAT OF DELPHI ROUNDS

Two rounds of Delphi survey exercise were performed from March to May of 2011. As pointed out by Mullen (2003), two or three rounds of Delphi survey are preferred and found in a significant number of previous studies. In this study, the main reason for launching two rounds of Delphi survey only is to minimise the fatigue and attritions of experts in repeated rounds but can allow feedback and revision of responses. Design of the questionnaire for Round 1 was based on a comprehensive review of published literature pertaining to the performance measurement of construction projects in general and available materials about TCC/GMP schemes in particular. In Round 1, the respondents were requested to select a minimum of five but a maximum of ten KPIs from a consolidated list of 15 various key performance measures which were considered as the most vital KPIs to evaluate the success of TCC/GMP projects in Hong Kong. They were also welcome to insert additional indicators if deemed appropriate. Round 2 of the questionnaire survey was related to all the KPIs provided on the questionnaire from Round 1, in addition to those KPIs suggested by the panel of experts in Round 1. After Round 1, the results were consolidated and then presented to the expert panel in Round 2. They were requested to freely adjust their original options in Round 2 if necessary.

5.2. SELECTION OF THE EXPERT PANEL

The success of a Delphi survey highly depends on the careful selection of experts (Chan *et al.*, 2001). A group of experts were selected to provide their opinions on the KPIs for TCC/GMP construction projects in Hong Kong. A purposive sampling approach was adopted to select the group of experts since the experts should have gained in-depth knowledge about TCC/GMP contracts and sound hands-on experience in the construction industry. The following criteria were set out to search for the eligible participants for this Delphi survey: (1) Participants should have extensive working experience of at least 10 years in the construction industry of Hong Kong; (2) Participants should have been engaged in at least one TCC/GMP construction project before in Hong Kong; and (3) Participants should hold a position of at least a professional grade in the TCC/GMP projects concerned. Only those industrial practitioners who have fulfilled all of the three criteria above were invited to participate in this Delphi survey, in order to obtain most valuable insights and representative opinions from them.

6. DELPHI SURVEY ROUND 1: IDENTIFYING THE MOST IMPORTANT KPIs

The questionnaire of Round 1 was developed based on a comprehensive literature review. The questionnaire together with an invitation letter, which explained the purpose of the research study, were dispatched to the 72 potential target respondents via postal mail in March of 2011, as identified from previous research studies on TCC/GMP schemes in Hong Kong (Chan *et al.*, 2007b; Chan *et al.*, 2011). A total of 16 practitioners ultimately participated in this study. The sixteen members of the expert panel represented a wide spectrum of construction professionals: three from client organisations, ten from contractor companies and three from consultant firms. The composition of the expert panel provided a holistic, balanced view for this Delphi study. Table 1 serves as a summary of their personal profiles.

The experts were requested to choose a minimum of five but a maximum of ten KPIs for TCC/GMP projects from a summary list of 15 KPIs provided on the survey form. They were also welcome to provide additional KPIs for TCC/GMP contracts in Hong Kong wherever deemed appropriate. Six additional KPIs suggested by the expert panel were carefully analysed. Table 2 lists out all the KPIs (i.e. 15 originally identified from the literature review and 6 additionally suggested by the expert panel) in Round 1 of the Delphi survey. Their frequencies of hit are also indicated in the same table.

7. DELPHI SURVEY ROUND 2: REFINING THE SELECTED KPIS

The questionnaires of Round 2 were mailed to the same group of panel experts in May of 2011. In this round, the results of Round 1 were consolidated and presented to the experts and they were requested to reconsider whether they would like to change any of their original choices or not after second thought, in light of the consolidated results from Round 1. Only 7 experts returned their completed questionnaires within a planned deadline of two weeks.

An electronic mail was individually sent to remind all the experts who had not yet returned their completed questionnaires, followed up a phone call if necessary. Finally, 14 out of the 16 experts returned their completed forms towards the end of May 2011. Two experts were unable to participate in the survey because of their heavy workload at that time.

Table 1: Personal Profiles of the Delphi Expert Panel

Expert	Position	Role	Years of Working Experience in Construction Industry	Hands-on Participation in at Least One TCC/GMP Project
1	Assistant Project Director	Client	More than 20 years	Yes
2	Partner	Consultant	16-20 years	Yes
3	Construction Manager	Contractor	16-20 years	Yes
4	Contract Advisor	Contractor	11-15 years	Yes
5	Project Manager – Contract and Cost	Contractor	More than 20 years	Yes
6	Engineer	Contractor	More than 20 years	Yes
7	Engineer	Contractor	More than 20 years	Yes
8	Commercial Manager	Contractor	More than 20 years	Yes
9	Construction Manager – Estimating and Subletting	Contractor	More than 20 years	Yes
10	Estimation Manager	Contractor	16-20 years	Yes
11	Contracts Manager	Contractor	More than 20 years	Yes
12	Commercial Manager	Contractor	More than 20 years	Yes
13	Technical Director	Consultant	16-20 years	Yes
14	General Manager (Contracts)	Contractor	More than 20 years	Yes
15	Quantity Surveyor	Client	More than 20 years	Yes
16	Contract Advisor	Client	More than 20 years	Yes

As observed from Table 3, there are altogether seven KPIS with a frequency percentage of 50% or higher selected by the Delphi panel of experts. Hence a total of seven most important KPIS were identified specifically for measuring the performance of TCC/GMP construction projects in Hong Kong. After two rounds of Delphi survey, it was found that the top seven KPIS for TCC/GMP projects in Hong Kong emphasise project success, relationships and people in broad terms, which are briefly discussed below.

MUTUAL TRUST BETWEEN PROJECT PARTNERS

All of the 14 panel experts believed “Mutual trust between project partners” to be a vital KPI for TCC/GMP schemes. Nystorm (2008) pointed out that most partnering projects applied the underlying concepts of a target cost-based contract. It is not possible to formally separate the role of partnering from the role of TCC. Wong and Cheung (2005) advocated that the establishment of mutual trust is essential to partnering success. Black *et al.* (2000) carried out partnering studies and concluded that the cultivation of mutual trust among partners is instrumental to the successful implementation of partnering. Partnering is often introduced in parallel to TCC/GMP contracts in Hong Kong as reported

by Chan *et al.* (2007a) and Anvuur and Kumaraswamy (2010). Another similar study by Yeung *et al.* (2007) on evaluating the success of partnering projects in Hong Kong via a Delphi study also recommended that “mutual trust and respect” is one of the important KPIs for partnering projects in Australia.

Table 2: Results of Round 1 Delphi Survey

Key Performance Indicators for TCC/GMP Projects		Total Frequency	Percentage
1.	Mutual trust between project partners	15	93.75
2.	Time performance	14	87.50
3.	Magnitude of disputes and conflicts	11	68.75
4.	Final out-turn cost exceeding the final contract target cost or guaranteed maximum price value or not	11	68.75
5.	Client's satisfaction on quality of completed work	11	68.75
6.	Contractor's feedback on client's decision making process	9	56.25
7.	Time required for the settlement of final project account	10	62.50
8.	Contractor's involvement in project design	8	50.00
9.	Design quality	8	50.00
10.	Time needed from the commencement of project design up to contract award	6	37.50
11.	Percentage of contractor's alternative design proposals approved by consultants in first go	6	37.50
12.	Safety performance	5	31.25
13.	Contractor's satisfaction on TCC/GMP contractual arrangement	6	37.50
14.	Environmental friendliness	2	12.50
15.	Cost per m ² of construction floor area (CFA) including foundations	1	6.25
16.	<i>Form of contract to be used</i>	1	6.25
17.	<i>Contractor's ability to perform cost management</i>	1	6.25
18.	<i>Appropriateness of risk allocation</i>	1	6.25
19.	<i>Time allowed for pre-construction preparation works</i>	1	6.25
20.	<i>Contractor's claim consciousness attitude</i>	1	6.25
21.	<i>Amount of works that the tenderer has in hand at the final stage of tendering</i>	1	6.25

Note: Additional KPIs suggested by the expert panel are indicated in *italics*.

TIME PERFORMANCE

As previously stated in literature review, “Time performance” is regarded as one of the common KPIs worldwide (KPI Working Group, 2000; Menches and Hanna, 2006). This KPI is also similar to “time certainty” as suggested by NHS ProCure21+ Guide (2011). Lam *et al.* (2007) considered time to be one of the KPIs for design-and-build construction projects in Hong Kong. Frampton (2003) opined that TCC/GMP procurement strategies allow early commencement of construction activities before design is fully completed. It would be interesting to see if TCC/GMP contracts outperform the others in terms of time certainty.

FINAL OUT-TURN COST EXCEEDING THE FINAL CONTRACT TARGET COST OR GUARANTEED MAXIMUM PRICE VALUE OR NOT

The main feature of TCC/GMP schemes is to incentivise the contractor to achieve cost savings by aligning the individual interests of the employer and those of the contractor together (Rose and Manley, 2010). It is logical that the cost performance of TCC/GMP projects (i.e. whether final out-turn cost exceeding the final contract target cost or guaranteed maximum price value or not) constitutes a significant KPI for this kind of projects like Chan *et al.* (2011).

Table 3: Results of Round 2 Delphi Survey

Key Performance Indicators for TCC/GMP Projects	Total	Percentage
1. Mutual trust between project partners	14	100.00
2. Time performance	12	85.71
3. Final out-turn cost exceeding the final contract target cost or guaranteed maximum price value or not	11	78.57
4. Magnitude of disputes and conflicts	10	71.43
5. Client's satisfaction on quality of completed work	10	71.43
6. Time required for the settlement of final project account	10	71.43
7. Contractor's involvement in project design	10	71.43
8. Contractor's feedback on client's decision making process	6	42.86
9. Design quality	6	42.86
10. Time needed from the commencement of project design up to contract award	6	42.86
11. Percentage of contractor's alternative design proposals approved by consultants in first go	4	28.57
12. Safety performance	4	28.57
13. Contractor's satisfaction on TCC/GMP contractual arrangement	3	21.43
<i>14. Contractor's ability to perform cost management</i>	2	14.29
<i>15. Appropriateness of risk allocation</i>	2	14.29
<i>16. Contractor's claim consciousness attitude</i>	2	14.29
<i>17. Form of contract to be used</i>	1	7.14
<i>18. Time allowed for pre-construction preparation works</i>	0	0.00
<i>19. Amount of works that the tenderer has in hand at the final stage of tendering</i>	0	0.00
20. Environmental friendliness	0	0.00
21. Cost per m ² of construction floor area (CFA) including foundations	0	0.00

Notes: (1) Additional KPIs suggested by the expert panel are indicated in *italics*; and (2) KPIs with percentage of 50% or higher are highlighted in **bold**.

MAGNITUDE OF DISPUTES AND CONFLICTS

This finding is consistent with Lam *et al.* (2007) and Toor and Ogunlana (2010). TCC/GMP projects are usually implemented in parallel to partnering spirit (Chan *et al.*, 2007a). It was suggested that partnering can be perceived to be a useful means to transform the contractual relationship into a cohesive, integrated project team with common goals and clear procedures for resolving disputes and conflicts in a timely and effective manner (Bench *et al.*, 2005). It would be important to evaluate whether TCC/GMP procurement strategies could effectively reduce disputes or disagreements between contracting parties.

CLIENT'S SATISFACTION ON QUALITY OF COMPLETED WORK

Quality is referred to as conformity to contract specifications and client's satisfaction on constructed facilities. It is always ranked among the top priorities of construction projects (Soetanto *et al.*, 2001). Not surprisingly, the quality of completed work was chosen as a KPI for TCC/GMP projects. The same has been widely reported in other literature on the performance measurement in construction (Cheung *et al.*, 2004; Lam *et al.*, 2007).

TIME REQUIRED FOR THE SETTLEMENT OF FINAL PROJECT ACCOUNT

A research study undertaken by Yiu *et al.* (2005) evaluated the performance of consultants in the construction industry of Hong Kong at four different stages, namely: (1) design/planning stage; (2)

tender stage; (3) construction stage; and (4) final account stage. The last stage (final account stage) recognises the settlement of final account contributing to the success of a construction project. Early settlement of final project account is regarded as one of the perceived benefits of employing the TCC/GMP forms of procurement (Chan *et al.*, 2007b). This KPI “Time required for the settlement of final project account” would be useful for gauging TCC/GMP projects for whether they can materialise this benefit.

CONTRACTOR’S INVOLVEMENT IN PROJECT DESIGN

The significance of integrating the construction expertise into the design process has been recognised by the construction industry (Song *et al.*, 2009). Mosey (2009) shared a similar perception that design contributions should not be made by design consultants only, but also by main contractors and specialist suppliers to achieve a complete and functional design. This aspect is particularly important in TCC/GMP construction projects, since in many cases the main contractors have been involved at an early stage of project delivery (Chan *et al.*, 2007a). The contractor's involvement in project design would probably affect the project outcomes in terms of time, cost, quality and buildability.

8. CONCLUSIONS

Through a two-round Delphi survey, a total of seven KPIs were sought specifically for TCC/GMP construction projects in Hong Kong. The identified KPIs consist of: (1) Mutual trust between project partners; (2) Time performance; (3) Final out-turn cost exceeding the final contract target cost or guaranteed maximum price value or not; (4) Magnitude of disputes and conflicts; (5) Client's satisfaction on quality of completed work; (6) Time required for the settlement of final project account; and (7) Contractor's involvement in project design. Apart from the traditional KPIs about time, cost and quality, the remaining four KPIs substantially focus on the collaborative relationship between the employer and the contractor. The identification of the KPIs has enhanced the understanding of project team member to implement a successful TCC/GMP construction project. The research findings from this study reflected that relationship-based issues such as mutual trust and contractor's involvement in project design play an important role for the performance of this kind of projects. This study has explored the area of performance measurement of TCC/GMP construction projects in Hong Kong by determining the KPIs via a two-round Delphi survey. Further research could be launched to investigate the relative importance of the respective KPIs sought and then formulate a composite index to gauge the overall performance levels of TCC/GMP construction projects in both Hong Kong and overseas.

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