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An empirical survey of the motives and benefits of adopting guaranteed maximum price and target cost contracts in construction

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Abstract

In light of increasing project complexity, constraints on programme schedule and limited budget, there exists a strong call for changes in contracting procedures in construction. Both the Guaranteed Maximum Price (GMP) and Target Cost Contracting (TCC) approaches with a gain-share/pain-share arrangement have been advocated to achieve better value for money and more satisfactory project performance. This paper aims to review the prevailing practices of GMP/TCC in general, and explore the motives and benefits of implementing the GMP/TCC scheme in comparison with the traditional fixed-price lump-sum contract in particular. The research study is based on a comprehensive literature review and an industry-wide empirical questionnaire survey for evaluating the relative importance of motives and benefits associated with GMP/TCC in Hong Kong. The survey data collected from 45 valid completed questionnaires were analysed using the mean score ranking technique, Kendall's concordance test, Spearman's rank correlation test and one-way ANOVA test. The perceived benefits were measured and ranked from the perspectives of the client, contractor and consultant for cross-comparison. The survey findings indicated that the three most common motives of clients behind their decision of adopting GMP/TCC include: (1) to generate an incentive for contractor to achieve cost saving; (2) to develop better working relationship within the project team; and (3) to tap in contractor's expertise in design and innovation. The top three perceived benefits of applying GMP/TCC were found to be: (1) early settlement of final project account; (2) improved partners' working relationship under a partnering arrangement; and (3) capability of integrating contractor's expertise in building designs and innovations prior to construction. The research results are particularly essential in assisting key project stakeholders to realise the potential benefits derived from the use of GMP/TCC contracts and in generating more useful insights into alternative integrated contracting strategies for the construction industry, so as to drive for excellence in overall project performance.

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1. Introduction

Construction is a very competitive and high-risk business (Chan et al., 2003). Under the traditional fixed-price lump-sum contract, it has long suffered from limited trust amongst contracting parties, lack of incentives and misalignment of objectives, which often result in confrontational working culture and finally leading to unfavourable project performance (Construction Industry Review Committee, 2001; Walker and Hampson, 2003). Contractors have

little incentives to devote efforts more than just meeting the minimum contractual requirements. Strong alarms have also been raised because of the practice of awarding contracts to the lowest bidders, which has been conducive to poor project management and low profit margins (Chan et al., 2004).

Some alternative integrated procurement methods have therefore been developed within the construction industry since the 1990s to satisfy the changing needs of clients and to improve overall project performance (Masterman, 2002). In particular, incentivisation measures have been successfully implemented in the United States, United Kingdom and Australia, to integrate the construction delivery process and to motivate service providers to seek continuous improvements in project outcomes (Construction Industry Review Committee, 2001). Previous overseas literature

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has revealed that guaranteed maximum price (GMP) and target cost contracting (TCC) procurement strategies can accrue a plethora of mutual benefits to all of the parties involved, provided they are properly structured, implemented and managed (Trench, 1991; Walker et al., 2000). The New Engineering Contract which includes various target cost contract options has been adopted in the engineering and construction sectors throughout the United Kingdom and overseas for several years (Broome and Perry, 1995; Perry, 1995).

Although GMP/TCC contracts have been practiced in some developed countries since the early 1990s, there is very limited empirical research to investigate the rationale behind and genuine merits of introducing the GMP/TCC scheme, especially in the Hong Kong context. Hence, based on an industry-wide empirical questionnaire survey towards various relevant key project stakeholders in Hong Kong, this paper aims to review the contemporary practices of GMP/TCC in general, and explore the underlying motives and perceived benefits of applying GMP/TCC in comparison with the traditional fixed-price lump-sum contract used within the construction industry in particular. Despite GMP/TCC being relatively new in Hong Kong, there are a number of projects adopting the procurement approach. Therefore, a comprehensive investigation of GMP/TCC is valuable and timely, in that any lessons learned from Hong Kong would be of international interest and reference. The target cost contracting principles should be introduced to the fullest possible extent in future projects for achieving more favourable project outcomes.

The governing concepts, underlying motives and potential benefits of GMP/TCC are first highlighted through a critical review of the prevailing literature. The research methodology including the survey methodology and the methods of data analysis are then illustrated. It is followed by the presentation of empirical survey results and discussions of the motives behind adopting the GMP/TCC scheme as well as those perceived benefits. Finally, concluding remarks and contributions of the study are presented at the end of the paper.

2. What are TCC and GMP?

2.1. Target cost contracting (TCC)

Before understanding the potential benefits, the respective definitions of GMP and TCC should be introduced first. The National Economic Development Office (United Kingdom) — Civil Engineering (1982) defined TCC as:

Target cost contracts specify a best estimate of the cost of the work to be carried out. During the course of the work, the initial target cost will be adjusted by agreement between the client or his nominated representative and the contractor to allow for any changes to the original specification. Any savings or overruns between target cost and actual cost at completion are shared between the parties to the contract with a pre-determined share ratio according to the contract conditions.

Trench (1991) shared the same view that under a target cost contract, the actual cost of completing the work is evaluated and

compared with an estimate or target cost of the work and the differences within a cost band are shared between the employer and the contractor. It is a unique arrangement that shifts from the fixed-price approach to a target cost approach based on joint determination and agreement between the contractor and the client on the allocation of shared risks. Some researchers even conducted research on how the clients and contractors set the best cost-sharing fraction in target cost contracts in construction (e.g. Perry and Barnes, 2000; Broome and Perry, 2002).

2.2. Guaranteed maximum pricing (GMP)

Boukendour and Bah (2001) considered GMP to be a hybrid arrangement consisting of a cost reimbursement contract and a call option for a fixed-price contract. The contractor guarantees that the project will be completed within the contract period in full accordance with the drawings and specifications and the cost to the owner will not exceed the initial GMP at main contract award.

Carty (1995) defined GMP to be:

The contractor and owner agree that the contractor will perform an agreed scope of work at a price not to exceed an agreed upon amount, the guaranteed maximum price (GMP)..... if the final actual cost and the agreed upon contractor's profit are less than the GMP, the owner and contractor will share the savings in cost based on an agreed upon formula. If the final actual cost exceeds the GMP without any changes to the defined scope, the contractor must solely bear the additional cost but not the owner.

Hence, GMP can be regarded as one of the forms of TCC with the sharing arrangement limited solely to the gain (Perry and Thompson, 1982). Fig. 1 graphically illustrates the definitions and the operational mechanisms of GMP and TCC contracts. In case of any savings or losses resulting from a difference between the actual cost at completion and the target cost (i.e. either scenario A or B), there is a sharing function to split the 'gain/pain' between the client and the contractor (Trench, 1991).

3. Features of GMP/TCC contracts

In a typical GMP/TCC construction project, two types of variations are often pre-defined under the conditions of contract: (1) design development variations (i.e. non GMP/TCC variations); and (2) GMP/TCC variations (Gander and Hemsley, 1997). The design development variations do not trigger a re-calculation of the GMP or target cost because they are deemed to be included in the fixed lump-sum of main contractor's direct works finalised at the main contract award. However, GMP/TCC variations can allow for the re-calculation of the GMP or target cost (Fan and Greenwood, 2004; Hong Kong Housing Authority, 2006) and they will be valued in accordance with the contract documents based on the measured works and schedule of rates. Generally, GMP/TCC variations arise only due to: (1) changes in scope of work such as change in floor area or volume; (2) change in function of an area; (3) change in quality of an area; (4) adjustment of provisional quantities or provisional sums; (5) corrected quantity errors by

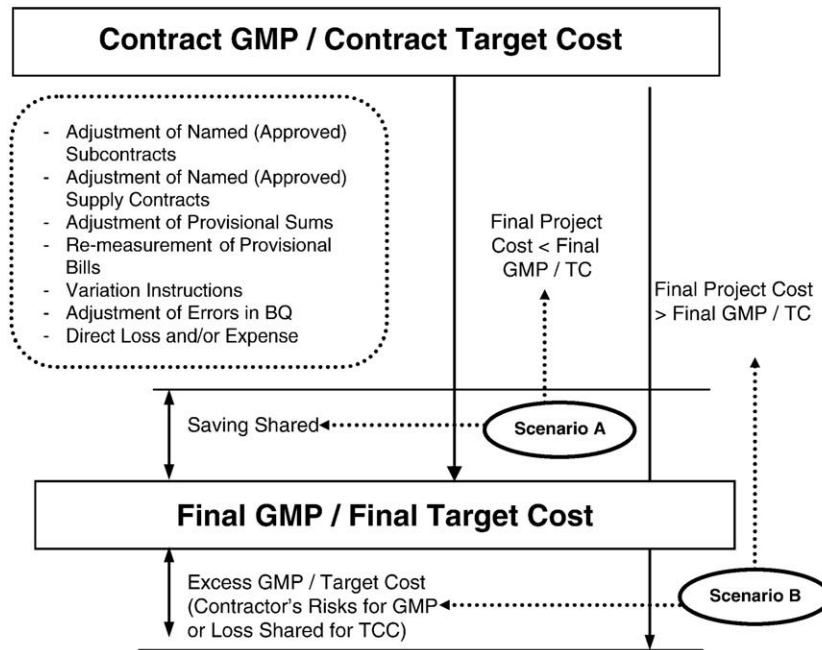


Fig. 1. Operational mechanism of GMP/TCC procurement strategy [adopted by Cheng (2004)].

consultants; and (6) unexpected additional fees or charges imposed by statutory authorities (Fan and Greenwood, 2004). Extras should therefore be related to scope changes requested by the client. The net cost adjustment of such GMP/TCC variations will be added to (for 'addition' work) or subtracted from (for 'omission' work) the contract GMP or target cost.

Chan et al. (2007a) further summarised the key characteristics in relation to the GMP/TCC procurement strategy as follows:

- Set an agreed ceiling price of the project at main contract award for the client.
- Reduce project duration by allowing early start of construction before the design is fully developed.
- The client retains greater control over a team of design consultants, main contractor and subcontractors.
- Bring in expertise in building designs and innovations in construction methods and materials from the contractor at both tender stage and post-tender stage to enhance the buildability of project.
- The contractor will price for any unforeseeable risks associated with future design development likely to be incurred under GMP/TCC allowance in the tender.
- The gain-share/pain-share mechanism provides financial incentives for the contractor to achieve cost saving after main contract award.
- Set up the adjudication committee to facilitate the resolution of various issues and disputes.
- Pre-agreement of price and time implications of any potential changes to the project and thus leading to early settlement of final project account.
- 'Open-book' accounting arrangement to enhance the accountability of project cost and variations, as well as the quantification of the costs of risk.

4. Literature review on the motives and benefits of GMP/TCC

It should be emphasised that the perceived benefits of GMP/TCC identified from the contemporary literature review (e.g. enhanced cost control, better time control, enhanced design buildability, improved working relationship, etc) are believed to be some of the underlying motives of adopting GMP/TCC which are also agreed by both Perry and Thompson (1982) and Avery (2006). The motives for rating by the respondents are generated from an extensive literature review as well as some face-to-face interviews with relevant experienced industrial practitioners (Chan et al., 2007a). The underlying motives and perceived benefits of adopting GMP/TCC are not only on the overall project performance in terms of time, cost and quality, but also on the improvement of working relationship amongst key project stakeholders. Table 1 provides the summary of the perceived benefits of GMP/TCC extracted from relevant reported literature including textbooks, research reports, journal articles, conference papers and internet materials with the corresponding frequencies of their citations.

4.1. Enhanced cost control

Compared with the fixed-price lump-sum contract, the GMP/TCC procurement strategy essentially offers a more realistic price ceiling or target cost of the project and constrains uncertainty for the client (Patterson, 1999; Perry and Barnes, 2000). Particularly, under the GMP approach, the client is only liable up to the agreed guaranteed maximum amount. GMP variations would only be recognised under the circumstances that additional works are required and approved by the client. Costs exceeding the GMP have to be solely borne by the contractor (Mills and Harris, 1995).

Table 1
Summary of the perceived benefits of GMP/TCC.

Perceived benefits of GMP/TCC	Hong Kong Housing Authority (2006)	Tang (2005)	Cheng (2004)	Fan and Greenwood (2004)	Sadler (2004)	Tang and Lam (2003)	Boukendour and Bah (2001)	Perry and Barnes (2000)	Patterson (1999)	Gander and Hemsley (1997)	Chevin (1996)	Mills and Harris (1995)	Trench [(1991)	National Economic Development Office (1982)	Total number of citations of a certain benefit
<i>Cost control</i>															
Greater price certainty and better control of overspending	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓		10
Client provides financial incentives for contractor to achieve cost saving	✓	✓	✓	✓	✓	✓	✓	✓					✓		9
Risk sharing on cost overrun	✓				✓		✓	✓				✓	✓		6
<i>Time control</i>															
Fast track project by allowing early start of construction before the design is fully developed		✓											✓		2
More effort of client's involvement in problem solving process					✓	✓							✓		3
Earlier settlement of final project account	✓				✓					✓					3
Greater flexibility of accommodating changes	✓	✓	✓					✓					✓		5
<i>Quality control</i>															
Greater client's control over building design and subcontracting process	✓	✓	✓												3
Selection of a right working team					✓								✓		2
Early contribution by contractor to both design and construction	✓	✓			✓						✓				4
Better estimate of the cost of quality work			✓											✓	2
<i>Working relationship</i>															
Incentives for effective collaboration between client and contractor		✓			✓		✓	✓			✓		✓		6
Conducive to improving partners' working relationship via partnering	✓				✓	✓									3
Total number of benefits identified from each publication	8	7	5	2	9	3	3	5	1	2	2	2	6	3	58

Note: The previous studies are ranked in decreasing chronological order of year of publication followed by the alphabetical order of the authors' surnames.

Hence, the client exercises a more stringent control against overspending under this special arrangement. In addition, the gain-share/pain-share mechanism under the GMP/TCC arrangement offers strong financial incentives for the contractor to become more efficient and to achieve cost saving (Perry and Barnes, 2000; Boukendour and Bah, 2001; Fan and Greenwood, 2004).

4.2. Better time control

GMP/TCC can facilitate the commencement of site construction activities before the design is fully completed (Frampton, 2003). Advanced works and early programme planning for faster construction particularly in early materials purchase and logistics management may also be facilitated due to early commencement of site construction (Hong Kong Housing Authority, 2006; Wong et al., 2006). Tang and Lam (2003) studied how the target cost contracting concepts can be applied to price adjustments for design-and-build construction projects in Hong Kong. Under TCC, they found that with the increased involvement of the client in problem solving process when compared with the traditional contracts, the decision on any changes can also be made more efficiently. The GMP/TCC approach may therefore speed up the entire process of problem solving (Trench, 1991).

Besides, since the arrangement of identifying variations under GMP/TCC contracts has been pre-agreed between the client and the contractor in the contract document, both the frequency of occurrence and magnitude of disputes and claims might be significantly reduced, and the preparation and agreement of the final project account tend to be finalised earlier than for the conventionally priced contracts (Gander and Hemsley, 1997). Furthermore, an Adjudication Committee which involves representatives from client, architect, quantity surveyor and main contractor is established under the GMP/TCC methodology to determine the nature and extent of the variation, and to facilitate the resolution of any unresolved issues (Hong Kong Housing Authority, 2006). Through the adjudicating mechanism, the efficiency could be enhanced through early settlement of final project account which has always been delayed by protracted debates on variations in conventional contracts.

Another essential advantage that GMP/TCC could bring is the greater flexibility to accommodate design changes because of the straightforward variation claiming mechanism and an 'open-book' accounting arrangement (Mills and Harris, 1995). Unlike the traditional contracting method, handling variations can therefore be less time-consuming and more transparent.

4.3. Better quality control

Another potential benefit derived from implementing GMP/TCC might be the improvement of construction quality. Chan et al. (2007b) discovered that about 27% of the surveyed projects had achieved a record of zero rework. The survey respondents further revealed that the quality performance of those GMP/TCC projects in terms of scope of rework measured as percentage of original contract sum is more superior to a construction project procured by the traditional fixed-price lump-sum approach. These

may be attributed to the better buildability of project design, more involvement from the client throughout the project delivery process and more effective communications derived from partnering spirit under the GMP/TCC scheme. It is unfortunate that at times, the conventional design-bid-build procurement method over-emphasises on price and sacrifice quality (Cheng, 2004). In sharp contrast, GMP/TCC sets a reasonable target price and facilitates the tendering of the domestic subcontractors' works packages on an open basis (Tay et al., 2000). This alternative contracting approach thus assists in selecting the right project team which has adequate hands-on experience to undertake the project and is capable of developing the client's design intent (Trench, 1991). This arrangement also eradicates the non value-adding multi-layered subcontracting, as tenders will then be analysed by the main contractor together with his team of design consultants. The team will then jointly make recommendations to the client for award on a competitive 'open-book' arrangement. With the approval of the client on selecting subcontractors, the quality standards of constructed facilities and workmanship could be maintained.

The GMP/TCC scheme may further improve overall construction quality because the client could retain more stringent control over the team of design consultants during the pre-contract and post-contract stages, thereby ensuring compliance with the initial design intent as stipulated in the client's project brief (Hong Kong Housing Authority, 2006). On the other hand, the contractor is also brought in at the design stage to advise on construction costs, building design, project programming, construction materials, alternative construction techniques and other buildability issues (Hong Kong Housing Authority, 2006) to mitigate the construction risk.

4.4. Improved working relationship

Bower et al. (2002) advocated that the GMP/TCC procurement method can be an effective means of motivating contractors to achieve better value and project performance by aligning their own financial objectives with the overall objectives of the project. Tang (2005) evaluated the success and limitations of GMP within the Hong Kong construction industry via three structured interviews and 34 completed survey questionnaires. It was revealed that GMP can result in reduction in disputes, better risk allocation, harmonious working relationships and higher levels of buildability.

In particular, the gain-share/pain-share mechanism generates incentives for effective collaboration between client and contractor in order to minimise the final cost of a project (Chevin, 1996; Sadler, 2004). By involving all of the relevant major project stakeholders, the pre-construction planning for the design development can reduce the conflicts and disputes often plaguing contracts. Sadler (2004) concluded that the GMP/TCC form of arrangement also allows the contractor and employer to determine the appropriate ownership of risks, and offers better value for money towards the client, which is in the client's long-term interest. What is more, a fair and effective dispute resolution mechanism and communication channels are provided by means of adjudication meetings, not only leading to reduction in dispute/claim occurrence,

but also improvement in working relationship amongst project team members arising from inter-disciplinary efforts (Ting, 2006).

With the gain-share/pain-share mechanism and the open-book accounting regime in place, the GMP/TCC form of contract is conducive to injecting ‘partnering’ spirit into the working relationships amongst the project team, with the objective of introducing a more co-operative and less litigious philosophy to the contract (Tang and Lam, 2003). Chan et al. (2004) conducted in-depth case studies on partnering projects in Hong Kong. They expressed that the developments of the GMP contracting approach in a number of building projects and the incentivisation agreement in the railway infrastructure projects have been proven to be effective in fostering a co-operative working atmosphere, which are largely derived from the perceived ‘partnering’ spirit cultivated amongst all contracting parties.

5. Survey methodology

An industry-wide empirical questionnaire survey was launched between May and June of 2007 in Hong Kong to solicit the experience-based perceptions of different key project stakeholders towards the motives and benefits of adopting the GMP/TCC approach. The 13 perceived benefits of GMP/TCC identified from the reported literature in Table 1 were further split and transformed into 17 individual statements describing specific benefits on the survey form with a view to providing a comprehensive list of GMP/TCC benefits for the target respondents to rate their degree of agreement based on their direct hands-on experience with GMP/TCC contracts. A total of 9 underlying motives and 17 perceived benefits of GMP/TCC identified from the contemporary literature (see Table 1) and a series of previous face-to-face interviews (Chan et al., 2007a) constitute the basis of the empirical survey questionnaire. Respondents were requested to select the motives behind the decision to implement the GMP/TCC procurement approach, and rate each of the identified benefits according to a five-point Likert scale delineating different levels of agreement (1 = strongly disagree; 3 = neutral and 5 = strongly agree) with reference to a particular GMP/TCC project they had been involved in. Respondents were also invited to suggest and rate any other unmentioned benefits based on their personal discretion and actual experience but no new benefits were received from them.

In this investigation, purposive sampling techniques which are regarded as a non-probability sampling or purposeful sampling tool were adopted for selecting the target survey respondents. Teddlie and Yu (2007) advocated that purposive sampling techniques are often used when the researcher wants to select a purposive sample that represents a broader group of cases as closely as possible or to set up comparisons amongst different types of cases on a certain dimension of interest. Maxwell (1997) further defined purposive sampling as a type of sampling in which particular settings, persons or events are deliberately selected for the important information they can provide that cannot be obtained from other sources. The researcher will pick a sample that he/she believes is representative to the population of interest (Tashakkori and Teddlie, 2003). Respondents are not selected randomly but by using the expert judgment of the researcher or

some available resources identified by the researcher. With a purposive sample, the researcher is likely to glean the opinions of the target population.

Local industrial practitioners, including those from the client organisations, consultants, main contractors and subcontractors, who have gained abundant hands-on experience in GMP/TCC construction projects in Hong Kong were the target respondents of the questionnaire survey. In this research, two stages of data collection were carried out. The first stage involved direct distribution of blank survey questionnaire from the senior staff of corresponding client organisations equipped with GMP/TCC experience to the representatives of their own project consultants, main contractors and subcontractors. Unfortunately, the response rate was not satisfactory. Subsequently, through personal networking of research team members within the industry, relevant contact persons provided by identified project clients, together with the full support of the Association for Project Management, Hong Kong Branch (APM-HK) and the Construction Industry Institute, Hong Kong (CII-HK), a total of 139 self-administered blank survey forms were distributed to individual industrial practitioners who have been involved with GMP/TCC projects, by means of postal mail and electronic mail during the second stage. Follow-up telephone calls were launched and electronic mails were sent where possible to elicit more detailed responses and/or provide further clarifications for any unclear/misunderstood items on the survey form.

Since the GMP/TCC concepts are still new in the local construction market, experience in adopting the procurement approach is rather limited with only about 20 GMP/TCC projects from 1998–2007 as cited by Chan et al. (2007a). However, all of the key project stakeholders in applying GMP/TCC had been covered in the questionnaire survey, their perceptions and opinions could substantially represent the GMP/TCC project population in Hong Kong over the past decade of 1998–2007. Hence, the chosen sample was regarded as truly representative of the survey population.

Finally, altogether 45 valid completed survey questionnaires were returned, representing a response rate of 23.6%. Given that GMP/TCC is a relatively new contractual arrangement being adopted in Hong Kong, this level of response rate was considered to be acceptable and adequate for further statistical analysis. Table 2 portrays the detailed breakdown of the questionnaires received. The 45 returned questionnaires were derived from various industry stakeholders including clients (16 respondents), consultants (12 respondents), main contractors (13 respondents) and subcontractors (4 respondents). Respondents were also classified into three key survey groups for further analysis and comparison, i.e. client group (16 nos.), consultant group (12 nos.), together with main contractor plus subcontractor group (17 nos.). Therefore, it is believed that each of the three groups was adequately represented in the survey.

Most of the survey respondents held a senior position in their organisations with abundant experience in the construction sector. All of the respondents have already acquired over 10 years of working experience within the industry with over 62% of them having more than 20 years. Regarding the experience with GMP/TCC, about 91% of the respondents possessed direct hands-on

Table 2
Summary of data collection and response rates.

Source	First stage data collection	Second stage data collection	Total
	Distribution of questionnaire through client organisations	Direct mail to individual target respondents	
Number of blank questionnaires sent out	52	139	191
Number of completed questionnaires received	7	38	45
Response rate	13.46%	27.34%	23.56%

experience in GMP/TCC projects despite various levels of involvement in terms of project numbers as revealed in Fig. 2. Amongst them, 38% (17 nos.) and 16% (7 nos.) of the respondents have been involved in 2–4 GMP/TCC projects and more than 4 projects, respectively. Merely 4 out of 45 respondents (8.9%) had no hands-on practical experience but with sound understanding of GMP/TCC scheme or principles as indicated on the survey form. Hence, all of the respondents were well-experienced professionals in the construction practice who should be able to provide reliable information and genuine opinions to the research.

6. Methods of data analysis

6.1. Mean score ranking technique

Descriptive statistics and the ‘mean score’ ranking technique were adopted to establish the relative importance of various benefits of GMP/TCC using the Statistical Package for Social Sciences (SPSS). Respondents were further classified into three key survey groups as categorised according to their roles involved in a project (i.e. client group, contractor group or consultant group) in order to facilitate more meaningful comparisons on the benefits of GMP/TCC. The five-point Likert scale described previously was used to calculate the mean score for each benefit, which was then used to determine their relative rankings in

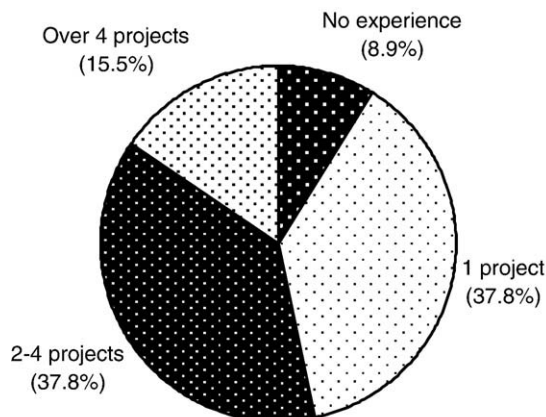


Fig. 2. Hands-on experience of the survey respondents with GMP/TCC (N=45).

descending order of importance. These rankings made it possible to cross-compare the relative importance of the benefits across different groups of respondents.

6.2. Cronbach's alpha reliability test

The Cronbach's alpha reliability (the scale of coefficient) measures were used to verify the internal consistency amongst the responses under the adopted Likert scale of measurement regarding the perceived benefits of GMP/TCC (Sanotos, 1999; Norusis, 2002). The Cronbach's alpha coefficients range from 0 to 1 in value and may be used to describe the reliability of factors extracted from dichotomous and/or multi-point formatted questionnaires or scales (Sanotos, 1999). If the items making up the score are all identical and perfectly correlated, then $\alpha=1$. If the items are all independent, then $\alpha=0$. Therefore, the higher the score, the more reliable the generated scale will be. Nunnally (1978) indicated 0.7 to be an acceptable reliability coefficient for pre-validated instruments, while non-validated items should have alpha values of at least 0.6. In addition, Tuckman (1999) recommended acceptable alpha values of 0.5 for attitude/perception assessment which is also supported by Yip and Poon (2009). The Cronbach's alpha tests were applied to test the reliability of the scales of the perceived benefits of the GMP/TCC practices in the questionnaire survey.

6.3. Kendall's concordance analysis

The Kendall's coefficient of concordance (W) was applied to measure the agreement of different respondents on their rankings of benefits based on mean values within a particular survey group. This statistical analysis aims to ascertain whether the respondents within an individual group respond in a consistent manner or not. Values of W can range from 0 to 1, with 0 indicating perfect disagreement and 1 exhibiting perfect agreement (Daniel, 1978). If the Kendall's coefficient of concordance (W) was statistically significant at a pre-defined significance level of say 10% (0.10), then a reasonable degree of consensus amongst the respondents within the group on the rankings of the benefits was indicated (Siegel and Castellan, 1988). In other words, a high or significant value of W reflects that different parties are essentially applying the same standard in ranking the benefits.

According to Siegel and Castellan (1988), W is only suitable when the number of attributes is less than or equal to 7. If the number of attributes is greater than 7, chi-square is used as a near approximation instead. If the actual calculated chi-square value equals or exceeds the critical value derived from the table for a certain level of significance and a particular value of degrees of freedom, then the null hypothesis that the respondents' sets of rankings are unrelated (independent) to each other within a survey group can be rejected.

6.4. Spearman's rank correlation test

The degree of correlation between any two survey groups on their overall rankings of the benefits of GMP/TCC was measured by the Spearman's rank correlation coefficient (r_s). The coefficient,

r_s , ranges between -1 and $+1$. Values between 0 and $+1$ indicate varying degrees of positive correlation and that low ranking in one group will correspond to a low ranking in the other group and also high ranking from one group will correspond to a high ranking of the other. Conversely, values between 0 and -1 produce varying degrees of inverse correlation, i.e. a low ranking from one group will correspond to a high ranking of the other group and vice versa. The closer the correlation value is to zero, the weaker the relationship between the two groups of variables (Albright et al., 2006). If r_s was statistically significant at a pre-determined significance level of 0.05 , then the null hypothesis that no significant correlation between the two groups on the rankings can be rejected. Therefore, there is adequate evidence to conclude that there is no significant disagreement between the two groups on the ranking exercise.

6.5. One-way ANOVA test

One-way analysis of variance (ANOVA) test for multiple samples was also carried out to detect any differences between the respondent groups on the mean values of their responses for a specific benefit of GMP/TCC. If the test result was significant at the 5% significance level, then the null hypothesis that no significant differences in the mean values between the respondent groups can be rejected. Thus, it can be concluded that the mean values of the benefits of GMP/TCC between the respondent groups are significantly different from each other at $p=0.05$ (Norusis, 2002).

7. Analysis and discussion of survey results

The results derived from the analysis of empirical questionnaire survey were cross-referenced to the published literature and to complement each other for validation.

7.1. Motives of introducing GMP/TCC

The respondents were requested to choose any underlying motives to introduce the GMP/TCC procurement strategy to their projects and they might select more than one motive. It was found from the survey results as indicated in Table 3 that ‘To generate an incentive to achieve cost saving’ is the most frequent motive of

implementing GMP/TCC contracts. As stated earlier, GMP/TCC is essentially a procurement approach which rewards the contractor for any savings made but penalises him when this sum is exceeded. This gain-share mechanism offers an enormous impetus for contractor to innovate, save cost, work efficiently and solve problems (Boukendour and Bah, 2001). In addition, ‘To develop better working relationship’ was perceived as the second most important motive because the GMP/TCC procurement approach together with partnering spirit promote deeper collaboration between the client and the contractor. Periodic partnering review meetings and the adjudication committee operated under the GMP/TCC umbrella also establish a solid platform to discuss any difficulties encountered and resolve any confrontational issues (Chan et al., 2003).

Both ‘To tap in contractor’s expertise in design’ and ‘To set an agreed ceiling price at main contract award’ were also regarded as the other two commonest underlying motives of adopting GMP/TCC. With the early involvement of contractor in the design development process, not only construction activities can be launched before the entire project design is finalised, but also the enhancement of buildability and environmental issues can be incorporated into the design (Hong Kong Housing Authority, 2006). Moreover, the fixed price of traditional lump-sum contract is usually not the ultimate price at project completion but the target cost concepts offer a price ceiling and reduces cost variations for the clients (National Economic Development Office, 1982; Mills and Harris, 1995).

From an individual group’s perspective, apart from the above primary reasons, one motive for the contractor group to implement GMP/TCC was the agreed ceiling price through which their project revenue could be guaranteed. On the other hand, ‘To improve risk management and control’ was another key motive to apply GMP/TCC by both the client group and the consultant group. The Mass Transit Railway Corporation (MTRC), a major railway service provider in Hong Kong, adopted the TCC approach for a new railway station project so as to align the project team’s ability to the high-risk profile of the project (Avery, 2006) and to allocate risks on an agreed basis between the client and the contractor (Mass Transit Railway Corporation, 2003). Other key features of GMP/TCC including the price ceiling, gain-share/pain-share mechanism, increased involvement of the client, as well as the open-book accounting regime, enable better accountability and quantification

Table 3
Frequency distribution of the motives behind implementing GMP/TCC.

Motive of GMP/TCC	All respondent group		Client group		Contractor group		Consultant group	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
To enhance quality of constructed facilities	13	34.2%	5	33.3%	3	27.3%	5	41.7%
Need an ‘open-book’ accounting arrangement	8	21.1%	4	26.7%	0	0.0%	4	33.3%
To develop better working relationship	25	65.8%	11	73.3%	6	54.5%	8	66.7%
Previous successful experience with GMP/TCC	11	29.0%	2	13.3%	4	36.4%	5	41.7%
To tap in contractor’s expertise in design	24	63.2%	9	60.0%	6	54.5%	9	75.0%
To generate an incentive to achieve cost saving	26	68.4%	13	86.7%	6	54.5%	7	58.3%
To improve risk management and control	22	57.9%	10	66.7%	4	36.4%	8	66.7%
Greater time saving by overlapping design and construction	15	39.5%	3	20.0%	5	45.5%	7	58.3%
To set an agreed ceiling price at main contract award	23	60.5%	8	53.3%	8	72.7%	7	58.3%
Total	38	–	15	–	11	–	12	–

of the costs of risk (National Economic Development Office, 1982; Boukendour and Bah, 2001; Wong, 2006).

7.2. Benefits of adopting GMP/TCC

7.2.1. Overall ranking of the benefits of GMP/TCC

It should be stressed that the ranking exercise is based on perception, not an objective assessment. A subjective assessment of the ranking result is made to the analysis of the perceived relative importance of the benefits in relation to the GMP/TCC procurement strategy. The fact that this subjective assessment does not provide any absolute value on the ranking position is recognised. Emphasis is then given only to those benefits that are placed as the most important and the least important in the ranking list (Chan and Kumaraswamy, 1996).

The Cronbach's alpha coefficient for the rated 'benefits' is 0.685 (F statistics=2.929, $p=0.000$) which is larger than 0.5 according to Tuckman (1999) and Yip and Poon (2009), indicating that the scale used for measuring the perceived benefits is acceptable and reliable at the 5% significance level. In addition, the reliability of the survey findings might be uncertain as nearly half (46.7%) of the respondents are either experienced in one or none of GMP/TCC project, while the remaining 53.3% of the respondents have been involved in two or more GMP/TCC projects. Therefore, ANOVA tests were undertaken on each of the GMP/TCC benefits amongst the respondents with different experience levels of participating in GMP/TCC projects. It was found that there are no statistically significant differences between the group of "no experience and 1 project" and the group of "2–4 projects and over 4 projects" in their views of the importance of GMP/TCC benefits (all of the actual calculated significance levels larger than the critical value of 5%). It was indicated that the two sets of opinion data can be grouped together for further analysis and the survey findings are regarded as valid, reliable and representative.

Table 4 lists the relative importance of those perceived benefits of GMP/TCC as evaluated by the survey respondents. Interestingly, all of the three survey groups believed and ranked 'Early settlement of final project account' (Mean=4.25; SD=0.839) to be the most significant benefit of applying GMP/TCC. This finding indeed echoes the statement made by Gander and Hemsley (1997) that the preparation of and consensus on the final project account under GMP/TCC tends to be completed earlier than for the traditional fixed-price contracts because both of the price and time implications of any potential changes to the project (i.e. variations) under the GMP/TCC philosophy have been pre-agreed well between the client and the contractor under the contract document. This arrangement will help mitigate potential claims and intractable disputes for the entire project. Another key benefit of GMP/TCC is the capability of integrating contractor's expertise and innovative ideas in both design and construction to enhance the buildability of project (Mean=4.20; SD=0.795) since the GMP/TCC arrangement allows the contractor to be brought in at the early design stage to provide technical advice on various buildability and environmental issues to be incorporated into the design (Wong et al., 2006).

Table 4

Perceived benefits of GMP/TCC in Hong Kong (all respondents).

Benefits of GMP/TCC	N	Mean [#]	Standard Deviation (SD)
1. Provide guarantee of avoiding budget overrun at main contract award for the client.	44	3.80	0.904
2. Client provides financial incentives for contractor to achieve cost saving.	45	4.11	0.775
3. Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP or target cost.	44	3.89	0.895
4. Achieve better value for money.	45	3.91	0.793
5. Fast track project by allowing early start of construction before the design is fully developed.	44	3.89	0.868
6. Early settlement of final project account.	44	4.25	0.839
7. Greater client's control over design consultants, main contractor and subcontractors.	44	3.48	1.089
8. Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project.	44	4.20	0.795
9. Domestic subcontractor's works packages are competitively tendered by approved or prequalified subcontractors and specialists on an open-book basis after the award of GMP/TCC contract as design develops.	45	3.81	0.804
10. Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.	44	3.66	0.987
11. Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement.	45	4.16	0.928
12. More effort of client's involvement in problem solving and subcontractor selection.	44	3.91	0.936
13. Limit the entitlements for claiming variations by contractor.	45	3.69	0.900
14. Enable a more equitable risk apportionment amongst project participants.	45	3.73	0.889
15. Contractor takes all the risks in design development by way of GMP/TCC allowance in the tender.	45	3.40	1.170
16. More opportunities for participants to express opinions and concerns openly and freely.	45	3.89	0.804
17. The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team.	45	3.93	0.889

Note: Items were rated on a 5-point Likert scale with 1 = strongly disagree; 3 = neutral and 5 = strongly agree.

Moreover, 'Conducive to improving partners' working relationship via partnering' was highly rated as the merit of GMP/TCC (Mean=4.16; SD=0.928). This is primarily attributed to the gain-share/pain-share mechanism with the common goal of achieving cost saving under GMP/TCC concepts as well as the partnering arrangement introduced to most of the surveyed projects (Chan et al., 2003). Traditional working relationships amongst project team members are often adversarial with the parties resorting to contractual claims and even litigation. The cost incentives generated by the GMP/TCC scheme serve as an essential vehicle to produce alignment of project objectives from various industry stakeholders and not just to motivate the contractor. Ting (2006)

also opined that the incentivisation approach can create a more proactive, co-operative working relationship amongst different contracting parties and reinforce the cultural shift away from traditional adversarial approach to new collaborative contracting. Furthermore, the GMP/TCC form of contract is conducive to instilling ‘partnering spirit’ into the relationships amongst the employer, main contractor, subcontractors and consultants, with the objective of introducing a more co-operative and less litigious philosophy to the contract (Tang and Lam, 2003; Hong Kong Housing Authority, 2006). This echoes with another two apparent benefits of GMP/TCC: “Client provides financial incentives for contractor to achieve cost saving” (Mean=4.11; SD=0.775); and “The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team” (Mean=3.93; SD=0.889).

“Achieve better value for money” (Mean=3.91; SD=0.793) and “More effort of client’s involvement in problem solving and subcontractor selection” (Mean=3.91; SD=0.936) are also perceived as the key merits of GMP/TCC. If GMP/TCC could help achieve competitive price, and generate stronger incentives for innovation, it would be an effective means of motivating contractors to achieve better value and project performance (Construction Industry Review Committee, 2001). Sadler (2004) added that scope changes/variations need to be kept to a minimum in order that GMP/TCC contracts can be administered as intended and that the approach might provide value for money for the client. In addition, the GMP/TCC approach requires a greater level of commitment and involvement by the client to the contract arising from the tendering and project management (Tang and Lam, 2003; Sadler, 2004), which was also considered as a major benefit of the GMP/TCC approach.

7.2.2. Agreement of respondents within each survey group

The perceived benefits of GMP/TCC were also assessed from different perspectives of the client group, contractor group and consultant group. As all of the key active players in adopting GMP/TCC had been included in the questionnaire survey, it was considered that the opinions and findings could substantially represent the GMP/TCC project pool in Hong Kong over the past decade of 1998–2007. Although the number of respondents drawn from each of the three respondent groups was limited, the research findings were still considered valid and representative given the scarce number of construction projects procured with the GMP/TCC approach in Hong Kong (about 20 as cited by Chan et al., 2007a).

The rankings derived from each of the respondent groups were transformed into a matrix as the imported data for the calculations of the Kendall’s coefficients of concordance (W) as shown in Table 5. The Kendall’s coefficient of concordance (W) for the rankings of benefits was 0.082, 0.147, 0.117 and 0.177 for ‘all respondent group’, ‘client group’, ‘contractor group’ and ‘consultant group’ respectively. The computed W ’s were all significant with $p=0.10$.

As the number of attributes considered were above seven, as mentioned previously the chi-square value would be referred to rather than the W value. According to the degree of freedom

($17-1=16$) and the allowable level of significance [10% as adopted by Idrus and Newman (2002)], the critical value of chi-square from table was found to be 23.54. For all of the four groups (‘all respondent group’, ‘client group’, ‘contractor group’ and ‘consultant group’), the actual computed chi-square values (59.04, 37.63, 31.82 and 33.98 respectively) were all above the critical value of chi-square of 23.54. This result indicates the null hypothesis that ‘There is no significant agreement amongst different respondents on the rankings within a particular group’ has to be rejected. Therefore, there is sufficient evidence to conclude that there is significant degree of agreement amongst the respondents within each group on the rankings of the benefits of GMP/TCC.

7.2.3. Agreement of respondents between survey groups

Since the internal consistency of the rankings within all respondent group and within each of the three respondent groups was now established, the next stage of analysis is to test whether there is any similar substantial correlation on the overall rankings amongst the respondents across the three various groups. Table 6 provides the test results of Spearman’s rank correlation coefficients (r_s) and the corresponding significance levels. As revealed in Table 6, although positive correlations are found on the rankings between any two groups of survey respondents, the null hypotheses that no significant correlation between clients–contractors, clients–consultants and contractors–consultants on the rankings of GMP/TCC benefits cannot be rejected. Hence, there is inadequate evidence to conclude that there is no significant disagreement between any two groups on the ranking exercise. This reflects the apparent diverse perspectives on the merits of the GMP/TCC approach amongst the three respondent groups.

In particular, while client and consultant groups considered Item 2 ‘Client provides financial incentives for contractor to achieve cost saving’ as the most important benefit, the contractor group ranked it out of the top 10 benefits as the 15th. One of the obvious differences between GMP/TCC contract and fixed-price lump-sum contract lies in which party gets the savings if any. Under a fixed-price contract, the contractor would get the entire savings whereas the client will share the savings with the contractor under the GMP/TCC arrangement. Therefore, other things being equal, the client is going to favour a GMP/TCC contract over a lump-sum contract, and to a contractor the GMP/TCC contract would be less desirable. Additionally, this disagreement may explain the different expectations and interpretation of the GMP/TCC rationale on financial incentives between the client/consultant side and the contractor side. The clients in collaboration with their team of consultants may often perceive the gain-share arrangement in principle to be a strong impetus for contractor to strive for cost saving (Boukendour and Bah, 2001) but the contractors themselves may find it difficult to achieve in practice due to unclear scope of work and plenty of unforeseen risks associated with GMP/TCC contracts (Fan and Greenwood, 2004), for example, incomplete design at tender stage.

The three groups also indicated a fairly different ranking on Item 13 ‘Limit the entitlements for claiming variations by contractor’.

Table 5
Ranking and Kendall's coefficient of concordance for the perceived benefits of GMP/TCC.

ID	Benefits of GMP/TCC	All respondent group		Client group		Contractor group		Consultant group	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
6	Early settlement of final project account.	4.22	1	4.07	5	4.50	1	4.00	1
11	Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement.	4.11	2	4.21	2	4.29	2	3.67	9
8	Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project.	4.11	2	4.21	2	4.14	3	3.89	3
2	Client provides financial incentives for contractor to achieve cost saving.	3.97	4	4.29	1	3.64	15	4.00	1
5	Fast track project by allowing early start of construction before the design is fully developed.	3.92	5	4.00	7	3.86	7	3.89	3
4	Achieve better value for money.	3.92	5	3.79	11	4.07	4	3.89	3
17	The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team.	3.86	7	4.07	5	3.93	6	3.44	11
1	Provide guarantee of avoiding budget overrun at main contract award for the client.	3.84	8	3.86	10	3.79	11	3.89	3
3	Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP or target cost.	3.84	8	4.00	7	3.79	11	3.67	9
12	More effort of client's involvement in problem solving and subcontractor selection.	3.81	10	3.71	13	3.86	7	3.89	3
16	More opportunities for participants to express opinions and concerns openly and freely.	3.81	10	4.14	4	3.86	7	3.22	14
13	Limit the entitlements for claiming variations by contractor.	3.73	12	3.5	15	3.86	7	3.89	3
14	Enable a more equitable risk apportionment amongst project participants.	3.73	12	3.71	13	4.00	5	3.33	12
9	Domestic subcontractor's works packages are competitively tendered by approved or prequalified subcontractors and specialists on an open-book basis after the award of GMP/TCC contract as design develops.	3.68	14	3.93	9	3.64	15	3.33	12
10	Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.	3.57	15	3.79	11	3.57	17	3.22	14
7	Greater client's control over design consultants, main contractor and subcontractor.	3.41	16	3.36	16	3.79	11	2.89	17
15	Contractor takes all the risks in design development by way of GMP/TCC allowance in the tender.	3.30	17	3.00	17	3.71	14	3.11	16
	Number (<i>N</i>)	45		16		17		12	
	Kendall's coefficient of concordance (<i>W</i>)	0.082		0.147		0.117		0.177	
	Actual calculated chi-square value	59.04		37.63		31.82		33.98	
	Critical value of chi-square from table	23.54		23.54		23.54		23.54	
	Degree of freedom (<i>df</i>)	16		16		16		16	
	Asymptotic level of significance	0.000		0.007		0.083		0.062	

H_0 = respondents' sets of rankings are unrelated (independent) to each other within each group.
Reject H_0 if the actual chi-square value is larger than the critical value of chi-square from table.

Both the consultant group and contractor group assigned a higher rank to this benefit (3rd and 7th respectively) because a wide variety of the potential changes to the project were agreed and defined by the contracting parties well in advance under the contract

documents (Gander and Hemsley, 1997), and the contractors may be more willing to accommodate design changes in order to share any cost savings generated (Mills and Harris, 1995). However, the client group ranked it very low (15th) because the

Table 6
Spearman's rank correlation test between groups of survey respondents on the perceived benefits of GMP/TCC.

Comparison of rankings between groups of survey respondents	r_s	Significance level	Conclusion
Client ranking vs Contractor ranking	0.293	0.254	Cannot reject H_0 at 5% significance level
Client ranking vs Consultant ranking	0.424	0.090	Cannot reject H_0 at 5% significance level
Contractor ranking vs Consultant ranking	0.369	0.145	Cannot reject H_0 at 5% significance level

H_0 = no significant correlation on the rankings between two groups.

H_a = significant correlation on the rankings between two groups.

Reject H_0 if the actual significance level (p -value) is less than the critical value of 5%.

clients may still need to accept those project variations and additional works arising from changes in original scope of work submitted by the contractors (Fan and Greenwood, 2004), particularly if the GMP or target cost is established early in the design process, and thus they did not totally agree it as a genuine benefit at all. The difference may also be attributed to their various areas of involvement in project activities. Contractors and consultants usually worked more closely on claim for variation issues and may find that many claims can be reduced and eliminated via the GMP/TCC form of contractual arrangement. Thus, they perceive that GMP/TCC could reduce the chance of claim occurrence.

Moreover, the consultant group ranked significantly lower (9th) on the Item 11 'Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement' than the other two respondent groups (2nd for both). Under GMP/TCC contracts in conjunction with a partnering arrangement, both the client and contractor have developed a common goal of achieving cost saving usually during the initial partnering workshop as the two ultimate direct beneficiaries by developing harmonious working relationship throughout the whole project life (Chevin, 1996; Chan et al., 2004; Sadler, 2004) whereas the team of consultants may not be liable for sharing the saving.

One-way ANOVA test (F -test) for multiple samples was then carried out to examine any significant differences amongst the client, contractor and consultant groups on their perceptions of the specific benefits of GMP/TCC as measured by the mean values. Despite the above-said profound diverse opinions on the rankings of specific benefits of GMP/TCC amongst the three survey groups, the results of one-way ANOVA test revealed that no statistically significant difference is found amongst them at the 5% significance level on their perceptions of a particular benefit measured by the mean values, for example, Item 1 'Provide guarantee of avoiding budget overrun at main contract award for the client (3.86 for client group; 3.79 for contractor group and 3.89 for consultant group). This result implies that all of these three respondent groups shared somewhat unanimous level of consensus measured in terms of the mean values on each of the 17 perceived benefits of GMP/TCC. The detailed results of the ANOVA test are found in Chan et al. (2007b).

8. Conclusions

The traditional form of contractual arrangement within the construction industry is perceived as being poorly suited to the open and transparent working relationship. The acknowledgment of the important role of motivation and its influence on

project success has thereby led to the increased use of incentive schemes (Ashley and Workman, 1986). Many organisations including developers and contractors have been striving to gain hands-on experience with incentive fee-based contracts in solving potential problems facing the construction industry today. This research study, through an extensive review of contemporary literature and an industry-wide questionnaire survey conducted in Hong Kong, has accomplished a comprehensive analysis of the motives and benefits based on a number of GMP/TCC construction projects.

Although the results only reported on some local findings, they are also vital to other countries for international comparisons. In addition to the perceived benefits, the survey results of other associated attributes of GMP/TCC like potential difficulties, key risk factors involved, critical success factors, overall project performance, and two successful local GMP/TCC case study projects had been collated (Chan et al., 2007b) and will be reported for dissemination and reference towards the research community and construction industry via subsequent journal publications and conference presentations.

The empirical survey findings indicated that the key motives behind clients' decision of adopting GMP/TCC were to generate an impetus for contractor to become efficient and to achieve cost saving by means of the gain-share/pain-share mechanism. Client organisations also intended to integrate contractor's expertise in design and innovation. Developing better working relationship within the project team is another significant driver for selecting the GMP/TCC contractual framework. On the other hand, early settlement of final project account was ranked as the top benefit of adopting the GMP/TCC approach, primarily due to the presence of the pre-agreed price and time implications of any potential changes to the project. Another key benefit of GMP/TCC is the capability to tap in contractor's expertise in building designs and innovations prior to the commencement of construction, and consequently enhancing the buildability of project design. Moreover, the gain-share/pain-share mechanism under GMP/TCC contracts was found to be conducive to developing mutual objectives and constituting an integrated, trustful working team for achieving better overall project performance. However, the research results also demonstrated that the position and role of various project participants may influence their perceptions on the GMP/TCC benefits.

Limitations of the research study include the conclusions drawn are indicative rather than conclusive, as merely 45 completed survey questionnaires were received and analysed owing to a limited number of GMP/TCC construction projects in Hong Kong. The number of case studies is also limited but the survey findings

would be valuable for future studies in this area. Moreover, the research was confined to the GMP/TCC practices within the Hong Kong construction industry. Due to limited resources, the comparison of project performance between the local GMP/TCC projects with overseas projects and other procurement strategies other than traditional fixed-price contracts were excluded from this study.

Useful findings regarding the real-life benefits of the GMP/TCC procurement approach have been obtained based on the collection and detailed analysis of completed and on-going GMP/TCC projects. The findings, in line with the [Construction Industry Review Committee \(2001\)](#)'s recommendations, are valuable reference for key project stakeholders to explore the genuine benefits accrued from introducing the GMP/TCC philosophy. With the identified key motives and benefits of implementing GMP/TCC in mind, decision makers are given sufficient evidence and useful pointers to determine whether to adopt GMP/TCC in future projects or not. Further studies can be planned to investigate more case studies and survey samples on GMP/TCC projects in future to confirm the applicability and reliability of the benefits determined from this study. Effective practical implementation strategies can also be suggested for enhancing overall project performance.

In addition, to launch an in-depth research for GMP/TCC procurement strategy, a comparison of GMP/TCC practices between Hong Kong and other countries with extensive experiences with GMP/TCC such as the United Kingdom and Australia is worth investigating for establishing best practices for implementation. It is hoped that the research study will stimulate a wider debate on the underlying motives and benefits of alternative integrated procurement strategies in both a local and international context for reference by the construction industry.

Another on-going research project looking at the identification of key risk factors and risk mitigation measures, together with the evaluation of various risk sharing mechanisms for GMP/TCC projects is now being launched in Hong Kong ([Chan et al., 2008](#)) and the key research findings will be compiled later via publications (e.g. [Chan et al., in press](#)). GMP/TCC is at a germinating stage of development in Hong Kong and the pace of introducing its concepts and applications in construction is gaining drastic momentum. Given a plethora of perceived benefits, a wider application of GMP/TCC form of procurement across a wide spectrum of the construction industry is anticipated with the purpose of delivering projects ahead of schedule, within budget, with high quality and far less disputes or claims.

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