Project Management Journal (PMJ)
(Final Accepted Manuscript), Volume 43, Issue 2, April 2012, Pages 4-20

A Comparative Study of the Benefits of Applying Target Cost Contracts between South Australia and Hong Kong

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ABSTRACT

This paper aims to identify and analyze the key benefits of adopting Guaranteed Maximum Price and Target Cost Contracts (GMP/TCC) over and above the traditional lump-sum contractual arrangement through an empirical questionnaire survey conducted in South Australia and compared with the findings in Hong Kong. The Mann-Whitney U Test indicated differences in perception between the two groups of respondents on the majority of the identified benefits. The study has provided an in-depth understanding of the perceived benefits of the GMP/TCC scheme, hence leading to a wider application of those alternative integrated procurement strategies in both regions for reference by the construction community at large.

KEYWORDS: benefits; guaranteed maximum price; target cost contracting; South Australia; Hong Kong

INTRODUCTION

The construction industry has often been criticized for its adversarial relationships with contracting parties, program delays, and budget overruns. There has been a strong call for changes in procurement and contractual procedures to improve the overall performance of construction projects (Latham, 1994). The Report of the Construction Industry Review Committee (CIRC), published by the Hong Kong Special Administrative Region (SAR), advocated that better project performance can be achieved by the adoption of more innovative integrated procurement strategies (e.g., Guaranteed Maximum Price [GMP] and Target Cost Contracting [TCC] approaches with a gain–share/pain–share arrangement [Construction Industry Review Committee, 2001]). It has been claimed that the advantage of these approaches lies in their incentives to the contractor to become efficient, achieve cost savings, and search for continuous improvement in project outcomes. The New Engineering Contract (NEC) also includes provisions to incorporate the contractual arrangement of TCC with a gain–share/pain–share mechanism under a collaborative teamwork approach. The Hong Kong SAR Government has started introducing the NEC form of contract in a series of pilot capital engineering and construction projects across different works departments, under the Works Branch of the Development Bureau, since the commencement of the first NEC project in August 2009 (Cheung, 2008).

The GMP contractual arrangement based on a target cost concept has been gaining popularity among the prospective private property developers, public housing departments, mass transportation service providers, and major international construction contractors in the United Kingdom, Australia, and Hong Kong over the past few decades (Trench, 1991; Walker et al., 2000; Chan et al., 2007a; Roja & Kell, 2008).

Both target cost contracts and GMP contracts have been applied for several years in some western countries, and these procurement approaches have been considered advantageous to construction projects with a high level of technical complexity (National Economic Development Office, 1982) and have been proven to benefit the construction market. Hands-on experience derived from the United Kingdom and Australia has indicated that the GMP/TCC style of procurement could bring considerable mutual benefits to all of the parties involved, provided that the risk factors are properly identified, analyzed, shared, and managed (Trench, 1991; Walker et al., 2000).

The aim of this study is to compare the perceptions of practitioners in Hong Kong and South Australia on the perceived benefits of applying GMP/TCC in the construction industry. The main reason for such a comparison is that both Hong Kong and Australia share similar practices in the construction industry in terms of tender documentation and project delivery. Both countries have similar commonwealth systems and are situated in the Asia-Pacific region; therefore, it is logical to compare their practices of GMP/TCC. However, South Australia has a longer history of employing GMP/TCC compared with Hong Kong. An extensive literature review has produced a detailed analysis of the perceived benefits of GMP/TCC; hence, in this paper, the findings of two empirical questionnaire surveys conducted in Hong Kong (Chan et al., 2011a) and South Australia (Perkin, 2008) using the same survey instrument, are presented, discussed, compared, and cross-referenced with other related studies.

Application of Target Cost Contracts in Construction

The Definitions of TCC and GMP

According to the Institution of Chemical Engineers (2007), a target cost contract is defined as "*a particular type of cost reimbursement contract in which the contractor is reimbursed his or her costs subject to the application of a formula, which allows the contractor to share in savings made, often called "gain share," or to contribute towards additional costs incurred, called "pain share," according to how well the parties are able to manage the cost of the work.*" Trench (1991) considered target cost contracting as a contractual arrangement under which the actual cost of completing the work is evaluated and compared with an estimate or a target cost of the work, and the difference within a cost band is shared between the employer and the contractor with a pre-determined share ratio. According to the Mass Transit Railway Corporation (2003), the employer and the contractor would share savings (gains) if the final account figure turns out to be less than the target cost. If the final account figure exceeds the target cost, they would share the excess (pain). On the contrary, contractors would keep all of the savings generated under the traditional procurement approach instead of sharing them.

Masterman (2002) defined GMP as an agreement under which the contractors would be rewarded for any savings made against the GMP value and be penalized when this sum is exceeded because of mismanagement or negligence according to an agreed-on share ratio. Under this procurement approach, the contractor is committed to guaranteeing that the project will be constructed within the contract period fully, in accordance with the drawings and specifications, and the cost to the owner will not exceed the initial GMP value agreed on during the main contract award. The contractor will be paid a prescribed sum for his or her services, along with any savings to the owner. If the final out–turn cost exceeds the pre–determined GMP value, the contractor bears solely the excess costs. Perry and Thompson (1982) opined that GMP can be regarded as one form of TCC, with sharing arrangement limited only to the gain. Under the GMP contractual arrangement, the owner is guaranteed that the ceiling price will not be exceeded (Clough & Sears, 1994; Cantirino & Fodor, 1999). Perhaps, the classical definitions of TCC and GMP appear to focus on one major area but do not highlight the pricing structures associated with those procurement approaches, thereby considerably reducing the possibilities of arbitrary contractual claims during the post–contract stage.

The Pricing Structures of GMP and TCC

If a GMP/TCC project is procured on a negotiated contract basis, the preferred contractor has already been identified within a group of contractors with a positive client relationship. Some of the GMP contracts (e.g., Chater House and York House in Hong Kong) have been awarded on a negotiated basis with a preferred contractor due to long–term corporate business relationships (Chan et al., 2011b). Under the negotiated bidding approach, the requirement does not detract from the objectives of obtaining a competitive bid, because the majority of the subcontracted work packages are ultimately bid on an "open–book" competitive basis. This information exchange, however, requires a high level of mutual trust within the project team, especially the main contractor. The quantum of the subcontracted packages competitively bid on may represent a range of 60% to 80% of the entire contract value (Chan et al., 2007a). In the case of negotiated tendering for GMP projects in Hong Kong, the negotiations are pursued at a tender stage based on a set of tender documents, including the GMP methodology, standard form of contract, design documentation (e.g., performance

specifications, schematic design and design development documentations for major elements and the like), and bills of quantities for builders' works (Chan et al., 2011b). The main contractor would submit a tender based on the tender documents, and the employer's consultants negotiate the amount of GMP with the main contractor. In the negotiation process, the contractor is required to provide, on an open–book basis, all information used in support of his or her tender pricing. The consultant quantity surveyor is responsible for ascertaining whether the main contractor's pricing for direct work are comparable with the prevailing market rates (Chan et al., 2007a).

In the case of using selective bidding, however, bidders will be invited to participate in pre–qualification exercises in the normal manner by submitting a preliminary proposal covering their corporate strength, financial stability, relevant work experience, past track record, expertise in alternative procurement methods, technical competence, organizational structures and personnel, and partnering commitment. The submissions are then reviewed and evaluated by the client in collaboration with his or her team of consultants. After a rigorous evaluation, a group of pre–qualified contractors will be shortlisted and invited to submit their bids.

If a two–stage bidding method is used, bidders selected through pre–qualification exercises will be invited to submit their bids according to the following preliminary materials supplied by the client and his or her team of consultants (Chan et al., 2007a):

1. Cost plan
2. Basic schematic/outline design of the drawings (e.g., approximately 20% of the design is complete)
3. Performance specifications for work packages
4. Other available information (e.g., amount of liquidated and ascertained damages)

After bid evaluation at the first stage, the shortlisted bidders are asked during the second stage to submit more detailed proposals based on: (1) bills of quantities; (2) a more complete set of design drawings (e.g., about 80% of the design is complete); and (3) performance specifications for the specialist work packages.

With regard to the information required for GMP/TCC contracts, both the guaranteed maximum price and target cost are estimated based on the preliminary design documentation provided by the client in conjunction with his or her team of consultants. Basic bid documents for GMP/TCC contracts are usually comprised of: (1) the cost for the main contractor's direct work (e.g., substructure work, reinforced concrete superstructure work, finishing work, and so forth); (2) domestic subcontractors' work packages; (3) provisional quantities; (4) contingency funds; and (5) design development allowance (Hong Kong Housing Authority, 2006). The information provided in the bid documents is not sufficient for construction and completion of the work; thus, the contractor allows for design development in his or her pricing and is encouraged to submit alternative cost–effective design proposals. Further design information and data will be provided by the client and his or her consultant team after the target cost is agreed on and issued to the main contractor according to the architect's instructions.

In general, bid documents for specialist subcontractors' work packages (e.g., electrical and mechanical installation, MVAC [mechanical ventilation and air conditioning] installation, plumbing and drainage, fire services installation, lift installation, and specialist external work) will be prepared by the main contractor in conjunction with the team of consultants. The bid

documents will be issued to pre–qualified or preferred subcontractors to control the scope and quality of work. The main contractor must identify any GMP change orders (i.e., subject to a re–calculation of the GMP value) within the subcontract bid documents prior to the invitation of bids (Fan & Greenwood, 2004). Upon issue of the subcontract bid documents to the bidders, the main contractor is deemed to have accepted that the scope of work described by the bid document for that particular subcontractor's work package is within the allowances included for design development (i.e., not subject to a re–calculation of the GMP value).

Bids will then be analyzed by the main contractor, together with his or her team of consultants, and the team will jointly make recommendations to the client for award on a competitive "open–book" arrangement, and subcontractors can be assured a fair assessment of their bids. The main contractor will enter into a domestic subcontract with the successful subcontractor. This process eliminates the requirement to adopt nominated subcontracts and their inherent liabilities. The main contractor also assures the client that the subcontractors will not assign or sublet their work without the prior approval of the client. Any procurement savings generated from the bidding of the domestic subcontractors' work will be incorporated into the final out–turn costs and will form the basis for the calculation of shared savings upon completion of the project.

Literature Review of the Benefits of GMP/TCC

Various benefits of GMP/TCC were identified from the contemporary literature in terms of cost control, time control, quality control, as well as working relationships between contracting parties.

More Stringent Cost Control

The procurement option of GMP/TCC offers a more realistic ceiling price or target cost of the project toward the owners (Perry & Barnes, 2000). From the owner's point of view, adopting GMP can increase the control over the project costs and he or she is liable only up to the agreed–on guaranteed maximum amount (Steele & Shannon, 2005).

Moreover, GMP/TCC is a procurement method in which the contractor is rewarded for the cost savings incurred but is penalized for budget overruns. This "reward and penalty" approach generates strong incentives for a contractor to be efficient and to achieve cost savings (Fan & Greenwood, 2004). As both the owner and contractor may benefit from the cost saving, they will become more motivated to collaborate and achieve cost minimization (Tang & Lam, 2003).

Faster Project Delivery

One of the criticisms of the traditional design-bid-build procurement approach is that it cannot offer the fast–track arrangement between the design phase and construction phase (Construction Industry Review Committee, 2001). Gogulski (2002) stated that one of the perceived advantages of the GMP form of procurement is that it enables work to start ahead of the production of final drawings to minimize the risk of late completion for the owners. He further pointed out that the owner plays a more active role throughout the project delivery process. Trench (1991) shared similar perceptions and considered that GMP/TCC may speed up the process of problem solving. Seymour (2002) reported that the Tseung Kwan O Railway Extension Project of the Mass Transit Railway Corporation in Hong Kong adopted a

TCC arrangement and achieved an early project completion in four and a half months.

As the arrangements of change orders under the GMP/TCC approach are pre–agreed on by the client and contractor, the occurrence of claims and/or disputes may be reduced, and the preparation and agreement of the final project account tend to be finalized earlier than those of conventionally priced contracts (Gander & Hemsley, 1997). Another advantage that GMP/TCC can bring is the greater flexibility to accommodate design changes because of the straightforward change order claiming mechanism and the ”open–book” accounting regime (Mills & Harris, 1995). Unlike the traditional contracting method, the valuation of change orders can therefore be less time–consuming and more transparent, leading to an early settlement of the final project account.

Better Quality Control

The third perceived benefit of GMP/TCC is the improvement of quality in construction projects. The GMP/TCC arrangement improves overall construction quality, because the owner can retain greater control over the team of design consultants during the pre–contract and post–contract award stages, thus ensuring compliance with the initial design intent stated in the client's project brief compared with the design–build procurement approach (Hong Kong Housing Authority, 2006). Tang and Lam (2003) stated that the client can also be motivated to put more effort into helping solve problems. On the contractor's side, the contractor is also brought in at the early design stage to advise on construction costs, building design, project programming, construction materials, alternative construction techniques, and other constructability issues. This arrangement can tap into the expertise and innovative ideas of contractors to further polish the design proposed by the design team (Hong Kong Housing Authority, 2006). All these issues develop the potential for producing savings in both time and cost and higher product quality. Moreover, with the contractor's contribution in the early design phase of the project, a more cost–effective contracting strategy with more constructable designs can be formulated.

A More Harmonious Working Relationship

Walker et al. (2002) advocated that the gain–share/pain–share mechanism encourages a teamwork approach to creating innovative ideas in problem solving through the case study of the Australian National Museum. Bower et al. (2002) opined that the GMP/TCC contracting approach can be effective in motivating contractors to achieve better value for money and project performance by linking their own financial objectives to the overall objectives of the project. The gain–share/pain–share mechanism generates a strong impetus for effective collaboration between the client and contractor in order to minimize the final out–turn cost of a project (Chevin, 1996; Sadler, 2004). Pre–construction planning for design development, which involves all relevant project stakeholders, can reduce the conflicts and disputes at a later time (Chan et al., 2007a). This contracting approach also allows the contractor and employer to determine the appropriate ownership of risks and encourages various contracting parties to agree on an equitable allocation of risks, which is in the client's long–term interest (Sadler, 2004). A fair and effective dispute resolution mechanism and communication opportunities are provided by means of adjudication meetings, not only leading to a reduction in claim or dispute occurrence (Hong Kong Housing Authority, 2006; Chan et al., 2011a), but also improving working relationships among project team members and incorporating interdisciplinary efforts into the project (Ting, 2006). In the traditional lump–sum approach, the design is almost completed and the price is fixed, which does not leave much room for

negotiation about who is right or wrong or for making any possible compromise. Under the GMP/TCC form of procurement, however, there is much more room for negotiation, because the design is incomplete and this is especially true if the gain–share/pain–share mechanism is introduced. For example, whether a change is classified as a design development item or a variation order under contract would be determined by the adjudication committee if the issue is in dispute.

Additionally, the GMP/TCC form of contract is useful in injecting the partnering spirit into the relationships among the owner, main contractor, subcontractors, and consultants, with the objective of introducing a more harmonious and less confrontational philosophy to the contract (Tang & Lam, 2003; Hong Kong Housing Authority, 2006). Chan et al. (2004) further suggested that the development of the GMP contracting approach in a number of building projects, and the incentivization agreement in the railway infrastructure projects in Hong Kong, have been proven to be effective in fostering a cooperative working atmosphere and a gain–share/pain–share working culture. This view is echoed by the findings of Bayliss et al. (2004), suggesting that the partnering approach was instrumental in reducing claims in the Tseung Kwan O Railway Extension, a civil engineering project procured with the TCC arrangement. Although there are no official statistics on the percentage of GMP/TCC projects performing adequately in both Australia and Hong Kong, there are some case studies reporting on the success of such contractual arrangements. For example, a recent study by Anvuur and Kumaraswamy (2010) suggested that two GMP cases of building projects in Hong Kong achieved a final out–turn cost within budget and were completed on time. Another private office development project using the GMP form of procurement was completed six days ahead of schedule with a cost savings of 15% (Chan et al., 2011b).

It should be emphasized, however, that the GMP/TCC form of project procurement is not without limitations. Roja and Kell (2008) found that the number of guaranteed maximum prices did not really guarantee construction cost in 75% of the public school GMP projects studied in the northwestern part of the United States. Fan and Greenwood (2004) believed that the projects procured with a GMP contractual arrangement should be drafted with care, particularly in the areas of scope of work and nature of change orders. A legal case in South Australia also shows that the contractual definition of reimbursable cost can be a source of dispute (i.e., *One Steel Manufacturing Pty Ltd [OneSteel] v United KG Pty Ltd [United]* [2006] SA SC 119).

It was discerned from this case that a provision in a building contract allowing the contractor to be reimbursed for cost incurred will be subject to an implied term that the cost be reasonably and properly incurred, unless the provision is inconsistent with other provisions of the contract. The above findings suggest that GMP/TCC should be applied with caution with regard to the definitions of change orders and reimbursable cost. A desktopAn Internet search has indicated that there is no published literature focusing on the international comparison of the benefits of GMP/TCC. The study reported in this paper intends to fill this gap of knowledge base. It is stressed that the purpose of this paper is not to advocate the application of GMP/TCC. Rather, this paper aims to draw a comparison of the perceptions on the perceived benefits of GMP/TCC between South Australia and Hong Kong and to investigate the probable reasons behind such differences in opinions between the West (e.g., Australia) and the East (e.g., Hong Kong).

Research Methods

The research study began with an extensive review of contemporary literature (including but not limited to textbooks, journal articles, conference papers, professional journals, research reports, dissertation reports, and Internet materials) to capture sufficient background knowledge about the concepts and applications of the GMP/TCC form of procurement. The objective of the literature review is to develop an overall research framework and prepare a suitable template for structured interviews and an empirical questionnaire survey. A total of 17 perceived benefits of implementing the GMP/TCC scheme were initially crystallized from the published literature. The items identified were subsequently scrutinized and verified through a series of face-to-face structured interviews with several relevant senior industrial practitioners, with a wealth of direct hands-on experience with GMP/TCC in both Hong Kong (Chan et al., 2007b) and South Australia (Perkin, 2008).

An industry-wide empirical questionnaire survey was first launched between May and June of 2007 in Hong Kong, with 191 blank questionnaires sent out, and 45 valid and completed survey forms returned for analysis by the end of June 2007. Local industrial practitioners based in Hong Kong, including clients, main contractors, consultants, and subcontractors with abundant hands–on experience in GMP/TCC construction projects were the target respondents of the survey. The purposive sampling method is a random selection of sampling units within the segment of the population with the most information on the characteristic of interest (Guarte & Barrios, 2006). This non–probability sampling tool was employed to select target respondents in this survey in both Hong Kong and South Australia. According to Teddlie and Yu (2007), this technique is often applied when the researcher wants to select a purposive sample representing a broader group of cases as closely as possible or to draw a comparison between different kinds of cases on a certain dimension of interest. The researcher is likely to glean the opinions of the target population with a purposive sample (Tashakkori & Teddlie, 2003). Because the cases of GMP and TCC were rather limited in Hong Kong and South Australia, the purposive sampling approach was regarded as an appropriate tool for sampling in this comparative study. The same questionnaire survey was then undertaken by the research collaborators based in South Australia between May and June of 2008 to solicit the perceptions of various project stakeholders toward these identified benefits and then to enable a direct comparison with Hong Kong.

Respondents from both regions were asked to rate each identified benefit pertaining to the GMP/TCC approach on a five–point Likert scale delineating different levels of agreement (1 denotes “strongly disagree”; 2 represents “disagree”; 3 denotes “neutral”; 4 represents “agree”; and 5 denotes “strongly agree”) with reference to a certain GMP/TCC construction project they had participated in. Respondents were also asked to suggest and rate any other unmentioned benefits based on their own experience and discretion, but ultimately they did not identify any new factors.

The Kendall’s Concordance Test

The Kendall’s coefficient of concordance (*W*) test 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 5% ($p < 0.05$), for example, then a reasonable degree of consensus among the respondents within the group on the rankings of benefits was indicated. In other words, a high or significant value of *W* reflects that different parties are essentially applying the same standard in ranking the benefits, as computed by the following formula (Siegel & Castellan, 1988):

$$W = \frac{\sum_{i=1}^{n} (\overline{R}_i - \overline{R})^2}{n(n^2 - 1)/12} \qquad (1)$$

where: n = number of benefits being ranked
$\overline{R}_i$ = average of the ranks assigned to the *i*th benefit
$\overline{R}$ = average of the ranks assigned across all benefits

If the number of attributes is greater than 7, the chi-square value is used as a near approximation instead (Siegel & Castellan, 1988). 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 degree 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. Therefore, it can be concluded that there is a significant degree of agreement on the rankings of benefits among the respondents within the group. The actual calculated chi–square value with (n – 1) degree of freedom is defined below:

$$\Psi^2 = k\,(n - 1)\,W \qquad (2)$$

where k = number of respondents ranking the benefits
n = number of benefits being ranked

The Mann-Whitney U Test

The Mann-Whitney U Test is a non-parametric statistical test that is applied in hypothesis testing involving two independent variables (Gibbons & Chakraborti, 2003) and is used to test if there is any statistically significant difference in the median values for each attribute under study between any two respondent groups. This statistical technique was adopted in a research study by Cheung et al. (2008) about the tolerance of clients and estimators toward errors in cost estimating and a study by Yu et al. (2008) comparing the perceptions on variables of construction project briefing of project managers and architects between Hong Kong and western countries. The Mann-Whitney U Test was undertaken in this paper to test the null hypothesis that, "There is no significant difference in the median values of the same benefit between the respondents from South Australia and Hong Kong," and the medians can be represented by mean ranks (Sheskin, 2007).

Null hypothesis H_0: $\theta_1 = \theta_2$
Alternative hypothesis H_a: $\theta_1 \neq \theta_2$

The level of significance (α) for testing these hypotheses was set at 0.05. The results can be interpreted by the Z-value and p-value. When the actual calculated p-value is less than the pre-defined significance level of 0.05, then the null hypothesis (H_0) can be rejected. Thus, it can be concluded that there is a significant difference in the median values of that benefit between the two respondent groups (Sheskin, 2007).

Survey Results and Discussion

The Profiles of Survey Respondents

A total of 191 blank survey questionnaires were sent to the target industrial practitioners with direct hands-on GMP/TCC experience in Hong Kong between May and June of 2007. Target survey respondents were given two weeks to complete and return their questionnaires. Reminders were sent to those who did not respond within the period, and two more weeks were provided to enable them to return their completed survey forms. Finally, 45 valid and completed questionnaires were returned for analysis by the end of June 2007, representing a response rate of 23.5%. On the Australian side, a total of 152 self-administered survey forms were forwarded to 72 Australian construction-related companies, including client organizations, design consultants, quantity surveyors, main contractors, subcontractors, and other related professionals via postal mail between May and June of 2008. Finally, 45 valid and completed survey forms were received for analysis by the end of June 2008, representing a response rate of 29.6%. Given the fact that both GMP and TCC were new to Hong Kong at that time, and there were only about 20 construction projects applying such contractual arrangements in Hong Kong (Chan et al., 2007a) up to the end of 2007, the response rate was considered satisfactory and acceptable. Table 1, along with Figures 1 and 2 summarize the profiles of respondents in Hong Kong and South Australia, who participated in the respective surveys.

Table 1: Profiles of survey respondents in Hong Kong and South Australia.

	Hong Kong	**South Australia**
Years of Experience in Construction Industry	Number of Respondents	Number of Respondents
Less than 5 years	0	1
5–10 years	0	6
11–15 years	6	10
16–20 years	11	12
> 20 years	28	16
Total	45	45
Hands-on Experience with GMP/TCC Projects		
No experience, but with sound understanding of underlying concepts and principles of GMP/TCC schemes	4	9
1 project	17	3
2–4 projects	17	17
Over 4 projects	7	15
Total	45	45

Although only the clients and main contractors are involved in a GMP/TCC contract, the consultants and subcontractors also play a key role throughout the overall project delivery process (e.g., the consultant quantity surveyor needs to assess the cost savings and value the change orders, whereas subcontractors execute the substantial amount of construction work as instructed by the main contractor under the terms and conditions of subcontracts); their opinions are considered relevant and important as a whole project team so they were also

invited to participate in this survey. The consultants are regarded as part of the project team, who not only interface with the clients but also the contractors, so their views were also solicited for collective regional comparison between South Australia and Hong Kong.

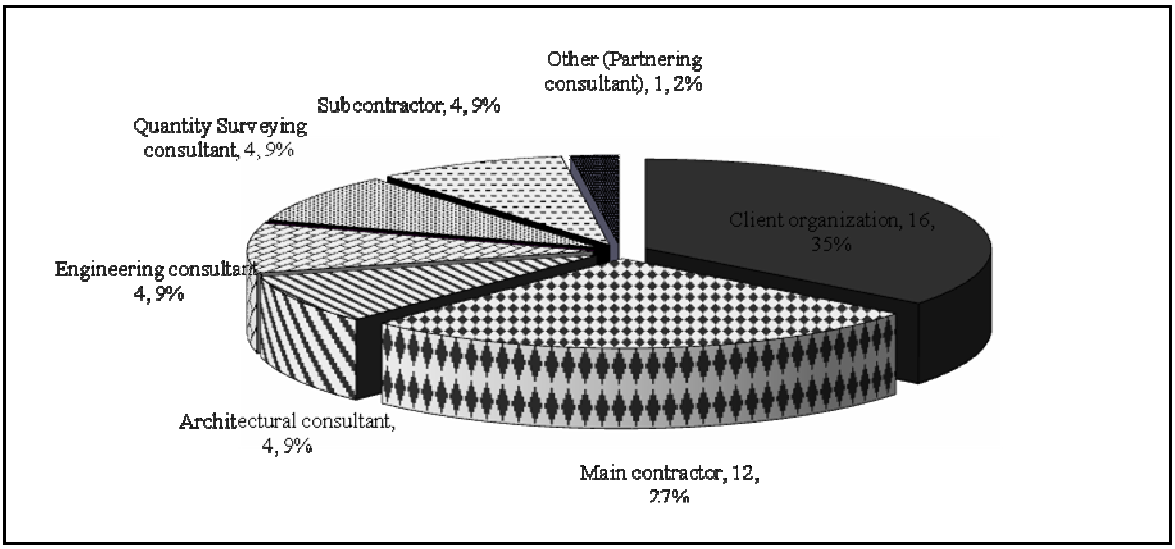

Figure 1: Types of employing organizations of the survey respondents in Hong Kong.

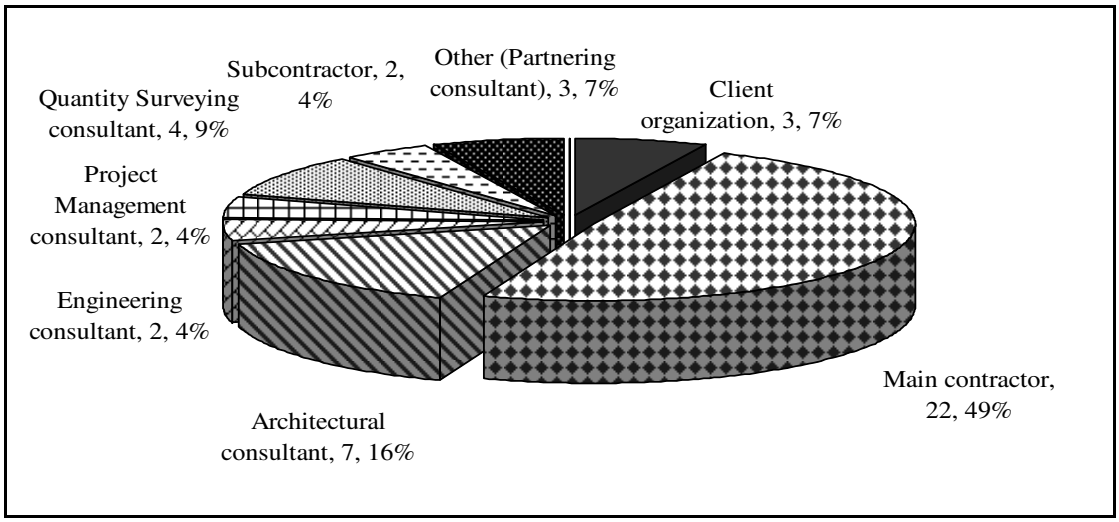

Figure 2: Types of employing organizations of the survey respondents in South Australia.

It would be ideal to differentiate between the perceived benefits according to the viewpoints of clients and contractors; however, due to the uneven mix between clients and contractors (particularly in South Australia, with a ratio of 3 to 22) and the limited number of samples of the survey indicated in Table 1, drawing an inter-group comparison according to the respondents' roles within each region, as well as between public client bodies and private client organizations, is not justified. The limitation of sample size also makes differentiating between the benefits of GMP and TCC separately difficult, even though GMP and TCC are somewhat different in terms of cost and time risk allocations. Some previous research studies on a similar topic, however, also pooled GMP and TCC together as cost incentive contracts for analysis (Arditi & Yasamis, 1998; Bower et al., 2002; Chan et al., 2007b), so the approach of analysis used in this study can be taken as justifiable and reasonable.

Overall Ranking of the Benefits of GMP/TCC in South Australia and Hong Kong

The mean scores of various perceived benefits derived from the Australian and Hong Kong surveys are presented in Table 2. According to the Australian respondents, "Early award of contracts can allow advanced work packages (e.g., demolition, foundation, and so forth) to be included in GMP or target cost" was ranked as the most significant benefit (Mean = 4.02, SD = 0.839) of applying GMP/TCC. However, the same benefit was ranked eighth by the respondents in Hong Kong (Mean = 3.89, SD = 0.895). This difference in ranking may be due to the different construction practices between the two regions. The demolition and foundation projects are usually procured in separate contracts on a fixed-price lump-sum basis in Hong Kong, so Hong Kong respondents did not regard it as a major benefit of the GMP/TCC approach. The Australian respondents considered it to be the most significant merit. This procurement arrangement of awarding the contract for early work packages to commence is also highlighted in the research by Davis Langdon and Seah (2004).

"Fast track project by allowing early start of construction before the design is fully developed" was perceived as the second most significant benefit by the Australian respondents (Mean = 3.84, SD = 0.976), but the same benefit was ranked eighth by the Hong Kong respondents (Mean = 3.89, SD = 0.868). The different construction practices between the two regions may contribute to such inconsistency in ranking. GMP/TCC can facilitate the commencement of site construction activities before the entire completion of the design similar to the design-and-build contract. Advanced work and early program planning for faster construction, particularly in the early purchase of materials, and logistics management may also be facilitated because of the early commencement of site construction (Chan et al., 2007a). The Australian practitioners believed that the division of the work into work packages helped shorten the overall project duration. This result echoes the findings of Arditi and Yasamis (1998), suggesting that incentive/disincentive contracts shorten the project duration of construction work. Moreover, Davis and Stevenson (2004) also reported that time saving is one of the dominant benefits of GMP in Western Australia. The Hong Kong respondents, however, did not share the same perception of this benefit, because it is common practice that the construction process is commenced before the design is fully completed with extensive use of contingency funds and provisional quantities in the Bills of Quantities. The designers tend to issue change orders to make design changes at the post-contract award stage. Actually, the GMP/TCC methodology can introduce some degree of flexibility in managing projects, which is one of the key requirements for project success when handling unpredictable situations such as design changes. This concept is supported by Puddicombe (2009) and Chan et al. (2011b), who recommended that GMP is suitable for construction projects with high complexity, when compared with lump-sum contracts and cost-plus contracts. Anvuur and Kumarawamy (2010) shared a similar view that the GMP mechanism can provide some employer flexibility for catering to short-term market changes and can also be a useful instrument for project work integration.

Interestingly, "Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the constructability of project" was ranked as the second most significant benefit by both the Australian (Mean = 3.84, SD = 0.878) and Hong Kong (Mean = 4.20, SD = 0.795) groups of respondents. This finding probably suggested that one of the key benefits associated with GMP/TCC is the capability of tapping into the contractor's expertise and innovative ideas in both design and construction to enhance the constructability of the project. This procurement option allows the contractor to be brought in at the early design stage to advise on building design, project programming, construction

materials, alternative construction techniques, and other constructability issues to be integrated into the design to mitigate the construction risk (Chan et al., 2007b).

Table 2: Comparison of mean scores and rankings of the perceived benefits of GMP/TCC between South Australia and Hong Kong.

Benefits of GMP/TCC	South Australian Group				Hong Kong Group			
	Rank	N	Mean[#]	S.D.	Rank	N	Mean[#]	S.D.
Early award of contracts can allow advanced work packages (e.g., demolition, foundation, etc.) to be included in GMP or target cost.	1	45	4.02	0.839	8	44	3.89	0.895
Fast track project by allowing early start of construction before the design is fully developed.	2	45	3.84	0.976	8	45	3.89	0.868
Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project.	2	45	3.84	0.878	2	44	4.20	0.795
Contractor takes all the risks in design development by way of GMP/TCC allowance in the tender.	4	45	3.62	0.960	17	45	3.40	1.170
Provide guarantee of avoiding budget overrun at GMP main contract award for the client.	5	45	3.56	1.198	12	44	3.80	0.904
Limit the entitlements for claiming variations by the contractor.	6	45	3.51	1.100	14	44	3.69	0.900
Client provides financial incentives for contractor to achieve cost savings.	7	45	3.36	1.090	4	44	4.11	0.775
Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement.	7	45	3.36	0.883	3	44	4.16	0.928
Early settlement of final project account.	9	45	3.33	1.022	1	42	4.25	0.839
More opportunities for participants to express opinions and concerns openly and freely.	10	45	3.31	0.949	8	44	3.89	0.804
The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team.	11	45	3.24	1.004	5	45	3.93	0.889
Enable a more equitable risk apportionment among project participants.	12	45	3.11	1.092	13	44	3.73	0.889
Achieve better value for money.	13	45	3.07	1.176	6	45	3.91	0.793
Domestic subcontractor's work 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.	13	45	3.07	0.915	11	45	3.81	0.804
More effort of client's involvement in problem solving and subcontractor selection.	15	45	2.91	1.083	6	42	3.91	0.936
Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.	16	45	2.87	0.869	15	45	3.66	0.987
Greater client control over design consultants, main contractor and subcontractors.	17	45	2.60	1.074	16	45	3.48	1.080

[#] *Items were rated on a 5-point Likert scale with 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly Agree.*

Agreement of Respondents between South Australia and Hong Kong

Table 3 summarizes the results of the Kendall's Concordance Test for the Australian survey and the Hong Kong survey. The two respective actual calculated values of chi-square (114.213 and 55.593) are larger than the critical value of chi-square found from the statistical table (26.30 for both the Australian and Hong Kong surveys. The null hypothesis that the respondents' sets of rankings are unrelated (independent) to each other within a survey group can be rejected; therefore, it can be concluded that there is a significant degree of agreement on the rankings of benefits among the respondents within the Australian and Hong Kong groups. This finding ensures that there was a good internal agreement of ranking perceptions within the Australian and Hong Kong groups before conducting the Mann-Whitney U Test.

Table 3: Results of the Kendall's concordance test on the perceived benefits of GMP/TCC between South Australia and Hong Kong.

Item	South Australian Group	Hong Kong Group
Number of survey respondents (N)	45	36
Kendall's coefficient of concordance (*W*)	0.159	0.097
Actual calculated chi-square value	114.213	55.593
Critical value of chi-square from table	26.30	26.30
Degree of freedom (df)	16	16
Asymptotic level of significance	< 0.001	< 0.001

Results of the Mann-Whitney U Test between South Australia and Hong Kong

Table 4 elicits and compares the results of the Mann-Whitney U Test on the perceptions of survey respondents toward the benefits of GMP/TCC between South Australia and Hong Kong. When the actual calculated p-value is below the prescribed significance level of 0.05 for a certain benefit, a large variation in the median values of that benefit between the Australian group and Hong Kong group is detected. The test results indicated the five perceived benefits of GMP/TCC with no significant difference in perceptions between the two regions to be: (1) Provide guarantee of avoiding budget overruns at the GMP main contract award for the client; (2) Early award of the contract can allow advanced work packages (e.g., demolition, foundation, and so forth) to be included in the GMP or target cost; (3) Fast track project by allowing early start of construction before the design is fully developed; (4) Limit the entitlements for claiming change orders by the contractor; and (5) Contractor takes all the risks in design development by way of GMP/TCC allowance in the bid.

On the other hand, the test results revealed that the Australian respondents held more divergent views compared with their Hong Kong counterparts on 12 out of 17 benefits, at a 5% significance level. It should also be noted that the difference in timing of launching the surveys in both regions (i.e., May–June of 2007 for the Hong Kong samples and May–June of 2008 for the Australian samples) may also be one of the contributors to the differences in opinions between the two groups of respondents as a result of changes in global economic conditions. In addition, the test results indicated that the mean ranks of the Australian respondents are almost always lower than those of the Hong Kong respondents, except for some benefits with statistically non-significant results. The cultural difference between the

East and the West may be conducive to the disparities in perceptions on the benefits of such contractual arrangements. Those more divergent results, with a significance level of less than 0.01, are summarized and discussed in this section.

Table 4: Results of Mann-Whitney U test on the perceptions of survey respondents on the perceived benefits of GMP/TCC between South Australia and Hong Kong.

No.	Variables (Benefits of GMP/TCC)	Mean Rank		Z-value	p-value
		South Australia	Hong Kong		
1.	Provide guarantee of avoiding budget overrun at GMP main contract award for the client.	42.22	46.88	-0.892	0.372
2.	Client provides financial incentives for contractor to achieve cost savings.	35.78	54.43	-3.677	0.000[a]
3.	Early award of contracts can allow advanced work packages (e.g., demolition, foundation, etc.) to be included in GMP or target cost.	46.74	42.15	-0.917	0.359
4.	Achieve better value for money.	35.98	54.23	-3.469	0.001 [a]
5.	Fast track project by allowing early start of construction before the design is fully developed.	44.13	44.88	-0.149	0.882
6.	Early settlement of final project account.	33.71	55.79	-4.217	0.000 [a]
7.	Greater client control over design consultants, main contractor, and subcontractors.	36.02	53.37	-3.293	0.001 [a]
8.	More effort of client's involvement in problem solving and subcontractor selection.	34.46	55.01	-3.933	0.000 [a]
9.	Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project.	39.43	49.80	-2.078	0.038[b]
10.	Domestic subcontractor's work 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.	35.20	52.61	-3.432	0.001 [a]
11.	Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.	37.13	52.21	-2.944	0.003 [a]
12.	More opportunities for participants to express opinions and concerns openly and freely.	36.91	53.27	-3.244	0.001 [a]
13.	Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement.	35.09	55.14	-3.831	0.000 [a]
14.	Limit the entitlements for claiming variations by the contractor.	42.69	47.36	-0.918	0.358
15.	Enable a more equitable risk apportionment among project participants.	37.79	52.38	-2.779	0.005 [a]
16.	Contractor takes all the risks in design development by way of GMP/TCC allowance in the tender.	45.23	41.60	-0.707	0.480
17.	The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team.	35.99	54.22	-3.479	0.001 [a]

[a] represents a p-value of less than 0.01.
[b] represents a p-value of less than 0.05, which indicates a significant statistical difference.

It should also be stressed that the legal structure and hands-on experience in handling GMP/TCC projects between the two jurisdictions may also contribute to the differences in perceptions of the two groups of respondents. In addition, as stated in the earlier section, because there were only about 20 GMP/TCC projects in Hong Kong when the survey was conducted, the likelihood of obtaining multiple responses from the same projects may be high. Yet, because the responses solicited are from various industrial practitioners, their personal opinions and professional judgments can be treated as individual and independent for our statistical analysis. As multiple responses may be obtained in some projects, which were considered successful cases (Bayliss et al., 2004; Anvuur & Kumaraswamy, 2010; Chan et al., 2011b), this might affect the survey results that the Hong Kong respondents from those successful cases may highly rate the benefits of GMP/TCC in this study due to more successful project outcomes achieved.

Item 2: Client provides financial incentives for contractor to achieve cost savings

As observed in Table 4, the Hong Kong respondents agreed more than the Australian respondents that providing financial incentives for the main contractor to achieve cost savings was a significant benefit of the GMP/TCC approach. This may be explained by the fact that the pace of development and application of GMP/TCC in Hong Kong is slower than in South Australia, and the underlying concepts of GMP/TCC are still new to most of the industrial practitioners in Hong Kong. Compared with the Australian respondents, the Hong Kong counterparts have gained less experience in handling GMP/TCC projects. The Hong Kong SAR Government is now considering introducing the NEC form of contract, which is associated with target cost options in a series of pilot capital projects across different relevant departments under the Works Branch of the Development Bureau (Cheung, 2008), so the Hong Kong respondents may be more impressed by the incentive provision under these new forms of procurement in Hong Kong. The novelty of GMP/TCC arrangements in Hong Kong has considerably impressed the Hong Kong respondents on the provision of financial incentives in such contractual arrangements. This benefit is also reflected in the typical GMP case study of Chater House (Chan et al., 2011b) and the TCC case study of the Tsim Sha Tsui Underground Railway Station Modification Works (Chan et al., 2010b) in Hong Kong.

Tang and Lam (2003) further stated that both the client and contractor in Hong Kong are motivated to cooperate and achieve cost minimization, because both parties may benefit from the cost savings. Nicolini et al. (2001) further found that both of the two pilot demonstration building projects in the United Kingdom obtained a cost reduction of 8% to 14%, 5% to 20% faster programs, and a 90% to 95% reduction in rework, compared with a similar project using the traditional contracting approach. The uneven mix of survey samples (e.g., fewer clients were represented in the Australian sample of only 3 compared with 16 clients in the Hong Kong sample) might influence the results obtained, which may have been a limitation of the study.

Item 4: Achieve better value for money

The Hong Kong professionals rated achieving better value for money more significantly than their Australian counterparts. One of the possible reasons for this may be the fact that the overall performance of those GMP/TCC projects in which the respondents were involved achieved savings in both time and cost (Chan et al., 2007a; Chan et al., 2010b). Hence, the respondents considered that the GMP/TCC approach could really achieve better value for money in project procurement. Another possible reason may be the fewer change orders

arising from those GMP/TCC projects compared with those procured by the traditional design-bid-build form of procurement in Hong Kong; thus, the deviation of final out-turn cost from the contract target cost becomes narrower.

Item 6: Early settlement of final project account

The Hong Kong respondents again showed more agreement with the statement, "Early settlement of final project account" than the Australian respondents. 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 tend to be completed earlier than those for the traditional fixed-price contracts, because both the price and time implications of any potential changes to the project (i.e., change orders) under the GMP/TCC philosophy have been pre-agreed on by the client and the contractor under the contract document. This arrangement will help mitigate potential claims and intractable disputes for the entire project.

Moreover, partnering is more commonly adopted in the Australian construction industry, and the relationship between the client and contractor is more harmonious in Australia; however, the traditional client–contractor relationship is adversarial in Hong Kong (Construction Industry Review Committee, 2001). The partnering concepts accompanied by the GMP/TCC form of procurement can considerably improve the working relationships between contracting parties (Chan et al., 2011a) and probably shorten the duration of the final account settlement.

Item 7: Greater client control over design consultants, main contractor, and subcontractors
Item 8: More effort of client's involvement in problem solving and subcontractor selection

The two groups of respondents exhibit different levels of agreement on Item 7, "Greater client control over design consultants, main contractor, and subcontractors" and Item 8, "More effort of client's involvement in problem solving and subcontractor selection," both related to the client's control and involvement. The design-and-build procurement option is more popular in the Australian construction market than in Hong Kong. The Hong Kong respondents welcomed the implementation of GMP/TCC, which encouraged more proactive participation of different contracting parties throughout the whole project development process. The client can retain more stringent control over the team of design consultants during the pre-contract and post-contract award stages, thereby ensuring compliance with the initial design intent as stipulated in the client's project brief (Hong Kong Housing Authority, 2006). It is not very surprising to obtain such a result, because this kind of procurement form ties the risk and reward of the client and contractor together, rather than an individual party's performance (Scott, 2001). This alignment of interests may motivate the clients to participate in the process of problem solving, subcontractor selection, and the whole project development in a more proactive manner, because the prompt problem solving would probably streamline the project development and would be beneficial to the overall performance of the project. Under GMP/TCC, with the increased involvement of the client in the problem-solving process, when compared with the traditional contracts, the decision on any changes can also be made more efficiently. The increased client's involvement in GMP/TCC does not seem to have a significant impact on the project duration, but such involvement may encourage the project team to generate cost-savings and/or time-saving solutions or strategies. Some relevant supporting case studies from previous research studies on GMP/TCC contracts in Hong Kong (e.g., Bayliss et al., 2004; Anvuur & Kumaraswamy, 2010; Chan et al., 2010b, 2011b) revealed that those projects achieved favorable time and

cost savings if properly procured.

Item 10: Domestic subcontractor's work packages are competitively bid on by approved or pre-qualified subcontractors and specialists on an open-book basis after the award of the GMP/TCC contract as the design develops

The mean rank by the Hong Kong respondents is higher than their Australian counterparts for this item; one of the possible explanations for this is that the traditional procurement approach is most commonly applied in Hong Kong (Construction Industry Review Committee, 2001). The GMP/TCC procurement arrangement is rather new to Hong Kong. In the case of GMP/TCC practices in Hong Kong, domestic subcontractors' work packages are competitively bid on among those approved or pre-qualified subcontractors and specialists on an open-book basis (between the client and main contractor) in order to control the range and quality of work. This alternative contracting approach assists in selecting the appropriate competent project team with the adequate hands-on experience to undertake the project and capable of developing the client's design intent (Trench, 1991). After the bid assessment, the main contractor will enter into a domestic subcontract with the successful subcontractor. This process eliminates the requirement to adopt nominated subcontracts and their inherent liabilities and constraints. On the other hand, the Australians have employed this practice longer and thus may have got more accustomed to such arrangement of subcontracting.

Item 11: Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes

The Hong Kong respondents considered "Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes" as a significant benefit of applying GMP/TCC to a greater extent than the Australian respondents. This finding may suggest that the Hong Kong respondents were satisfied with the adjudication clause, which was seldom used in the standard form of contract commonly used in Hong Kong in projects procured with GMP/TCC. Both Chan et al. (2003) and Beach et al. (2005) suggested that applying partnering concepts reduced the problems with contractual claims and disputes. They may appreciate the effectiveness of adjudication committee and meetings due to the successful experience with TCC projects (Bayliss et al., 2004; Chan et al, 2010b). Furthermore, as revealed by the internal guidelines for GMP contract procurement issued by the Hong Kong Housing Authority (2006) of the Hong Kong SAR Government, an adjudication committee that involves representatives from the client, architect, quantity surveyor, and main contractor is established under the GMP/TCC methodology to determine the nature and extent of the change orders and facilitate the expeditious resolution of any contentious issues within the project team.

Item 12: Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement
Item 13: More opportunities for participants to express opinions and concerns openly and freely

According to Chan et al. (2007a), partnering was practiced in the majority of GMP and TCC projects based on their research study in Hong Kong. The rationale behind this phenomenon may be that the partnering concepts are useful in aligning individual objectives of various project stakeholders to common objectives of the projects and in facilitating the gain-share/pain-share philosophy associated with GMP/TCC. Similar to the items discussed

in this section, the Hong Kong respondents held a more positive view on the benefits of Item 12, "Conducive to improving partners' working relationship via the gain-share/pain-share mechanism and partnering arrangement," as well as Item 13, "More opportunities for participants to express opinions and concerns openly and freely." The application of TCC through the partnering/alliancing concepts in Australia is more mature than that in Hong Kong, and the working relationship between owners and contractors is more cooperative and less confrontational there. The Hong Kong respondents may score the improved working relationship and free expression of opinions and concerns via partnering higher than the Australian group of professionals, because the Hong Kong practitioners may have experienced a more drastic change in the working relationship under a partnering environment in those projects.

Item 15: Enable a more equitable risk apportionment among project participants

As indicated in Table 3, the Australian respondents perceived this item as positively as their Hong Kong counterparts; perhaps, past experience may be one of the possible reasons for this finding. A case study of a GMP project launched by Rose and Manley (2007) in Australia revealed that one of the negative drivers of implementing the financial incentive mechanism was inequitable risk allocation, based on their interview data and opinions. On the other hand, the case studies conducted by both Chan et al. (2008a) and Chan et al. (2010b) demonstrated that the projects with the GMP and TCC forms of arrangement were completed within budget and ahead of schedule. These previous successes should reinforce the confidence in procuring GMP/TCC contracts by the Hong Kong respondents. Sadler (2004) concluded that this contractual arrangement also enables the contractor and employer to determine the appropriate ownership of risks, encourages various contracting parties to agree on an equitable allocation of risks, and offers better value for money toward the client, which is in the client's long-term interest.

Item 17: The gain-share arrangement helps establish mutual objectives and produce an integrated, trustful working team

The feature of target cost contracts is to share the risk of cost overrun between the owner and the contractor so that both parties have a common objective in mind. This view is supported by Davis and Stevenson (2004), who suggested that encouraging teamwork with mutual trust and common goals was one of the merits of GMP. The Hong Kong respondents were more positive in rating this statement in the questionnaire survey. The survey reflects the willingness of the Hong Kong respondents to attempt the gain-share mechanism, despite having less experience with GMP/TCC compared with their Australian counterparts. This partnering spirit under the GMP/TCC procurement arrangement also tied the benefits of both contracting parties together and produced an integrated working team filled with mutual trust.

Conclusions

Based on an extensive review of comprehensive literature and an empirical questionnaire survey, an analysis of the perceived benefits associated with the GMP/TCC scheme was generated in the Australian perspective, and the survey results were compared with those from Hong Kong. It was found that the respondents in South Australia and Hong Kong held different views in a number of benefits according to the results of the Mann-Whitney U Test. Various possible underlying reasons have been given; such differences in perceptions between the two groups of respondents may be attributed to the different pace of

development, the application of the GMP/TCC form of procurement, as well as the implementation of the partnering approach between Australia and Hong Kong (Chan et al., 2007b).

With the perceived benefits of GMP/TCC in mind, decision makers (i.e., clients) are given useful directions and references to determine whether or not to apply GMP/TCC in future projects. Limitations of the research study lie in the fact that only 45 completed survey questionnaires were received each from Australia and Hong Kong. The limited number and uneven mix of survey samples, which are common problems encountered in research studies based on questionnaire surveys, restricted the scope of analysis. For example, it is not justified to compare the opinions between the Hong Kong client group and the Australian client group, between public client bodies and private client organizations within each region, as well as between GMP and TCC, on the perceived benefits of GMP/TCC. However, more inter-group comparisons may be undertaken in the future if the sample size within each group of survey respondents can be made larger, more representative, and well-balanced. Nevertheless, the survey findings would be valuable for future studies in this area, when more GMP/TCC projects are launched and completed in the future.

Both GMP and TCC schemes have been practiced in Australia for decades, whereas these procurement strategies have not received as wide attention as they should, because few research studies have been undertaken in this area. This research study has provided a holistic comparison between South Australia and Hong Kong in terms of the benefits of applying the GMP/TCC procurement strategies. The research findings reported in this paper should give industrial practitioners an in-depth understanding of GMP/TCC contracts and their associated benefits during implementations in both Hong Kong and South Australia. We hope that the research study will stimulate a wider debate on the underlying benefits associated with GMP/TCC in both local and international contexts for reference by the construction industry at large. Another research project focusing on risk identification, risk analysis, risk mitigation, and risk allocation inherent with GMP/TCC contracts have been completed recently in Hong Kong, Australia, and the United Kingdom (Chan et al., 2008b) and the key research findings have been reported in other publications (e.g., Chan et al., 2010a; 2011c).

Notes:

The empirical survey questionnaire used in this study was compiled and based on the terminologies used in the United Kingdom to suit the target respondents in both Hong Kong and South Australia, who are more familiar with these terms in their current practices; however, Table 5 compares the use of different terminologies between the United Kingdom and the United States, as used on the survey form for reference.

Table 5: Comparison of the different terminologies between the United Kingdom and the United States as used on the survey questionnaire.

U.K. Terminology	U.S. Terminology
Tender	Bid
Design-and-build	Design-build
Variations	Change Orders
Buildability	Constructability
Provisional Monies	Contingency Funds

Acknowledgments

The authors would like to acknowledge the organizations and industrial practitioners for participating in the empirical questionnaire survey launched in both Hong Kong and South Australia and for providing their valuable opinions and necessary project information to facilitate this research study. The authors would also like to thank The Hong Kong Polytechnic University for providing financial support to this research initiative (HK PolyU General Research Grants Allocation 2008/09 with Project Account Code: BRE-A-SA42). The work described in this paper was further supported by another grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (RGC Project No. PolyU 5107/07E). This paper forms part of the RGC funded research project entitled, "Evaluating the Key Risk Factors and Risk Sharing Mechanisms for Target Cost Contracting (TCC) Schemes in Construction" with several different objectives but sharing a common background of study and research methodology.

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