Research Monograph

An Investigation of Guaranteed Maximum Price (GMP) and Target Cost Contracting (TCC)

Procurement Strategies in Hong Kong Construction Industry

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2. Ir Gilbert LAW	Project Manager	Swire Properties Ltd
3. Mr Edmond LO	Project Manager	Swire Properties Ltd
4. Ir Rohit PATEL	Head of Planning and Pre-construction Engineering	Gammon Construction Ltd
5. Mr James ROBINSON	Executive Director (Projects and Quantity Surveying)	Hongkong Land Ltd
6. Mr SUEN Mau Hing	Head of Quantity Surveying	Hongkong Land Ltd
7. Mr Arthur SHIA	Director	WT Partnership (HK) Ltd
8. Ms Teresa TANG	Contracts Administration Manager – Operations	Mass Transit Railway Corporation Ltd
9. Ms Susanna WONG	Senior Architect	Hong Kong Housing Authority
10. Mr WONG Sai Fuk	Construction Manager (Estimating and Subletting)	Gammon Construction Ltd

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- Construction Industry Institute, Hong Kong (CII-HK)

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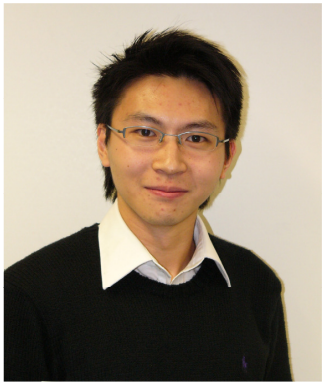

Dr James MW WONG, *BSc(Hons), PhD,* obtained his BSc(Hons) degree in Building Technology and Management and PhD degree in Construction Economics from the Department of Building and Real Estate of PolyU. He has more than 5 years hands-on research experience in construction economics and management. He is currently a Postdoctoral Research Fellow at the Department of Civil Engineering, The University of Hong Kong. His research interests include construction economics and forecasting, construction procurement systems, project management, labour economics as well as education in the built environment.

EXECUTIVE SUMMARY

The construction industry has long suffered from limited trust amongst contracting parties, lack of incentives and misalignment of objectives, which might eventually result in poor project performance. Consequently, the guaranteed maximum price (GMP) and target cost contracting (TCC) approaches, with a gain-share/pain-share arrangement serving as a cost incentive mechanism, have emerged as innovative procurement strategies for clients to minimise risks, avoid claims and integrate the diverse interests of a complex construction project. However, there is still a lack of research evidence to evaluate the levels of success and lessons learned from previous GMP/TCC projects. Besides, since this project delivery method is at a germinating stage of development in Hong Kong, a comprehensive investigation of its applications in relation to local conditions is indispensable and timely.

Based on systematic and comprehensive review of published literature, selected case studies and a series of in-depth interviews on the perceptions of relevant experienced industrial practitioners, this study aims to explore the key attributes of GMP/TCC including the underlying motives, perceived benefits, potential difficulties, key risk factors, critical success factors, overall project performance and optimal project conditions for adopting GMP/TCC scheme in Hong Kong. A research survey questionnaire based on the literature review and interviews findings was also compiled to collect empirical data on the above attributes from those industrial practitioners who have gained abundant hands-on experience in applying the GMP/TCC procurement strategy. A total of 191 survey questionnaires were sent out and 45 valid completed forms were received which yielded a response rate of 23.56% for further statistical analysis by using the Kendall's Concordance Test and Spearman's Rank Correlation Test.

The survey results indicated that the most common motives behind the decision of adopting the GMP/TCC approach for the surveyed projects are to: (1) Generate an incentive for the contractor to achieve cost saving; (2) Develop better working relationship amongst project team members; and (3) Tap in contractor's expertise in design and innovation. The survey respondents ranked: (1) Early settlement of final project account; (2) Conductive to improve partners' working relationship via

partnering; and (3) Bring in expertise in building designs and innovations in construction methods and materials from contractor, as the top three benefits of using GMP/TCC.

However, (1) Keeping the design development pace with contractor's programme for tendering the domestic subcontractor's works packages; (2) More involvement by the clients in a project; and (3) Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development due to unclear scope of work, were also perceived as the three most significant difficulties encountered with GMP/TCC. Furthermore, (1) Involvement of any inexperienced or claim conscious contractors; (2) Disputes arising from changes in scope of work; and (3) Unforeseen design development risks, were regarded as key risk factors when implementing this new way of GMP/TCC contracting arrangement.

To achieve the chance of better project outcomes, experienced practitioners shared a consistent view that (1) reasonable share of cost saving and fair risk allocation; (2) partnering spirit from all contracting parties; (3) the right selection of project team; and (4) well-defined scope of work in client's project brief, are identified to be essential successful ingredients for introducing GMP/TCC scheme. A set of best practice guidelines are also recommended for enhancing the successful implementation of GMP/TCC scheme in the Hong Kong construction industry based on those critical success factors sought from this research.

Case studies of local completed GMP/TCC construction projects reflected that the overall project performance was favourable, especially on the aspects of project schedule, final project cost and dispute (claim) occurrence. The survey respondents also exhibited a strong support to the future use of GMP/TCC contracting arrangement. The survey findings indicated that (1) client's requirements for higher level of buildability and innovation; (2) large and technically complex projects with higher risk profile; and (3) projects with tight schedule, are considered to be appropriate to launch the GMP/TCC scheme. This procurement strategy, however, might not be suitable for projects where it is difficult to define the scope of work at early stage or a lot of changes are expected.

The study is significant in contributing to new knowledge and practical information of GMP/TCC applications and implementation, in both a local and international context. The findings from this research study are particularly valuable in assisting key project stakeholders in minimising the detriments brought about by potential difficulties/risks in and maximising the benefits derived from implementing GMP/TCC concepts. More importantly, this study, complying with the CIRC's recommendations, provides sufficient groundwork for construction clients and contracting organisations to develop a best practice framework for successful implementation of GMP/TCC procurement process in future construction projects.

Further studies can be planned to investigate more case studies and survey samples on GMP/TCC projects in future to verify the applicability and reliability of the critical success factors identified in this study. Effective and practical strategies can also be suggested for enhancing overall project performance. Based on the solid findings of this study, comparison of GMP/TCC practices between Hong Kong and countries with extensive experiences in GMP/TCC such as the United Kingdom and Australia is also worth investigating. Given the favourable project performance outcomes, a wider adoption of GMP/TCC in both the building sector and the infrastructure sector is anticipated with the purpose of delivering projects ahead of schedule, within budget, with high quality and far less disputes or claims. It is expected that the application of GMP/TCC in the local construction industry is set to grow.

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1.1 Background of the Study

The construction industry has long suffered from a lack of co-operation, limited trust and misalignment of objectives, often resulting in an adversarial working relationship amongst all project stakeholders, and eventually inducing poor project performance (Chan *et al*., 2004). Strong alarms have also been raised in Hong Kong that the tendency to award contracts to the lowest bidders has been conducive to low profit margins. Both consultants and contractors have therefore little incentive to put in efforts more than just meeting the minimum contractual requirements. In addition, the traditional design-bid-build procurement approach, beset with fragmented working culture and non value-adding multi-layered subcontracting, has led to the poor quality of constructed facilities (CIRC, 2001). Hence, various project stakeholders have been advocating for changes in construction contracting procedures to achieve better value for money and more satisfactory project performance.

Novel procurement methods have been developed in 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 Kingdom and Australia, to integrate the construction delivery process and to motivate service providers to seek continuous improvements in project outcomes (CIRC, 2001). Previous overseas triumphant cases indicated that the guaranteed maximum price (GMP) and target cost contracting (TCC) procurement approaches with a gain-share/pain-share arrangement serving as a cost incentive mechanism, can accrue considerable mutual benefits to all of the parties involved, provided they are properly structured, implemented and managed (Trench, 1991; Walker *et al.*, 2000). The Report of the Construction Industry Review Committee (CIRC) published by the Hong Kong Special Administrative Region in January 2001 also recommended that outstanding project performance can result, amongst other things, from the implementation of more innovative integrated

procurement strategies such as GMP and TCC for complex and high-risk construction projects.

Both the GMP and TCC approaches have appeared to be innovative alternative procurement strategies in Hong Kong for clients to mitigate risks, avoid claims, integrate the diverse interests of a complex construction project and offer incentives to provide "value-added" services. The GMP arrangement based on a target cost concept has been gaining popularity amongst other alternative procurement strategies since the completion of the first project introducing GMP in Hong Kong. This was the commercial development of 1063 King's Road developed by a leading private property developer, Hong Kong Land Ltd in Quarry Bay completed in August 1999. The project was completed on time and the final out-turn cost is 11%-38% less than similar buildings using the traditional procurement system (Ho, 2000).

Table 1.1 lists some of the GMP/TCC construction projects in Hong Kong. The quasi-government mass transportation service provider, Mass Transit Railway Corporation Ltd (MTRCL), has experimented with the target cost contracting approach through the implementation of incentivisation agreements (IA) in the Tseung Kwan O Railway Extension (TKE) contract (Bayliss, 2002; MTRC, 2003). A preliminary review of these successful case study projects has revealed that the GMP/TCC approach could offer financial incentives for the contractor to become efficient and to achieve cost saving, as well as to allocate risks on an agreed basis between the client and the contractor.

Table 1.1 List of some GMP/TCC construction projects in Hong Kong

Project Name	Project Nature	Project Time-frame	GMP or TCC
Client Organisation – Hongkong Land Ltd			
Chater House	A prestigious rental commercial development in Central	Oct 2000 – Jul 2002	GMP
1063 King's Road	A rental commercial development in Quarry Bay	Nov 1997 – Aug 1999	GMP
Alexandra House Refurbishments	A prestigious rental commercial development in Central	Nov 2002 – Nov 2003	GMP
Tradeport Hong Kong Logistics Centre	A commercial logistics hub for the Asia region at Chek Lap Kok	Jul 2001 – Dec 2002	GMP
Landmark Redevelopment Phase 6 – York House	A rental commercial redevelopment in Central	Jan 2005 – Oct 2006	GMP
Client Organisation – Swire Properties Ltd			
The Orchards	A twin tower residential development in Quarry Bay	Aug 2001 – Sep 2003	GMP
Three Pacific Place	A prestigious rental commercial development in Wanchai	Jun 2002 – Aug 2004	GMP
One Island East	A 70-storey Grade AAA office tower in Quarry Bay	Apr 2006 – Mar 2008	GMP
Client Organisation – Australian International School			
Australian International School	A private educational building	Aug 2000 – Aug 2001	GMP
Client Organisation – Gammon Skanska Ltd			
Tseung Kwan O Technology Park	A private technology park	Nov 2001 – Dec 2002	GMP
Client Organisation – Hong Kong SAR Government and Hong Kong Jockey Club			
Hong Kong Park	A public recreational park	------	GMP
Client Organisation – DHL Aviation (Hong Kong) Ltd			
DHL Central Asia Hub	A private express cargo sortation and delivery terminal building at Chek Lap Kok	Feb 2003 – Jun 2004	GMP
Client Organisation – Hong Kong Housing Authority			
Public Housing Development at Eastern Harbour Crossing Site Phase 4	A public rental housing development in Yau Tong as a pilot study project	Jun 2006 – Jun 2009	Modified GMP
Client Organisation – Mass Transit Railway Corporation Ltd			
Tseung Kwan O Railway Extension – the sixth operational railway line with 5 stations	13 civil engineering contracts, 4 building services contracts as well as 17 electrical and mechanical contracts (e.g. C601-Hang Hau Station and Tunnels, C654-Platform Screen Doors)	Mar 1999 – Sep 2002	TCC
Tseung Kwan O Railway Extension – Contracts 609 A & B	Piling Works of Tseung Kwan O Depot – Areas A & B	Feb 1999 – May 2000	TCC
Tsim Sha Tsui Metro Station Modification Works (MTRC Contract C4420)	Tsim Sha Tsui Metro Station Modification Works	Apr 2002 – Sep 2005	TCC
Tung Chung Cable Car Project	A sightseeing transportation facility including civil and building works	Jun 2004 – Dec 2005	TCC

1.2 Research Aim and Objectives

This research study aims to investigate the applications of GMP/TCC practices based on reported literature and some selected case study projects recently completed in Hong Kong. Specific objectives are to:

(i) Investigate and compare the GMP/TCC implementation practices amongst the selected projects and with other contracting approaches in terms of organisational structures; duties and responsibilities of the parties involved; control mechanisms and project performance.

(ii) Explore the perceptions of clients, consultants, main contractors and subcontractors on the motives, benefits, difficulties and success factors of applying GMP/TCC contracts in comparison with other procurement approaches.

(iii) Identify the potential key risk factors involved in and optimal project conditions suitable for implementing the GMP/TCC approach amongst all project stakeholders.

(iv) Establish a set of effective guidelines for successful implementation of GMP/TCC schemes in the Hong Kong construction industry. The guidelines could help promote best practices and avoid potential pitfalls.

1.3 Research Approach

The overall research method can be described as follows:

a. To review relevant literature from textbooks, journals, magazines and newsletters, proceedings of conferences, workshop reports, seminar notes, together with internet materials, to investigate the related research on GMP/TCC procurement strategies worldwide.

b. To carry out structured interviews with project participants who have gained practical GMP/TCC experience in Hong Kong to identify the local practices of GMP/TCC and solicit the viewpoints of the participants.

c. To conduct an empirical questionnaire survey towards the project participants representing different organisation types to investigate the features and implementation processes of the GMP/TCC approach in Hong Kong.

d. To analyse the information and data collected statistically to examine the perceptions of key project stakeholders on the motives, benefits, difficulties, success factors, risk factors, project performances and prevailing practices of adopting the GMP/TCC approach.

e. To provide a set of best practice guidelines for successful implementation of GMP/TCC schemes in Hong Kong.

1.4 Significance and Value of the Research

The Hong Kong construction industry has long suffered from a lack of co-operation, mutual trust, effective communication and incentive provisions contributing to poor project implementation in terms of time, cost and quality. To achieve value for money in construction procurement, service providers and suppliers should be motivated or given incentives to provide "value-added" services, which are of material benefit to the end-users. A guaranteed maximum price and target cost contracting approach was suggested to 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 (CIRC, 2001).

Although GMP and TCC have been practiced in the United Kingdom and Australia for several years, and a number of construction projects are employing the concept, not all these projects have been equally successful. Moreover, very limited research evidence has been found, especially in the Hong Kong context to assess the levels of success and lessons learned from those previous GMP/TCC projects, despite

multitudinous literature about the practices of GMP/TCC in overseas countries (Levien, 1988; Trench, 1991; Gilbreath, 1992; Kerzner, 1995; Ferreira and Rogerson, 1999; Blumkin and Schwartz, 2003; Drysdale, 2003).

Hence, there is a strong justification for a comprehensive research study of GMP/TCC applications in Hong Kong with the intention of reaping the perceived benefits and exploring their implementation processes for achieving construction excellence from those successful cases. Since GMP/TCC is relatively new in Hong Kong, such a comprehensive investigation in relation to Hong Kong conditions is valuable and timely. The research findings of this study are also expected to provide sufficient groundwork for client bodies and contracting organisations to develop a set of best practice guidelines and an exemplary framework for GMP/TCC process or scheme for future construction projects. This research also forms a solid foundation for a subsequent comparative study of GMP/TCC practices between the United Kingdom, Australia and Hong Kong.

1.5 Structure of this Report

This research report is composed of six chapters. The first chapter is a general introduction to the research. It consists of an introductory background of the GMP/TCC practices and the research problem. This chapter also outlines the approach, aim and objectives, as well as value of the research.

Chapter Two reviews the published literature of GMP/TCC on the practices and processes, features, benefits, difficulties, risk factors and success factors. The literature review forms a crucial step for developing research framework, launching structured interviews and the empirical questionnaire survey.

Chapter Three presents the methodology adopted for the research, including the research framework, details of literature review, case study, structured interview, questionnaire survey, data collection and data analysis techniques applied to achieve the research objectives.

Chapter Four examines the viewpoints of different contracting parties, based on two in-depth case studies, in terms of the motives behind to adopt GMP/TCC, benefits, difficulties, key risk factors and critical success factors in implementing the GMP/TCC strategy.

Chapter Five reports on and discusses the results from the data analysis on the questionnaire survey. The GMP/TCC practices are critically assessed by an empirical analysis. Besides, the overall performances of those GMP/TCC projects are also evaluated by comparing with conventional procurement approach. Based on the review of related literature, structured interviews, case studies and questionnaire survey, a set of practical guidelines for successful implementation of GMP/TCC schemes are also suggested to establish best practice framework for the implementation of future target cost-based contracts.

Chapter Six gives a review of project objectives and a summary of the major findings of the research. It concludes the research and discusses the limitations and contributions from the study. The possible core directions for future research are also recommended.

1.6 Chapter Summary

This introductory chapter has provided the research scope and the justifications of carrying out the research. The background of GMP/TCC procurement strategies is introduced. The aim and objectives of the study are also clearly stated. The research approach is depicted together with the value of the research and the structure of the report.

CHAPTER 2 LITERATURE REVIEW OF GMP AND TCC APPROACH

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2.1 Introduction

The method by which construction services are procured is a critical determinant of the success of a project (Chan and Yung, 2003). The movement for change within the construction industry has led to an increasing belief that the procurement approach should be tailored to integrate the project team through aligning the objectives and aspirations of various project stakeholders, the sharing of risks and the extent to which the employer wishes to be an integral part of the design and construction processes. In practice, the guaranteed maximum price (GMP) and target cost contracting (TCC) procurement approaches have been successfully implemented in construction to achieve these goals. This chapter critically reviews, based on the reported literature, these two innovative integrated procurement strategies specifically on the implementation processes and features, benefits, difficulties, risk factors and critical success factors. The literature review aims to capture background information, which forms a strong basis for developing interview questions and research survey as well as establishing guidelines for successful implementation of the GMP/TCC approach in construction.

2.2 Definitions of GMP and TCC

GMP/TCC is an incentive-based procurement strategy which will award the contractor for any savings made against the guaranteed price / target cost and penalise him when this sum is exceeded as a result of his/her own mismanagement or negligence according to a pre-agreed share ratio (Masterman, 2002). The contractor usually includes a sum for future design development (in the form of GMP/TCC allowance) and for any unforeseeable risks (Gander and Hemsley, 1997).

2.2.1 Target cost contracting (TCC)

The National Economic Development Office (UK) – 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. Savings or overruns between target cost and actual cost at completion are shared between the parties to the contract."

(NEDO, 1982:1)

Trench (1991:13) 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. MTRC (2003) also opined that "the client and the contractor would share savings (gains) if the final account figure turns out to be less than the target. Should the final account exceed the target, they would share the excess (pain)". 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.

2.2.2 Guaranteed maximum pricing (GMP)

Boukendour and Bah (2001), on the other hand, considered the GMP as a hybrid arrangement consisting of a cost imbursement 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 be exceeded the initial GMP agreed at main contract award.

Carty (1995) regarded GMP to be:

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

(Carty, 1995:322)

Kerzner (1995) expanded Carty (1995)'s definition of GMP as:

"… the contractor is paid a fixed fee for his profit and reimbursed for the actual cost of engineering, materials, construction labour, but only up to the ceiling figure established as the 'maximum guaranteed'. Savings below the maximum guaranteed are shared between owner and contractor, whereas the contractor assumes the responsibility for any over-run beyond the guaranteed maximum price."

(Kerzner, 1995, as cited by Ferreira and Rogerson, 1999)

Hence, GMP can be considered as one of the forms of TCC with the sharing arrangement limited only to the gain (Perry and Thompson, 1982).

Figure 2.1 graphically illustrates the definitions and the operational mechanisms of GMP and TCC. A ceiling price and a gain-share/pain-share mechanism are established in the construction contract under this agreement (Clough and Sears, 1994; Patterson, 1999; Cantirino and Fodor, 2003).

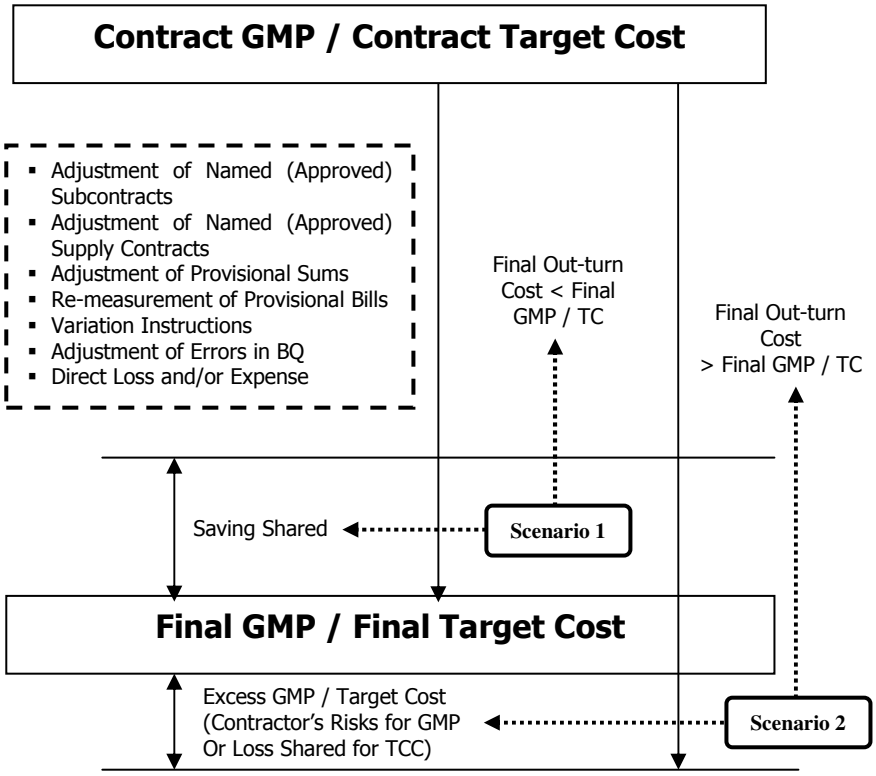

Figure 2.1 Gain-share/Pain-share mechanism of GMP/TCC procurement strategy [adapted from Cheng (2004)]

2.3 Characteristics of GMP/TCC

2.3.1 Tendering method

If a GMP/TCC project is procured on a negotiated contract basis, the preferred contractor has already been identified by the way of a corporate business relationship within the group of companies. Particularly in Hong Kong, the majority of the GMP contracts have been awarded on a negotiated basis with a preferred contractor due to internal corporate relationships (e.g. Developer Hongkong Land Ltd working with Main Contractor Gammon Construction Ltd). However, in the case of selective tendering basis, tenderers will be invited to pre-qualify in the normal manner by submitting a preliminary proposal detailing corporate strength, relevant work experience, past track record, expertise in alternative procurement method, technical competence, financial stability, organisational structures and personnel, partnering commitment, etc. Subsequently, the proposals are reviewed by the client in

collaboration with his team of consultants. After rigorous evaluation, a group of pre-qualified contractors will be shortlisted and invited to submit a tender. Figure 2.2 indicates a typical procurement route of the GMP/TCC approach.

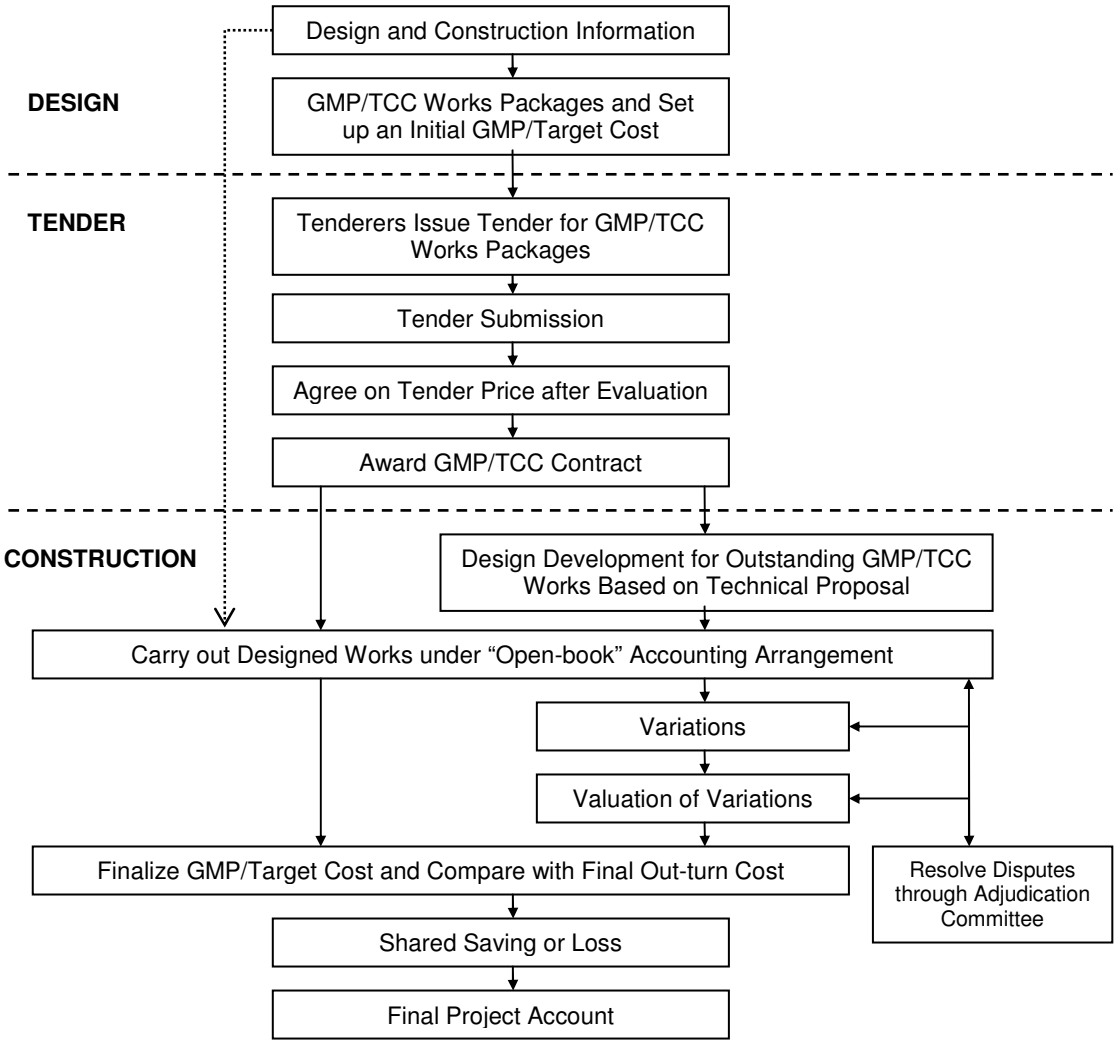

Figure 2.2 GMP/TCC Contract Procurement Route [adapted from HKHA (2006)]

In the case of two-stage tender method, selective tenderers after pre-qualification will be invited to submit their tenders based on the following preliminary materials supplied by client and their consultants:

(i) Cost plan

(ii) Base schematic/outline design drawings (e.g. ~20% of design complete)

(iii) Performance specifications for works packages

(iv) Other available information

After tender evaluation, shortlisted tenderers are then requested during the second stage to submit more detailed proposals based on: (i) Bill of Quantities; (ii) More complete set of design drawings; and (iii) Performance specifications for works packages. Under the negotiated tendering approach, the requirement does not detract from the objectives of obtaining a competitive tender, as the majority of the subcontract packages are ultimately tendered on an 'open-book' competitive tender basis. This information exchange, however, requires a high level of mutual trust among the project team, especially the main contractor. The quantum of the subcontract packages competitively tendered may represent a range of 60-80% of the contract value.

With regard to the information required for the GMP/TCC contracts, both the guaranteed maximum price and target cost are estimated based on preliminary design documentation provided by client and his team of consultants. Tender documents for GMP contracts usually comprise: (1) cost for main contractor's direct works (e.g. substructure works, reinforced concrete superstructure works, finishes works, etc); (2) domestic subcontractor's works packages; (3) provisional quantities[1]; (4) provisional sums[2]; and (5) design development allowance (HKHA, 2006), as shown in Figure 2.3. The information provided in the tender documents is not sufficient for construction and completion of the works. The contractor is thus allowed in his tender pricing for design development. Further design information will be provided by the client and his team of consultants after the target cost is agreed and issued to the main contractor under Architect's Instructions.

[1] 'Provisional Quantities' means works quantified at the time of contracting based on a specification which is reasonably defined but where the design has not progressed to ascertain a defined quantity of works.

[2] 'Provisional Sums' means sums provided for work or expenditure which cannot be entirely foreseen, defined, quantified or detailed at the time the tender documents are issued (items without Bills of Quantities).

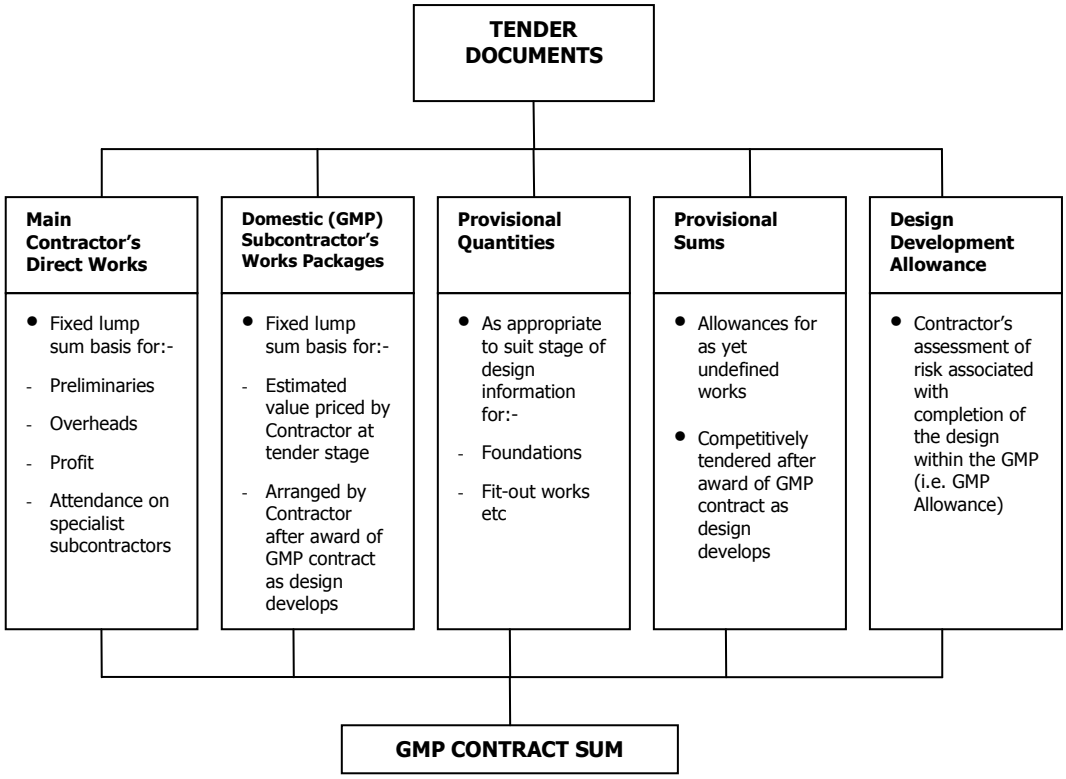

Figure 2.3 Tender documents for a typical GMP project [adapted from HKHA (2006)]

Generally, tender documents for domestic subcontractor's works packages (e.g. electrical and mechanical installation, MVAC installation, plumbing and drainage, fire services installation, lift installation, specialist external works, etc) will be prepared by the main contractor in conjunction with the team of consultants. The tender documents will be issued to pre-qualified or preferred subcontractors to control the range and quality of work. The main contractor must identify any GMP variations (i.e. subject to a re-calculation of the GMP) within the subcontract tender documents prior to the issue of tenders. Upon issue of the subcontract tender documents to the tenderers, the main contractor is deemed to have accepted that the scope of work described by the tender document for that particular subcontractor's works package is within the allowances included for design development (i.e. not subject to a re-calculation of the GMP).

Tenders will then be analysed by the main contractor together with his 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 of a fair

assessment of their tendered sum. 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 that the subcontractors will not assign or sublet their works without the approval of the client. Any procurement savings generated in the tendering of the domestic subcontractors' works will be incorporated into the final out-turn costs, and will form the basis for calculation of shared savings at completion of the project.

2.3.2 Pricing mechanism

A GMP/TCC contract, like other standard cost-based contracts, requires that details of the contractor's tender pricing for any GMP/TCC subcontract works packages be made fully available to the client but usually through an 'open-book' accounting arrangement. The contractor's accounts must be open to scrutiny by the client, and the client must satisfy himself that the contractor's supporting staff on-site will include a strong administrative team and an accountant experienced in this procedure. The clients pay these costs to the contractor, subject to satisfactory checks of constructed facilities. The use of open-book accounting regime enables better accountability and quantification of the costs of risk (NEDO, 1982).

The GMP/TCC procurement approach is also characterised by the agreement that the works will be completed within the contract period and the cost to the client will not exceed the target cost, as warranted by the contractor (Gander and Hemsley, 1997). In adopting the GMP approach, Cantirino and Fodor (2003) stated that in case the actual cost is greater than the negotiated guaranteed maximum price, the client will merely be liable up to the guaranteed maximum amount and the excess costs would be paid by the contractor. The price ceiling is thereby established for the project and the financial risk borne by the client is moderated significantly (Boukendour and Bah, 2001).

The gain-share/pain-share mechanism is another unique feature of the target cost contracting strategy introduced to the construction contract (Trench, 1991). If there is any savings or loss resulting from a difference between the actual cost and the target cost, there is a sharing function to split the 'gain/pain' between the client and the

contractor. This mechanism thus creates a strong incentive for the contractor to save project cost by incorporating contractor's expertise and innovations in both design and construction methods. Figure 2.4 provides an example to demonstrate the implementation of this gain-share/pain-share philosophy for GMP/TCC construction projects.

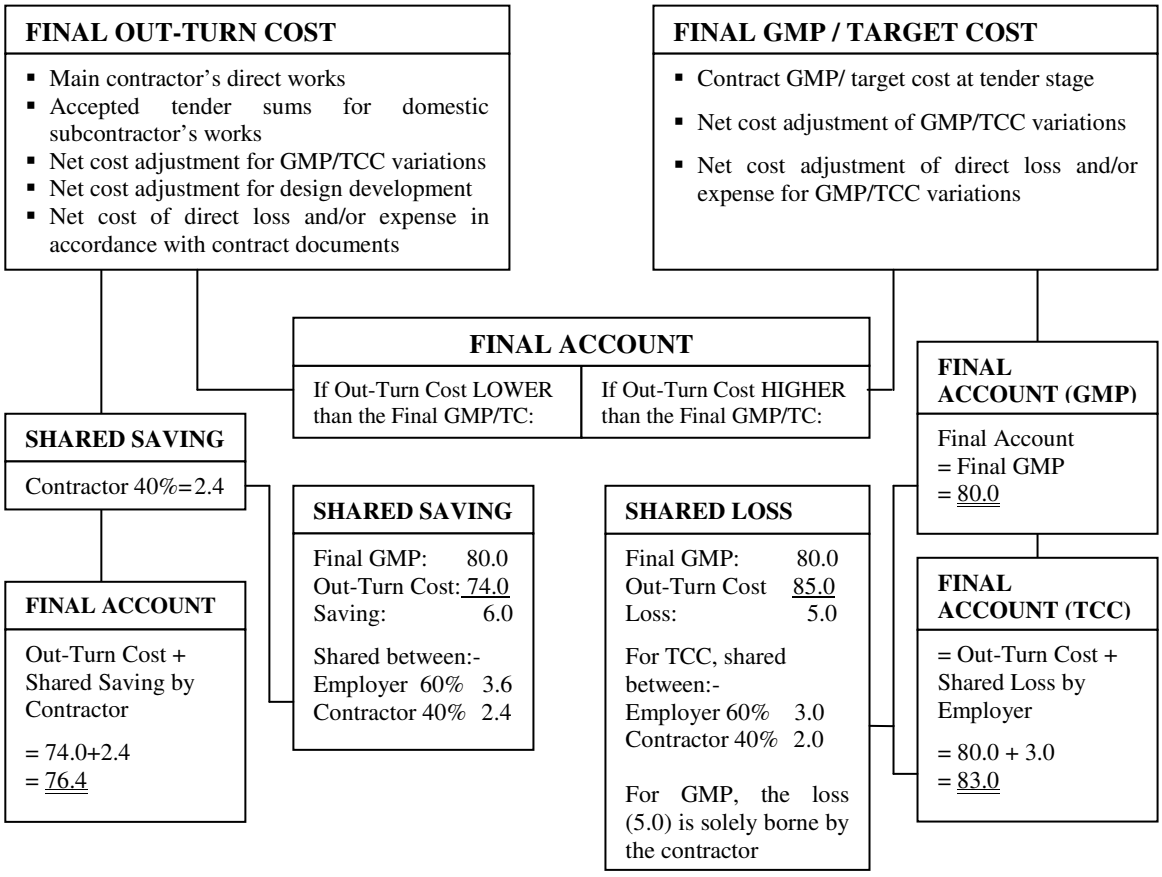

Figure 2.4 Example for illustrating the gain-share/pain-share philosophy of the GMP/TCC approach [adapted from HKHA (2006)]

"Open-book" accounting regime envisages that during the negotiation of GMP / target cost, the main contractor must provide on an open-book basis all the information and data used in support of his tender pricing to project team members including:

- construction programmes, method statements and resource programmes
- pricing of the preliminaries and contract conditions
- details of pricing obtained for domestic subcontractor's works packages
- details of attendances on subcontractors
- details of main contractor's direct works
- detailed breakdown and calculations for overheads and profit

2.3.3 Contractor's inputs in design and construction

GMP/TCC is regarded as a crossover of traditional design-bid-build and design-and-build contracts (Fan and Greenwood, 2004). Figure 2.5 compares the characteristics amongst the three procurement approaches. GMP/TCC can bring in expertise in building designs and innovations in construction methods or materials from the contractor (Masterman, 2002). Whereas both GMP/TCC and design-and-build contracts are structured for better utilisation of contractor's expertise, GMP/TCC allows opportunity for clients to exercise greater control over the process of design development and project cost whilst at the same time integrating contractor's expertise and innovations under a defined framework.

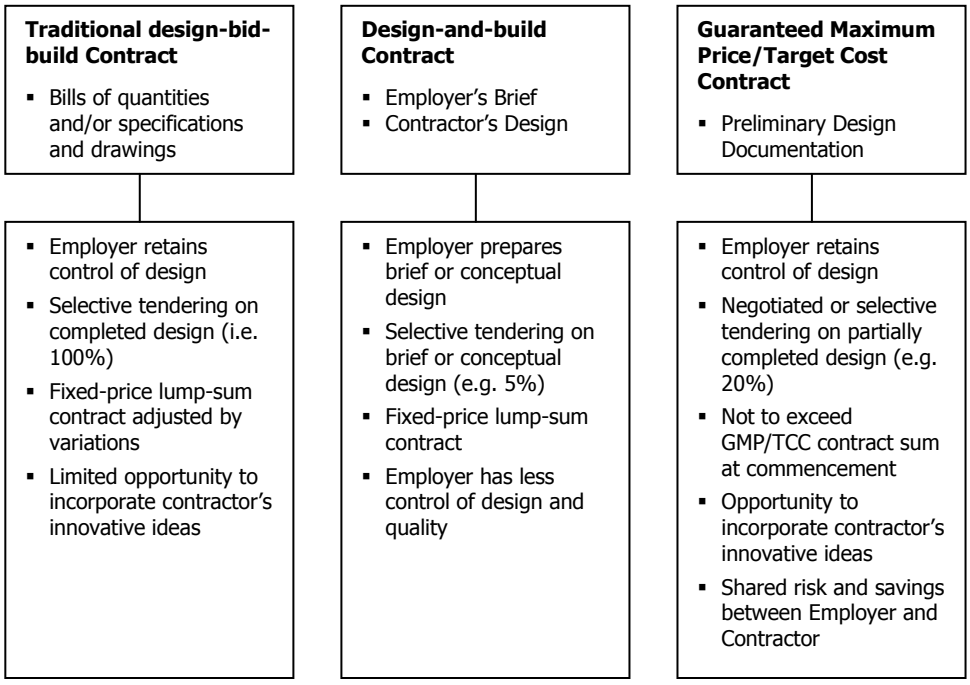

Figure 2.5 Comparison amongst alternative procurement methods [adapted from HKHA (2006)]

2.3.4 Project variations (Consultant's instructions)

In a typical GMP/TCC construction project, two types of variations are often pre-defined in 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 tender stage. However, GMP/TCC variations

can allow for the re-calculation of the GMP or target cost (Fan and Greenwood, 2004; HKHA, 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: (i) changes in scope of work such as change in floor area or volume; (ii) change in function of an area; (iii) change in quality of an area; (iv) adjustment of provisional quantities or provisional sums; (v) corrected quantity errors by consultants; and (vi) 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.

The contractor should notify the architect in writing, advising the value and extension of time (if any) if the contractor wishes to make a claim arising out of a GMP/TCC variation; or he disagrees with the architect's decision as to whether or not the architect's instruction is a GMP/TCC variation, all in accordance with the agreed GMP/TCC methodology. If the architect and the contractor disagree on the definition of a GMP/TCC variation, the architect should convene a meeting of the Adjudication Committee to determine the nature and extent of the variation, and to facilitate the resolution of any unresolved issues, which involves representatives from client, architect, quantity surveyor and main contractor (HKHA, 2006). The intent is to settle any issues at source with a view to enhancing efficiency and accountability. There must be a strong commitment and willingness by all contracting parties to make the GMP/TCC process succeed, and it is better through the teamwork spirit and co-operation of all project team members that this can be achieved (Tay *et al*., 2000), for example, via partnering.

To sum up, the GMP/TCC procurement strategy exhibits the following salient features (Chan *et al*, 2006):

- Set an agreed ceiling price of the project at main contract award for the client in case of GMP procurement strategy.
- Guarantee the project to be completed within contract period by allowing early start of construction before the design is fully developed.

- The client retains greater control over 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, hence enhancing the buildability of project through the submission of alternative proposals.
- The gain-share/pain-share mechanism provides financial incentives for contractor to achieve cost saving in pre-agreed proportion after main contract award by driving procurement process efficiently.
- Contractor takes all the risks likely to be incurred in design development by way of GMP/TCC allowance in the tender.
- As project design would not be fully developed at the tender stage, the contractor will price for design development.
- Adjudication Committee is set up to facilitate the resolution of various issues, which includes representatives from client, architect, quantity surveyor and main contractor.
- Set common goals for project stakeholders to produce an integrated, trustful working team under a partnering arrangement.
- Pre-agreement of price and time implications of any potential changes to the project and thus leading to an early settlement of final project account.
- The details of the contractor's pricing are made through an 'open-book' accounting arrangement to enhance the accountability of the project cost and variations, as well as quantification of the costs of risk.

2.4 Perceived Benefits of GMP/TCC

The benefits of the GMP/TCC are not only on the project performance in term of time, cost and quality, but also on the improvement of working relationship amongst project stakeholders. Table 2.1 provides the summary of the perceived benefits of GMP/TCC extracted from reported literature with the corresponding frequencies of their citations.

Table 2.1 Perceived benefits of GMP/TCC

Perceived Benefits of GMP/TCC	HKHA (2006)	Tang (2005)	Cheng (2004)	Fan and Greewood (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)	NEDO (1982)	**Total number of hits of a certain benefit**
Cost Control															
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
Time Control															
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					✓	✓							✓		3
Earlier settlement of final project account	✓				✓					✓					3
Greater flexibility of accommodating changes	✓	✓	✓					✓						✓	5
Quality Control															
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
Working Relationship															
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.

2.4.1 In respect of cost control

The GMP/TCC procurement strategy essentially offers a more realistic price ceiling / target cost of the project and constrains uncertainty for the client (Patterson, 1999; Perry and Barnes, 2000). Particularly, under the GMP approach, client is only liable up to the agreed guaranteed maximum amount. GMP variations would only be constituted in the circumstances that additional work is required and approved by the client. Costs exceeding the GMP have to be solely borne by the contractor. The risk on

cost overrun is thereby shared with the contractor (Mills and Harris, 1995). Hence, the client has a greater control against overspending under this special feature of the GMP/TCC approach. Thus, the GMP/TCC approach limits the client's exposure to substantial cost increase by restricting the provisions for adjusting the contract price and designing a very tight and controlled variation procedure (Lewis, 1999).

In addition, GMP/TCC is a procurement approach which will award the contractor for savings made but penalise him when this sum is exceeded. This gain-share/pain-share mechanism offers strong incentives to the contractor to be efficient and to achieve cost savings (Fan and Greenwood, 2004; Boukendour and Bah, 2001). Tang and Lam (2003) further state that both the client and contractor will be more motivated to co-operate and achieve cost minimisation because both parties may benefit from the cost saving. Perry and Barnes (2000) show that contractors are motivated to secure certainty of yield on target cost contracts by increasing their share of savings percentage.

2.4.2 In respect of time control

Owing to the sequential nature for a typical construction project, the conventional design-bid-build procurement method could not offer the fast-track arrangement between the design and construction phases. In contrast, GMP/TCC can facilitate the commencement of construction activities before the design is fully completed (Frampton, 2003). The substantial overlapping of design with construction, analogous to the design-and-build contract, would shorten the duration required for overall project development. Additionally, with the more involvement of the client in problem solving when compared with the traditional contracts, the decision for any changes can be made more efficiently (Tang and Lam, 2003). The GMP/TCC approach may therefore speed up the problem solving process (Trench, 1991).

Besides, since the arrangements of variations under the GMP/TCC approach are pre-agreed between the client and the contractor, the occurrence of claims / disputes might be reduced, and the preparation and agreement of the final project account tend to be finalised earlier than for the conventionally priced contract (Gander and Hemsley, 1997). Furthermore, 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 advantage that the GMP/TCC could bring is greater flexibility to accommodate design changes because of the straightforward variation claiming mechanism and the 'open-book' accounting arrangement (Mills and Harris, 1995). Unlike the traditional contractual method, handling variations can therefore be less time-consuming and more transparent.

2.4.3 In respect of quality control

Another perceived benefit of implementing GMP/TCC is the improvement of construction quality. Conventional contractual methods over-emphasise 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, which ensures that the employer receives competitively priced tenders from approved subcontractors and specialists (Tay *et al*., 2000). This contracting approach therefore helps select the right project team which has adequate experience and is capable to develop the client's design intent (Trench, 1991). This arrangement also eradicates the non value-adding multi-layered subcontracting and maintains the quality standards of constructed facilities and workmanship.

In addition, the GMP/TCC arrangement improves overall construction quality as the client could retain greater control over the team of design consultants during the pre-contract and post-contract stages, thereby ensuring compliance with the initial design intent stated in the client's project brief (HKHA, 2006). The client can also be affected to put in more efforts in helping solve problems (Tang and Lam, 2003). 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 (HKHA, 2006). Besides, GMP/TCC allows a better estimation of the costs of construction that meet the client's requirements on quality (NEDO, 1982). All these issues develop the potential for producing savings in time and cost, and higher quality of products. Moreover, with the contractor's contribution at the early design stage of the project, a more cost effective contracting strategy with buildable design can be formulated.

Hence, the GMP works packages can provide an opportunity for contractor to add value to the project, such as promoting better integration between building services installation and reinforced concrete construction, driving innovation throughout the whole project life and optimising contractor's expertise in specialist design and precast construction.

2.4.4 In respect of working relationship

Bower *et al.* (2002) stated that the GMP/TCC contracting approach 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. In particular, the gain-share/pain-share mechanism generates incentives for effective collaboration between client and contractor in order to minimise the out-turn cost of a project (Chevin, 1996; Sadler, 2004). By involving all relevant project stakeholders, the pre-construction planning for the design development can reduce the conflicts and disputes at later time. This 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 best interest (Sadler, 2004). What is more, a fair and effective dispute resolution mechanism and communication opportunities are provided by means of adjudication meetings, not only leading to reduction in claim / dispute occurrence, but also improvement in working relationship amongst project team members and incorporation of inter-disciplinary efforts into the project (Ting, 2006).

In addition, the GMP/TCC form of contract is conducive to inputting 'partnering' 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; HKHA, 2006). Chan *et al*. (2004) expressed that the developments of the GMP contracting approach in a number of building projects and the incentivisation agreement in the railway infrastructure projects in Hong Kong have been proven to be effective in fostering a co-operative working atmosphere and a gain-share/pain-share working culture, which are largely derived from the perceived 'partnering' spirit cultivated amongst all contracting parties.

To sum up, the perceived benefits of GMP/TCC comprise the followings:

- Provide guarantee of avoiding budget overrun at GMP main contract award for the client.
- Client provides financial incentives for contractor to achieve cost saving.
- Fast track project by allowing early start of construction before the design is fully developed.
- Early settlement of final project account because the valuation of variations must be agreed progressively during the construction phase.
- Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project.
- Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.
- Conducive to improving partners' working relationship via partnering.
- Limit the entitlements for claiming variations by contractor.
- Enable a more equitable risk apportionment amongst project participants.
- More opportunities for participants to express opinions and concerns openly and freely.
- The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team.

2.5 Potential Difficulties in Implementing GMP/TCC

Despite the above identified benefits in adopting the GMP/TCC approach, a review of the literature indicates that there are a number of common difficulties in implementing the GMP/TCC concepts. Table 2.2 shows the matrix of the identified difficulties and the corresponding frequencies of their citations.

Table 2.2 Potential difficulties in implementing GMP/TCC

Potential difficulties in implementing GMP/TCC	HKHA (2006)	Tang (2005)	Cheng (2004)	Fan and Greewood (2004)	Sadler (2004)	Tang and Lam (2003)	Perry and Barnes (2000)	Tay *et al.* (2000)	Patterson(1999)	Minogue (1998)	Gander and Hemsley (1997)	Chevin (1996)	Mills and Harris (1995)	**Total number of hits of a certain difficulty**
Unclear definition of changes in scope of work leading to unnecessary disputes	✓	✓	✓	✓	✓			✓	✓		✓	✓		9
Difficult to evaluate the revised contract price when an alternative design is proposed by the contractor					✓	✓		✓						3
Higher costs to adopt GMP/TCC for contractor to cover additional risks		✓			✓		✓	✓		✓	✓	✓	✓	8
Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts	✓					✓								2
Design development must keep pace with contractor's programme for tendering domestic subcontractor's works packages otherwise potential delay may occur	✓													1
Lack of standard form of GMP/TCC building contract in Hong Kong											✓			1
Unfamiliarity with or misunderstanding of GMP/TCC concepts		✓	✓		✓									3
Too complicated form of contractual agreement					✓									1
Total number of difficulties identified from each publication	3	3	2	1	5	2	1	3	1	1	3	1	2	**28**

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

2.5.1 Unclear definition of changes in scope of work

The major problem encountered whilst implementing the GMP/TCC approach is the unclear definition of a scope change (Gander and Hemsley, 1997). Unclear explanations of any scope changes may cause disputes with the natural tendency of the client and contractor pulling in opposite directions to achieve their own objectives (Cheng, 2004; Fan and Greenwood, 2004). The tendency of the contractor is to view variations as a 'scope change' to maximise his chance of getting extra payment whereas the client wants to keep as many changes as possible under 'design development' to minimise cost increase, not to mention a desire to achieve potential cost savings. Tang and Lam (2003) stress that it is difficult to evaluate the revised contract price when an alternative design is proposed by the contractor and it takes time to reassess the cost implication. Tay *et al.* (2000) also express that this is an aspect of GMP/TCC approach that is very difficult to administer. Hence, the

GMP/TCC scheme might not be an appropriate procurement approach for contracts where many changes are expected or it would be difficult to define the scope of work (Trench, 1991).

2.5.2 Cost premium for GMP/TCC

In general, the contractor under the GMP/TCC style of procurement takes on more responsibilities than the traditional approach and has included in his tender an allowance for design development and unforeseeable risks (Sadler, 2004). One common response is for the general contractor to simply pass the risks down the line to the subcontractors (Lewis, 2002). It has also been pointed out that this will then inflate the bid price for the contractor to commit to the guaranteed price by covering additional risks. In the majority of cases, tenders for GMP contracts may be between 1% and 3% higher than equivalent tenders sought under a JCT 80 with quantities standard form of contract in favourable conditions where the contract sum is the de-facto guaranteed maximum price (Mills and Harris, 1995). In other words, the client gains a degree of cost certainty, but the price usually is not the lowest price. However, where fixed price is more important than ascertaining the lowest price, a GMP/TCC contract may be the favourable answer.

2.5.3 Greater commitment by project participants

The GMP/TCC approach requires a greater level of commitment and involvement by all project parties to the contract arising from the methodology of tendering, not only for the main target cost contract, but also individually for the domestic subcontractor's works packages (Tang and Lam, 2003). Sadler (2004) claims that the client has to be more involved and closely monitor the project when using the GMP/TCC approach because the design is being developed after the contractor has committed to a ceiling price. The design development should keep in good progress with contractor's programme for tendering domestic subcontractor's works packages, otherwise potential delay may arise. These additional administrative requirements might result in the relevant parties having to commit more personnel to the project, together with the potential higher fees to be incurred by design consultants in evaluating tenders for domestic subcontracts after the award of main contract (HKHA, 2006).

2.5.4 Unfamiliarity with GMP/TCC methodology

The GMP/TCC is a rather new concept in the local construction industry. Project stakeholders unfamiliar with the corresponding contractual arrangement may easily generate arguments between the parties (Cheng, 2004). Project participants might not be used to working in this novel way and may find it uncomfortable and difficult to change the traditional way they work (Sadler, 2004). Difficulties have often been experienced in setting an agreed ceiling price; monitoring the ceiling price as changes to the work occur; setting allowances for design development and unexpected risks; and determining the cost-sharing formula of GMP/TCC projects. Gander and Hemsley (1997) also state that the absence of standard form of GMP/TCC contract would result in a greater possibility of drafting errors and misunderstanding of liabilities between the parties. It is a complicated form of contractual agreement and some projects do not warrant the administrative effort and support that is required to set up and implement this form of contract (Sadler, 2004).

In conclusion, GMP/TCC may have the following potential difficulties in implementation:

- Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work.
- Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees.
- Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise leading to potential delay.
- Previous GMP Contracts in Hong Kong have used the "Hong Kong Standard Form of Building Contract – Private Edition with Quantities", with suitable amendments as necessary to reflect the GMP methodology and rules, i.e. Lack of standard form of GMP/TCC building contract in the local context.
- Longer time in preparing contract documents.
- Unfamiliarity or misunderstanding of GMP/TCC concepts by senior management.
- Difficult to develop trust and understanding from contractor as a project team.

- Too complicated form of contractual agreement.
- Clients had to be more involved in a project.
- A project team may find it difficult to adapt to this new way of working (e.g. joining force between consultants and main contractor in design work).
- Not suitable for projects where it is difficult to define the scope of work.

2.6 Key Risks of GMP/TCC

Risks are regarded as the possible exposure to economic loss (Stuckhart, 1984). These risks should be identified and analysed before the appropriate response is determined (Broome and Perry, 2002). Although the GMP/TCC procurement approach has been implemented in a number of construction projects for several years, some of the projects have been exposed to very high risks or uneven allocation of risks.

Table *2.3* summarises the potential risk factors inherent with the GMP/TCC approach as sought from relevant published literature.

Table 2.3 Key risks of GMP/TCC

Key Risks of GMP/TCC	HKHA (2006)	Tang (2005)	Cheng (2004)	Fan and Greewood (2004)	Sadler (2004)	Tang and Lam (2003)	Tay *et al.* (2000)	Patterson(1999)	Minogue (1998)	Gander and Hemsley (1997)	Chevin (1996)	Mills and Harris (1995)	**Total number of hits of a certain risk factor**
Financial risks													
The client may pay more than the ceiling price	✓	✓	✓		✓	✓				✓	✓		7
Contractor may earn lower profit or even a loss due to unclear definition of scope of work		✓	✓	✓					✓			✓	5
Contractor bears any unforeseen design development risks		✓	✓	✓	✓		✓		✓	✓	✓	✓	9
Dispute risks													
Disputes may arise due to the changes in scope of work	✓	✓		✓	✓		✓	✓					6
Inexperienced or claim conscious contractors jeopardise GMP/TCC process	✓	✓	✓										3
The lack of standard form of GMP/TCC contract leads to misunderstanding of liabilities between the contracting parties			✓							✓			2
Total number of risk factors identified from each publication	3	5	5	3	3	1	2	1	2	3	2	2	**32**

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

2.6.1 Financial risks

Uebergang *et al*. (2004) stress that the GMP / target cost is not definitely 'guaranteed' or 'maximum' price, as it will be adjusted in the event of unforeseen changes that occurred as a part of the construction work. The client may take certain financial risks of paying over the ceiling price once the scope change is considered as a GMP/TCC variation. The client may also carry the risk of paying variations more than under the traditional procurement method because the contractor may attempt to inflate the estimated costs of work during the negotiation process, thereby gaining the maximum advantage where prospective savings can be achieved (Gander and Hemsley, 1997; Baldwin and McCaffer, 1991). Perry and Barnes (2000) also emphasise that the TCC approach requires the client to carry more risks than conventionally priced contracts. If a lot of changes are expected in the project, the client is not advised to adopt GMP/TCC as this may cause significant, intractable claims.

The GMP provision clearly involves the contractor in increased financial risk as the excess costs over the GMP due to uncertainties arising from site conditions would be absorbed by him (Stukhart, 1984). The contractor also has to bear the risks of unforeseen ground conditions, design development and compliance with performance specifications, for which he may earn lower profit or even incur a loss due to unclear definition of scope of work (Fan and Greenwood, 2004). The contractor would thus impose additional charge to their tender price, as additional works or scope change can only be claimed if they are assessed to be GMP/TCC variations. Sadler (2004) therefore advocates that TCC is considered as a more equitable risk sharing approach owing to the presence of pain-share mechanism. Hence, GMP may induce a high initial tender cost since the contractor solely bears the risk of cost overrun if alleged changes to the defined scope of work are not justified (Chevin, 1996).

2.6.2 Dispute risks

Under the GMP/TCC form of project delivery, disputes may arise during the design development and construction phases of the works as to which architect's instructions constitute GMP / target cost variations and which are deemed to be design development (HKHA, 2006). The employer may regard any design variations as

entirely at the risk of the contractor, while the contractor may argue that certain changes fall outside the original scope of the work and their additional costs should be claimable (Fan and Greenwood, 2004). This is thus potentially the largest area for dispute, particularly if the target cost is established early in the design process (Tay *et al.,* 2000). Chevin (1996) also states that disputes would be inevitable with this procurement approach because there is a lack of clarity as to whether a change should be considered as a variation to the target cost. The occurrence of disputes therefore greatly depends on how well the client builds up the outline design of project.

Furthermore, as the GMP/TCC approach is being developed, the experience of applying this procurement method is still relatively scarce. If inexperienced or claim-conscious contractors are appointed, there is a potential danger for the contracting parties to become confrontational (HKHA, 2006). Therefore, contractors must be fully conversant with the principles of the GMP/TCC contracting approach and be prepared to recognise the risks they have taken on board with the novel procurement approach (Fan and Greenwood, 2004). Besides, the lack of standard form of contract for GMP/TCC procurement arrangement may be conducive to misunderstanding of liabilities between project stakeholders (Gander and Hemsley, 1997). This might jeopardise the application of target cost procurement strategy in the local context.

To sum up, key risks factors associated with GMP/TCC are perceived to be:

- Disputes may arise due to the changes in scope of work.
- Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to re-assess the cost of the entire project.
- Inexperienced or claim-conscious contractors may jeopardise GMP/TCC process.
- The client may pay more because contractor may inflate the estimated costs to cover his additional risks.
- Contractor may earn lower profit or even a loss due to unclear definition of scope of work.
- No standard form leads to misunderstanding of liabilities between parties.
- Difficult to use successfully on contracts where many changes are expected.
- Contractor may not foresee design development risks thus taking more risks.
- Client may carry more risks than the traditional procurement approach because of incomplete design at tender stage.

- Financial risk – Variations due to changes in scope of work may induce more cost to the client than under the traditional procurement approach.

2.7 Critical Success Factors for GMP/TCC Projects

Several empirical studies and opinions of industrial practitioners from archival data related to factors driving the success of GMP/TCC projects were reviewed. These factors are summarised in Figure 2.6.

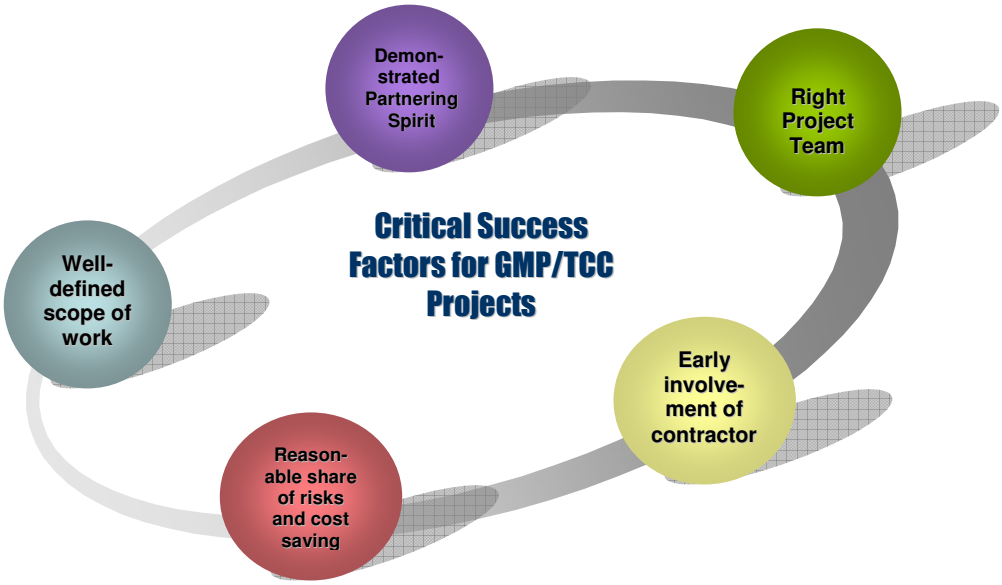

Figure 2.6 Significant factors contributing to the GMP/TCC success

2.7.1 Well-defined scope of work

As disputes often arise between the contractor and the client over whether client's changes are design development or scope change, the scope of contractor's work has to be clearly defined in the client's project brief (Tang, 2005). NEDO (1982) stresses that the successful implementation of target cost contracts depends on a sound understanding by both the client and contractor of the principles underlying the procurement approach, and of the roles and relationships brought about by the use of this form of procurement. Sadler (2004) adds that scope changes / variations need to be kept to a minimum in order that the GMP/TCC contract can be administered as intended and that the approach might provide value for money of construction.

2.7.2 Demonstrated partnering spirit

As concluded by Chan *et al*. (2004), more satisfactory project outcomes could be achieved by more harmonious working relationship and effective communication amongst project participants. Tay *et al*. (2000) also stress that for a target cost contract to be successful, there must be a genuine willingness to achieve co-operation or demonstrate partnering spirit between the parties. This enables project participants to work together towards common goals and generate a teamwork culture to resolve disputes and to complete the project without having to revert to protracted contractual claims requiring litigious resolutions. It is therefore important to establish an adjudication committee under the GMP/TCC arrangement to assist in the prompt resolution of disputes. In addition, Tang and Lam (2003) advocate that without an open-minded attitude towards the other party's opinion, GMP/TCC is difficult to be implemented. Hence, the target cost approach relies heavily on mutual trust and fairness (Sadler, 2004).

2.7.3 Right selection of project team

A right selection of project team is essential in facilitating mutual trust, effective communication, efficient co-ordination and productive conflict resolution (Chan *et al*., 2002). Gander and Hemsley (1997) thus suggest that the recruitment of an experienced project team is crucial to the success of a GMP/TCC project, as inexperienced GMP/TCC contractors can generate to a lack of clarity regarding their responsibilities. NEDO (1982) also claims that the success of the contract is closely related to the managerial efforts expended by various project parties in formulating and administering the contract. The presence of a strong contract management team on-site is of paramount importance for managing and supervising the operations of the GMP/TCC from the outset.

2.7.4 Reasonable share of risks and cost saving

A clear and fair allocation of risks between employer and contractor is vital to the success of a GMP/TCC project (Mills and Harris, 1995). Perry and Barnes (2000) advise that employers should recognise the importance of realistic target estimates, which would include appropriate risk contingencies. Sadler (2004) also recommends

that employers should be careful not to accept a combination of fee and share that does not motivate the contractor to keep the cost down. A high contractor's share, however, may motivate the contractor to maximise upward adjustment of the target for events that may occur during the course of the contract. Hence, a reasonable share of cost saving between employer and contractor is also indispensable to the success of those projects procured with GMP/TCC. Tang and Lam (2003) suggest the percentage of sharing cost savings for GMP construction projects in Hong Kong as shown in Table 2.4.

Table 2.4 Shared saving percentage apportionment [adapted from Tang and Lam (2003)]

Scenario	Client's Share	Contractor's Share
Final Out-turn Cost > Final GMP	0%	100%
Final Out-turn Cost < Final GMP		
(a) Saving < 5%	67%	33%
(b) Saving = 5-10%	50%	50%
(c) Saving > 10%	33%	67%

On the other hand, Fan and Greenwood (2004) state that contractors should understand the risks they are taking on, beware of undescribed work, and of 'design development' and ensure that their subcontractors' bids reflect the risks that they will be taking on. Decision should also be made about the nature of the contracting process, the employer's requirements and whether the work is of the sort that would enable the contractor to ascertain enough about what is actually encompassed within the scope of work in order to make a realistic assessment of the price (Lewis, 2002).

2.7.5 Early involvement of the contractor in design development

It is imperative to tap in the expertise of the contractor and suppliers during the design stage and before the design has been finalised (Sadler, 2004). As discussed, this enables technical advice on buildability and environmental issues to be integrated into the design by the contractor. Their early involvement and influences on the design process, construction methods and materials are critical to the success of the project in terms of time, cost and quality (HKHA, 2006).

In conclusion, the critical factors leading to the success of GMP/TCC projects are summarised as follows:

- Standard form of contract for GMP/TCC projects.
- Well-defined scope of work in client's project brief.
- Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors.
- A right selection of project team.
- Reasonable share of cost saving and fair risk allocation.
- Partnering spirit from all contracting parties.
- Early involvement of the contractor in design development.
- Establishment of adjudication committee and meeting to resolve any issues and disputes.
- Proactive main contractor throughout the GMP/TCC process to deal with any intractable issues.
- 'Open-book' accounting regime as provided by the main contractor in support of his tender pricing.

2.8 Chapter Summary

This chapter provides a comprehensive review of the relevant GMP/TCC studies and literature. The definitions of GMP/TCC as advocated by several researchers and organisations have been examined to enhance good understanding of the GMP/TCC procurement approach in construction. In addition, the characteristics, benefits, difficulties, risk factors and significant ingredients for successful implementation of GMP/TCC contracting strategies have been reviewed. The literature review forms a solid foundation for launching this study.

CHAPTER 3 RESEARCH METHODOLOGY

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this chapter is to describe the methodology adopted in this research. A research framework is first introduced, followed by the quantitative and qualitative techniques used for data analysis. In this study, case studies were carried out to explore the current GMP/TCC practices in Hong Kong. Additionally, an empirical questionnaire survey was conducted to collect quantitative data for relevant statistical analyses to achieve the research objectives.

3.2 Research Framework

A research process model adopted by Walker (1997) was applied in this research as shown in Figure 3.1. This model provided a useful process for basic and applied research. It aimed to convert vague ideas into a set of testable hypotheses, which are examined specifically for the research questions. Four major research tools, i.e. review of literature, case study methodology, structured interview and questionnaire survey, were applied in collecting appropriate and sufficient information and data of projects using GMP/TCC based contracts in Hong Kong. The research scrutinised a number of GMP/TCC construction projects in Hong Kong. The scope of the study was restricted to those construction projects which were completed recently under a GMP/TCC approach in Hong Kong. Contacts were made with the key participants of the target projects for data collection.

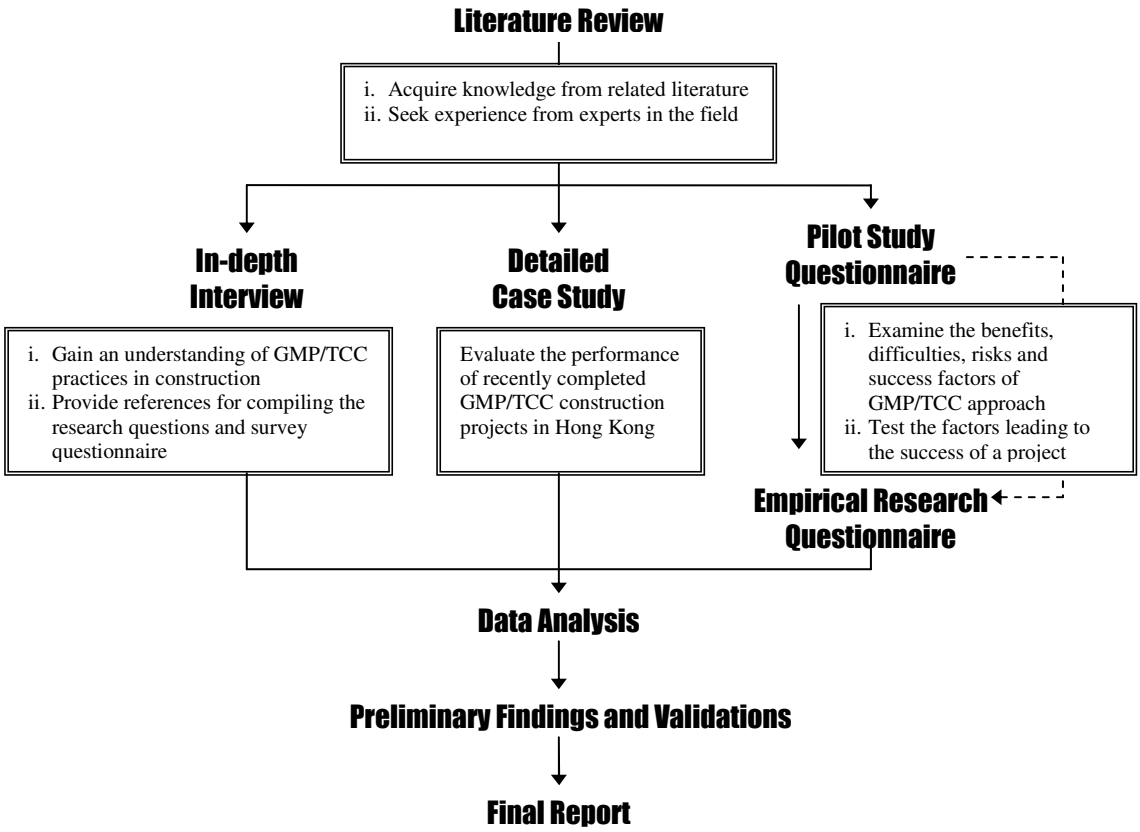

Figure 3.1 Overall research framework for the study [adapted from Walker (1997)]

3.3 Research Approach

3.3.1 Literature review

The research study began with an extensive review of relevant materials from textbooks, professional journals, research reports and refereed publications to acquire background knowledge about GMP/TCC procurement approaches. To ensure a comprehensive review, other relevant publications including conference proceedings, dissertation reports, internet information and other sources were also sought. Past and current implementation practices, whether locally or overseas, on GMP/TCC were documented. The purposes of the literature review were: (1) to establish sufficient groundwork for the research; (2) to develop an overall research framework for the research study; (3) to prepare an appropriate template for the structured interviews, questionnaire surveys and case studies; and (4) to formulate practical guidelines for successful implementation of the GMP/TCC approach.

3.3.2 Case study method

The study analysed a number of case studies of GMP/TCC projects in Hong Kong, as shown in

Table *3.1*, on the basis of a common methodology. Case studies were co-ordinated to extract similar information from the target projects, including organisational structures, responsibilities, relationships and communications, satisfaction levels, motivation levels, risks, project performances, major benefits and difficulties faced by respondents using the GMP/TCC approach and process via a structured survey form. Such information enabled the exploration of the reasons as to why GMP/TCC contracts are or are not favoured in the construction industry; the identification of the criteria adopted by the industry to evaluate the performance of a GMP/TCC project; and the compilation of a list of essential factors contributing to the successful implementation and improvement of a GMP/TCC project.

Table 3.1 Selected GMP/TCC cases for the research in Hong Kong

Project Name	Project Nature	GMP/TCC
Client Organisation – Hongkong Land Ltd		
Chater House	A prestigious rental commercial development in Central	GMP
1063 King's Road	A rental commercial development in Quarry Bay	GMP
Alexandra House Refurbishments	A prestigious rental commercial development in Central	GMP
Tradeport Hong Kong Logistics Centre	A commercial logistics hub for the Asia region at Chek Lap Kok	GMP
Landmark Redevelopment Phase 6 – York House	A rental commercial redevelopment in Central	GMP
Client Organisation – Swire Properties Ltd		
The Orchards	A twin tower residential development in Quarry Bay	GMP
Three Pacific Place	A prestigious rental commercial development in Wanchai	GMP
Client Organisation – Hong Kong Housing Authority		
Public Housing Development at Eastern Harbour Crossing Site Phase 4	A public rental housing development in Yau Tong as a pilot study project	Modified GMP
Client Organisation – Mass Transit Railway Corporation Ltd		
Tseung Kwan O Railway Extension – the sixth operational railway line with 5 stations	13 civil engineering contracts, 4 building services contracts as well as 17 electrical and mechanical contracts (e.g. C601-Hang Hau Station and Tunnels, C654-Platform Screen Doors)	TCC
Tsim Sha Tsui Metro Station Modification Works (MTRC Contract C4420)	Tsim Sha Tsui Metro Station Modification Works	TCC
Tung Chung Cable Car Project	A sightseeing transportation facility including civil and building works	TCC

The case studies comprise a number of GMP/TCC projects of different sizes, types and client groups, based on the information collected from a series of structured interviews and an empirical questionnaire survey (see Sections 3.3.3 and 3.3.4). In each case, information on the patterns of implementation details, processes, satisfaction levels, motivation levels, perceived benefits, potential difficulties and various measures of project performances within each project were captured. Features, similarities, differences and lessons learned from these cases were explored and compared. All the cases were analysed on both an individual basis and collectively in order to draw valid and representative conclusions.

The information and data gleaned from all the participants associated with a project, i.e. the client group (project owner, consultants, users, financiers and statutory organisations) and the constructor group (main contractor, subcontractors, operators and suppliers) were compared and analysed. During the process of data analysis, both the procedural regularity and the consistency were studied together with the suitability of the procedures in relation to the objectives of the project. Given a particular set of GMP/TCC project objectives and by comparing with contemporary projects, it is essential to determine whether the procedures being adopted by the respective organisations have common threads, and if not, to identify the possible reasons.

Amongst these cases, two in-depth case studies are selected for a critical examination of the whole implementation process of the GMP/TCC approach. Viewpoints of different project participants in terms of the motives behind of adopting GMP/TCC, benefits, difficulties and key risk factors in implementing GMP/TCC strategy were solicited. Most importantly, the critical success factors and the lessons learned from the two case study projects are evaluated and discussed. Various measures of project performances are also assessed by comparing with the conventional procurement method. The approach adopted for each case study is mapped and the decision-making process in the selection of particular details and processes are documented.

3.3.3 Structured interview

In order to explore the application of GMP/TCC practices in the local context, a series of structured in-depth interviews were launched with relevant experienced industrial practitioners in the Hong Kong construction industry. Since the GMP/TCC approach is relatively new in the local industry, application and experience are confined to a limited number of construction organisations. Senior professional staff from the leading property developers and major construction companies having gained abundant hands-on experience in using the GMP/TCC strategy in Hong Kong were targeted for this study. Data on the case study projects were collected through face-to-face interviews and retrieval from collaborating firms. Key participants in those cited GMP/TCC projects were the targets of the interviews, and such interviews were fully documented and compared for analysis. In addition, the details of GMP/TCC mechanism, and the project data used in compiling the key performance indicators[3] were also gleaned so as to verify the findings derived from various sources and compare the performance levels of the projects. The information obtained from the interviews was also used to validate and supplement the findings of the questionnaire survey.

The leading property developers and major construction companies in Hong Kong were considered for the interview exercise. From these, altogether seven organisations were approached according to their hands-on experience in using GMP/TCC. A total of ten individuals at the managerial level (including clients, contractors and consultants) were finally willing to take part in seven face-to-face interviews undertaken between January and April of 2006. As all of the key active players in adopting GMP/TCC had been included in the interviews, it was considered that the opinions and findings could substantially represent the GMP/TCC project pool in Hong Kong over the past decade of 1997-2006. The details of the interviewees are shown in Table 3.2. Copies of relevant materials including the project's scope of work, contract terms and letters of award on GMP/TCC, in-house guidelines or best practice framework for implementing GMP/TCC scheme, case reports, as well as website materials were obtained as secondary source of evidence to support primary opinions and information gleaned during the interviews.

[3] A key performance indicator (KPI) is the measure of the performance of the process that is critical to its success (Takim and Akintoye, 2002).

Table 3.2 Details of 10 interviewees participating in 7 interview meetings for GMP/TCC procurement strategy in Hong Kong

ID	Sector	Stakeholder	Position of Interviewee	Type of Organisation
1	Private	Client 1	Executive Director (Projects and Quantity Surveying)	Leading private property developer
2	Private	Client 1	Head of Quantity Surveying	Leading private property developer
3	Private	Consultant 1	Director	Quantity Surveying consultant firm
4	Private	Client 2	Project Manager	Leading private property developer
5	Private	Client 3	Project Manager	Leading private property developer
6	Private	Contractor 1	Head of Planning and Pre-construction Engineering	Major construction company
7	Private	Contractor 1	Construction Manager (Estimating and Subletting)	Major construction company
8	Quasi-government	Client 4	Contracts Administration Manager – Operations	Quasi-government railway service provider
9	Quasi-government	Client 5	Chief Executive Officer	Subsidiary of a quasi-government railway service provider
10	Public	Client 6	Senior Architect	Public sector housing developer

Notes: (1) Interviewees with ID 1-3 joined together for the same interview meeting on 8 February 2006 and Interviewees with ID 6-7 on 24 January 2006.
(2) Names of the interviewees are not shown for the sake of privacy.

Since the interviewees were all senior construction personnel with sufficient experience in delivering GMP/TCC projects, the interviews were flexibly structured to facilitate free flow of ideas. The following open-ended questions were asked to convey a general idea of the information solicited, while the interviewees were encouraged to express on the subject, without being restrained by the following pre-determined subject areas (see Appendix I):

i. Section A : Definition and Process of GMP/TCC (e.g. motives behind to implement GMP/TCC)
ii. Section B : Characteristics of GMP/TCC (e.g. benefits, difficulties, success factors and risk factors)
iii. Section C : Performance of GMP/TCC (e.g. schedule, cost, quality, dispute occurrence, etc)
iv. Section D : Suitability of GMP/TCC (e.g. large and complex projects)

The key findings of the interview survey on the aforesaid research questions are summarised in Table 3.3 and the detailed findings and discussions have been reported in a conference paper (Chan *et al.*, 2007a) and a journal paper (Chan *et al.*, 2007b).

Table 3.3 Summary of the interview findings on GMP/TCC procurement strategy

Areas of Interest		Client 1	Consultant 1	Client 2	Client 3	Contractor 1	Client 4	Client 5	Client 6	Total no. of hits
Motives to adopt GMP/TCC	To improve risk management and control	✓	✓	✓			✓	✓	✓	6
	To generate an incentive to achieve cost saving and work efficiently	✓	✓		✓	✓			✓	5
	To tap in contractor's expertise in design and construction methods		✓	✓		✓	✓		✓	5
	To develop better working relationship	✓			✓				✓	3
	To set an agreed ceiling price at main contract award	✓	✓	✓						3
Benefits of GMP/TCC	Provide financial incentives for contractor to achieve cost saving and innovate	✓	✓		✓			✓	✓	5
	Bring in expertise in building designs and innovations in construction methods from contractor to enhance the buildability of the project	✓		✓		✓	✓			4
	Conducive to improving partners' working relationship via partnering	✓	✓	✓	✓	✓	✓		✓	7
	Enable a more equitable risk apportionment amongst project participants	✓	✓			✓	✓	✓	✓	6
	Limit the entitlements for claiming variations by contractor	✓		✓	✓					3
	Early settlement of final project account	✓	✓	✓	✓				✓	5
Difficulties of GMP/TCC	Difficult to develop trust and understanding from contractor as a project team	✓							✓	2
	Unfamiliarity with or limited understanding of GMP/TCC concepts by project team members	✓		✓		✓	✓	✓		5
	Arbitrary to determine whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development	✓	✓	✓	✓				✓	5
Risks in implementing GMP/TCC	Client may carry more risks than the traditional procurement approach because of the unclear scope of work			✓	✓					2
	Contractor may not foresee design development risks thus taking more risks.			✓		✓				2
	Disputes may arise due to the changes in scope of work	✓	✓					✓	✓	4
	Market risk due to the mismatch of the prevailing demand of real estate market.	✓		✓						2
Critical success factors for GMP/TCC	Demonstrated partnering spirit from all contracting parties	✓	✓	✓	✓	✓		✓	✓	7
	Right selection of project team	✓							✓	2
	Well-defined scope of work in client's project brief			✓	✓				✓	3
	Reasonable share of cost saving and fair risk allocation	✓	✓	✓	✓	✓	✓			6
	Early implementation of GMP/TCC	✓	✓	✓	✓	✓			✓	6
	Familiarity and experience of GMP/TCC methodology amongst project stakeholders	✓	✓	✓	✓				✓	5
Suitability to adopt GMP/TCC	Large and technically complex project that contains higher risks	✓	✓	✓	✓	✓	✓			6
	Client's requirements for buildability and innovation		✓	✓					✓	3
	Project with life cycle cash flow	✓	✓							2
	Project with tight schedule for design					✓			✓	2

3.3.4 Empirical questionnaire survey

An empirical research questionnaire was developed, based on the knowledge acquired from the published literature and the face-to-face interviews, to solicit the perceptions of key project stakeholders on the motives, processes, benefits, difficulties, risk factors, success factors, project performances and prevailing practices of GMP/TCC arrangements. Senior staff of client organisations, consulting practices and construction firms were approached via a set of self-administered survey questionnaires. The questionnaire was also distributed through relevant industrial network and professional bodies. The questionnaire consisted of ten sections (see Appendix II).

Table *3.4* shows the structure of the questionnaire.

Table 3.4 Structure of the empirical survey questionnaire on GMP /TCC practices in Hong Kong

Section	Area of information
A	Respondent's information
B	Project characteristics
C	Benefits of GMP/TCC
D	Risks of implementing GMP/TCC
E	Difficulties in implementing GMP/TCC
F	Critical success factors (CSF) for GMP/TCC projects
G	Personal opinions on GMP/TCC
H	Project performance
I	Comparing GMP/TCC with the traditional procurement approach
J	Suitability for adopting GMP/TCC

Section A – Respondent's information

The first part of the questionnaire contains six questions on the general information of the respondents. These questions include respondents' job information and their company information. Experience in participating GMP/TCC projects is also collected. Since it is a project-based survey, respondents are required to answer the questions based on a GMP/TCC project they had been involved with. If the respondent has no hands-on experience but with sound understanding of GMP/TCC schemes or principles, they are diverted to answer both Section C (Benefits of GMP/TCC) and Section D (Risk of implementing GMP/TCC) only.

Section B – Project characteristics

This section asks respondents to give detailed information of the GMP/TCC project with which they had been involved, including project name, type of client, nature of project, contract sum, contract duration, payment mechanism, tendering method, the organisation and the stage to introduce GMP/TCC to the project, motives to implement GMP/TCC approach, and partnering practices.

Section C – Benefits of GMP/TCC

This section of the questionnaire seeks the respondents' perceptions on the benefits of the GMP/TCC procurement strategy. A five-point Likert scale delineating different levels of agreement (1 = strongly disagree and 5 = strongly agree) was used. The identified benefits of GMP/TCC on the questionnaire are listed as follows:

1. Provide guarantee of avoiding budget overrun at GMP main contract award.
2. Client provides financial incentives for contractor to achieve cost saving.
3. Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost.
4. Achieve better value for money.
5. Fast track project by allowing early start of construction before the design is fully developed.
6. Early settlement of final project account.
7. Greater client's control over design consultants, main contractor and subcontractors.
8. Bring in expertise in building designs and innovations on construction methods and materials from contractor to enhance the buildability of the project.
9. Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops.
10. Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.
11. Conducive to improving partners' working relationship via partnering.
12. More effort of client's involvement in problem solving and subcontractor selection.
13. Limit the entitlements for claiming variations by contractor.
14. Enable a more equitable risk apportionment amongst project participants.

15. Contractor takes all the risks in design development by way of GMP allowance in the tender.
16. More opportunities for participants to express opinions and concerns.
17. The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team.

Respondents are invited to suggest and rate any other factors based on their personal discretion and actual experience.

Section D – Risks of implementing GMP/TCC

Respondents are asked to rate the risk factors inherent with GMP/TCC projects in this section. The same five-point Likert scale used in the previous section (1 = strongly disagree and 5 = strongly agree) is also applied. The key risk factors sought include:

1. Disputes may arise due to changes in the scope of work.
2. Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project.
3. Inexperienced or claim conscious contractors jeopardise the GMP/TCC process.
4. The client may pay more because contractor may inflate the estimated costs to cover his additional risks.
5. Contractor may earn lower profit or even incur a loss due to unclear definition of the scope of work.
6. No standard form leads to misunderstanding of liabilities between parties.
7. Difficult to use successfully on contracts where many changes are expected.
8. Contractor may not foresee design development risks thus taking more risks.
9. Client may carry more risks than the traditional procurement approach.
10. Variations may cost more than under the traditional procurement approach

Section E – Difficulties in implementing GMP/TCC

In this section, respondents are invited to rate the difficulties which they had experienced in the GMP/TCC project. Analogous to the previous sections, the five-point Likert scale (1 = strongly disagree and 5 = strongly agree) is adopted. Below is a list of potential difficulties in implementing GMP/TCC:

1. Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development, i.e. unclear scope of work.

2. Increased commitment and involvement by project managers and design consultants in evaluating tenders (mainly on technical elements) for domestic subcontracts after the award of main contract, i.e. potential for incurring higher consultant fees.
3. Design development must keep pace with contractor's programme for tendering the domestic subcontractor's works packages otherwise delay may result.
4. Lack of standard form of GMP/TCC building contract in the local context.
5. Longer time in preparing contract documents.
6. Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management.
7. Difficult to develop trust and understanding from contractor as a project team member.
8. Too complicated form of contractual agreement.
9. Difficult to launch subcontracting with back-to-back contract terms.
10. Clients had to be more involved in a project.
11. A project team may find it difficult to adapt to this new way of working.
12. Not suitable for projects where it is difficult to define the scope of work early.

Section F – Critical success factors (CSF) for GMP/TCC projects

This section aims to evaluate the critical success factors of a GMP/TCC project. The five-point Likert scale (1 = strongly disagree and 5 = strongly agree) is used. The perceived factors contributing to the success of GMP/TCC projects were found to be:

1. Standard form of contract for GMP/TCC projects
2. Well defined scope of work in client's project brief
3. Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors
4. A right selection of project team
5. Reasonable share of cost saving and fair risk allocation
6. Partnering spirit from all contracting parties
7. Early involvement of the contractor in design development
8. Establishment of adjudication committee and meeting
9. Proactive main contractor throughout the GMP/TCC process
10. Open-book accounting regime as provided by the main contractor in support of his tender pricing

Section G – Personal opinions on GMP/TCC

Personal opinions on the future application and development of GMP/TCC are sought in this section. Two statements are postulated for respondents to rate according to a five-point Likert scale (1 = strongly disagree and 5 = strongly agree):

1. I believe that GMP/TCC procurement strategy will be increasingly adopted within the future construction industry of Hong Kong.
2. I will promote the application of GMP/TCC in future projects.

Section H – Project performance

This section requires the respondents to assess various aspects of performance of their GMP/TCC projects. The performance measures under assessment cover:

1. Time performance
2. Cost performance
3. Quality performance
4. Dispute (claim) occurrence
5. Overall project performance

Section I – Comparing GMP/TCC with the traditional procurement approach

This section further asks respondents to indicate how the performance of the GMP/TCC project was different from a project procured by the traditional design-bid-build approach in terms of the following measures:

1. Time performance
2. Cost performance
3. Quality performance
4. Incentive to innovation
5. Occurrence, magnitude and resolution of disputes
6. Risk management and control
7. Overall project performance

Section J – Suitability for adopting GMP/TCC

The final section of the survey questionnaire requests respondents to rate the following project conditions which they consider are suitable for adopting GMP/TCC scheme.

1. Large and technically complex project that contains higher risks
2. Project with tight schedule
3. Project with life cycle cash flow
4. Client's requirements for buildability and innovation
5. Infrastructure project involving many interfacing works
6. Landmark type project

3.4 Data Analysis and Validation of Research Findings

Opinions solicited from structured interviews and data collected from the questionnaire survey were analysed to explore the respondents' perceptions on the GMP/TCC approach. The analysis of interview opinions relied on the fundamental concepts of 'content analysis' research method in designing the survey component and analysing the interview dialogues. Content analysis classifies textual materials, reducing it to more relevant, manageable bits of data (Weber, 1990). It is applied to obtain information and understanding of issues relevant to the general aims and specific questions of a research project (Gillham, 2000). The information and data acquired from the interviews was first audio-recorded and later transcribed in written dialogues. The interview dialogues were forwarded back to corresponding interviewees afterwards for verification via email transmission. A systematic account of information and data obtained from in-depth interviews was archived for subsequent analysis.

Opinions on a set of common questions collected during the seven face-to-face interviews were then properly organised and analysed using the method of 'content analysis' in a matrix table format (i.e. each question posed against answers from each interviewee) to capture any similarities and differences for comparisons. This approach can help identify the most commonly perceived factors for each GMP/TCC attribute under study as adopted by Chan *et al* (2003) in determining the perceived partnering benefits identified from the reported literature and Yeung *et al* (2007) in digging out the key elements of project alliancing and strategic alliancing in construction. Outcomes derived from the analysis of interviews were cross-referenced to the published literature and to complement each other for validation.

Non-parametric statistical techniques were applied to analyse the quantitative data acquired from the questionnaire survey. The Statistical Package for Social Sciences (SPSS) was used to handle the statistical calculations. The Kendall's Coefficient of Concordance (*W*) was used to measure the agreement of different respondents on the rankings within a particular group. This statistical analysis aims to ascertain whether the respondents within an individual group respond in a consistent manner. Values of *W* can range from 0 to 1, with 0 indicating perfect disagreement and 1 indicating perfect agreement (Daniel, 1978). A high or significant value of *W* can reject the null hypothesis that there is a complete lack of consensus amongst responses within a group (Chan, 1998). In other words, a high or significant value of W indicates that different parties are essentially applying the same standard in ranking the attributes under study.

The Cronbach's alpha reliability coefficients are also tested. Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability (Norusis, 2002). The technique was employed to examine the internal consistency amongst the responses under the adopted Likert scale. The standardised Cronbach's alpha is defined as:

$$\text{Cronbach's } \alpha = (k/(k-1)*[1- \Sigma (S^2_i)/ S^2_{sum}] \quad (3.1)$$

where k is the number of items (variables), S^2_i is the variance of the *i*th item and S^2_{sum} is the variance of the total score formed by summing all of the items (Cronbach, 1951). Alpha coefficients range in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous and/or multi-point formatted questionnaires or scales (Santos, 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 is. The Cronbach's alpha tests were applied to test the reliability of the scales of the benefits, difficulties, risk factors and success factors of the GMP/TCC practices in the questionnaire survey (Sections C – F).

The level of agreement between any two survey groups on their rankings of various aspects of GMP/TCC scheme was measured by the Spearman's Rank Correlation Coefficient (r_s) as shown in Equation 3.2. The coefficient, r_s, ranges between –1 and +1. A value of +1 indicates a perfect positive linear correlation whereas negative values indicate negative linear correlation meaning that low ranking on one is associated with high ranking on the other. If the correlation is close to 0, then it implies that no linear relationship is present between the two groups on the variable (Albright *et al*., 2006). If Spearman's rank correlation coefficient (r_s) was significant at the 0.05 level (i.e. the actual calculated p-value < the allowable value 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. Independent 2-sample T-tests and One-way Analysis of Variance (ANOVA) tests (F-Tests) for multiple samples were also carried out to detect any differences between the respondent groups on the mean values of their responses for a specific attribute related to the GMP/TCC approach. If the test results were significant at the 0.05 level (i.e. the actual calculated p-value < the allowance value of 0.05), then the null hypothesis that no significant differences in the mean values between the respondent groups can be rejected. Thus, there is sufficient evidence to conclude that there are significant differences in the mean values between respondent groups (Norusis, 2002).

$$r_s = 1 - \frac{6\sum d^2}{n\left(n^2 - 1\right)} \tag{3.2}$$

where d = the difference between each rank of corresponding values of x and y and n = the number of pairs of values.

Research data and subsequent analyses were triangulated from multiple sources to enhance the credibility of the findings. Results derived from the analysis of in-depth interviews, empirical questionnaire survey and case studies were cross-referenced to the published literature and to complement each other. The inputs via discussions and moderations with prominent industrial practitioners involved in the study were organised to generate relevant information and to supplement and/or confirm the outcomes and explanations from these analyses. A comprehensive report in the form of a research monograph, journal articles and conference papers documenting the key

findings of the whole study were compiled for dissemination and reference within the research community and construction industry. This can be achieved by consolidating the research results into a coherent set of findings. Recommendations for successful implementation of GMP/TCC projects and further investigations were also suggested based on the research outcomes. This research certainly adds to the body of new knowledge in the area of GMP/TCC applications and implementation, in both a national and international context.

3.5 Chapter Summary

This chapter provides a detailed account of the research framework and the methodologies adopted to achieve the research objectives. This study started with an extensive literature review, followed by collecting opinions through face-to-face interviews and data from an empirical questionnaire survey. The study focuses on and evaluates a number of case studies of GMP/TCC projects in Hong Kong. Perceptions of key project stakeholders on the motives, processes, benefits, difficulties, risk factors, success factors, project performances and prevailing practices of GMP/TCC arrangements were solicited and analysed. The results of the case studies and the quantitative analysis of the questionnaire survey are presented in Chapter Four and Chapter Five, respectively.

CHAPTER 4 CASE STUDY

CHAPTER 4 CASE STUDY

4.1 Introduction

This chapter considers the role of motivational and incentive mechanisms in successful contracting under the GMP and TCC approach illustrated by two real-life cases in Hong Kong: Chater House and MTRC Tsim Sha Tsui Railway Station Modification Works. Both projects were completed ahead of schedule, with significant cost savings, fewer and earlier resolution of claims, early settlement of final project account, more productive working environment and higher job satisfaction with far less time spent on pointless disputes (MTRC, 2003; Chan *et al*., 2004; Wong, 2006). The motives behind, benefits, difficulties and success factors of implementing the GMP/TCC approach are critically examined.

The two case studies are primarily based on the perceptions of the various target project participants obtained from structured interviews. Background information about the two projects was also collected to complement the qualitative data collected from interviews and to strengthen the case study. Collection and comparing data from multiple sources (interviews, questionnaire survey and archives in this study) help enhance the credibility of the findings. The case studies are useful to assess the whole contractual implementation process by which project participants make GMP/TCC work. The reference to project names and participants is solely for academic reporting purposes without bias from the authors, their institutions and the research sponsors.

4.2 Chater House

The Chater House office tower rises 29 storeys on Hong Kong's Central Business District site, accommodating high-end retail space on the lower floors with international Grade A standard. The project consisted of 3-storey basement, a 3-storey podium and a 23-storey tower. The site of Chater House was formerly occupied by

Swire House owned by the private property developer, Hongkong Land Ltd. The construction phase of the building was undertaken under three contracts comprising demolition of the existing building (Swire House), construction of the foundation and construction of the above-ground superstructure elements. The overall GFA was approximately 74,000m^2. The final contract sum was approximately HK$1.5 billion, with final contract duration of 635 days, spanned from October 2000 to July 2002. The GMP procurement contract with a cost saving sharing mechanism was adopted as an incentive formula under a negotiated tendering method.

Set against a backdrop of declining standards in local construction, adversarial client / contractor working relationships and in-difference towards progressive thinking, the Client of the Chater House set out to create an environment that encouraged development of new ideas, new ways of working and new technologies, with a vision to achieve the elusive win-win outcome and excellent quality, cut construction waste and raise safety standards of workers (HK-BEAM, 2005). Resulting from time and efficiency initiatives, the cost of the project was reduced by about HK$270 million, equivalent to 15% of the original budget (Uebergang *et al*., 2004).

Client
Hongkong Land Ltd

Project Manager
Hongkong Land (Project Management) Ltd

Main Contractor
Gammon Skanska Ltd

Design Architect
Kohn Pederson Fox Associates

Project Architect
Aedas LPT Ltd

Structural Engineer
Ove Arup & Partners (HK) Ltd

E&M Engineer
WSP Hong Kong Ltd

Quantity Surveyor
WT Partnership (HK) Ltd

Source: Hong Kong Demonstration Projects Website: http://www.hkci.org/

4.2.1 GMP approach and features

The project was procured by a negotiated Guaranteed Maximum Price (GMP) contract. The mechanism of the GMP contract was envisaged and required the major project stakeholders to work as a team in determining the construction methods, programmes, pricing details, preliminaries, and conditions of contract. The initial GMP was set when the basic schematic design was completed i.e. 25%-30% of the complete design, which was the stage of submitting general building plans to the government regulatory body. A lump sum was given for the building concrete frame but the other works packages were let on an open-book basis. Negotiations were pursued at the tender stage with the client's preferred contractor, based on the following documents:

i. GMP methodology	▪ Tender requirements for the GMP and its objectives ▪ Rules for negotiations ▪ Pre-contract and post-contract administration procedures ▪ Division of works packages ▪ Subcontract package procurement ▪ Agreement of variations and scope changes ▪ Adjudication of issues in respect of adjustment to the GMP
ii. Standard form of contract	
iii. Design documentation	▪ Performance specification ▪ Plans, sections and elevations corresponding with Buildings Department submissions ▪ Schematic design and design development documentation for major elements including structure, E&M services, fire protection and lifts/escalators.
iv. Builders bill of quantities	▪ All packages (including E&M services) issued for guidance but serving as a measured basis for pricing and negotiating the GMP

As stated in the 'GMP Methodology', the information provided in the tender documents was not complete and/or not sufficient for construction and completion of the works. Therefore, the main contractor allowed in his tender pricing for design development. Further design information was provided by the employer and his team of consultants after the GMP was agreed and issued to the main contractor under architect's instructions.

The Main Contractor submitted a tender based on the tender documents and the employer's consultants subsequently negotiated the GMP. When the GMP was agreed, the main contractor submitted a new tender based on the latest tender documents to the employer with the agreed GMP, for acceptance by the Client. During the negotiation process, the Main Contractor was required to provide on an 'open book' basis all information used in support of his tender pricing. The Quantity Surveyor was responsible to ascertain if the Main Contractor's direct works were comparable with current market rates. If the Main Contractor's pricing exceeds current market rates and no agreement can be reached between the Main Contractor and the Quantity Surveyor, then these works will be competitively tendered.

All remaining nominated and domestic subcontract works packages were competitively tendered; the former principally led by the Client's consultant team, the latter by the Main Contractor. A common thread running through the procurement process was the 'around-table' agreement by all parties on those subcontractors invited to tender for the work and the subsequent award of those subcontracts. A concept similar to the GMP approach with gain-share arrangement was adopted with domestic subcontractors as an incentive mechanism.

The agreement of the guaranteed maximum price was an ongoing process, with a price agreed at 20% of design complete and reviewed at 40%, 60%, 80% and the full design (Ho, 2002). Notwithstanding the GMP, the Client, Consultants and the Contractor agreed to work together as a team to reduce costs. This process operated in parallel with a Partnering Agreement that was undertaken by all parties to the project. Savings that arise through the administration of the GMP contract were shared between the Client and the Contractor on the basis of 60/40 respectively. Costs exceeding the GMP are solely borne by the contractor, therefore the risk on cost overrun is significantly shared by the contractor. The schematic tendering process for the Chater House project is presented in Figure 4.1.

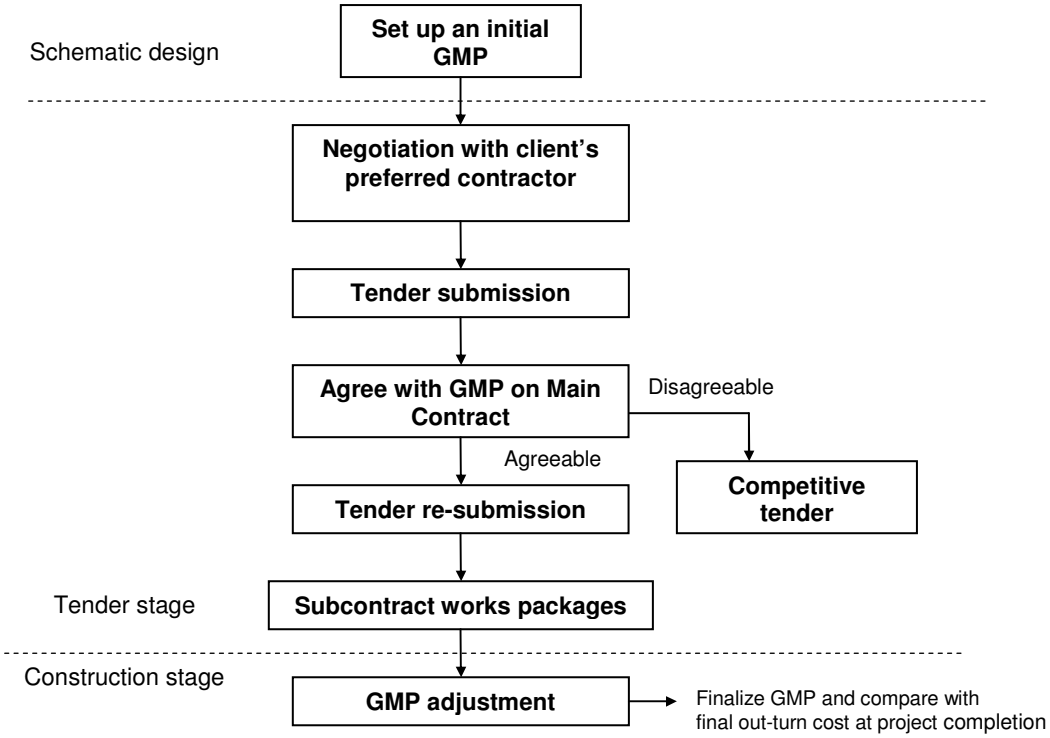

Figure 4.1 GMP tendering process for the Chater House project

The Architect issues instructions throughout the course of the works. For Main Contractor's direct works, Architects' instructions which are not GMP variations are deemed to be included in the fixed lump sums finalised at tender stage. All other Architects instructions are determined as either design development variations or GMP variations, and valued in accordance with the methodology in the contract. If the Architect and the Contractor cannot agree on the definition of a GMP variation, the Architect is required to convene a meeting of the Adjudication Committee comprising the Client, Architect, Main Contractor and Quantity Surveyor to determine the nature and extent of the variation.

4.2.2 Motives behind of adopting GMP

The project client intended to follow a procurement route that complimented the partnering strategy. Traditional forms of building contract were reviewed and discounted as being poorly suited to the open and transparent working relationship being fostered by the client. As a hybrid contract based on the standard negotiated form but capped in price and with a fixed completion date had been used successfully

on the client's two previous building developments. Additionally, reverting to a number of research literature, the client followed the direction of the GMP, a 'co-operative contracting' approach that would achieve the following objectives:

- To achieve a competitive price;
- To retain control over the design and construction processes.
- The procurement route must be "fast-track".
- To maximise value-for-money.
- To achieve a level of quality in line with the rest of client's portfolio and its expectations for the new building.
- A transfer of risk and a sharing of reward with the main contractor.

(HKCI, 2006)

4.2.3 Benefits of GMP

The overall performance of constructing the Chater House was superior when compared with a similar project procured by the conventional approach. The GMP contract helped achieve competitive price, stronger incentive to innovation, value for money and excellent quality which were in line with the Client's expectations. The contracting process also sought to retain control over the design and construction processes and to accomplish a mutually acceptable risk sharing mechanism and rewards with the Main Contractor.

The major benefit of the GMP approach is the capability to cope with serious problems such as late design changes by the 'open-book' accounting arrangement. In the case of Chater House, as the office rental market began its decline in 2000, the architects were asked to revisit the design that had already obtained Buildings Department's approval. The building was redesigned as a more regular shape that would cost less to build while offering a footprint that tenants preferred (Tam, 2002). This usually would result in significant problems and delay to the project. However, under the GMP contractual arrangement, these issues were resolved in a timely and efficient manner on account of the management, partnering spirit and decision-making methodologies adopted.

In addition, tendering of the domestic subcontractor's works packages was on an 'open-book' basis, ensuring the Client received competitively priced tenders from approved subcontractors and specialists. By tendering only to approved subcontractors, the Client retained an element of control over the subcontractors to be considered for the works packages. The adoption of the GMP approach also enabled the early involvement of the Contractor's buildability advice on alternative construction techniques and materials during the design process. Hence, time and quality performance was thereby guaranteed.

The Contractor has taken into consideration the design development risk by ways of the GMP allowance in the tender, and the Client had the comfort of a "not-to-exceed" contract sum early in the development process, which can only be adjusted to reflect scope changes or adjustments to provisional quantities or provisional sums. It allows a certain degree of flexibility on cost by setting aside the design development fund for miscellaneous variations. The GMP form of contract was also conducive to implementing partnering into the working relationships between project stakeholders, with the objective of achieving the 'maximum price' by adopting a more co-operative and less contractual or litigious approach to the contract. Furthermore, as the valuation of variations must be agreed progressively during the construction phase, the occurrence of disputes was greatly reduced and the preparation and agreement of the final project account was finalised earlier than an average traditional lump sum contract.

4.2.4 Difficulties of GMP

The principal problem of applying the GMP approach to the Chater House project, similar to those revealed by scholars, was the definition of the scope of work which was also the largest area exposed to disputes. As unforeseen changes occur as part of the construction work and the price will require arbitrary adjustment. The natural tendency of the client pulls in opposite directions with the contractor to achieve their own objectives. Despite that the definition of GMP variations was recorded in the methodology document, the contractor tended to view variations as a scope change to maximise end savings whereas the client showed a preference for design development to maximise the value of the works even if potential cost savings were sacrificed.

Another difficulty in adoption was the disapproval and unfamiliarity with the GMP arrangement. Despite that GMP was procured by a structured process, the consultants did not fully trust in this procurement method when compiling the contract with the owner. If frequent variations are made without setting aside proper design development allowance, or if serious conflicts between contractor and consultants occur, the GMP may be unsuccessful. It is therefore not easy to adapt to this new procurement method.

4.2.5 Critical success factors for GMP

Project participants hold a consistent view that the genuine willingness to achieve co-operation has made the Chater House project a success. A structured partnering process as shown in Figure 4.2 was adopted as a complimentary strategy to the guaranteed maximum price approach, which included partnering workshops, partnering champions, partnering performance monitoring exercise and conflict resolution mechanism. The partnering approach allowed various project participants opportunities to express their concerns and problems freely. It helped facilitate effective communication, enhance mutual trust and improve working relationships amongst project team members in order to achieve common goals (Chan *et al.*, 2004). With the relationship of developed mutual trust amongst the contracting parties, the 'open-book' arrangement under the GMP contract further enhanced confidence and formulated an essential factor to the project success.

Additionally, crucial to the GMP is the establishment of an adjudication process and the adjudication committee to report on the status of a variation submission and to determine the classification of various variations submitted by the contractor. It is also important to reach a mutual agreement on the valuation of variations as prompt as possible in order not to affect the overall progress of the project. The impartiality of the consultant quantity surveyor within the adjudication committee was considered to be an influential success factor for GMP.

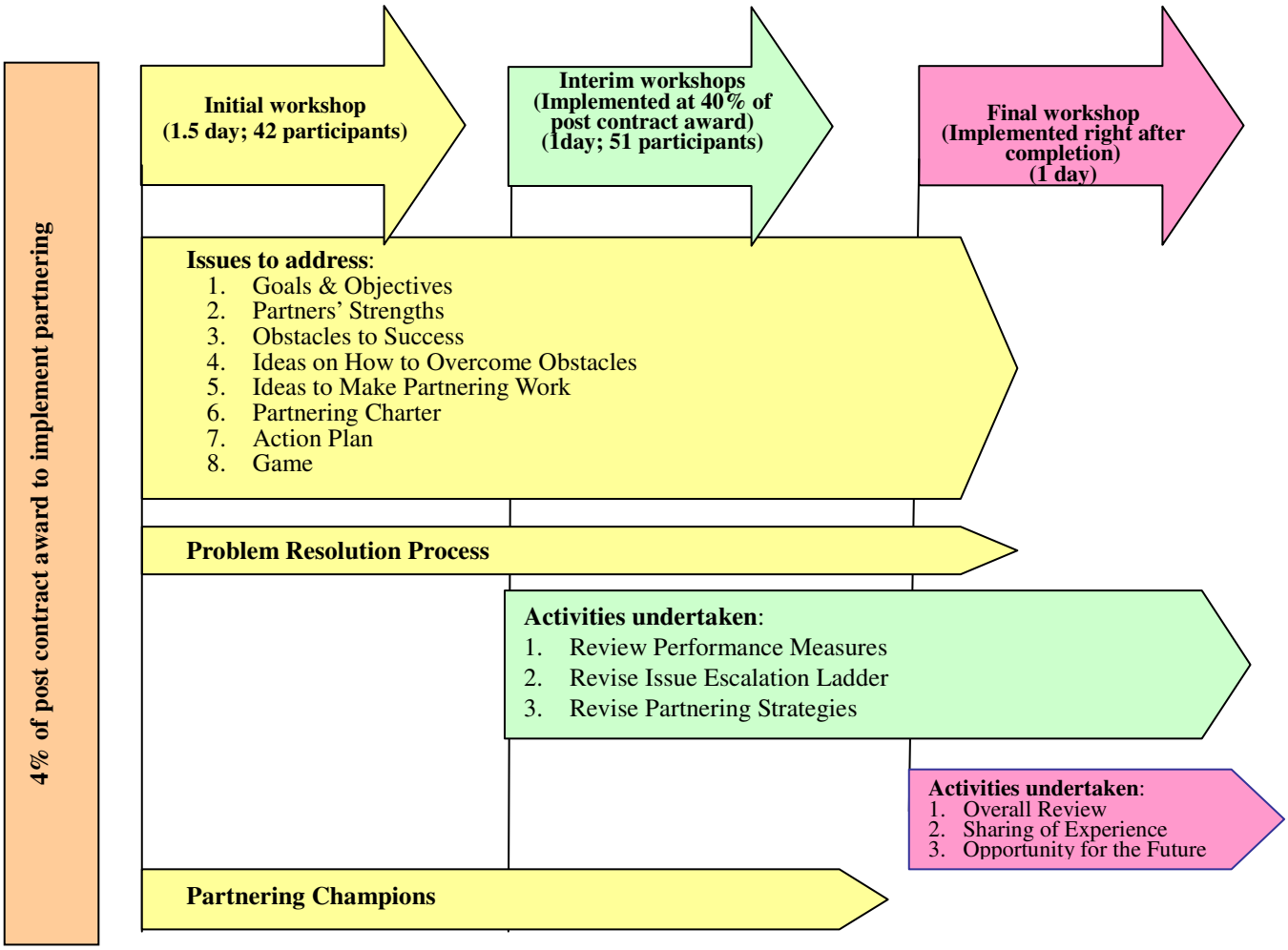

Figure 4.2 Partnering approach and process for Chater House [Chan *et al.* (2004)]

The process of subcontract procurement was also regarded as an essential ingredient for GMP success. The project was procured based on an 'open-book' accounting arrangement with joint tendering and selection of subcontractors. With the client's dedication to achieve his expectations in terms of quality and performance, the main contractor had the opportunity to participate in the selection procedure that would ideally result in (i) better working relationship with the appointed subcontractor; and (ii) to resolve interface omissions between works packages. The main contract document also prohibited the use of multi-player or multi-layered subcontracting unless prior approval of the client is sought. Moreover, the sharing of cost savings between the main contractor and subcontractors encourage construction excellence through innovation and efficiency.

Besides, under the GMP approach adopted in the Chater House, the main contractor team was able to participate in an early design stage. Mutual trust could be smoothly transferred to site level and extended throughout the whole contract period. Correspondence became more constructive in getting matters resolved promptly at site level instead of through contractual procedures. The technical innovations implemented by the main contractor also helped reduce project cost and time significantly. The introduction of GMP at the initial stage of project development can thus allow early contribution by the contractor to both design and construction methods.

4.3 MTRC Tsim Sha Tsui Railway Station Modification Works

The Tsim Sha Tsui (TST) Railway Station Modification Works project was the first fully 'open-book' Target Cost Contract (TCC) in Hong Kong. It attempted to make innovation and value engineering a priority backed by the gain-share/pain-share formula of the TCC process. The contract involved the connection of the pedestrian subway links of the new Kowloon-Canton Railway Corporation (KCRC) East Tsim Sha Tsui Station to the existing Mass Transit Railway Corporation (MTRC) Tsim Sha Tsui Station at the south end, and to improve passenger access and egress at the north end. The station modification required a single level extension to one end of the existing underground structure. The key objectives of the works were:

(i) to build subways linking to East Rail and forming an integral part of the Tsim Sha Tsui subway network for the government;
(ii) to relieve congestion and to improve station accessibility because of the increase in passengers and new developments in the area;
(iii) to provide a better travelling environment for passengers; and
(iv) to provide convenient station access for passengers with special needs by constructing a passenger lift

(HKCI, 2006)

This extension was constructed beneath Nathan Road, in one of the busiest districts of Hong Kong, within a cut and cover cofferdam. Other station modifications required significant alterations to the existing station structure whilst maintaining passenger

flows at all times. The risk profile was huge and the period for completion was tight. However, the project was successfully completed in terms of both time and cost. The contract value of the project was initially set at HK$300M in April 2002 with a contract period of 36 months. The target cost had risen by HK$12.5m to HK$312.5M to take account of a number of variations. The final out-turn cost was contained to HK$297.7M which produced a gain share pot of HK$14.8M (about 5% of cost saving). The time and cost profiles of the project is shown in Figure 4.3. The project was successfully completed in September 2005, i.e. seven months earlier than the contract completion date. This case study effectively justified the use of alternative contracting strategies that best align the project team to the high risk profile of the project (Avery, 2006).

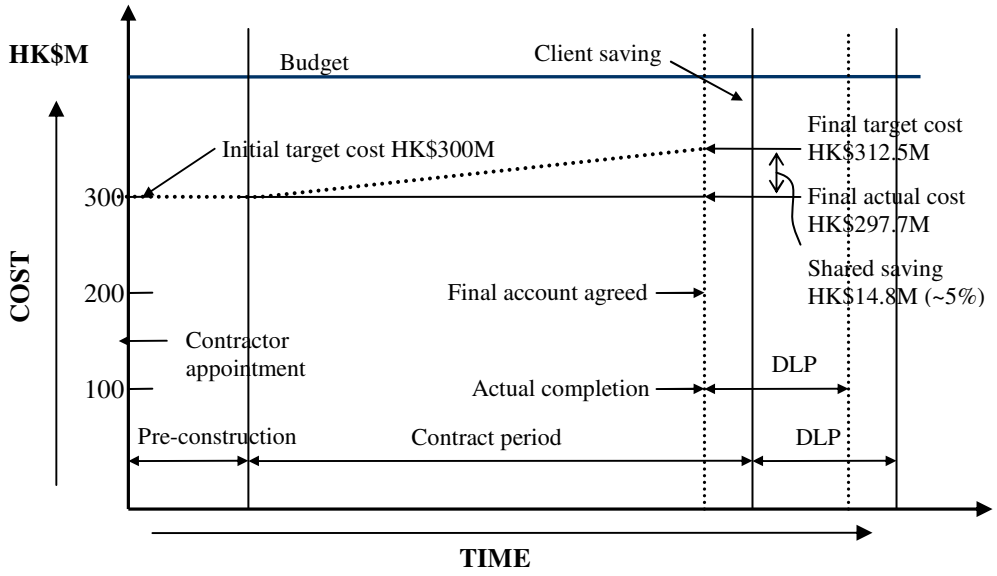

Figure 4.3 The cost and time profiles of the Tsim Sha Tsui Railway Station Modification Works (Avery, 2006)

Project Manager and Owner
Mass Transit Railway Corporation Ltd

Main Contractor
Kumagai Gumi Company Ltd

E&M Engineer
Balfour Beatty Group Ltd

Instrumentation Subcontractor
Fugro Geotechnical Services (HK) Ltd

Cladding / Architectural Steelwork
Inka Ltd

Ceilings Subcontractor
Litecraft Electrical and Metal Manufacturing Ltd

4.3.1 TCC approach and features

The main contract was awarded through a two-stage tendering process. At stage one seven prequalified contractors were invited to submit their tenders, consisting of a detailed technical proposal and a fee proposal with the schedule certainty. Two-envelope tender assessment method was adopted for the development of a detailed proposal used for assessment at stage two. Adjudication was mainly focused on the quality of the technical submission and achievement of the proposed schedule. Two potential contractors were shortlisted to the second stage whilst the unsuccessful contractors were reimbursed for administration expenses.

The two shortlisted contractors were given three months and full access to the design time, with the aim of optimising the technical side of the scheme to achieve the best overall solution. This involved a value engineering exercise, a full risk analysis and careful consideration of all schedule issues to ensure the achievement of the target completion date. In parallel, the contractors were involved in the analysis and estimation of the target price for the contract. Subsequently, senior management team adjudicated on the final proposals against a full marking regime to award the contract.

Under the target cost contracting arrangement, the Client described the tender price quoted by the Contractor as the initial target cost. During the contract execution stage, the Contractor was paid the actual construction cost for the work done. If the final construction cost, termed as the Final Actual Cost[4], differed from the Final Target Cost[5], the difference would be split between the Client and the Contractor based on a pre-determined gain-share/pain-share model set out in the contract.

A sum of money was set aside based on the risk quantification exercise as a contingency pool. Savings arising from the innovation, value engineering initiative, management and mitigation of the shared works would go into the pool. However, any revision to the initial target cost of the construction programme has to be agreed between the contractor and the client when the impacts and consequences of the instructions have been determined (Wong, 2006). A gain/pain sharing ratio between

[4] Final actual cost – the expenditures on the project under pre-defined and permissible categories, actually incurred by the contractor.
[5] Final target cost – the initial target cost plus the target cost variations.

the contracting parties was agreed at the early stage of the project. Consequently, the gain or pain in the pool at the end of the contract would be shared on a 50:50 basis as shown in Figure 4.4.

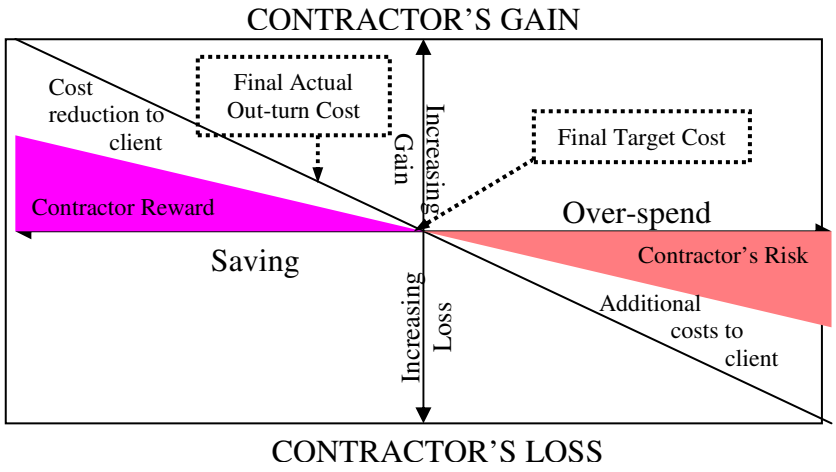

Figure 4.4 The gain-share/pain-share arrangement for Tsim Sha Tsui Railway Station Modification Works (Avery, 2006)

The target cost contract operated by the Client was on an 'open-book' gain-share/pain-share basis. The contractors were given specific instructions on areas of the bid where the costs were fixed and in particular the contractor's preliminary costs. The addition for overhead and profit was fixed as a percentage at the outset. Based on a joint risk assessment conducted at tender stage, risks were reasonably allocated and suitable contingencies were identified, i.e. where the contractor accepted full responsibility for specific risks it will need to ensure that a suitable contingency was included in the tender price. For the client accepted risks, the TCC may be altered up or down based on a valuation of the risk impact.

4.3.2 Motives behind for adopting TCC

The experience of Tseung Kwan O Railway Extension (TKE) project has proved that the implementation of incentivisation agreement (IA) is beneficial to the overall project performance. IA is similar to TCC in principle, where the Employer and the Contractor mutually agreed at the start date that all remaining works from this agreed date will be calculated with an estimated cost for their risks with the gain-share/pain-share arrangement. The advantage of IA lies in the incentives to the Contractor to

become efficient and to achieve savings. MTRC considered that it would be a mistake if not to introduce incentive schemes to the TST railway station modification project. After a great deal of searching and reviewing, the mechanism of a fully open-book target cost contracting using the gain-share/pain-share philosophy was adopted, with the aim to achieve excellent project performance. The Client also intended to use this project as the benchmark model for their future target cost construction projects.

The primary reason for adopting the TCC approach in the TST railway station modification works was to provide financial incentives for contractors to contribute and save cost by offering innovative ideas. Given the substantial uncertainties and the high risk profile of the project, using the traditional fixed price lump sum contract might result in a plethora of claims and poor working relationship amongst contracting parties. The implementation of the TCC through the gain-share/pain-share mechanism would achieve better certainty on time, quality and cost to the Client and help encourage the contractors focusing jointly on the management and mitigation of the risks inherent with the project.

In addition, it was intended to vastly improve the working relationships and bring in a more co-operative approach to conflict resolution. The client wished to align the project objectives by providing the best overall solution without compromising to the safety and operation of the railway while offering a realistic balance between the programme and total project cost (Dunn and Jones, 2004). The claims were also expected to be minimised using this innovative integrated procurement approach.

4.3.3 Benefits of TCC

The target cost contracting exercised more rigorous controls on tender process, subcontract procurement, risk management, contract administration as well as higher transparency requirement in financial controls and higher quality of information demand for forward financial planning. These significantly contributed to the excellent performance of the TST railway station modification works project. In particular, through a proper performance-based remuneration, the contractor's financial interests and those of the client become more closely collaborative and it is in the financial interests of both parties to co-operation (Wong, 2006). However, a

post-contract review facilitated by the partnering consultant identified that the partnering working team was not as integrated and transparent as had been considered.

The working relationships on this project via the partnering arrangement have been outstanding (Sadler, 2004). The use of gain-share, and more importantly the pain-share arrangement absent from the GMP contract helped align the individual objectives of various project stakeholders to the overall objectives of the project, and establish harmonious working relationships within an integrated team. The agreements arose from the TCC and partnering initiatives that encouraged the contractors and MTRC to manage works together and shared any consequent benefits and losses. Project participants responded that more opportunities are available for them to express opinions and concerns openly and freely under the TCC arrangement.

Another apparent advantage of the TCC approach in this project lied in the incentive to the contractor to become efficient and to achieve cost savings, resulting in better value for money for the entire project development. Expertise in construction designs and innovations in construction methods and materials were brought in from contractor to enhance the buildability of the project. Furthermore, a more equitable risk apportionment amongst project participants was offered when compared with the traditional procurement approach. The project required early involvement of the contractor in design phase to assist in the identification and apportionment of risks (Dunn and Jones, 2004). The use of 'open-book' accounting regime also enabled quantification of the costs of risks and prevented the project risks from causing adverse effects on the contractor's cash flow (Wong, 2006).

4.3.4 Difficulties of TCC

Subsequent to the decision of applying TCC to the TST railway station modification works project, the rationale behind had to be explained to the directorate of MTRC and the Government as the major stakeholder. However, obtaining endorsement from the directorate was not easy (Avery, 2006). With the risk profile of the contract the usual solution in Hong Kong would be a design and build lump sum contract with the entire risks passed onto the contractor. The difficulty was compounded primarily because a fully cost reimbursable target cost contract with the gain-share/pain-share

formula was unheard of in Hong Kong. The TCC concept was accepted as it was made clear that the issue of cost reimbursement would be monitored closely.

At the tender stage, the project lacked a suitable form of contract for TCC within the MTRC internal standard contract agreements. There was also a prime concern about the use of an unfamiliar form of contract such as the Engineering and Construction Contract. Changes were thus made to an existing MTRC contract. During the construction stage, similar problem occurred as in the Chater House Project, disputes arose because Architects / Engineers Instructions arbitrarily constituted target cost variations or were deemed to be design development due to unclear scope of work. Adjudication meetings were held with the partnering facilitator and relevant contracting parties to resolve any controversial issues and intractable disputes.

4.3.5 Critical success factors for TCC

The overall project success was contributed by the good working relationships amongst project stakeholders and the target cost procurement approach which had assisted in establishing shared objectives, common interests and an open-book accounting environment. A partnering consultant was appointed to facilitate the team building, enhance communication amongst the team members and to monitor project progress on a regular basis. Building integrated and committed teams can facilitate the accomplishment of smooth project delivery as well as of equitable risk sharing mechanism.

A right selection of project team is therefore essential. Under the TCC arrangement in this project, the Client was involved in subcontractor selection and a similar target cost contractual arrangement had also been entered into the mechanical and electrical subcontractors. Strong leadership and proactive contractor was also of prime importance to deal with any unexpected issues and potential disputes, and the choice made by all involved would either make or potentially break the strategy and the processes necessary for real success (Avery, 2006).

Another important element of the strategy was the transparency of the entire project development process. The project stakeholders decided from the outset that there was

to be one set of records for the project team and this was implemented since the initial stage. Mutual trust and close working relationship were therefore critical in implementing the 'open-book' accounting regime. The application of a 'shared' site office for the whole project team further catalysed the communication and integration amongst the contracting parties under a teamwork culture.

4.4 Chapter Summary

This chapter critically investigates the respective performances of the GMP and TCC practices in Hong Kong using case study methodology. The GMP/TCC applications and features, motives, benefits, difficulties and critical success factors for implementing the GMP/TCC approach are explored based on one selected GMP project (Chater House) and one selected TCC project (MTRC Tsim Sha Tsui Railway Station Modification Works). The findings are summarized in Table 4.1.

These case study findings are particularly useful in promoting best practices and establishing practical guidelines for successful implementation of GMP/TCC projects. The next Chapter further examines the GMP/TCC approach in the Hong Kong construction industry via an extensive empirical questionnaire survey.

Table 4.1 Summary of the two case study projects

	Chater House	MTRC Tsim Sha Tsui Railway Station Modification Works
Project nature	A prestigious rental commercial development in Central, Hong Kong	Railway station modification works involving connection of the pedestrian subway links in Tsim Sha Tsui, Kowloon
Contracting approach	Negotiated Guaranteed Maximum Price (GMP)	Target Cost Contracting (TCC) using two-stage tender process
Gain-share arrangement	Client : Contractor = 60 : 40	Client : Contractor = 50 : 50
Pain-share arrangement	Nil	Client : Contractor = 50 : 50
Underlying motives	▪ To cap contract price for client ▪ To attain co-operative contracting approach ▪ To retain control over the design and construction processes ▪ To maximise value for money ▪ To achieve a high level of quality ▪ A transfer of risks and a sharing of reward with the main contractor	▪ To achieve excellent project performance ▪ To provide financial incentives for contractor to contribute and save cost by offering innovative ideas ▪ To improve partners' working relationship ▪ To introduce a more co-operative approach to conflict resolution and minimise claims ▪ To align individual objectives of various parties with overall project objectives
Key benefits	▪ Superior project performance ▪ Help achieve competitive tender price ▪ Stronger incentive to innovation ▪ Achieve better value for money ▪ Retain control over the design and construction processes ▪ Accomplish a mutually acceptable risk sharing mechanism ▪ Able to cope with serious problems ▪ Improve buildability of project design ▪ Conducive to partnering implementation amongst key project stakeholders ▪ Early settlement of final project account	▪ More rigorous controls on tender process, subcontract procurement, risk management and contract administration ▪ Higher transparency requirement in financial controls and higher quality of information exchange ▪ Harmonious working relationship via partnering arrangement ▪ To align individual objectives of various parties with overall project objectives ▪ Provide financial incentives for the contractor to become efficient and to achieve cost saving ▪ Enhance buildability of project design ▪ More equitable risk apportionment
Difficulties encountered	▪ Disputes arose due to unclear scope of work ▪ Disapproval of / unfamiliarity with the GMP procurement approach	▪ Unfamiliarity with TCC concepts by senior management ▪ Lack of a suitable form of contract for TCC in the local context ▪ Disputes arose due to unclear scope of work
Critical success factors	▪ Willingness to achieve co-operation ▪ Establishment of an effective adjudication process and adjudication committee ▪ 'Open-book' accounting arrangement with joint tendering and selection of subcontractors. ▪ Early involvement of the main contractor in design development	▪ Good working relationship and right selection of project team ▪ Shared objectives with common interests ▪ Open-book accounting environment ▪ Strong leadership and proactive contractor ▪ Transparency of the entire project development process

CHAPTER 5 RESULTS OF RESEARCH SURVEY

CHAPTER 5 RESULTS OF RESEARCH SURVEY

5.1 Introduction

This chapter presents the results of an empirical questionnaire survey based on some recently completed GMP/TCC construction projects in Hong Kong. The sample size and respondents' profile are first presented. Then the perceptions of key project stakeholders on the GMP/TCC approach are explored and analysed including the motives, benefits, difficulties, success factors, risk factors, project performances and suitability of GMP/TCC scheme. The differing perceptions of clients, consultants, and contractors on these aspects of GMP/TCC are compared to examine if they have consensus on a particular issue. Lastly, effective practical guidelines for successful implementation of GMP/TCC projects are put forward as recommendations for improvement.

5.2 Sample Size and Respondents' Profile

Local industrial practitioners who have gained hands-on experience in participating in GMP/TCC construction projects 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 questionnaire from the senior staff of corresponding client organisations to the representatives of project consultants, main contractor and subcontractors. Unfortunately, the response rate was not satisfactory. Subsequently, through personal networking of research team members with the construction industry, 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 survey questionnaires were distributed to individual industrial practitioners by means of postal mail and electronic mail at the second stage. Follow-up telephone calls and electronic communication were undertaken where possible to elicit more detailed

responses and/or provide further clarifications for any unclear or misunderstood items on the survey form. Finally, a total of 45 completed survey questionnaires were returned and used for analysis, generating 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 is considered acceptable and useful for further analysis.
Table 5.1 shows the detailed breakdown of the questionnaires received.

Table 5.1 Summary of data collection and response rates

		First stage data collection	**Second stage data collection**	
Source		Distribution of questionnaire through client organisations	Direct mail to target respondents	**Total**
Number of questionnaire sent out		52	139	191
Number of returned questionnaire	No hands-on experience in GMP/TCC	0	4	4
	All returned questionnaire	7	34	41
Total questionnaires received		7	38	45
Response rate	Returned questionnaire (no hands-on experience)	0%	2.88%	2.09%
	All returned questionnaire	13.46%	27.34%	23.56%

Respondents represented different roles in the local construction industry. Table 5.2 and Figure 5.1 show the backgrounds of the respondents by type of organisation. About 36% and 27% of them were from client organisations and main contractors respectively. Respondents from consultants including architectural, engineering and quantity surveying consultants account for approximately 27% of the total respondents.

Type of organisation	Frequency	Percentage
Client organisation	16	35.6%
Main contractor	12	26.7%
Architectural consultant	4	8.9%
Engineering consultant	4	8.9%
Q.S. consultant	4	8.9%
Subcontractor	4	8.9%
Other (Partnering consultant)	1	2.2%
Total	45	100%

Table 5.2 Organisation type of the survey respondents *(N=45)*

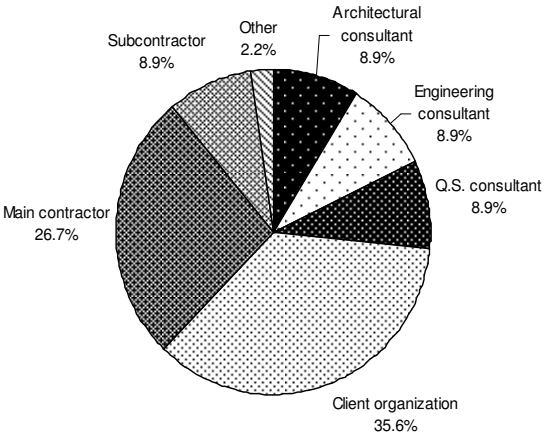

Figure 5.1 Organisation type of the survey respondents *(N=45)*

The coverage of the construction organisations under study was comprehensive in terms of their size as shown in Table 5.3 and Figure 5.2. Approximately 9% of the respondents' firms with less than 100 staff whilst over half of the respondents (60%) worked for firms with more than 500 staff.

Size of organisation	Frequency	Percentage
100 staff or below	4	8.9%
101-500 staff	14	31.1%
Over 500 staff	27	60.0%
Total	45	100%

Table 5.3 Organisation size of the survey respondents (number of employees) *(N=45)*

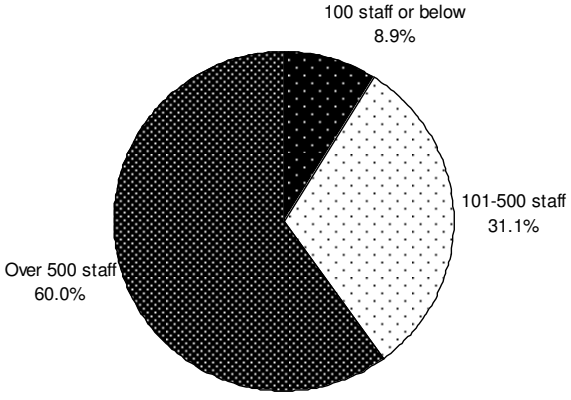

Figure 5.2 Organisation size of the survey respondents (number of employees) *(N=45)*

Most of the respondents held a senior position in their organisation with abundant experience in the construction industry as indicated in Table 5.4 and Figure 5.3. All respondents had over 10 years experience working in the industry and over 62% of the respondents had more than 20 years of professional working experience. As to the

GMP/TCC experience, over 90% of respondents possessed hands-on experience of participating in one or more GMP/TCC projects as revealed in Table 5.5 and Figure 5.4. Merely 4 out of 45 of the respondents (8.9%) had no hands-on practical experience but with sound understanding of GMP/TCC schemes or principles; and they were invited to answer both "**Section C – Benefits of GMP/TCC**" and "**Section D – Risks of Implementing GMP/TCC**" only. Hence, most of the respondents were well-experienced professionals in the construction practice who should provide reliable information to the research.

Year of construction experience	Frequency	Percentage
11-15 years	6	13.3%
16-20 years	11	24.4%
> 20 years	28	62.2%
Total	45	100%

Table 5.4 Experience level of the survey respondents *(N=45)*

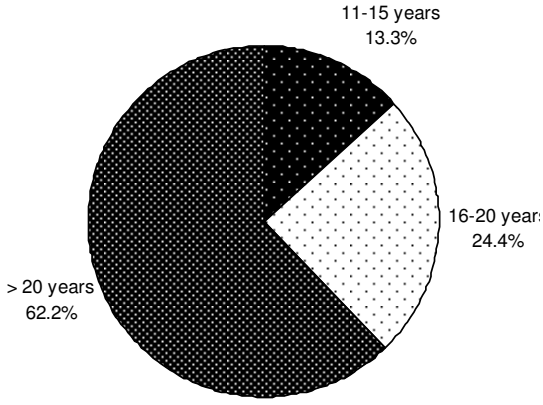

Figure 5.3 Experience level of the survey respondents *(N=45)*

Experience in GMP/TCC projects	Frequency	Percentage
No experience	4	8.9%
1 project	17	37.8%
2-4 projects	17	37.8%
Over 4 projects	7	15.6%
Total	45	100%

Table 5.5 GMP/TCC hands-on experience of the survey respondents *(N=45)*

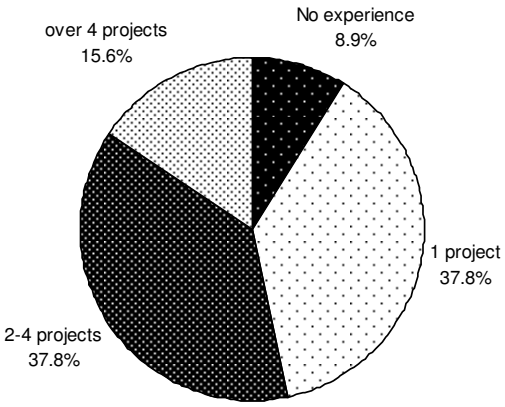

Figure 5.4 GMP/TCC hands-on experience of the survey respondents *(N=45)*

5.3 GMP/TCC Practices in Hong Kong

A total of 14 construction projects were covered in the questionnaire survey, which can substantially represent the GMP/TCC project pool in Hong Kong over the last five years. Table 5.6 shows the GMP/TCC practices of the 14 projects. The projects covered in the survey can be broadly classified into three major groups: residential, commercial and infrastructure projects. It is interesting to note that for projects adopting GMP/TCC practices, the GMP approach dominated the residential and commercial sectors (building sector) whilst the TCC was frequently applied to infrastructure projects. This differing observation might be attributed to the possible higher risk profile for infrastructure projects, while GMP might not be adequately fair to the contractor side to bear high risk without the presence of pain-share mechanism. The adoption of either GMP or TCC, nevertheless, depended heavily on the Client's experience and preferences. It was reflected that the two leading private property developers (i.e. Hongkong Land Ltd. and Swire Properties Ltd.), together with the major railway transportation service provider (i.e. Mass Transit Railway Corporation Ltd.) are taking a pioneering role in introducing the GMP/TCC style of procurement to their projects in Hong Kong. In addition, most of the surveyed projects used selective tendering method in order to facilitate adequate competition amongst the competent contractors. Negotiated tendering is, however, not unusual for several surveyed GMP projects because of the long-term close working relationship between the Client and the Contractor.

As also indicated in Table 5.6, the GMP/TCC was introduced at different stages throughout the whole project life but mainly at outline design stage or detailed design stage. Nevertheless, more recent projects introduced the GMP/TCC at an earlier stage in order to tap in the Contractor's expertise in design and innovative ideas in construction methods and selection of materials. For instance, the York House Project developed by the Hongkong Land, they implemented the GMP contract at the feasibility stage to seek improvements in buildability, innovation and efficiencies through reaping the perceived benefits and mitigating unforeseeable risks together with her partnering Contractor.

			Payment Mechanism		Tendering Method		Who introduced GMP/TCC?		At what stage was GMP/TCC decided to be introduced?				
	Start Date	Completion Date	GMP	TCC	Selective	Negotiated	Client	Main Contractor	Feasibility	Outline Design	Detailed Design	Complete Design	Construct -ion
Residential													
i. The Orchards	Aug 2001	Sep 2003	✓		✓		✓				✓		
ii. Public Housing at Eastern Harbour Crossing Site Phase 4	Jun 2006	Jun 2009	✓[6]		✓		✓			✓			
Commercial													
i. 1063 King's Road	Nov 1997	Aug 1999	✓			✓	✓			✓			
ii. Chater House	Oct 2000	Jul 2002	✓			✓	✓			✓			
iii. Alexandra House Refurbishments	Nov 2002	Nov 2003	✓		✓		✓				✓		
iv. Tradeport Hong Kong Logistics Centre	Jul 2001	Dec 2002	✓		✓		✓			✓			
v. Landmark Redevelopment Phase 6 (York House)	Jan 2005	Oct 2006	✓			✓	✓		✓				
vi. Three Pacific Place	Jun 2002	Aug 2004	✓		✓		✓					✓	
vii. TKO Technology Park	Nov 2001	Dec 2002	✓			✓	✓			✓			
viii. Wynn Resorts Macau	Jun 2004	Aug 2006	✓		✓		✓				✓		
ix. Omni Bershire Place Hotel Renovation New York	Jan 1996	Oct 2004	✓		✓		✓						
Infrastructure													
i. MTRC Tsim Sha Tsui Railway Station Modification Works	Apr 2002	Sep 2005		✓	✓		✓			✓			
ii. MTRC Contract 604 – Yau Tong Station	Jan 2001	Jun 2002		✓	✓		✓						✓
iii. MTRC Contract – Tung Chung Cable Car	Jun 2004	Dec 2005		✓	✓		✓			✓			

Table 5.6 GMP/TCC practices of the surveyed projects (I)

[6] According to the interviewee of the Hong Kong Housing Authority (HKHA) and relevant tender documents, the Modified GMP (MGMP) approach has divided the scope of the work into two main parts: main contractor's direct works and MGMP works packages. For direct works, traditional model of procurement is adopted. And the rest of the works (approximately 20% of the contract value), the GMP works packages are developed and the scope of work is defined. Those packages open up the room for the contractor's expertise and innovation that drive them to construct in a better and efficient way such as higher levels of sustainability and construction efficiency.

Table *5.7* further reveals the partnering practice implemented in the surveyed GMP/TCC projects. It is worth noting that most of these projects (85.7% of the total surveyed projects) implemented GMP/TCC in conjunction with partnering so as to align the individual objectives to common objectives of the projects, enhance communication of the project participants, and facilitate the implementation of gain-share/pain-share philosophy associated with GMP/TCC projects. The majority of the surveyed GMP/TCC projects introduced partnering approach at the construction stage. The infrastructure sector (i.e. MTRCL) included a partnering provision in the construction contract at the tender stage for Tsim Sha Tsui Railway Station Modification Works and Tung Chung Cable Car Project. More recently, the partnering approach has been adopted as early as at the feasibility stage, including the York House and the TKO Technology Park, so long as the Client and the Contractor have developed a long-term intimate working relationship for years.

Table 5.7 Partnering practices of the surveyed projects (II)

	Was partnering adopted?		**At what stage was partnering decided to be adopted?**				
	Yes	No	Feasibility	Outline Design	Detailed Design	Tender	Construct-ion
Residential							
i. The Orchards	✓						✓
ii. Public Housing Development at Eastern Harbour Crossing Site Phase 4	✓						✓
Commercial							
i. 1063 King's Road	✓						✓
ii. Chater House	✓						✓
iii. Alexandra House Refurbishments	✓				✓		
iv. Tradeport Hong Kong Logistics Centre	✓				✓		
v. Landmark Redevelopment Phase 6 (York House)	✓		✓				
vi. Three Pacific Place	✓						✓
vii. TKO Technology Park	✓		✓				
viii. Wynn Resorts Macau		✓					
ix. Omni Bershire Place Hotel Renovation New York		✓					
Infrastructural							
i. MTRC Tsim Sha Tsui Railway Station Modification Works	✓					✓	
ii. MTRC Contract 604 – Yau Tong Station	✓						✓
iii. MTRC Contract – Tung Chung Cable Car	✓					✓	

Moreover, the respondents were asked to select the motive(s) behind the decision to implement the GMP/TCC procurement approach. The results are indicated in Figure 5.5 and Table 5.8. It was found that 'To generate an incentive to achieve cost saving' is the most significant motive for implementing the GMP/TCC approach. As stated earlier, GMP/TCC is a procurement approach which will award the contractor for savings made but penalise him when this sum is exceeded. This gain-share/pain-share mechanism offers strong incentives to the contractor to become efficient and to achieve cost savings (Boukendour and Bah, 2001). In addition, 'To develop better working relationship' and 'To tap in contractor's expertise in design' are also common motives. Therefore, it is imperative to explore more possibilities for better quality product, savings in cost and time to achieve a win-win situation to the benefit of both the client and the contractor.

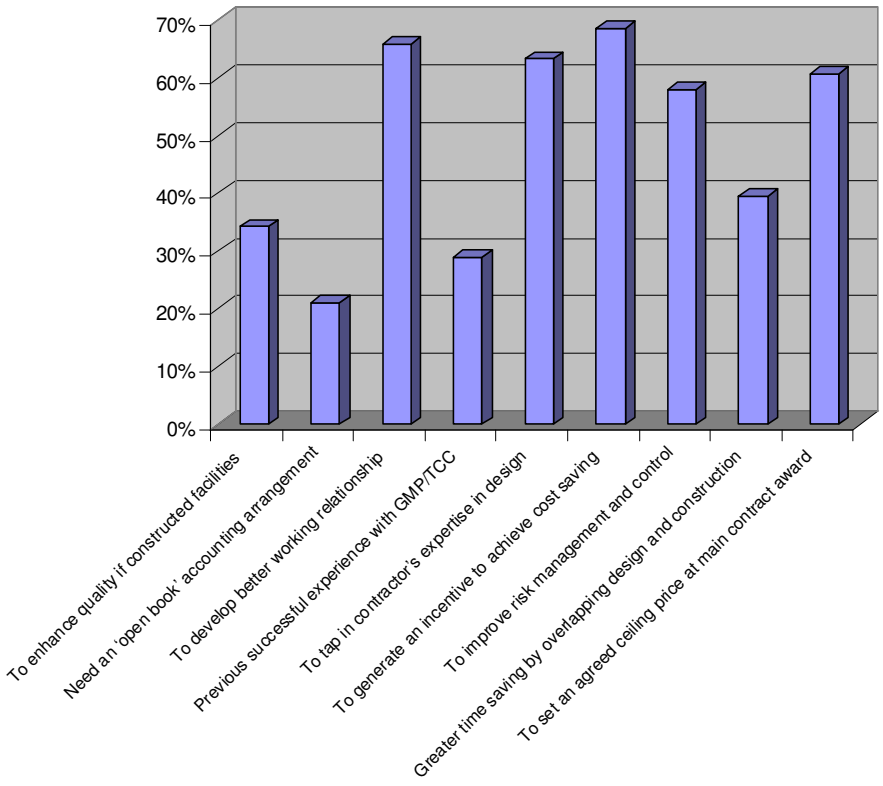

Figure 5.5 Motives behind to implement GMP/TCC *(N=38)*

Table 5.8 Motives behind to implement GMP/TCC *(N=38)*

Motive	Frequency	Percentage
To enhance quality of constructed facilities	13	34.21%
Need an 'open-book' accounting arrangement	8	21.05%
To develop better working relationship	25	65.79%
Previous successful experience with GMP/TCC	11	28.95%
To tap in contractor's expertise in design	24	63.16%
To generate an incentive to achieve cost saving	26	68.42%
To improve risk management and control	22	57.89%
Greater time saving by overlapping design and construction	15	39.47%
To set an agreed ceiling price at main contract award	23	60.53%
Total	**38**	**------**

5.4 Benefits and Difficulties of GMP/TCC

In order to critically assess the pros and cons of the GMP/TCC approach, a total of 17 perceived benefits and 12 potential difficulties of using this procurement strategy were initially identified from the published literature as well as structured interviews with relevant senior industrial practitioners. An industry-wide empirical survey was then conducted between April and June of 2006 in Hong Kong to explore different project stakeholders' perceptions towards these identified benefits and difficulties. Respondents were requested to rate their degree of agreement against each of the statements regarding the benefits and difficulties of the GMP/TCC approach according to a five-point Likert scale (1 = Strongly Disagree and 5 = Strongly Agree) with reference to a particular GMP/TCC project they had been involved. Respondents were further classified into three main categories of groups (i.e. client group, contractor group and consultant group) in order to facilitate more meaningful comparisons on the various attributes of GMP/TCC under investigation. The contractor group consisted of main contractors and subcontractors while the consultant group was made up of consultants from various disciplines.

Cronbach alpha reliability (the scale of coefficient) measures were examined to verify the internal consistency of the responses under the variables regarding the benefits and difficulties of GMP/TCC independently. The Cronbach's coefficient alpha for the 'benefit' section is 0.685 (F statistics = 2.929, p = 0.000) and that for the 'difficulty' section is 0.737 (F statistics = 14.953, p = 0.000), indicating that the scale used for

measuring these attributes is reliable at the 5% significance level.

5.4.1 Benefits of GMP/TCC

Table *5.9* shows the perceived benefits of the GMP/TCC approach as rated by the respondents. Interestingly, 'Early settlement of final project account' (mean = 4.25) was considered as the most significant benefit of the GMP/TCC procurement approach. This finding echoes with the statement made by Gander and Hemsley (1997) that the agreement of the final project account tends to be finalised earlier than the traditional priced contracts, as the arrangements of variations under the GMP/TCC philosophy are pre-agreed between the client and the contractor. Another key benefit of the GMP/TCC scheme is the ability to bring in contractor's expertise in design and construction to enhance project buildability (mean = 4.20), because the GMP/TCC arrangement allows the contractor to be brought at the early design stage to advise on various buildability issues (Wong *et al*, 2006).

Moreover, improvement of working relationship amongst project partners was highly rated as the merit of GMP/TCC (mean = 4.16). This is primarily attributed to the gain-share/pain-share mechanism with the common goal of achieving cost saving under the GMP/TCC contracts as well as the partnering arrangement adopted for most of the surveyed projects (Chan *et al*, 2003). Traditional relationships amongst the project team members are often adversarial with the parties resorting to contractual claims and litigation. The cost incentives offered by the GMP/TCC scheme are used as an essential tool to produce alignment on project objectives and not just to motivate the contractor. Ting (2006) also opined that the incentivisation can create a more proactive, co-operative working atmosphere between the contracting parties and reinforces the cultural shift away from traditional, adversarial approach to contracting.

The perceived benefits of GMP/TCC were also assessed from different perspectives of the client group, contractor group and consultant group. The rankings by 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 5.10. The next stage of the analysis was to test whether there is any similar substantial agreement amongst the respondents across the three various groups. Table 5.11 shows

the test results of Spearman's rank correlation coefficients (r_s) and the corresponding significance levels.

Table 5.9 Perceived benefits of GMP/TCC approach in Hong Kong (all respondents)

Benefits of GMP/TCC	N	Mean[#]	Standard Deviation
1. Provide guarantee of avoiding budget overrun at GMP main contract award.	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/ 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 work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops.	42	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 partnering.	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 allowance in the tender.	42	3.40	1.170
16. More opportunities for participants to express opinions and concerns.	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

Items were rated on a 5-point Likert scale with 1 = Strongly Disagree and 5 = Strongly Agree.

As indicated in Table 5.11, the null hypotheses that no significant correlation between clients-contractors, clients-consultants and contractors-consultants on the ranking of GMP/TCC benefits cannot be rejected. 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 ranked Item 2 'Client provides financial incentives for contractor to achieve cost saving' as the top benefit that GMP/TCC could bring, the contractor group ranked it as the 15th. This disagreement is attributed to the different expectations of the GMP/TCC rationale on financial incentives between the client / consultant side and contractor side. However, Boukendour and Bah (2001) emphasised that the gain-share/pain-share mechanism intends to offer

well co-ordinated motives to the contractor to become efficient and to achieve cost savings. The three groups also have a quite different ranking on Item 13 'Limit the entitlements for claiming variations by contractor'. In addition, Consultant group ranked significantly lower on the Item 11 'Conducive to improving partners' working relationship via partnering' than the other two respondent groups.

Table 5.10 Ranking and Kendall's coefficient of concordance for the benefits of GMP/TCC approach

ID	Benefit	All Respondents		Clients		Contractors		Consultants	
		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 partnering.	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 GMP main contract award.	3.84	8	3.86	10	3.79	11	3.89	3
3	Early award of contract can allow advance works packages (e.g. demolition, foundation, etc.) to be included in GMP/ 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.	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 work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP 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 allowance in the tender.	3.30	17	3.00	17	3.71	14	3.11	16
	Number (n)	37		14		14		9	
	Kendall's Coefficient of Concordance (W)	0.082		0.147		0.094		0.177	
	Level of Significance	0.000		0.007		0.178[†]		0.062[†]	

H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group
Reject H_0 if the actual significance level (p-value) is less than the allowable value of 5%

[†] It is noted that the significance levels of the Kendall's Coefficient of Concordance (W) for the Contractor group and Consultant group are greater than the critical level i.e. 0.05, therefore we cannot reject the null hypothesis that there is a complete lack of consensus among responses within a group. Readers should take note of this when interpreting the research findings in this section.

Table 5.11 Spearman's rank correlation test between groups of respondents for the GMP/TCC benefits

Comparison	r_s	Significance	Conclusion
Client ranking vs Contractor ranking	0.293	0.254	Cannot reject H_0 at 5% sig. level
Client ranking vs Consultant ranking	0.424	0.090	Cannot reject H_0 at 5% sig. level
Contractor ranking vs Consultant ranking	0.369	0.145	Cannot reject H_0 at 5% sig. 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 allowable value of 5%

One-way ANOVA tests (F-tests) for multiple samples were carried out to examine any significant differences amongst the client, contractor and consultant groups on their perceptions of the specific benefits of the GMP/TCC approach measured by the mean values. However, the results revealed that no significant difference is found amongst the client, contractor and consultant groups at the 5% significance level. This finding reveals that the three groups of respondents share somewhat analogous views on the merits that GMP/TCC could derive.

Independent 2-sample T-tests were also conducted to further examine the difference of perceptions between the two specific groups: respondents involved in GMP projects and TCC projects respectively. The TCC group rated significantly higher than the GMP group on the Item 4 'GMP/TCC scheme would bring better value for money' (sig. = 0.028), but the GMP group perceived the benefit of the Item 5 'Fast track project by allowing early start of construction before the design is fully developed' significantly higher than the TCC group (sig. = 0.030). The results of these ANOVA tests and T-tests are reported in Appendix III.

5.4.2 Difficulties of GMP/ TCC

Table 5.12 shows the potential difficulties in implementing the GMP/TCC procurement scheme as perceived by the respondents. Keeping the design development pace with contractor's programme for tendering the domestic subcontractor's works packages, and more involvement by the clients in the project, are ranked as the top problems with GMP/TCC, with the mean values of 4.03 and

4.02 respectively. These two major obstacles may be stemmed from unclear scope of work in client's project brief and unfamiliarity with the GMP/TCC methodology. Furthermore, 'Disputes over whether Architects'/Engineers' Instructions constituted GMP/TCC variations or were deemed to be design development' was also highly rated as the difficulty in managing GMP/TCC projects (mean = 3.79). Fan and Greenwood (2004) also emphasised that disputes may easily arise during the design development and construction phases of the works as to which Architects' Instructions should be classified as GMP / target cost variations and which are deemed to be design development.

Table 5.12 Potential difficulties of GMP/TCC projects in Hong Kong (all respondents)

Difficulties in implementing GMP/TCC	N	Mean[#]	Standard Deviation
1. Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work.	39	3.79	0.910
2. Increased commitment and involvement by project managers and design consultants in evaluating tenders (mainly on technical elements) for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees.	39	3.46	0.854
3. Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay.	39	4.03	0.628
4. Lack of standard form of GMP/TCC building contract in the local context.	39	3.69	0.950
5. Longer time in preparing contract documents.	39	3.28	0.972
6. Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management.	39	3.10	1.021
7. Difficult to develop trust and understanding from contractor as a project team.	40	2.50	1.013
8. Too complicated form of contractual agreement.	41	2.61	0.919
9. Difficult to launch subcontracting with back-to-back contract terms.	40	2.50	0.816
10. Clients had to be more involved in a project.	41	4.02	0.758
11. A project team may find it difficult to adapt to this new way of working.	41	2.90	0.995
12. Not suitable for projects where it is difficult to define the scope of work early.	41	3.39	1.202

Items were rated on a 5-point Likert scale with 1 = Strongly Disagree and 5 = Strongly Agree.

The difficulties of GMP/TCC were further investigated, analogous to the previous 'benefit' section, by testing the disparity of the rankings rated by the client group, contractor group and consultant group. The rankings by each respondent group were transformed into a matrix as the imported data for the calculations of the Kendall's coefficients of concordance (*W*), as shown in Table 5.13. The computed *W*'s for all groups are significant at 5% significance level, the null hypothesis that the

respondents' ratings within a group are unrelated can thus be rejected. Subsequently, the level of agreement amongst the three groups of respondents on the ranking was tested using the Spearman's rank correlation coefficient (r_s). Table 5.14 reveals the results of Spearman's rank correlation test and the corresponding significance levels.

Table 5.13 Ranking and Kendall's coefficient of concordance for the difficulties in implementing GMP/TCC approach

ID	Difficulty	All Respondents		Clients		Contractors		Consultants	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
3	Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay.	4.03	1	4.00	2	4.15	1	3.90	1
10	Clients had to be more involved in a project	3.97	2	4.33	1	3.85	2	3.70	2
1	Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work.	3.63	3	3.58	4	3.69	3	3.60	3
4	Lack of standard form of GMP/TCC building contract in the local context.	3.57	4	3.75	3	3.62	6	3.30	5
12	Not suitable for projects where it is difficult to define the scope of work early.	3.43	5	3.33	6	3.69	3	3.20	6
2	Increased commitment and involvement by project managers and design consultants in evaluating tenders (mainly on technical elements) for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees.	3.40	6	3.00	9	3.69	3	3.50	4
5	Longer time in preparing contract documents.	3.17	7	3.42	5	3.23	7	2.80	8
6	Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management.	3.17	7	3.25	8	3.08	8	3.20	6
11	A project team may find it difficult to adapt to this new way of working.	2.91	9	3.33	6	2.77	10	2.60	9
8	Too complicated form of contractual agreement.	2.57	10	2.42	10	2.85	9	2.40	11
7	Difficult to develop trust and understanding from contractor as a project team.	2.49	11	2.42	10	2.77	10	2.20	12
9	Difficult to launch subcontracting with back-to-back contract terms.	2.49	11	2.33	12	2.54	12	2.60	9
	Number (n)	35		12		13		10	
	Kendall's Coefficient of Concordance (W)	0.300		0.379		0.313		0.313	
	Level of Significance	0.000		0.000		0.000		0.000	

H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group
Reject H_0 if the actual significance level (p-value) is less than the allowable value of 5%

Table 5.14 Spearman's rank correlation test between groups of respondents for the GMP/TCC difficulties

Comparison	r_s	Significance	Conclusion
Client ranking vs Contractor ranking	0.772	0.003	Reject H_0 at 1% sig. level
Client ranking vs Consultant ranking	0.785	0.002	Reject H_0 at 1% sig. level
Contractor ranking vs Consultant ranking	0.912	0.000	Reject H_0 at 1% sig. 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 allowable value of 5%

Table 5.13 indicates that the rankings by all respondents and individual groups of clients, consultants and contractors were not significantly different as deduced from the values of significance level (all equal to 0.000). There was considerable agreement in all three parties that the GMP/TCC approach is vulnerable in the necessity to keep pace the design development with contractor's programme for tendering the domestic subcontractor's works packages, and the additional involvement of client throughout the whole project delivery process. The results are consistent with the findings reported by Sadler (2004) and HKHA (2006). Merely by direct observation, the Client group ranked Item 2 'Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts i.e. potential for incurring higher consultant fees' noticeably lower (9th) than the other two groups (3rd and 4th). This may be due to the fact that the tender evaluation of domestic subcontractors is primarily undertaken by the team of design consultants and contractor's project manager, not the client himself, so the client does not perceive it as a difficulty of GMP/TCC at all.

The null hypotheses that no significant correlation between clients-contractors, clients-consultants and contractors-consultants on the ranking of GMP/TCC difficulties, as indicated in Table 5.14, were all rejected. This reveals that the three groups of respondents held an extremely consistent view on the difficulties encountered with the GMP/TCC approach. Results from the One-way ANOVA tests also show that there are no significant differences amongst the client, contractor and consultant groups on the perceptions of the specific difficulties in implementing GMP/TCC construction projects. Independent 2-sample T-tests were also carried out to test for the existence of any significant difference of perceptions between the two respective respondents involved in GMP projects and TCC projects. The GMP group rated considerably higher than the TCC group also on the Item 2 (sig. = 0.006). This might reflect that the GMP projects would require heavier commitment and involvement by project managers and design consultants to evaluate subcontract tenders than the TCC projects because of the more fierce competition in the building sector of Hong Kong than in the infrastructure sector. The results of these ANOVA tests and T-tests are presented in Appendix III.

5.5 Key Risks and Critical Success Factors for GMP/TCC

A total of ten key risk factors and ten critical success factors of the GMP/TCC procurement approach were primarily sought from the reported literature and structured interviews with relevant senior industrial practitioners. Different project stakeholders were invited to score their level of agreement against each of the statements related to those identified key risk factors and critical success factors, based on a five-point Likert scale (1 = Strongly Disagree and 5 = Strongly Agree) with reference to a particular GMP/TCC project they had participated.

Cronbach alpha reliability (the scale of coefficient) measures were applied to check for the internal consistency of the responses under the variables pertaining to the risk factors and the success factors of GMP/TCC correspondingly. The Cronbach's coefficient alpha for the 'risk' section is 0.757 (F statistics = 13.338, p = 0.000) and that for the 'success' section is 0.681 (F statistics = 11.360, p = 0.000), implying that the scale used for measuring these parameters is reliable at the 5% significance level.

5.5.1 Key risk factors (KRFs)

Table 5.15 gives the summary of the rated key risk factors of implementing the GMP/TCC approach. 'Involvement of inexperienced or claim conscious contractors in the GMP/TCC project' was considered as the most significant risk factor (mean = 3.89), as they might jeopardise the entire GMP/TCC process. This risk has also been alerted by Gander and Hemsley (1997) and HKHA (2006). In addition, 'Disputes may arise due to the changes in scope of work' (mean = 3.80) because of unclear scope of work in client's project brief, together with 'Contractor may not foresee design development risks thus taking more risks' (mean = 3.60) due to incomplete design at tender stage, were also highly scored as the key risks inherent with this procurement method.

The difference in the rankings of implementing the KRFs of GMP/TCC rated by the client group, contractor group and consultant group were tested. The rankings by each respondent group were tabulated for the calculations of the Kendall's coefficients of concordance as reported in Table 5.16. The results confirm that the null hypothesis

that the respondents' ratings on risk factors of GMP/TCC projects within a certain group are unrelated to each other can be rejected at the 5% significance level. The subsequent stage of the analysis was to test the consensus among the groups of respondents on the ranking exercise using the Spearman's rank correlation test. Table 5.17 indicates the Spearman's rank correlation coefficients (r_s) and the corresponding significance levels.

Table 5.17 indicates that the null hypotheses that no significant correlation between clients-consultants and contractors-consultants on the ranking of risks associated with GMP/TCC scheme can be rejected at the 5% significance level. However, this null hypothesis between the client group and contractor group cannot be rejected at the 5% significance level. This reveals that the diverse perceptions on the risks inherent with the GMP/TCC approach between these two respondent groups. The main disparities were found in Item 6 'No standard form leads to misunderstanding of liabilities between parties' which was ranked 1st by contractors but 8th by clients; and Item 5 'Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work' again ranked 1st by contractors but 7th by clients.

Table 5.15 Key risk factors of GMP/TCC projects in Hong Kong (all respondents)

Key risk factors of GMP/TCC	N	Mean[#]	Standard Deviation
1. Disputes may arise due to the changes in scope of work.	45	3.80	0.869
2. Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project.	45	3.13	1.036
3. Inexperienced or claim conscious contractors jeopardise GMP/TCC process.	44	3.89	0.895
4. The client may pay more because contractor may inflate the estimated costs to cover his additional risks.	45	2.93	1.009
5. Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work.	44	3.45	1.022
6. No standard form leads to misunderstanding of liabilities between parties.	45	3.49	0.920
7. Difficult to use successfully on contracts where many changes are expected.	45	3.38	1.211
8. Contractor may not foresee design development risks thus taking more risks.	45	3.60	0.939
9. Client may carry more risks than the traditional procurement approach.	45	2.69	0.925
10. Variations may cost more than under the traditional procurement approach.	45	2.53	0.815

Items were rated on a 5-point Likert scale with 1 = Strongly Disagree and 5 = Strongly Agree.

Table 5.16 Ranking and Kendall's coefficient of concordance for the risks of GMP/TCC approach

		All Respondents		Clients		Contractors		Consultants	
ID	**Risk**	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
3	Inexperienced or claim conscious contractors jeopardise GMP/TCC process.	3.89	1	3.60	1	3.88	4	4.23	1
1	Disputes may arise due to the changes in scope of work.	3.80	2	3.47	2	4.00	1	3.92	2
8	Contractor may not foresee design development risks thus taking more risks.	3.64	3	3.47	3	3.75	6	3.69	3
6	No standard form leads to misunderstanding of liabilities between parties.	3.50	4	3.00	8	4.00	1	3.46	4
5	Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work.	3.45	5	3.00	7	4.00	1	3.31	5
7	Difficult to use successfully on contracts where many changes are expected.	3.41	6	3.40	4	3.81	5	2.92	8
2	Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project.	3.09	7	3.07	6	3.00	7	3.23	6
4	The client may pay more because contractor may inflate the estimated costs to cover his additional risks.	2.95	8	2.67	9	3.00	7	3.23	6
9	Client may carry more risks than the traditional procurement approach.	2.70	9	3.20	5	2.25	10	2.69	9
10	Variations may cost more than under the traditional procurement approach.	2.50	10	2.47	10	2.56	9	2.46	10
	Number (n)	44		15		16		13	
	Kendall's Coefficient of Concordance (W)	0.249		0.173		0.445		0.332	
	Level of Significance	0.000		0.005		0.000		0.000	
	H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group Reject H_0 if the actual significance level (p-value) is less than the allowable value of 5%								

Table 5.17 Spearman's rank correlation test between groups of respondents for the risks of GMP/TCC

Comparison	**r_s**	**Significance**	**Conclusion**
Client ranking vs Contractor ranking	0.320	0.367	Cannot reject H_0 at 5% sig. level
Client ranking vs Consultant ranking	0.644	0.044	Reject H_0 at 5% sig. level
Contractor ranking vs Consultant ranking	0.728	0.017	Reject H_0 at 5% sig. 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 allowable value of 5%			

One-way ANOVA tests were carried out to indicate if there are significant differences amongst the three groups of respondents regarding their perceptions on the specific risk factors of the GMP/TCC approach at the 5% significance level. The contractor group considered a significantly higher rank than the client group (sig. = 0.002) that the absence of standard form as a risk of GMP/TCC (Item 6). The contractor group also expressed a remarkably higher perception than the client group (sig. = 0.008) and the consultant group (sig. = 0.035) that their profit margin will be greatly affected due to the unclear scope of work under the GMP/TCC arrangement (Item 5). However, the client group rated significantly higher than the contractor group (sig. = 0.004) that client carry more risks than the traditional procurement approach (Item 9).

Independent 2-sample T-tests were then undertaken to assess the difference of perceptions between the GMP group and TCC group. The TCC group had a significantly higher perception than the GMP group that on Item 9 "Client may carry more risks than the traditional procurement approach" (sig. = 0.018). It is not surprising to notice this diversified view because of the pain-share mechanism is also established under the TCC agreement from the gain-share arrangement (Clough and Sears, 1994). In contrast, the risk of cost overrun under the GMP scheme is solely borne by the main contractor as its sharing arrangement limited only to the gain (Perry and Thompson, 1982). The results of these ANOVA tests and T-tests are reported in Appendix III.

5.5.2 Critical success factors (CSFs)

Table 5.18 compares the mean scores of the critical success factors of applying the GMP/TCC approach as perceived by the survey respondents. Both Item 5 'Reasonable share of cost saving and fair risk allocation' (mean = 4.54) and Item 6 'Partnering spirit from all contracting parties' (mean = 4.54) were equally discerned as the most critical success factors for the GMP/TCC projects. As Sadler (2004) highlights, construction projects procured by target cost contracting rely critically on fairness and trust. With the feature of unclear scope of work at the tender stage under the GMP/TCC methodology, Mills and Harris (1995) state that a fair allocation of risk, setting reasonable target cost and share of cost saving / loss between employer and contractor are essential to the operation of GMP/TCC scheme. The survey results are also consistent with the proposition made by Tay *et al*. (2000) that a genuine willingness to achieve co-operation or partnering spirit between the project parties is critical for a successful implementation of target cost contract.

In addition, Item 4 'A right selection of project team' (mean = 4.46) was also favorably rated as the GMP/TCC success factor. Chan *et al*. (2002) also stress that a right project team is important to the success of a project, because as indicated previously, inexperienced or claim conscious contractors may jeopardise the implementation of GMP/TCC process. Furthermore, it is noteworthy that 'Well defined scope of work in client's project brief' (mean = 4.39); 'Proactive main contractor throughout the GMP/TCC process' (mean = 4.37); and 'Early involvement

of the contractor in design development' (mean = 4.30) are also highly rated as CSFs for the GMP/TCC projects.

Table 5.18 Critical success factors for GMP/TCC projects in Hong Kong (all respondents)

Critical success factors of GMP/TCC	N	Mean#	Standard Deviation
1. Standard form of contract for GMP/TCC projects.	39	3.44	1.071
2. Well defined scope of work in client's project brief.	41	4.39	0.771
3. Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors.	41	4.17	0.667
4. A right selection of project team.	41	4.46	0.745
5. Reasonable share of cost saving and fair risk allocation.	41	4.54	0.552
6. Partnering spirit from all contracting parties.	41	4.54	0.596
7. Early involvement of the contractor in design development.	40	4.30	0.648
8. Establishment of adjudication committee and meeting.	41	3.83	0.803
9. Proactive main contractor throughout the GMP/TCC process.	41	4.37	0.662
10. Open book accounting regime as provided by the main contractor in support of his tender pricing.	40	4.05	0.783

Items were rated on a 5-point Likert scale with 1 = Strongly Disagree and 5 = Strongly Agree.

The differing opinions on the rankings of CSFs for GMP/TCC projects as perceived by the client group, contractor group and consultant group were investigated. The rankings by each respondent group were transformed into a matrix as the imported data for calculating the Kendall's coefficients of concordance as shown in Table 5.19. The results support that the null hypothesis that the respondents' ratings on CSFs for GMP/TCC projects within a certain group are unrelated to each other can be rejected at the 5% significance level. This reflects unanimous agreement within each of the three participating parties in ranking the CSFs for implementing the GMP/TCC approach. The next stage of the analysis was to test the consensus amongst the groups of respondents on the ranking exercise using the Spearman's rank correlation test. Table 5.20 summarises the Spearman's rank correlation coefficients and the corresponding significance levels.

Table 5.20 manifests that all the null hypotheses that no significant correlation between clients-contractors, clients-consultants and contractors-consultants on the ranking of CSFs for GMP/TCC projects can be rejected. This reveals that the three groups of respondents shared a similar view on this particular aspect. There was unanimous agreement from all three parties that 'Reasonable share of cost saving and fair risk allocation', together with 'Partnering spirit from all contracting parties', are the most essential ingredients to drive the success of GMP/TCC projects.

Table 5.19 Ranking and Kendall's coefficient of concordance for the CSFs of GMP/TCC approach

ID	Critical Success Factor	All Respondents		Clients		Contractors		Consultants	
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
5	Reasonable share of cost saving and fair risk allocation.	4.59	1	4.54	2	4.77	1	4.45	1
6	Partnering spirit from all contracting parties.	4.51	2	4.54	2	4.62	3	4.36	3
4	A right selection of project team.	4.46	3	4.46	4	4.46	5	4.45	1
2	Well defined scope of work in client's project brief.	4.43	4	4.23	6	4.77	1	4.27	4
9	Proactive main contractor throughout the GMP/TCC process.	4.41	5	4.62	1	4.31	6	4.27	4
7	Early involvement of the contractor in design development.	4.35	6	4.38	5	4.62	3	4.00	8
3	Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors.	4.16	7	4.08	7	4.31	6	4.09	7
10	Open book accounting regime as provided by the main contractor in support of his tender pricing.	4.08	8	3.92	8	4.15	8	4.18	6
8	Establishment of adjudication committee and meeting.	3.78	9	3.54	9	3.92	9	3.91	9
1	Standard form of contract for GMP/TCC projects.	3.41	10	3.23	10	3.62	9	3.36	10
	Number (n)	37		13		13		11	
	Kendall's Coefficient of Concordance (W)	0.232		0.276		0.350		0.195	
	Level of Significance	0.000		0.000		0.000		0.023	
	H_0 = Respondents' sets of rankings are unrelated (independent) to each other within each group Reject H_0 if the actual significance level (p-value) is less than the allowable value of 5%								

Table 5.20 Spearman's rank correlation test between groups of respondents for the CSFs of GMP/TCC approach

Comparison	r_s	Significance	Conclusion
Client ranking vs Contractor ranking	0.652	0.014	Reject H_0 at 5% sig. level
Client ranking vs Consultant ranking	0.786	0.007	Reject H_0 at 1% sig. level
Contractor ranking vs Consultant ranking	0.668	0.028	Reject H_0 at 5% sig. 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 allowable value of 5%

Results from the One-way ANOVA tests indicated that there are significant differences amongst the three groups of respondents concerning their perceptions on Item 7 'Early involvement of the contractor in design development'. Independent 2-sample T-tests further showed that the contractor group rated significantly higher on this factor than the consultant group (sig. = 0.007). Independent 2-sample T-tests were also applied to evaluate the difference of perceptions on CSFs of the GMP/TCC approach between the GMP group and TCC group. The GMP group rated Item 2 'Well defined scope of work in client's project brief' considerably higher than the TCC group (sig. = 0.023). With the lack of the pain-share arrangement under the GMP approach, defining scope of work properly and sufficiently in client's project brief is thus more influential in risk management and control when compared with the TCC approach. Furthermore, the TCC respondents considered that Item 9 'Proactive main contractor throughout the GMP/TCC process' was a more critical success factor when compared with GMP respondents' perceptions (sig. = 0.011). This might be attributed to the necessary appointment of a proactive contractor for delivering a complex

infrastructure project to deal with any unforeseen issues procured by the TCC scheme, as stressed by Avery (2006). The results of these ANOVA tests and T-tests are recorded in Appendix III.

5.6 Project Performance

The respondents were also asked to assess the performance of the GMP/TCC projects in which they were involved, including the (1) time performance; (2) cost performance; (3) quality performance; (4) dispute (claim) occurrence; and (5) overall project performance. In particular, the time, cost and quality, being recognised as the most important measurement criteria used to evaluate the performance of a construction project, were also highly rated. The findings are indicated in Tables 5.21 – 5.25 and graphically shown in Figures 5.6 – 5.10.

5.6.1 Time performance

Over 43% of the surveyed projects were completed on schedule and over 32% were completed ahead of schedule. The superior time performance might be due to on the one hand, the GMP/TCC scheme allows the early commencement of construction activities before the design is fully completed (Frampton, 2003). On the other hand, overall project efficiency is enhanced with the more involvement of the client in problem solving process as well as the presence of 'open-book' accounting arrangement (Mills and Harries, 1995; Tang and Lam, 2003).

Time Performance	Frequency	Percentage
Ahead schedule by > 5%	4	10.8%
Ahead schedule by 1-5%	8	21.6%
On schedule	16	43.2%
Behind schedule by 1-5%	8	21.6%
Behind schedule by > 5%	1	2.7%
Total	37	100%

Table 5.21 Time performance of the GMP/TCC surveyed projects *(N=37)*

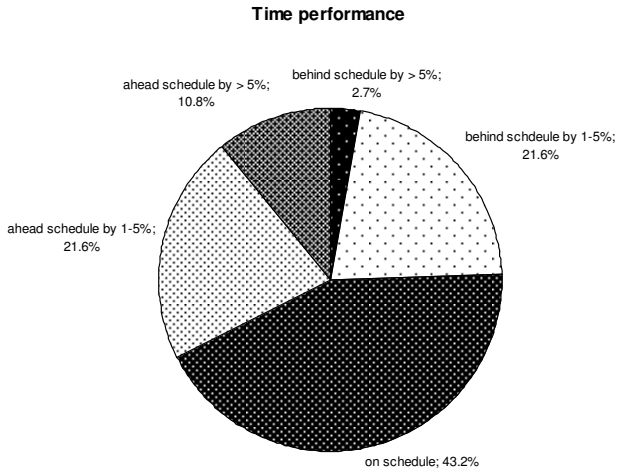

Figure 5.6 Time performance of the GMP/TCC surveyed projects *(N=37)*

5.6.2 Cost performance

26.3% of the surveyed projects were completed on budget against the final GMP / target cost and about 58% achieved cost savings. Merely 15.8% of them were of cost overrun. This evidently reflects the positive influence of the financial incentives generated from the gain-share/pain-share mechanism for contractors to save cost and innovate achieve cost saving (Barnes, 1981).

Cost Performance	Frequency	Percentage
Saving on budget by > 5%	4	10.5%
Saving on budget by 1-5%	18	47.4%
On budget	10	26.3%
Overrun budget by 1-5%	4	10.5%
Overrun budget by >5%	2	5.3%
Total	38	100%

Table 5.22 Cost performance of the GMP/TCC surveyed projects *(N=38)*

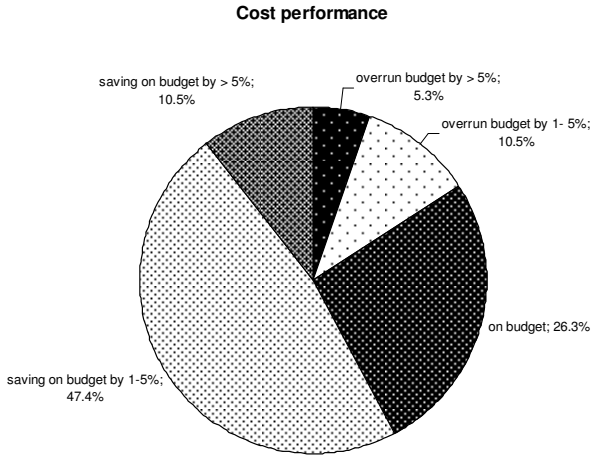

Figure 5.7 Cost performance of the GMP/TCC surveyed projects *(N=38)*

5.6.3 Quality performance

Nearly half of the surveyed projects (47.0%) were scored as 'above an average project' in terms of scope of rework measured as percentage of original contract sum, reflecting the quality performance of the GMP/TCC projects was not very satisfactory. However, it is worth noting that 26.5% of the projects had achieved a record of zero rework. These may be attributed to the better buildability of project design, more involvement from the client and more effective communications derived from partnering spirit under the GMP/TCC scheme.

Quality Performance	Frequency	Percentage
Zero work	9	26.5%
Below an average project by > 5%	3	8.8%
Below an average project by 1-5%	6	17.6%
Above an average project by 1-5%	15	44.1%
Above an average project by > 5%	1	2.9%
Total	34	100%

Table 5.23 Quality performance of the GMP/TCC surveyed projects *(N=34)*

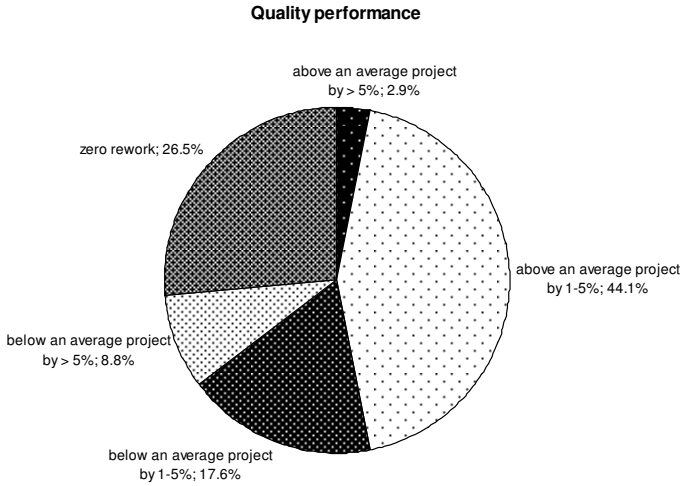

Figure 5.8 Quality performance of the GMP/TCC surveyed projects *(N=34)*

5.6.4 Dispute (claim) occurrence

The occurrence of disputes/claims arising from the surveyed projects was improved under the GMP/TCC procurement approach. Approximately 40% of the respondents perceived that the dispute/claim occurrence emerging from their projects was below an average project and 43.8% of the respondents even found a "dispute-free" record. This outstanding performance may be, to a great extent, on account of the ability to align individual team members' objectives with the overall objectives of the project. Yet again, the gain-share/pain-share mechanism generates strong incentives for an effective collaboration and partnering spirit between client and contractor (Chevin, 1996). Involving the contractor at the pre-construction stage for design development can also reduce intractable conflicts and potential disputes at the construction stage.

Unquestionably, the dispute resolution mechanism and the communication opportunities by means of adjudication meetings could further lead to the reduction in claim/dispute occurrence.

Dispute (claim) occurrence	Frequency	Percentage
Dispute free	14	43.8%
Below an average project by > 5%	8	25.0%
Below an average project by 1-5%	5	15.6%
Above an average project by 1-5%	5	15.6%
Total	32	100%

Table 5.24 Dispute (claim) occurrence of the GMP/TCC surveyed projects *(N=32)*

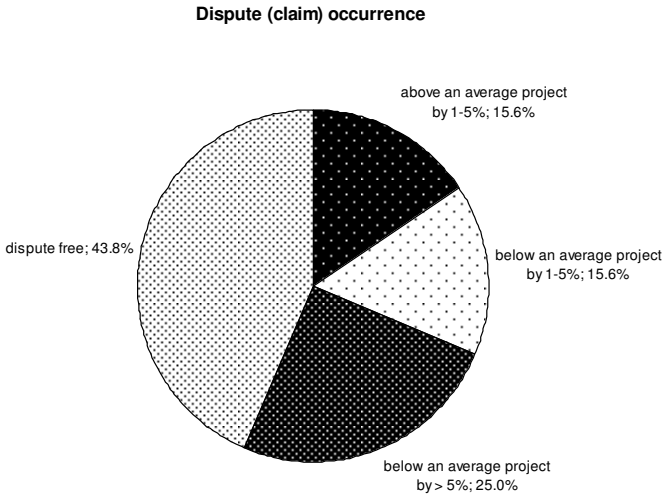

Figure 5.9 Dispute (claim) occurrence of the GMP / TCC surveyed projects *(N=32)*

5.6.5 Overall project performance

The overall performance of the 14 surveyed GMP/TCC projects was very satisfactory. More than three-quarters of those (78.4%) evaluated their projects as either 'successful' or 'very successful'. Only 8.3% of the respondents described their GMP/TCC projects as either 'unsuccessful' or 'very unsuccessful'.

Overall performance	Frequency	Percentage
Very successful	9	24.3%
Successful	20	54.1%
Average	4	10.8%
Unsuccessful	2	5.4%
Very unsuccessful	2	5.4%
Total	37	100%

Table 5.25 Overall performance of GMP/TCC surveyed projects *(N=37)*

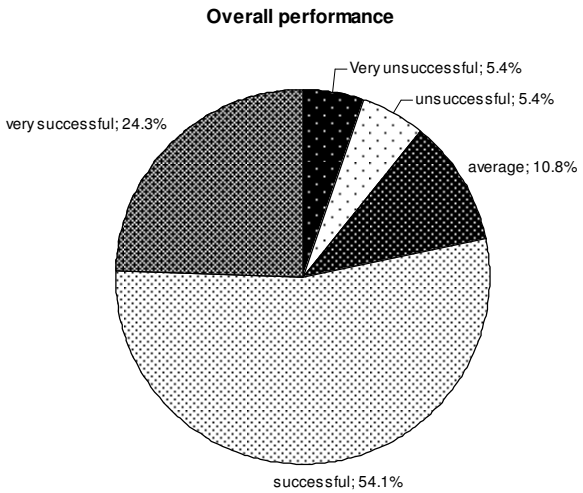

Figure 5.10 Overall performance of GMP/TCC surveyed projects *(N=37)*

Further to the evaluation of GMP/TCC presented above, it is valuable to compare the performance of the GMP/TCC projects with a construction project procured by the traditional design-bid-build approach. Respondents were requested to compare various performance measures based on a five-point Likert scale (1 = Much worse; 3= Same and 5 = Much better). The results of the analysis are showed in Table 5.26. It is worth noting that all performance measuring indicators are above the middle value of three, reflecting that the project performance in terms of time, cost, quality, innovation, occurrence of disputes, risk management and overall performance is better than that of a project using traditional design-bid-build approach. Amongst those indicators, it is found that GMP/TCC can considerably generate incentive to innovation (mean = 3.93). Overall project performance (mean = 3.83), cost performance (mean = 3.76) and time performance (mean = 3.71) were also regarded as better when adopting the GMP/TCC approach rather than the traditional method.

Table 5.26 Comparing GMP/TCC with the traditional procurement approach

Comparing GMP/TCC with the Traditional Procurement approach	N	Mean[#]	Standard Deviation
1. Time performance	41	3.71	0.716
2. Cost performance	41	3.76	0.799
3. Quality performance	40	3.43	0.712
4. Incentive to innovation	41	3.93	0.685
5. Occurrence, magnitude and resolution of disputes (e.g. claims)	41	3.68	0.820
6. Risk management and control	41	3.61	0.833
7. Overall project performance	41	3.83	0.667

Items were rated on a 5-point Likert scale with 1 = Much worse; 3 = Same and 5 = Much better

5.7 Suitability for Adopting GMP/TCC

Respondents were finally requested to rate the project conditions that are suitable for adopting GMP/TCC scheme based on a five-point Likert scale (1 = Very unsuitable and 5 = Very suitable). The results are summarised in Table 5.27. It was considered that projects with high level of client's requirements for buildability and innovation are appropriate to implement the GMP/TCC approach (mean = 3.97), since the contractor could be brought in at the early design stage to advise on various buildability issues under the GMP/TCC scheme. Financial incentives are also available for contractor to innovate on design, construction methods and use of materials.

Empirical findings also indicated that large and technically complex projects with high risk profile and tight schedule (mean = 3.60) are suitable to adopt the GMP/TCC style of procurement. This might be due to the contractor's guarantee on the agreed contract period and the project cost. The GMP/TCC approach is also featured by allowing the contractor and employer to determine the appropriate ownership of risks and encourages the parties to agree on an equitable allocation of risk, making the procurement method suitable for those high risk projects. GMP/TCC can also contribute to fast track project by allowing early commencement of construction before the design is fully developed, especially for those with tight project schedule. NEDO (1982) reviewed the target cost contracts as particularly advantageous in certain complex construction projects.

Table 5.27 Suitability for adopting GMP/TCC

Suitability for adopting GMP/TCC	N	Mean[#]	Standard Deviation
1. Large and technically complex project that contains higher risks	40	3.60	1.057
2. Project with tight schedule	40	3.60	0.871
3. Project with life cycle cash flow	40	3.38	0.705
4. Client's requirements for buildability and innovation	40	3.97	0.577
5. Infrastructure project involving many interfacing works	40	3.45	0.876
6. Landmark type project (New Central Government Complex and LegCo Building at Tamar)	40	3.50	0.877

Items were rated on a 5-point Likert scale with 1 = Very unsuitable; 3= Same and 5 = Very suitable.

5.8 Personal Opinions on GMP/TCC

The respondents were asked to indicate their personal opinions on the future development of the GMP/TCC practices in Hong Kong. The results are graphically shown in Figure 5.11 and Figure 5.12. Nearly 60% of the respondents considered that the GMP/TCC procurement strategy will be increasingly adopted within the future construction industry of Hong Kong. Merely 10% of them disagreed with this speculation. More encouragingly, 67.5% of the respondents will promote the application of the GMP/TCC in future projects. This might reflect that the GMP/TCC practices with incentivisation measures applied in Hong Kong could indeed help satisfy the changing needs of clients and improve overall project performance through a co-operative working atmosphere amongst the contracting parties.

Increasing adoption of GMP/TCC	Frequency	Percentage
Disagree	4	10.0%
Neutral	13	32.5%
Agree	18	45.0%
Strongly agree	5	12.5%
Total	40	100%

Table 5.28 Respondents' views on the increasing adoption of the GMP/TCC approach in the future *(N=40)*

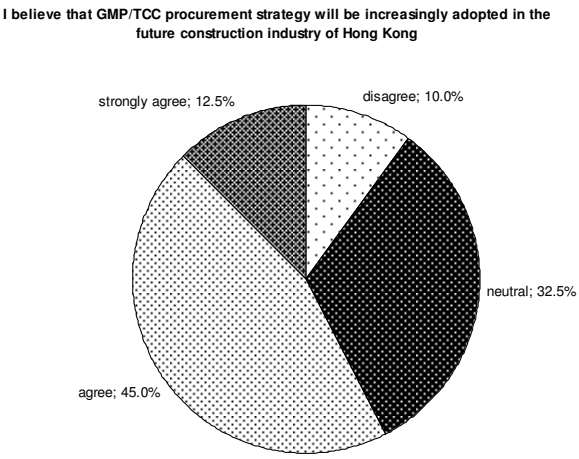

Figure 5.11 Respondents' views on the increasing adoption of the GMP/TCC approach in the future *(N=40)*

Future promotion of GMP/TCC	Frequency	Percentage
Disagree	5	12.5%
Neutral	8	20.0%
Agree	23	57.5%
Strongly agree	4	10.0%
Total	40	100%

Table 5.29 Respondents' views on the promotion of the GMP/TCC approach in future projects *(N=40)*

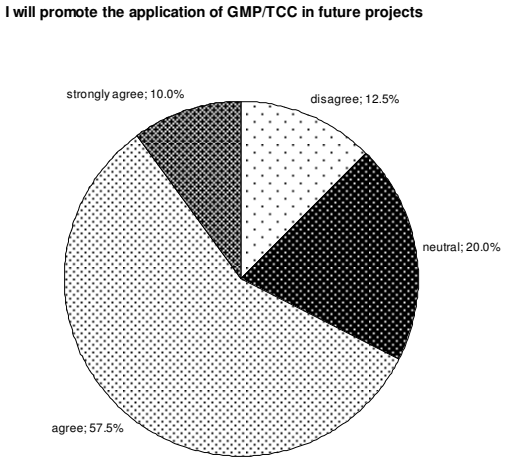

Figure 5.12 Respondents' views on the promotion of the GMP/TCC approach in future projects *(N=40)*

5.9 Guidelines for Successful Implementation of GMP/TCC Approach

Having conducted the comprehensive review of literature, interviews with project participants, case studies and questionnaire survey on the GMP/TCC approach in various aspects, it is worthwhile, with full of evidence, putting forward a set of effective practical guidelines for successful implementation of GMP/TCC projects in the Hong Kong construction industry. The recommended guidelines aim to promote best practices and avoid potential pitfalls in implementing the GMP/TCC procurement approach. Four important but interrelated critical success factors are identified and graphically shown in Figure 5.13. They include: (1) partnering spirit (cultivated via

open-book accounting regime and adjudication committee); (2) fair risk allocation; (3) well-defined scope of work; and (4) early involvement of contractor.

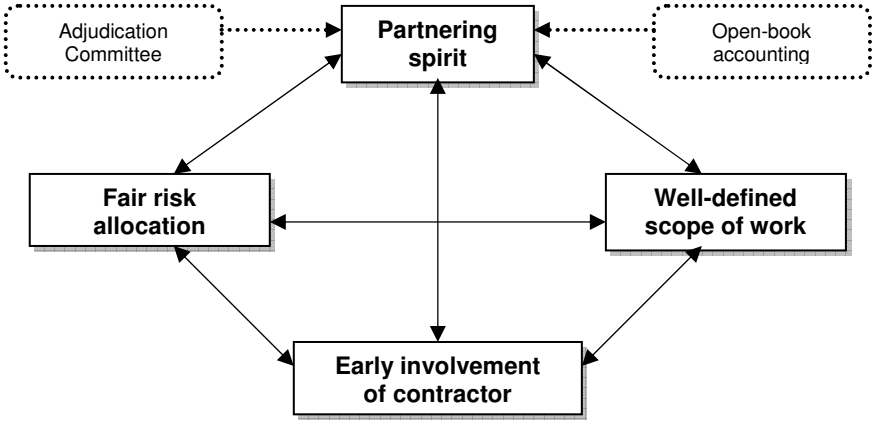

Figure 5.13 Determinants of successful GMP/TCC projects

5.9.1 Cultivation of partnering spirit and right selection of project team

The importance of cultivating partnering spirit for GMP/TCC projects has been emphasised and echoed by several scholars and experienced practitioners. The findings from the interviews and questionnaire survey also clearly indicated that partnering spirit, or close working relationship, among all contracting parties is one of the most critical factors to drive the success of a construction project procured by the GMP/TCC approach. They held a consistent view that partnering spirit should be developed hand-in-hand with GMP/TCC to make the project a success. Tay *et al*. (2000) have stressed that there must be genuine willingness and commitment to achieve co-operation between the right parties to achieve a successful GMP/TCC project. It is also of great importance that incentives for all participants tie the performance to the project objectives (Bower *et al*, 2002).

Partnering can greatly improve communication, enhance mutual trust, help resolve disputes and improve working relationships amongst project team members (Chan *et al*, 2004). Openness of information increases confidence and should lead to active collaboration through the closer alignment of motivation. This partnership philosophy and open-minded attitude become particularly essential for GMP/TCC projects as

unclear scope of work is involved at the initial stage of the project and at the same time the project team may not be familiar with the procurement methodology. Hence, the success of GMP/TCC depends largely on contractor's initiative and expertise to propose alternatives for best value products, as well as mutual trust, receptiveness and competence of both the project team and the contractor for innovation. Selecting the right partners with requisite commitment and competence is an essential ingredient to underpin the success of the GMP/TCC approach.

In order to promote partnering spirit within the project team, the transparency of the project accounting and an appropriate arrangement of adjudication process are particularly crucial. The contractor's tender pricing should be open to scrutiny by the client and his team of consultants with proper auditing system. NEDO (1982) also emphasised that the adoption of 'open-book accounting' can achieve better accountability and working relationship. On the other hand, the adjudication process is imperative to ensure that any disputes can be promptly resolved at the site level and sustain the harmonious working relationship by an independent party. One of the interviewees further suggested that the rules within the GMP/TCC methodology must be fully observed and the adjudication procedures should be adequately followed to minimise the potential for disputes. The Adjudication Committee therefore plays an important role in avoiding intractable disputes but its success would be highly dependent on the mutual trust and partnering commitment between the client's team and contractor's team.

5.9.2 Fair allocation of risks and reasonable share of cost savings

The GMP/TCC provision would involve the contractor in increased financial risk as the excess costs over the target cost due to uncertainties during the design development will be solely borne by him (Stukhart, 1984). Although the risk shared by the client is thereby lessened significantly (Boukendour and Bah, 2001), contractors must be fully conversant with the principles of the GMP/TCC contracting approach and be prepared to recognise the risks they have taken on board with the novel procurement approach (Fan and Greenwood, 2004). However, as clearly revealed from the survey findings and the literature review, a transparent and fair allocation of risks between the employer and the contractor is essential in

implementing the GMP/TCC methodology. The CIRC Report (2001) also advocated that the onerous or unfair allocation of risks can give rise to claims and disputes. Hence, clients should allow the tender an allowance for design development and risks clearly and rationally (Sadler, 2004).

Because of this unique arrangement of the target cost approach based on joint determination and agreement between the contractor and the client on the allocation of shared risks, it is advised that clients should recognise the importance of realistic target cost estimates, which would include appropriate risk contingencies. Sadler (2004) recommended that clients should evaluate the combination of fee and share not only to allocate the risks fairly, but also to ensure that the incentive is of sufficient value to motivate the contractor. Perry and Barnes (2000) have put forth a strong case for avoiding setting the contractor's share at less than 50%. Tang and Lam (2003) proposed various percentages of shares between the client and the contractor depending on the extent of cost saving achieved as indicated in Table 2.4. Broome and Perry (2002) further suggested that an appropriate contract strategy should aim to align the motivations of the parties so as to maximise the likelihood of project objectives being achieved, taking account of the constraints and risks that act on the project and the strengths and weaknesses of the parties participating in it. However, different contract and incentive structures are required to meet differing project objectives and circumstances (Bower *et al*, 2002).

5.9.3 Well-defined scope of work in client's project brief

The uncertain scope of work during the design development has been proved as the major inherent shortcoming of the GMP/TCC approach. With design development being a continuously evolving process in GMP/TCC contracts, interpretation of changes whether they arise out of design development or GMP /TCC variations could lead to potential disputes if not readily resolved (Gander and Hemsley, 1997). Chevin (1996) also claimed that disputes would be somewhat inevitable with the GMP/TCC procurement approach because of the lack of clarity as to the variations to the target cost. McCally (1997) proposed the following procedures and key considerations to handle variations:

a) A clearly defined processing procedure and supervision plan;
b) Clear instructions regarding the scope of changes;
c) Timely issuance of a request for proposal (RFP) to the contractor;
d) Timely response by the contractor to RFPs;
e) Timely review of the contractor's proposals and pricing;
f) Timely issuance of work authorisation;
g) Timely performance of the changed work; and
h) Prompt payment for change-order work.

Particularly, scope changes / variations need to be kept to a minimum in order that the GMP/TCC contract can operate as intended and so that the approach might provide value for money. It is also essential to define the scope of work as detailed and accurate as possible at the initial stages of a construction project. The respondents of the survey, with hands-on experience in GMP/TCC projects, also concurred the importance of a well-defined work scope in the client's project brief, which was likewise emphasised by McCally (1997) and Tang (2005).

As mentioned before, one important factor in making effective management arrangements is to ensure that the individual motives of different contracting parties should line up as closely as possible with those of the client. However, this is largely determined by the details of the contracts established amongst various stakeholders. In order to achieve this, the client's objectives must be clear and consistent (Bower *et al*, 2002). NEDO (1982) also stressed that the successful implementation of a target cost contract depends on a clear understanding by both the client and contractor of the principles underlying the procurement approach. More importantly, the main contractor should recognise the risks regarding the undescribed work during the 'design development' and ensure that the subcontractors' bids reasonably reflect the borne risks (Fan and Greenwood, 2004).

5.9.4 Early involvement of the contractor in design development

Most of the local industrial practitioners involved in the empirical survey stressed the importance of early implementation of the GMP/TCC scheme. Sadler (2004) also stated that tapping in the expertise of the contractor at the design stage is beneficial to

the target cost-type contracts. If a proactive contractor is involved more at the pre-construction stage, advanced works and programme planning particularly in materials procurement will be greatly enhanced. Their early involvement and influences are critical to the success of the project in terms of time, cost and quality (HKHA, 2006). By introducing the GMP/TCC approach at the design stage, the buildability of the project could be enhanced and thereby reducing possible risks and disputes at subsequent stages. This also allows the contractor and employer to determine the appropriate ownership of risks and encourages reaching an equitable allocation of risks associated with a project (Sadler, 2004).

In addition, as involvement of inexperienced or claim conscious contractors in the GMP/TCC process was identified as a key risk factor, a set of best practice guidelines and recommendations for implementing this innovative procurement strategy is therefore valuable to those contracting parties who are not familiar with the GMP/TCC methodology.

5.9.5 Go for GMP/TCC or not?

The above are the key factors for the successful implementation of GMP/TCC procurement strategy, however as stressed earlier, the selection of procurement method is a critical element of the success of a project (Chan and Yung, 2003). Thus the decision to select GMP/TCC approach for project delivery process should be made cautiously. If the client intends to improve risk management and control by transferring the risk of cost overrun to the contractor, GMP/TCC is a preferred choice as an agreed ceiling price can be set by the client at main contract award and a financial incentive mechanism is provided for the contractor to achieve cost saving and innovate. Lewis (1999) also echoed the importance of fixed price rather than ascertaining the 'lowest bid price' in the first place. Therefore large and technically complex projects with a high risk profile and tight schedule might be suitable to adopt the GMP/TCC approach, as indicated by the survey findings and recommended by both NEDO (1982) and Wong (2006).

Moreover, the survey results have suggested that projects which require buildability and innovation are appropriate to implement the GMP/TCC approach, since the

GMP/TCC style of procurement allows the contractor to bring in advice on various buildability issues at the design stage. The financial incentives also generate a strong impetus for contractors to innovate on design concepts and construction methods, and at the same time to facilitate the alignment of the mutual objectives from different contracting parties (Ashley and Workman, 1986). Moreover, incentivisation of a contract requires a clear and precise objective of what is to be achieved (Bower *et al*, 2002).

However, if plenty of changes or variations are anticipated in a project, a client is not advised to adopt GMP/TCC because intractable disputes and cost risks may arise significantly in case of disagreement on the changes amongst the contracting parties. Tay *et al*. (2000) claimed that this is an aspect of the GMP/TCC approach that is intricate to manage. Hence, GMP/TCC might not be an appropriate procurement method for contracts containing numerous changes and those difficult to define the scope of work early (Trench, 1991). Gander and Hemsley (1997) also illustrated that a refurbishment building project, which may essentially involve late changes, is particularly difficult to deal with a GMP contract. Last but not the least, familiarity with and experience of the GMP/TCC methodology amongst the project stakeholders are recurrently perceived as the critical success factor for this contracting approach. Contractors acquiring this unique contracting experience are thus remarkably crucial to project success (Gander and Hemsley, 1997).

5.10 Chapter Summary

This chapter has presented the results of an empirical questionnaire survey on the benefits, difficulties, risk factors, critical success factors, performance measurements and suitability for adopting GMP/TCC scheme in the Hong Kong construction industry. Through the cost incentive mechanism, decent working relationship amongst project partners and the ability to enhance buildability, survey respondents in unanimity considered that the project performance procured by the GMP/TCC is by far better than those procured by the traditional design-bid-build approach. However, disputes over whether change orders are classified as target cost variations or design development has proved to be a key risk factor inherent with GMP/TCC. Hence,

developing partnering spirit amongst all contracting parties, together with reasonable share of cost saving with fair risk allocation were regarded as the most critical factors to successfully implement the GMP/TCC strategies. Additionally, based on the findings from literature review, interviews, case studies and questionnaire survey, a set of basic guidelines for implementing the GMP/TCC approach in the Hong Kong construction industry are put forward. These guidelines are valuable to develop a best practice framework for applying GMP/TCC scheme in the future construction projects, both locally and overseas.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

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6.1 Introduction

The Hong Kong construction industry has been characterised by fragmented working culture and adversarial working relationship, the tendency to award contracts to the lowest bidders, and non value-adding multi-layered subcontracting for several years, leading to inferior quality of constructed facilities (CIRC, 2001). The acknowledgement 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). Hands-on experience derived from the local context has indicated that guaranteed maximum price (GMP) and target cost contracting (TCC) approaches have accrued considerable mutual benefits to all of the parties involved. They aims to develop a co-operative teamwork spirit based on a partnering working relationship, which has been globally recommended as an appropriate means of realising high-risk construction projects (Wong, 2006).

To provide sufficient groundwork for construction clients to establish a best practice framework for GMP/TCC scheme in future construction projects, this research study has reported the key issues related to the GMP/TCC procurement strategy, based on a review of published literature, real-life case studies, perceptions of various key project stakeholders via a series of face-to-face interviews, accompanied by an extensive empirical questionnaire survey. Those issues discussed include the underlying motives of adopting the GMP/TCC procurement, perceived benefits and potential difficulties, key risk factors and critical success factors, project performance, together with optimal project conditions suitable for adopting the GMP/TCC approach. Conclusions from these research objectives are presented in this chapter. The contribution to knowledge and the application of the research are also highlighted. Lastly, recommendations are suggested to direct future research.

6.2 Review of the Research Objectives

To establish the best practice framework for the GMP/TCC procurement approach, the construction industry should understand the perceptions of various project stakeholders on the afore-mentioned key issues of the procurement approach based on some selected case study projects recently completed in Hong Kong. An awareness of these aspects is reflected in the research objectives stated in this study which are to: (i) investigate and compare the GMP/TCC implementation practices amongst the selected projects and with other contracting approaches; (ii) explore the motives, benefits, difficulties and success factors of applying GMP/TCC contracts; (iii) identify the potential key risk factors involved in and optimal project conditions suitable for implementing the GMP/TCC approach amongst all project stakeholders; and (iv) establish a set of validated guidelines for successful implementation of GMP/TCC schemes in the Hong Kong construction industry. The corresponding conclusions of these research objectives are reported as follows.

6.2.1 GMP/TCC implementation practices

At present, the adoption of GMP/TCC in Hong Kong is limited to a few leading property developers and one major railway transportation service provider (Ting, 2006). Amongst them, the GMP approach dominated the building sector whilst the TCC procurement was frequently applied to infrastructure projects subject to client's experience and preferences. Most of the surveyed projects used selective tendering method in order to facilitate adequate competition amongst the potential bidders. Negotiated tendering is also common by way of the close corporate relationship within the group of companies. The majority of these local projects implemented GMP/TCC in conjunction with partnering concepts so as to align the individual objectives of contracting parties with the overall objectives for each project, and to promote better communication and the implementation of gain-share/pain-share philosophy.

The key characteristics of GMP/TCC include the agreed ceiling price / target cost where the contractor guarantees for the client; the gain-share/pain-share mechanism facilitating financial incentives for contractor to achieve cost saving in pre-agreed

proportion; the presence of Adjudication Committee for the resolution of various contentious issues; early involvement of contractor at early design stage to bring in expertise in building designs and innovations in construction methods and materials; and the 'open-book' accounting arrangement for the contractor's tender pricing details.

6.2.2 Motives, benefits, difficulties and success factors of applying GMP/TCC

Traditional form of design-bid-build procurement approach was perceived as being poorly suited to the open and transparent working relationship. Thus, the key motives behind the decision of adopting the GMP/TCC approach initiated by clients were to develop better working relationship and to generate an impetus for the contractor to become efficient and to achieve cost saving using the pain-share/gain-share risk sharing mechanism. Client organisations also intended to align the project objectives and thereby exploring more possibilities for better quality products, savings in cost and time to achieve a win-win situation through an equitable sharing of risks and a more co-operative approach to the benefit of both the client and the contractor.

Case studies of GMP/TCC projects in Hong Kong have demonstrated that the overall project performance is remarkable, especially on time, cost and dispute/claim occurrence performance. Apart from providing incentives for contractor to achieve better value for money and enhance innovation, the gain-share/pain-share mechanism together with the partnering arrangement under the GMP/TCC approach helps establish mutual objectives and produce an integrated, trustful working team to achieve the excellence of performance. Another key merit 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. In addition, the pre-agreement of price and time implications of foreseeable project variations could lead to substantial reduction of dispute occurrence and an early settlement of final project account.

However, the research has unveiled that the major difficulty in applying the GMP/TCC approach was the unclear scope of work which might lead to disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development. Arbitrary price adjustment is required to confront

the unforeseen changes. Additionally, keeping the design development pace with contractor's programme for tendering the domestic subcontractor's works packages, and more involvement by the clients were also perceived as the fundamental problems with GMP/TCC. Lack of standard form of GMP/TCC contract and unfamiliarity with GMP/TCC concepts may further impede the application of this new way of contracting arrangement.

To make GMP/TCC project a success, experienced industrial practitioners held a consistent view that partnering spirit from all contracting parties and the right selection of project team are indispensable. Shared objectives, effective communication and mutual trust can be accomplished under the GMP/TCC contractual arrangement and partnering umbrella. The team spirit can be further enhanced under an open-book accounting environment throughout the GMP/TCC process. Reasonable share of cost saving and fair risk allocation are also essential to the accomplishment of smooth project delivery through innovation and efficiency. Furthermore, well-defined scope of work in client's project brief, proactive main contractor, early involvement of the contractor in design development and formation of adjudication committee are also discerned as critical success factors for GMP/TCC projects.

6.2.3 Key risk factors and optimal conditions for implementing GMP/TCC

One of the key risks inherent with the GMP/TCC approach is the involvement of inexperienced or claim conscious contractors, as they might jeopardise the entire contracting process. Dispute risk also arises due to the change in scope of work particularly if the GMP or target cost is established early in the design process. The client may regard design variations as contractor's entire risk, whereas the contractor may strive for claims for the changes falling outside the original scope of work. Furthermore, although variations due to change in scope of work may induce higher risks to the client than under the traditional priced contracts, contractor may also be threatened because of the unforeseeable design development risk owing to the incomplete design at tender stage.

Clients ought to identify and adopt the best suited procurement arrangement that maximises the ability of all parties in the construction supply chain to add value to the project in full alignment with his expectations. Findings of this study indicate that large and technically complex projects with high risk profile and tight schedule are appropriate to adopt the GMP/TCC scheme, so that the client could make use of the contractor's guarantee on the agreed contract period and the project cost. More equitable allocation of risks is another factor to make this procurement method suitable for those high risk projects.

In addition, projects requiring a high level of buildability and innovation are considered to be suitable to implement the GMP/TCC approach, as the contractor is brought in at the early design stage to advise on various buildability issues and can be motivated by the gain-share/pain-share financial incentive scheme for cost saving and generating innovation. This procurement strategy, however, might not be suitable for projects where difficult to define the scope of work at early stages or a lot of changes are expected so as to avoid unnecessary claims and disputes.

6.2.4 Guidelines for successful implementation of GMP/TCC scheme

A set of effective practical guidelines for successful implementation of GMP/TCC projects in the Hong Kong construction industry are established based on the research findings from this study as discussed in Section 5.9. Four essential successful ingredients for adopting the GMP/TCC scheme identified include: (i) partnering spirit; (ii) fair risk allocation; (iii) well-defined scope of work; and (iv) early involvement of contractor.

In particular, to improve the adversarial working relationship amongst project team members, clients are encouraged to integrate the construction delivery process via a teamwork approach. If incentives created by the gain-share/pain-share arrangement are applied correctly under GMP/TCC umbrella, both the client and the contractor can focus on the appropriate business objectives that will lead to successful project results. It is therefore highly recommended that partnering spirit with fair risk allocation should be developed hand-in-hand with GMP/ TCC to make the project a success.

Although GMP/TCC has been adopted in the Hong Kong construction industry for some years, the application of this novel procurement strategy is still limited to a few major local developers. This might be attributed to the unfamiliarity, difficulties and risks of adopting the GMP/TCC approach including the existence of a gray area in the GMP/TCC contracts in defining the design development and the scope change. Hence, it is urged that the client's project brief for GMP/TCC projects ought to be carefully developed to help reduce the chance of disputes. Partnering commitment and adjudication committee, however, are useful means to resolve any intractable disputes.

Given the perceived benefits, it is worth enhancing the receptivity of GMP/TCC procurement strategy in the local context. Ting (2006) recommended the following improvement measures:

- Demonstrate commitment from client
- Select the right construction partner
- Share success stories with other practitioners
- Strengthen social interactions within the project team
- Promote through recognition award
- Develop standard form of GMP/TCC contract in Hong Kong

6.3 Contributions from the Research

To achieve value for money in construction procurement, service providers and suppliers should be motivated or given incentives to provide "value-added" services, which are of material benefit to the end-users. A GMP/TCC contracting approach 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 (CIRC, 2001). However, GMP/TCC is relatively new in Hong Kong with limited empirical research, an evaluation of the local GMP/TCC applications to explore their implementation processes for achieving construction excellence from those successful cases is thus indispensable and timely.

This research study accomplishes a comprehensive analysis of the GMP/TCC procurement approach via an in-depth investigation of the lessons learned from

previous GMP/TCC construction projects in Hong Kong. The features, motives behind, perceived benefits, potential difficulties, key risk factors, as well as critical successful ingredients of the GMP/TCC procurement strategy are extensively explored. The actual overall project performance in terms of project schedule, final project cost, quality performance and occurrence of disputes (claims) was measured to unveil the benefits of GMP/TCC implementation. A series of industry-wide interviews and an empirical questionnaire survey were also launched to solicit experts' perceptions on the GMP/TCC arrangement in the local context. The research study is significant in contributing to new knowledge and practical information of GMP/TCC applications and implementation, in both a national and international context.

The research findings are essential in assisting key project stakeholders in mitigating the hindrances caused by potential difficulties/risks in and maximising the benefits accrued from introducing GMP/TCC concepts. This study, complying with the CIRC's (2001) recommendations, provides sufficient groundwork for further research in the field and for client bodies and contracting organisations to develop a best practice framework for implementing successful GMP/TCC scheme in future construction projects. A set of validated guidelines and recommendations are significant for key project stakeholders to consider in implementing future GMP/TCC procurement strategy. Last but not the least, this research study also forms a solid foundation for a subsequent comparative study of GMP/TCC practices between the United Kingdom, Australia and Hong Kong.

6.4 Limitations of the Study

This research study has the following limitations:

- The conclusions drawn from this study are indicative rather than comprehensive, as merely 45 completed questionnaires were received and analysed owing to a limited number of GMP/TCC projects in Hong Kong. The number of case studies is also limited but providing an in-depth project investigation. However, the survey findings together with the feedback from the interviewees would be valuable for future studies in this area.

- The research was confined to the GMP/TCC practices in 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 priced contracts were excluded from this study.
- Relative simple statistical tools were applied in this study. In order to establish the best practice framework for implementing the GMP/TCC scheme, it is worth further examining the relationship between the success factors and the project performance criteria using more robust modelling methods such as factor analysis and multiple regression analysis.

6.5 Recommendations for Future Research

Useful findings regarding the benefits, difficulties, risk factors, critical success factors as well as project performance of GMP/TCC procurement approach have been obtained based on the collection and detailed analysis of completed and on-going GMP/TCC projects. 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 critical success factors determined from this study. Effective practical strategies can also be suggested for enhancing overall project performance.

In addition, to launch an in-depth research for GMP/TCC procurement strategy, comparison of GMP/TCC practices between Hong Kong and countries with extensive experiences in GMP/TCC such as the United Kingdom and Australia is worth investigated. This would help create a fuller picture for not only how project can be benefited from and limited by GMP/TCC contract, but also better development of this type of procurement scheme. Although GMP/TCC project delivery is at a germinating stage of development in Hong Kong, a wider adoption of GMP in the building sector, together with the infrastructure sector using TCC is anticipated in order to deliver projects within schedule, within budget, with high quality and far less disputes or claims. Another on-going research project focusing on identifying key risk factors and evaluating various risk sharing mechanisms for GMP/TCC projects is underway in Hong Kong and the major research findings will be reported later via publications.

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APPENDICES

Appendix I	List of Interview Questions
Appendix II	Blank Survey Questionnaire
Appendix III	Results of ANOVA Tests and T-Tests Between Groups of Survey Respondents

APPENDIX I: LIST OF INTERVIEW QUESTIONS

An Investigation of Guaranteed Maximum Price (GMP) and Target Cost Contracting (TCC) Procurement Strategies in Hong Kong

List of Interview Questions

Purpose: The aim of the interview is to solicit the opinions of different project stakeholders towards the implementation of GMP/TCC scheme in the Hong Kong construction Industry. Target interviewees may include representatives from client organisations, consulting practices, main contractors and subcontractors who have gained hands-on experience in undertaking construction projects with GMP/TCC approach in Hong Kong.

A. Definition and Process of GMP/TCC

1. How would you define GMP/TCC approach in construction? Explain briefly the implementation mechanism or current practice framework for GMP/TCC by your organisation.

2. Which is the first construction project that adopted GMP/TCC approach undertaken by your organisation? When?

3. What are the motives behind the decision to implement GMP/TCC instead of traditional fixed-price lump-sum contract?

4. At what stage would you introduce GMP/TCC? How would you decide when to introduce GMP/TCC? What percentage of design complete would be considered adequate for the adoption of GMP/TCC? How long would it take to confirm the initial GMP/TCC after the introduction of GMP/TCC? How would you say the contribution of GMP/TCC to project performance outcomes if it is introduced in **(a) pre-tender (design) stage; (b) tender stage;** and **(c) post contract award stage**?

5. Do you have any gain-share/pain-share contractual arrangements in using GMP/TCC contracts? What is the arrangement for engaging contractor at pre-GMP/TCC stage, e.g. 2-stage tendering method including technical proposal first followed by fee proposal?

B. Characteristics of GMP/TCC

6. What are the major benefits that GMP/TCC project brings to your organisation? (e.g. time, cost, quality, working relationship, etc)

7. What are the essential elements for successful GMP/TCC scheme in construction?

8. Different project stakeholders may face different difficulties in implementing GMP/TCC. In your opinion, what are the three major difficulties that you may face in implementing GMP/TCC contract (as a client/consultant/contractor/subcontractor etc)? Were the difficulties resolved? If so, please illustrate how they were resolved.

9. Can you name the key potential risks involved in implementing GMP/TCC contract that you have encountered as a client or a contractor? Any mitigation measures to deal with?

10. Does the GMP/TCC scope include builder's work only or include E&M works as well?

11. Do you really think that the GMP/TCC contract achieve their intended purposes and why?

12. Was project partnering adopted for the GMP/TCC project as well? If so, at what stage was partnering introduced to your project? How did partnering facilitate the implementation of GMP/TCC?

C. Performance of GMP/TCC

13. How would you compare a GMP/TCC project *versus* a non-GMP/TCC project in terms of the measures:
    a) schedule performance
    b) cost performance
    c) quality performance
    d) safety performance
    e) incentive to innovation
    f) occurrence, magnitude and resolution of disputes (e.g. claims)
    g) risk management and control
    h) overall project performance

14. Are you satisfied with previous GMP/TCC contracts? Do you wish to repeat GMP/TCC again in future projects? If yes, what aspects would need to be improved for further development?

D. Suitability of GMP/TCC

15. Based on your experience, could you identify 3 project conditions that are most suitable for adopting GMP/TCC? (e.g. large and complex projects)

APPENDIX II: BLANK SURVEY QUESTIONNAIRE

About the Respondent

1. Date: _____

2. Position in your company: _____

3. Years of professional working experience in the construction industry:
   ❑ < 5 years ❑ 5-10 years ❑ 11-15 years ❑ 16-20 years ❑ > 20 years

4. Type of organisation in which you are working:
   ❑ Client organisation ❑ Main contractor ❑ Architectural consultant
   ❑ Engineering consultant ❑ Project management consultant ❑ Q.S. consultant
   ❑ Subcontractor ❑ Supplier / Manufacturer ❑ Other:_____

5. Size of your organisation: ❑ 100 staff or below ❑ 101-500 staff ❑ Over 500 staff

6. Please indicate your experience in participating GMP/TCC projects.
   ❑ No hands-on experience but with sound understanding of GMP/TCC schemes or principles
   (**Please proceed to answer both Sections C and D only**).
   ❑ 1 project ❑ 2-4 projects ❑ over 4 projects

Project Characteristics

1. Project name: _____

2. Your position in the project: _____

3. Type of client: ❑ Government ❑ Private ❑ Quasi-government ❑ Other: _____

4. Nature of project: ❑ Residential ❑ Commercial ❑ Industrial ❑ Institutional
   ❑ Infrastructure ❑ Other: _____

5. Contract sum at contract award: HK$ _____ million

6. Contract duration: _____ calendar days / months (from _____ to _____)

7. Which payment mechanism did the project adopt?
   ❑ Guaranteed maximum price ❑ Target cost contracting
   ❑ Other: _____

8. Which type of tendering method was used for main contract?
   ❑ Open tendering ❑ Selective tendering ❑ Negotiated tendering
   ❑ Other: _____

9. Who introduced the use of GMP/TCC?
   ❑ Client ❑ Main contractor ❑ Design consultant ❑ Do not know
   ❑ Other: _____

10. At what stage was GMP/TCC decided to be introduced?
    ❑ Feasibility stage ❑ Outline design stage ❑ Detail design stage
    ❑ Complete design stage ❑ Construction stage

11. What was/were the motive(s) behind the decision to implement the GMP/TCC procurement?
    (You may select more than one box.)
    ❑ To enhance quality of constructed facilities ❑ Need an 'open book' accounting arrangement
    ❑ To develop better working relationship ❑ Previous successful experience with GMP/TCC
    ❑ To tap in contractor's expertise in design ❑ To generate an incentive to achieve cost saving
    ❑ To improve risk management and control ❑ Greater time saving by overlapping design and construction
    ❑ To set an agreed ceiling price at main contract award / commencement
    ❑ Other: _____

12. Was partnering adopted for the project? ❑ Yes ❑ No

13. If yes, at what stage was partnering decided to be adopted?
    ❑ Feasibility stage ❑ Outline design stage ❑ Detail design stage
    ❑ Tender stage ❑ Construction stage

Benefits of GMP/TCC

Please rate the following benefits that GMP/TCC projects would bring to you and other project participants.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know
1. Provide guarantee of avoiding budget overrun at GMP main contract award.	❑	❑	❑	❑	❑	❑
2. Client provides financial incentives for contractor to achieve cost saving.	❑	❑	❑	❑	❑	❑
3. Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost.	❑	❑	❑	❑	❑	❑
4. Achieve better value for money.	❑	❑	❑	❑	❑	❑
5. Fast track project by allowing early start of construction before the design is fully developed.	❑	❑	❑	❑	❑	❑
6. Early settlement of final project account.	❑	❑	❑	❑	❑	❑
7. Greater client's control over design consultants, main contractor and subcontractors.	❑	❑	❑	❑	❑	❑
8. Bring in expertise in building designs and innovations on construction methods and materials from contractor to enhance the buildability of the project.	❑	❑	❑	❑	❑	❑
9. Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops.	❑	❑	❑	❑	❑	❑
10. Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes.	❑	❑	❑	❑	❑	❑
11. Conducive to improving partners' working relationship via partnering.	❑	❑	❑	❑	❑	❑
12. More effort of client's involvement in problem solving and subcontractor selection.	❑	❑	❑	❑	❑	❑
13. Limit the entitlements for claiming variations by contractor.	❑	❑	❑	❑	❑	❑
14. Enable a more equitable risk apportionment amongst project participants.	❑	❑	❑	❑	❑	❑
15. Contractor takes all the risks in design development by way of GMP allowance in the tender.	❑	❑	❑	❑	❑	❑
16. More opportunities for participants to express opinions and concerns.	❑	❑	❑	❑	❑	❑
17. The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team.	❑	❑	❑	❑	❑	❑
18. Other: _____	❑	❑	❑	❑	❑	❑

Risks of Implementing GMP/TCC

Please rate the following risk factors inherent in GMP/TCC projects.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know
1. Disputes may arise due to the changes in the scope of work.	❑	❑	❑	❑	❑	❑
2. Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project.	❑	❑	❑	❑	❑	❑
3. Inexperienced or claim conscious contractors jeopardize the GMP/TCC process.	❑	❑	❑	❑	❑	❑
4. The client may pay more because contractor may inflate the estimated costs to cover his additional risks.	❑	❑	❑	❑	❑	❑
5. Contractor may earn lower profit or even incur a loss due to unclear definition of the scope of work.	❑	❑	❑	❑	❑	❑
6. No standard form leads to misunderstanding of liabilities between parties.	❑	❑	❑	❑	❑	❑
7. Difficult to use successfully on contracts where many changes are expected.	❑	❑	❑	❑	❑	❑
8. Contractor may not foresee design development risks thus taking more risks.	❑	❑	❑	❑	❑	❑
9. Client may carry more risks than the traditional procurement approach.	❑	❑	❑	❑	❑	❑
10. Variations may cost more than under the traditional procurement approach.	❑	❑	❑	❑	❑	❑
11. Other: _____	❑	❑	❑	❑	❑	❑

Difficulties in Implementing GMP/TCC

Please rate the following difficulties that you had experienced in this GMP/TCC project.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know
1. Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work.	❑	❑	❑	❑	❑	❑
2. Increased commitment and involvement by project managers and design consultants in evaluating tenders (mainly on technical elements) for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees.	❑	❑	❑	❑	❑	❑
3. Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay may result.	❑	❑	❑	❑	❑	❑
4. Lack of standard form of GMP/TCC building contract in the local context.	❑	❑	❑	❑	❑	❑
5. Longer time in preparing contract documents.	❑	❑	❑	❑	❑	❑
6. Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management.	❑	❑	❑	❑	❑	❑
7. Difficult to develop trust and understanding from contractor as a project team.	❑	❑	❑	❑	❑	❑
8. Too complicated form of contractual agreement.	❑	❑	❑	❑	❑	❑
9. Difficult to launch subcontracting with back-to-back contract terms.	❑	❑	❑	❑	❑	❑
10. Clients had to be more involved in a project.	❑	❑	❑	❑	❑	❑
11. A project team may find it difficult to adapt to this new way of working.	❑	❑	❑	❑	❑	❑
12. Not suitable for projects where it is difficult to define the scope of work early.	❑	❑	❑	❑	❑	❑
13. Other: _____	❑	❑	❑	❑	❑	❑

Critical Success Factors (CSF) for GMP/TCC Projects

Please rate the following factors that you consider critical to the success of this GMP/TCC project.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know
1. Standard form of contract for GMP/TCC projects	❑	❑	❑	❑	❑	❑
2. Well defined scope of work in client's project brief	❑	❑	❑	❑	❑	❑
3. Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	❑	❑	❑	❑	❑	❑
4. A right selection of project team	❑	❑	❑	❑	❑	❑
5. Reasonable share of cost saving and fair risk allocation	❑	❑	❑	❑	❑	❑
6. Partnering spirit from all contracting parties	❑	❑	❑	❑	❑	❑
7. Early involvement of the contractor in design development	❑	❑	❑	❑	❑	❑
8. Establishment of adjudication committee and meeting	❑	❑	❑	❑	❑	❑
9. Proactive main contractor throughout the GMP/TCC process	❑	❑	❑	❑	❑	❑
10. Open book accounting regime as provided by the main contractor in support of his tender pricing	❑	❑	❑	❑	❑	❑
11. Other: _____	❑	❑	❑	❑	❑	❑

Personal Opinions on GMP/TCC

Please indicate your personal opinions on GMP/TCC.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I believe that GMP/TCC procurement strategy will be increasingly adopted within the future construction industry of Hong Kong.	❑	❑	❑	❑	❑
2. I will promote the application of GMP/TCC in future projects.	❑	❑	❑	❑	❑

Project Performance

Please indicate the following aspects of performance of this GMP/TCC project.

1. Time performance:

❑ on schedule	❑ ahead schedule by:		❑ behind schedule by:
	❑ below 1%	❑ 1-5%	❑ 6-10%	❑ more than 10%

2. Cost performance:

❑ on budget against final GMP/Target Cost	❑ saving on budget against final GMP/Target Cost by:		❑ overrun budget against final GMP/Target Cost by:
	❑ below 1%	❑ 1-5%	❑ 6-10%	❑ more than 10%

3. Quality performance (in terms of scope of rework measured as percentage of original contract sum):

❑ Zero rework	❑ above an average project by:		❑ below an average project by:
	❑ below 1%	❑ 1-5%	❑ 6-10%	❑ more than 10%

4. Dispute (Claim) occurrence:

❑ Dispute-free	❑ above an average project by:		❑ below an average project by:
	❑ below 1%	❑ 1% to 5%	❑ 6% to 10%	❑ more than 10%

5. Overall performance (Level of success for this project in achieving the stated objectives):

❑ very unsuccessful ❑ unsuccessful ❑ average ❑ successful ❑ very successful

Comparing GMP/TCC with the Traditional Procurement Approach

Please indicate how you would compare a GMP/TCC project versus a project procured by the traditional approach in terms of the following measures.	Much better	Better	Same	Worse	Much worse
1. Time performance	❑	❑	❑	❑	❑
2. Cost performance	❑	❑	❑	❑	❑
3. Quality performance	❑	❑	❑	❑	❑
4. Incentive to innovation	❑	❑	❑	❑	❑
5. Occurrence, magnitude and resolution of disputes (e.g. claims)	❑	❑	❑	❑	❑
6. Risk management and control	❑	❑	❑	❑	❑
7. Overall project performance	❑	❑	❑	❑	❑

Suitability for Adopting GMP/TCC

Please rate the following project conditions that you think are suitable for adopting GMP/TCC scheme.	Very unsuitable	Unsuitable	Neutral	Suitable	Very suitable
1. Large and technically complex project that contains higher risks	❑	❑	❑	❑	❑
2. Project with tight schedule	❑	❑	❑	❑	❑
3. Project with life cycle cash flow	❑	❑	❑	❑	❑
4. Client's requirements for buildability and innovation	❑	❑	❑	❑	❑
5. Infrastructure project involving many interfacing works	❑	❑	❑	❑	❑
6. Landmark type project (e.g. New Central Government Complex and LegCo Building at Tamar)	❑	❑	❑	❑	❑
7. Other: _____	❑	❑	❑	❑	❑

End of the questionnaire

Thank you for your valuable contribution

APPENDIX III: RESULTS OF ANOVA TESTS AND T-TESTS BETWEEN GROUPS OF SURVEY RESPONDENTS

BENEFITS OF GMP/TCC

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Benefit 1: Provide guarantee of avoiding budget overrun at GMP main contract award	Client	15	3.73	.884	.228	3.24	4.22	2	5
	Contractor	16	3.81	.750	.187	3.41	4.21	3	5
	Consultant	13	3.85	1.144	.317	3.16	4.54	2	5
	Total	44	3.80	.904	.136	3.52	4.07	2	5
Benefit 2: Client provides financial incentives for contractor to achieve cost saving	Client	16	4.31	.602	.151	3.99	4.63	3	5
	Contractor	16	3.75	.931	.233	3.25	4.25	2	5
	Consultant	13	4.31	.630	.175	3.93	4.69	3	5
	Total	45	4.11	.775	.116	3.88	4.34	2	5
Benefit 3: Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost	Client	16	3.81	.655	.164	3.46	4.16	3	5
	Contractor	16	3.75	1.000	.250	3.22	4.28	2	5
	Consultant	12	4.17	1.030	.297	3.51	4.82	2	5
	Total	44	3.89	.895	.135	3.61	4.16	2	5
Benefit 4: Achieve better value for money	Client	16	4.00	.816	.204	3.56	4.44	3	5
	Contractor	16	3.81	.750	.188	3.41	4.21	2	5
	Consultant	13	3.92	.862	.239	3.40	4.44	3	5
	Total	45	3.91	.793	.118	3.67	4.15	2	5
Benefit 5: Fast track project by allowing early start of construction before the design is fully developed	Client	16	3.63	.957	.239	3.11	4.14	2	5
	Contractor	16	4.06	.929	.232	3.57	4.56	2	5
	Consultant	12	4.00	.603	.174	3.62	4.38	3	5
	Total	44	3.89	.868	.131	3.62	4.15	2	5
Benefit 6: Early settlement of final project account.	Client	16	4.19	1.109	.277	3.60	4.78	1	5
	Contractor	16	4.38	.619	.155	4.05	4.70	3	5
	Consultant	12	4.17	.718	.207	3.71	4.62	3	5
	Total	44	4.25	.839	.126	3.99	4.51	1	5
Benefit 7: Greater client's control over design consultants, main contractor and subcontractor	Client	16	3.38	1.088	.272	2.80	3.95	2	5
	Contractor	15	3.67	1.113	.287	3.05	4.28	2	5
	Consultant	13	3.38	1.121	.311	2.71	4.06	2	5
	Total	44	3.48	1.089	.164	3.15	3.81	2	5
Benefit 8: Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project	Client	16	4.25	.577	.144	3.94	4.56	3	5
	Contractor	16	4.31	.704	.176	3.94	4.69	3	5
	Consultant	12	4.00	1.128	.326	3.28	4.72	2	5
	Total	44	4.20	.795	.120	3.96	4.45	2	5
Benefit 9: Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops	Client	15	3.53	.743	.192	3.12	3.94	2	4
	Contractor	16	3.88	.806	.202	3.45	4.30	2	5
	Consultant	11	4.09	.831	.251	3.53	4.65	3	5
	Total	42	3.81	.804	.124	3.56	4.06	2	5
Benefit 10: Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes	Client	16	3.75	1.125	.281	3.15	4.35	2	5
	Contractor	16	3.56	.814	.203	3.13	4.00	2	5
	Consultant	12	3.67	1.073	.310	2.98	4.35	2	5
	Total	44	3.66	.987	.149	3.36	3.96	2	5
Benefit 11: Conducive to improving partners' working relationship via partnering	Client	16	4.31	.946	.237	3.81	4.82	2	5
	Contractor	16	4.06	.929	.232	3.57	4.56	2	5
	Consultant	13	4.08	.954	.265	3.50	4.65	2	5
	Total	45	4.16	.928	.138	3.88	4.43	2	5
Benefit 12: More effort of client's involvement in problem solving and subcontractor selection	Client	16	4.06	.929	.232	3.57	4.56	2	5
	Contractor	15	3.93	1.100	.284	3.32	4.54	1	5
	Consultant	13	3.69	.751	.208	3.24	4.15	2	5
	Total	44	3.91	.936	.141	3.62	4.19	1	5
Benefit 13: Limit the entitlements for claiming variations by contractor	Client	16	3.69	.873	.218	3.22	4.15	2	5
	Contractor	16	3.94	.772	.193	3.53	4.35	3	5
	Consultant	13	3.38	1.044	.290	2.75	4.02	2	5
	Total	45	3.69	.900	.134	3.42	3.96	2	5
Benefit 14: Enable a more equitable risk apportionment amongst project participants	Client	16	3.94	.772	.193	3.53	4.35	3	5
	Contractor	16	3.56	1.031	.258	3.01	4.11	2	5
	Consultant	13	3.69	.855	.237	3.18	4.21	2	5
	Total	45	3.73	.889	.133	3.47	4.00	2	5
Benefit 15: Contractor takes all the risks in design development by way of GMP allowance in the tender	Client	14	3.00	.784	.210	2.55	3.45	2	5
	Contractor	16	3.81	1.223	.306	3.16	4.46	2	5
	Consultant	12	3.33	1.371	.396	2.46	4.20	2	5
	Total	42	3.40	1.170	.181	3.04	3.77	2	5

Benefit 16: More opportunities for participants to express opinions and concerns	Client	16	4.00	.816	.204	3.56	4.44	2	5
	Contractor	16	3.81	.981	.245	3.29	4.34	1	5
	Consultant	13	3.85	.555	.154	3.51	4.18	3	5
	Total	45	3.89	.804	.120	3.65	4.13	1	5
Benefit 17: The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team	Client	16	4.19	.655	.164	3.84	4.54	3	5
	Contractor	16	3.94	1.063	.266	3.37	4.50	1	5
	Consultant	13	3.62	.870	.241	3.09	4.14	2	5
	Total	45	3.93	.889	.133	3.67	4.20	1	5

ONE-WAY ANOVA TESTS

		Sum of Squares	df	Mean Square	F	Sig.
Benefit 1: Provide guarantee of avoiding budget overrun at GMP main contract award	Between Groups	.096	2	.048	.056	.946
	Within Groups	35.063	41	.855		
	Total	35.159	43			
Benefit 2: Client provides financial incentives for contractor to achieve cost saving	Between Groups	3.238	2	1.619	2.930	.064
	Within Groups	23.207	42	.553		
	Total	26.444	44			
Benefit 3: Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost	Between Groups	1.328	2	.664	.822	.447
	Within Groups	33.104	41	.807		
	Total	34.432	43			
Benefit 4: Achieve better value for money	Between Groups	.284	2	.142	.218	.805
	Within Groups	27.361	42	.651		
	Total	27.644	44			
Benefit 5: Fast track project by allowing early start of construction before the design is fully developed	Between Groups	1.744	2	.872	1.165	.322
	Within Groups	30.688	41	.748		
	Total	32.432	43			
Benefit 6: Early settlement of final project account.	Between Groups	.396	2	.198	.272	.763
	Within Groups	29.854	41	.728		
	Total	30.250	43			
Benefit 7: Greater client's control over design consultants, main contractor and subcontractor	Between Groups	.817	2	.409	.334	.718
	Within Groups	50.160	41	1.223		
	Total	50.977	43			
Benefit 8: Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project	Between Groups	.722	2	.361	.560	.576
	Within Groups	26.438	41	.645		
	Total	27.159	43			
Benefit 9: Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops	Between Groups	2.084	2	1.042	1.666	.202
	Within Groups	24.392	39	.625		
	Total	26.476	41			
Benefit 10: Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes	Between Groups	.282	2	.141	.139	.871
	Within Groups	41.604	41	1.015		
	Total	41.886	43			
Benefit 11: Conducive to improving partners' working relationship via partnering	Between Groups	.613	2	.307	.345	.710
	Within Groups	37.298	42	.888		
	Total	37.911	44			
Benefit 12: More effort of client's involvement in problem solving and subcontractor selection	Between Groups	.996	2	.498	.557	.577
	Within Groups	36.640	41	.894		
	Total	37.636	43			
Benefit 13: Limit the entitlements for claiming variations by contractor	Between Groups	2.193	2	1.096	1.376	.264
	Within Groups	33.452	42	.796		
	Total	35.644	44			
Benefit 14: Enable a more equitable risk apportionment amongst project participants	Between Groups	1.156	2	.578	.721	.492
	Within Groups	33.644	42	.801		
	Total	34.800	44			
Benefit 15: Contractor takes all the risks in design development by way of GMP allowance in the tender	Between Groups	5.015	2	2.507	1.914	.161
	Within Groups	51.104	39	1.310		
	Total	56.119	41			
Benefit 16: More opportunities for participants to express opinions and concerns	Between Groups	.315	2	.157	.235	.792
	Within Groups	28.130	42	.670		
	Total	28.444	44			
Benefit 17: The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team	Between Groups	2.348	2	1.174	1.519	.231
	Within Groups	32.452	42	.773		
	Total	34.800	44			

Independent 2-sample T-Test

Group Statistics

	Which payment mechanism did the project adopt?	N	Mean	Std. Deviation	Std. Error Mean
Benefit 1: Provide guarantee of avoiding budget overrun at GMP main contract award	Guaranteed maximum price	30	3.93	.868	.159
	Target cost contracting	9	3.44	1.014	.338
Benefit 2: Client provides financial incentives for contractor to achieve cost saving	Guaranteed maximum price	30	4.00	.830	.152
	Target cost contracting	10	4.40	.699	.221
Benefit 3: Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost	Guaranteed maximum price	29	3.93	1.033	.192
	Target cost contracting	10	3.80	.632	.200
Benefit 4: Achieve better value for money	Guaranteed maximum price	30	3.77	.774	.141
	Target cost contracting	10	4.40	.699	.221
Benefit 5: Fast track project by allowing early start of construction before the design is fully developed	Guaranteed maximum price	29	4.07	.753	.140
	Target cost contracting	10	3.40	.966	.306
Benefit 6: Early settlement of final project account.	Guaranteed maximum price	29	4.48	.634	.118
	Target cost contracting	10	3.90	1.197	.379
Benefit 7: Greater client's control over design consultants, main contractor and subcontractor	Guaranteed maximum price	30	3.63	1.098	.200
	Target cost contracting	10	3.30	1.059	.335
Benefit 8: Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project	Guaranteed maximum price	29	4.17	.889	.165
	Target cost contracting	10	4.20	.632	.200
Benefit 9: Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops	Guaranteed maximum price	28	3.93	.716	.135
	Target cost contracting	9	3.44	1.130	.377
Benefit 10: Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes	Guaranteed maximum price	30	3.73	.980	.179
	Target cost contracting	9	3.67	1.118	.373
Benefit 11: Conducive to improving partners' working relationship via partnering	Guaranteed maximum price	30	4.13	.937	.171
	Target cost contracting	10	4.40	1.075	.340
Benefit 12: More effort of client's involvement in problem solving and subcontractor selection	Guaranteed maximum price	30	3.97	.765	.140
	Target cost contracting	10	3.80	1.476	.467
Benefit 13: Limit the entitlements for claiming variations by contractor	Guaranteed maximum price	30	3.83	.950	.173
	Target cost contracting	10	3.40	.843	.267
Benefit 14: Enable a more equitable risk apportionment amongst project participants	Guaranteed maximum price	30	3.67	.922	.168
	Target cost contracting	10	4.00	.943	.298
Benefit 15: Contractor takes all the risks in design development by way of GMP allowance in the tender	Guaranteed maximum price	30	3.37	1.245	.227
	Target cost contracting	7	3.14	.900	.340
Benefit 16: More opportunities for participants to express opinions and concerns	Guaranteed maximum price	30	3.83	.791	.145
	Target cost contracting	10	4.10	.738	.233
Benefit 17: The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team	Guaranteed maximum price	30	3.80	.925	.169
	Target cost contracting	10	4.30	.823	.260

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Benefit 1: Provide guarantee of avoiding budget overrun at GMP main contract award	Equal variances assumed	.611	.439	1.426	37	.162	.489	.343	-.206	1.183
	Equal variances not assumed			1.310	11.752	.215	.489	.373	-.326	1.304
Benefit 2: Client provides financial incentives for contractor to achieve cost saving	Equal variances assumed	.103	.750	-1.367	38	.180	-.400	.293	-.992	.192
	Equal variances not assumed			-1.492	18.205	.153	-.400	.268	-.963	.163
Benefit 3: Early award of contract can allow advanced works packages (e.g. demolition, foundation, etc.) to be included in GMP/ target cost	Equal variances assumed	3.653	.064	.376	37	.709	.131	.349	-.576	.838
	Equal variances not assumed			.473	26.073	.640	.131	.277	-.438	.701
Benefit 4: Achieve better value for money	Equal variances assumed	.038	.847	-2.292	38	.028	-.633	.276	-1.193	-.074
	Equal variances not assumed			-2.414	16.972	.027	-.633	.262	-1.187	-.080
Benefit 5: Fast track project by allowing early start of construction before the design is fully developed	Equal variances assumed	2.209	.146	2.253	37	.030	.669	.297	.067	1.271
	Equal variances not assumed			1.991	12.979	.068	.669	.336	-.057	1.395
Benefit 6: Early settlement of final project account.	Equal variances assumed	1.105	.300	1.967	37	.057	.583	.296	-.017	1.183
	Equal variances not assumed			1.470	10.790	.170	.583	.396	-.292	1.457
Benefit 7: Greater client's control over design consultants, main contractor and subcontractor	Equal variances assumed	.285	.596	.838	38	.407	.333	.398	-.472	1.138
	Equal variances not assumed			.854	15.965	.406	.333	.390	-.494	1.161
Benefit 8: Bring in expertise in building designs and innovations in construction methods and materials from contractor to enhance the buildability of the project	Equal variances assumed	1.175	.285	-.090	37	.929	-.028	.306	-.647	.592
	Equal variances not assumed			-.106	22.143	.916	-.028	.259	-.565	.510
Benefit 9: Domestic subcontractor's work packages are competitively tendered by approved / prequalified subcontractors and specialists on an open book basis after the award of GMP contract as design develops	Equal variances assumed	5.676	.023	1.523	35	.137	.484	.318	-.161	1.129
	Equal variances not assumed			1.209	10.149	.254	.484	.400	-.406	1.374
Benefit 10: Provide a dispute resolution mechanism by way of adjudication committee leading to reduction in disputes	Equal variances assumed	.074	.787	.173	37	.863	.067	.384	-.712	.846
	Equal variances not assumed			.161	11.940	.875	.067	.413	-.835	.968
Benefit 11: Conducive to improving partners' working relationship via partnering	Equal variances assumed	.189	.666	-.752	38	.457	-.267	.355	-.985	.451
	Equal variances not assumed			-.701	13.861	.495	-.267	.381	-1.084	.550
Benefit 12: More effort of client's involvement in problem solving and subcontractor selection	Equal variances assumed	11.719	.001	.465	38	.644	.167	.358	-.558	.892
	Equal variances not assumed			.342	10.658	.739	.167	.487	-.910	1.243
Benefit 13: Limit the entitlements for claiming variations by contractor	Equal variances assumed	.035	.852	1.282	38	.208	.433	.338	-.251	1.118
	Equal variances not assumed			1.362	17.265	.191	.433	.318	-.237	1.104

Benefit 14: Enable a more equitable risk apportionment amongst project participants	Equal variances assumed	.825	.369	-.985	38	.331	-.333	.339	-1.019	.352
	Equal variances not assumed			-.974	15.178	.346	-.333	.342	-1.062	.396
Benefit 15: Contractor takes all the risks in design development by way of GMP allowance in the tender	Equal variances assumed	7.060	.012	.447	35	.658	.224	.501	-.793	1.241
	Equal variances not assumed			.547	12.063	.594	.224	.409	-.667	1.115
Benefit 16: More opportunities for participants to express opinions and concerns	Equal variances assumed	.008	.931	-.937	38	.355	-.267	.284	-.843	.309
	Equal variances not assumed			-.972	16.475	.345	-.267	.274	-.847	.314
Benefit 17: The gain share arrangement helps establish mutual objectives and produce an integrated, trustful working team	Equal variances assumed	.009	.923	-1.518	38	.137	-.500	.329	-1.167	.167
	Equal variances not assumed			-1.611	17.217	.125	-.500	.310	-1.154	.154

DIFFICULTIES IN IMPLEMENTING GMP/TCC

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Difficulty 1:Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work	Client	14	3.57	.646	.173	3.20	3.94	2	4
	Contractor	14	3.57	1.089	.291	2.94	4.20	2	5
	Consultant	11	3.64	1.027	.310	2.95	4.33	2	5
	Total	39	3.59	.910	.146	3.29	3.88	2	5
Difficulty 2: Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees	Client	14	3.21	.893	.239	2.70	3.73	2	5
	Contractor	14	3.64	.745	.199	3.21	4.07	2	5
	Consultant	11	3.55	.934	.282	2.92	4.17	2	5
	Total	39	3.46	.854	.137	3.18	3.74	2	5
Difficulty 3: Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay	Client	13	4.00	.577	.160	3.65	4.35	3	5
	Contractor	14	4.14	.663	.177	3.76	4.53	3	5
	Consultant	12	3.92	.669	.193	3.49	4.34	3	5
	Total	39	4.03	.628	.101	3.82	4.23	3	5
Difficulty 4: Lack of standard form of GMP/TCC building contract in the local context	Client	13	3.85	.899	.249	3.30	4.39	2	5
	Contractor	14	3.71	.914	.244	3.19	4.24	2	5
	Consultant	12	3.50	1.087	.314	2.81	4.19	2	5
	Total	39	3.69	.950	.152	3.38	4.00	2	5
Difficulty 5: Longer time in preparing contract documents	Client	13	3.54	1.050	.291	2.90	4.17	2	5
	Contractor	14	3.21	.699	.187	2.81	3.62	2	5
	Consultant	12	3.08	1.165	.336	2.34	3.82	2	5
	Total	39	3.28	.972	.156	2.97	3.60	2	5
Difficulty 6: Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management	Client	15	2.93	1.163	.300	2.29	3.58	1	4
	Contractor	13	3.08	.954	.265	2.50	3.65	2	5
	Consultant	11	3.36	.924	.279	2.74	3.98	2	5
	Total	39	3.10	1.021	.163	2.77	3.43	1	5
Difficulty 7: Difficult to develop trust and understanding from contractor as a project team	Client	14	2.29	1.139	.304	1.63	2.94	1	4
	Contractor	14	2.79	.975	.261	2.22	3.35	2	5
	Consultant	12	2.42	.900	.260	1.84	2.99	1	4
	Total	40	2.50	1.013	.160	2.18	2.82	1	5
Difficulty 8: Too complicated form of contractual agreement	Client	15	2.40	.828	.214	1.94	2.86	1	4
	Contractor	14	2.79	.893	.239	2.27	3.30	2	5
	Consultant	12	2.67	1.073	.310	1.98	3.35	1	5
	Total	41	2.61	.919	.143	2.32	2.90	1	5
Difficulty 9: Difficult to launch subcontracting with back-to-back contract terms	Client	14	2.36	.745	.199	1.93	2.79	1	4
	Contractor	14	2.50	.760	.203	2.06	2.94	2	4
	Consultant	12	2.67	.985	.284	2.04	3.29	1	4
	Total	40	2.50	.816	.129	2.24	2.76	1	4
Difficulty 10: Clients had to be more involved in a project	Client	15	4.33	.617	.159	3.99	4.68	3	5
	Contractor	14	3.86	.770	.206	3.41	4.30	2	5
	Consultant	12	3.83	.835	.241	3.30	4.36	3	5
	Total	41	4.02	.758	.118	3.79	4.26	2	5
Difficulty 11: A project team may find it difficult to adapt to this new way of working	Client	15	3.20	.941	.243	2.68	3.72	2	4
	Contractor	14	2.71	.726	.194	2.29	3.13	2	4
	Consultant	12	2.75	1.288	.372	1.93	3.57	1	5
	Total	41	2.90	.995	.155	2.59	3.22	1	5
Difficulty 12: Not suitable for projects where it is difficult to define the scope of work early	Client	15	3.20	1.146	.296	2.57	3.83	1	5
	Contractor	14	3.79	1.122	.300	3.14	4.43	2	5
	Consultant	12	3.17	1.337	.386	2.32	4.02	1	5
	Total	41	3.39	1.202	.188	3.01	3.77	1	5

ONE-WAY ANOVA TEST

		Sum of Squares	df	Mean Square	F	Sig.
Difficulty 1:Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work	Between Groups	.033	2	.017	.019	.981
	Within Groups	31.403	36	.872		
	Total	31.436	38			
Difficulty 2: Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees	Between Groups	1.394	2	.697	.954	.395
	Within Groups	26.299	36	.731		
	Total	27.692	38			
Difficulty 3: Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay	Between Groups	.343	2	.172	.422	.659
	Within Groups	14.631	36	.406		
	Total	14.974	38			
Difficulty 4: Lack of standard form of GMP/TCC building contract in the local context	Between Groups	.758	2	.379	.407	.669
	Within Groups	33.549	36	.932		
	Total	34.308	38			
Difficulty 5: Longer time in preparing contract documents	Between Groups	1.393	2	.696	.727	.491
	Within Groups	34.505	36	.958		
	Total	35.897	38			
Difficulty 6: Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management	Between Groups	1.188	2	.594	.557	.578
	Within Groups	38.402	36	1.067		
	Total	39.590	38			
Difficulty 7: Difficult to develop trust and understanding from contractor as a project team	Between Groups	1.869	2	.935	.907	.413
	Within Groups	38.131	37	1.031		
	Total	40.000	39			
Difficulty 8: Too complicated form of contractual agreement	Between Groups	1.132	2	.566	.659	.523
	Within Groups	32.624	38	.859		
	Total	33.756	40			
Difficulty 9: Difficult to launch subcontracting with back-to-back contract terms	Between Groups	.619	2	.310	.451	.640
	Within Groups	25.381	37	.686		
	Total	26.000	39			
Difficulty 10: Clients had to be more involved in a project	Between Groups	2.261	2	1.131	2.074	.140
	Within Groups	20.714	38	.545		
	Total	22.976	40			
Difficulty 11: A project team may find it difficult to adapt to this new way of working	Between Groups	2.103	2	1.051	1.065	.355
	Within Groups	37.507	38	.987		
	Total	39.610	40			
Difficulty 12: Not suitable for projects where it is difficult to define the scope of work early	Between Groups	3.332	2	1.666	1.163	.323
	Within Groups	54.424	38	1.432		
	Total	57.756	40			

Independent 2-sample T-Test

Group Statistics

	Which payment mechanism did the project adopt?	N	Mean	Std. Deviation	Std. Error Mean
Difficulty 1:Disputes over whether Architects/Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work	Guaranteed maximum price	28	3.61	.994	.188
	Target cost contracting	10	3.50	.707	.224
Difficulty 2: Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees	Guaranteed maximum price	29	3.66	.814	.151
	Target cost contracting	9	2.78	.667	.222
Difficulty 3: Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay	Guaranteed maximum price	29	4.03	.626	.116
	Target cost contracting	9	3.89	.601	.200
Difficulty 4: Lack of standard form of GMP/TCC building contract in the local context	Guaranteed maximum price	30	3.67	1.028	.188
	Target cost contracting	8	3.75	.707	.250
Difficulty 5: Longer time in preparing contract documents	Guaranteed maximum price	30	3.17	.913	.167
	Target cost contracting	8	3.50	1.069	.378
Difficulty 6: Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management	Guaranteed maximum price	28	3.25	.928	.175
	Target cost contracting	10	2.70	1.252	.396
Difficulty 7: Difficult to develop trust and understanding from contractor as a project team	Guaranteed maximum price	29	2.69	.891	.165
	Target cost contracting	10	2.00	1.247	.394
Difficulty 8: Too complicated form of contractual agreement	Guaranteed maximum price	30	2.73	.907	.166
	Target cost contracting	10	2.30	.949	.300
Difficulty 9: Difficult to launch subcontracting with back-to-back contract terms	Guaranteed maximum price	30	2.60	.855	.156
	Target cost contracting	9	2.22	.667	.222
Difficulty 10: Clients had to be more involved in a project	Guaranteed maximum price	30	4.00	.788	.144
	Target cost contracting	10	4.10	.738	.233
Difficulty 11: A project team may find it difficult to adapt to this new way of working	Guaranteed maximum price	30	2.97	.964	.176
	Target cost contracting	10	2.80	1.135	.359
Difficulty 12: Not suitable for projects where it is difficult to define the scope of work early	Guaranteed maximum price	30	3.40	1.163	.212
	Target cost contracting	10	3.20	1.317	.416

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Difficulty 1:Disputes over whether Architects/ Engineers Instructions constituted GMP/TCC variations or were deemed to be design development i.e. unclear scope of work	Equal variances assumed	1.444	.237	.313	36	.756	.107	.343	-.588	.802
	Equal variances not assumed			.367	22.458	.717	.107	.292	-.498	.712
Difficulty 2: Increased commitment and involvement by project managers and design consultants in evaluating tenders for domestic subcontracts after the award of main contract i.e. potential for incurring higher consultant fees	Equal variances assumed	1.030	.317	2.934	36	.006	.877	.299	.271	1.484
	Equal variances not assumed			3.265	16.128	.005	.877	.269	.308	1.447
Difficulty 3: Design development must keep pace with contractor's programme for tendering the domestic sub-contractor's works packages otherwise potential delay	Equal variances assumed	.001	.980	.615	36	.542	.146	.237	-.334	.626
	Equal variances not assumed			.629	13.843	.540	.146	.232	-.352	.643
Difficulty 4: Lack of standard form of GMP/TCC building contract in the local context	Equal variances assumed	3.349	.076	-.215	36	.831	-.083	.388	-.870	.703
	Equal variances not assumed			-.267	15.901	.793	-.083	.313	-.746	.580
Difficulty 5: Longer time in preparing contract documents	Equal variances assumed	.614	.438	-.886	36	.381	-.333	.376	-1.096	.429
	Equal variances not assumed			-.807	9.897	.439	-.333	.413	-1.255	.588
Difficulty 6: Unfamiliarity with or misunderstanding of GMP/TCC concepts by senior management	Equal variances assumed	3.290	.078	1.466	36	.151	.550	.375	-.211	1.311
	Equal variances not assumed			1.270	12.717	.227	.550	.433	-.387	1.487
Difficulty 7: Difficult to develop trust and understanding from contractor as a project team	Equal variances assumed	1.834	.184	1.901	37	.065	.690	.363	-.045	1.425
	Equal variances not assumed			1.613	12.320	.132	.690	.428	-.239	1.619
Difficulty 8: Too complicated form of contractual agreement	Equal variances assumed	.083	.774	1.294	38	.204	.433	.335	-.245	1.111
	Equal variances not assumed			1.265	14.893	.225	.433	.343	-.298	1.164
Difficulty 9: Difficult to launch subcontracting with back-to-back contract terms	Equal variances assumed	2.376	.132	1.215	37	.232	.378	.311	-.252	1.008
	Equal variances not assumed			1.391	16.720	.182	.378	.272	-.196	.951
Difficulty 10: Clients had to be more involved in a project	Equal variances assumed	.001	.974	-.353	38	.726	-.100	.283	-.674	.474
	Equal variances not assumed			-.365	16.405	.720	-.100	.274	-.680	.480
Difficulty 11: A project team may find it difficult to adapt to this new way of working	Equal variances assumed	1.364	.250	.453	38	.653	.167	.368	-.578	.911
	Equal variances not assumed			.417	13.605	.683	.167	.400	-.693	1.027
Difficulty 12: Not suitable for projects where it is difficult to define the scope of work early	Equal variances assumed	.055	.816	.456	38	.651	.200	.438	-.688	1.088
	Equal variances not assumed			.428	13.994	.675	.200	.467	-.802	1.202

RISKS OF IMPLEMENTING GMP/TCC

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Risk 1: Disputes may arise due to the changes in scope of work	Client	16	3.50	1.033	.258	2.95	4.05	2	5
	Contractor	16	4.00	.730	.183	3.61	4.39	2	5
	Consultant	13	3.92	.760	.211	3.46	4.38	2	5
	Total	45	3.80	.869	.129	3.54	4.06	2	5
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Client	16	3.19	1.223	.306	2.54	3.84	2	5
	Contractor	16	3.00	.894	.224	2.52	3.48	2	5
	Consultant	13	3.23	1.013	.281	2.62	3.84	2	5
	Total	45	3.13	1.036	.154	2.82	3.44	2	5
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Client	15	3.60	.910	.235	3.10	4.10	2	5
	Contractor	16	3.88	.806	.202	3.45	4.30	2	5
	Consultant	13	4.23	.927	.257	3.67	4.79	2	5
	Total	44	3.89	.895	.135	3.61	4.16	2	5
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Client	16	2.63	1.025	.256	2.08	3.17	2	5
	Contractor	16	3.00	1.155	.289	2.38	3.62	2	5
	Consultant	13	3.23	.725	.201	2.79	3.67	2	4
	Total	45	2.93	1.009	.150	2.63	3.24	2	5
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Client	15	3.00	1.134	.293	2.37	3.63	2	5
	Contractor	16	4.00	.816	.204	3.56	4.44	3	5
	Consultant	13	3.31	.855	.237	2.79	3.82	2	4
	Total	44	3.45	1.022	.154	3.14	3.77	2	5
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Client	16	3.00	.966	.242	2.49	3.51	2	5
	Contractor	16	4.00	.730	.183	3.61	4.39	3	5
	Consultant	13	3.46	.776	.215	2.99	3.93	2	4
	Total	45	3.49	.920	.137	3.21	3.77	2	5
Risk 7: Difficult to use successfully on contracts where many changes are expected	Client	16	3.31	1.195	.299	2.68	3.95	1	5
	Contractor	16	3.81	.834	.209	3.37	4.26	2	5
	Consultant	13	2.92	1.498	.415	2.02	3.83	1	5
	Total	45	3.38	1.211	.181	3.01	3.74	1	5
Risk 8: Contractor may not foresee design development risks thus taking more risks	Client	16	3.38	1.025	.256	2.83	3.92	2	5
	Contractor	16	3.75	.931	.233	3.25	4.25	2	5
	Consultant	13	3.69	.855	.237	3.18	4.21	2	5
	Total	45	3.60	.939	.140	3.32	3.88	2	5
Risk 9: Client may carry more risks than the traditional procurement approach	Client	16	3.13	.885	.221	2.65	3.60	2	4
	Contractor	16	2.25	.683	.171	1.89	2.61	1	4
	Consultant	13	2.69	1.032	.286	2.07	3.32	2	5
	Total	45	2.69	.925	.138	2.41	2.97	1	5
Risk 10: Variations may cost more than under the traditional procurement approach	Client	16	2.56	.629	.157	2.23	2.90	2	4
	Contractor	16	2.56	.892	.223	2.09	3.04	2	4
	Consultant	13	2.46	.967	.268	1.88	3.05	1	5
	Total	45	2.53	.815	.121	2.29	2.78	1	5

ONE-WAY ANOVA TEST

		Sum of Squares	df	Mean Square	F	Sig.
Risk 1: Disputes may arise due to the changes in scope of work	Between Groups	2.277	2	1.138	1.546	.225
	Within Groups	30.923	42	.736		
	Total	33.200	44			
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Between Groups	.455	2	.227	.204	.816
	Within Groups	46.745	42	1.113		
	Total	47.200	44			
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Between Groups	2.774	2	1.387	1.796	.179
	Within Groups	31.658	41	.772		
	Total	34.432	43			
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Between Groups	2.742	2	1.371	1.369	.265
	Within Groups	42.058	42	1.001		
	Total	44.800	44			
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Between Groups	8.140	2	4.070	4.538	.017
	Within Groups	36.769	41	.897		
	Total	44.909	43			
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Between Groups	8.014	2	4.007	5.757	.006
	Within Groups	29.231	42	.696		
	Total	37.244	44			
Risk 7: Difficult to use successfully on contracts where many changes are expected	Between Groups	5.780	2	2.890	2.064	.140
	Within Groups	58.798	42	1.400		
	Total	64.578	44			
Risk 8: Contractor may not foresee design development risks thus taking more risks	Between Groups	1.281	2	.640	.717	.494
	Within Groups	37.519	42	.893		
	Total	38.800	44			
Risk 9: Client may carry more risks than the traditional procurement approach	Between Groups	6.125	2	3.063	4.081	.024
	Within Groups	31.519	42	.750		
	Total	37.644	44			
Risk 10: Variations may cost more than under the traditional procurement approach	Between Groups	.094	2	.047	.068	.934
	Within Groups	29.106	42	.693		
	Total	29.200	44			

Independent 2-sample T-Test

Independent Samples Test – Clients and Contractors

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Risk 1: Disputes may arise due to the changes in scope of work	Equal variances assumed	6.316	.018	-1.581	30	.124	-.500	.316	-1.146	.146
	Equal variances not assumed			-1.581	27.000	.125	-.500	.316	-1.149	.149
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Equal variances assumed	5.472	.026	.495	30	.624	.188	.379	-.586	.961
	Equal variances not assumed			.495	27.476	.625	.188	.379	-.589	.964
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Equal variances assumed	.961	.335	-.892	29	.380	-.275	.308	-.906	.356
	Equal variances not assumed			-.888	28.020	.382	-.275	.310	-.909	.359
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Equal variances assumed	.598	.445	-.972	30	.339	-.375	.386	-1.163	.413
	Equal variances not assumed			-.972	29.582	.339	-.375	.386	-1.164	.414
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Equal variances assumed	2.458	.128	-2.832	29	.008	-1.000	.353	-1.722	-.278
	Equal variances not assumed			-2.802	25.332	.010	-1.000	.357	-1.735	-.265
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Equal variances assumed	1.667	.207	-3.303	30	.002	-1.000	.303	-1.618	-.382
	Equal variances not assumed			-3.303	27.923	.003	-1.000	.303	-1.620	-.380
Risk 7: Difficult to use successfully on contracts where many changes are expected	Equal variances assumed	4.205	.049	-1.372	30	.180	-.500	.364	-1.244	.244
	Equal variances not assumed			-1.372	26.807	.181	-.500	.364	-1.248	.248
Risk 8: Contractor may not foresee design development risks thus taking more risks	Equal variances assumed	.642	.429	-1.083	30	.287	-.375	.346	-1.082	.332
	Equal variances not assumed			-1.083	29.728	.287	-.375	.346	-1.082	.332
Risk 9: Client may carry more risks than the traditional procurement approach	Equal variances assumed	3.153	.086	3.130	30	.004	.875	.280	.304	1.446
	Equal variances not assumed			3.130	28.191	.004	.875	.280	.303	1.447
Risk 10: Variations may cost more than under the traditional procurement approach	Equal variances assumed	3.295	.080	.000	30	1.000	.000	.273	-.557	.557
	Equal variances not assumed			.000	26.962	1.000	.000	.273	-.560	.560

Independent Samples Test – Contractors and Consultants

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Risk 1: Disputes may arise due to the changes in scope of work	Equal variances assumed	.075	.786	.277	27	.784	.077	.278	-.493	.647
	Equal variances not assumed			.276	25.354	.785	.077	.279	-.497	.651
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Equal variances assumed	1.323	.260	-.651	27	.520	-.231	.354	-.958	.496
	Equal variances not assumed			-.643	24.241	.526	-.231	.359	-.971	.510
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Equal variances assumed	.500	.486	-1.105	27	.279	-.356	.322	-1.016	.305
	Equal variances not assumed			-1.089	24.026	.287	-.356	.327	-1.030	.318
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Equal variances assumed	5.608	.025	-.626	27	.537	-.231	.369	-.987	.525
	Equal variances not assumed			-.656	25.564	.518	-.231	.352	-.955	.493
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Equal variances assumed	.532	.472	2.224	27	.035	.692	.311	.054	1.331
	Equal variances not assumed			2.213	25.274	.036	.692	.313	.048	1.336
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Equal variances assumed	.929	.344	1.920	27	.065	.538	.280	-.037	1.114
	Equal variances not assumed			1.908	25.086	.068	.538	.282	-.043	1.120
Risk 7: Difficult to use successfully on contracts where many changes are expected	Equal variances assumed	9.712	.004	2.025	27	.053	.889	.439	-.012	1.791
	Equal variances not assumed			1.913	17.900	.072	.889	.465	-.088	1.866
Risk 8: Contractor may not foresee design development risks thus taking more risks	Equal variances assumed	.667	.421	.172	27	.865	.058	.335	-.630	.746
	Equal variances not assumed			.174	26.548	.863	.058	.332	-.625	.740
Risk 9: Client may carry more risks than the traditional procurement approach	Equal variances assumed	3.792	.062	-1.384	27	.178	-.442	.320	-1.098	.213
	Equal variances not assumed			-1.327	20.040	.199	-.442	.333	-1.137	.253
Risk 10: Variations may cost more than under the traditional procurement approach	Equal variances assumed	.075	.786	.292	27	.773	.101	.346	-.609	.811
	Equal variances not assumed			.289	24.828	.775	.101	.349	-.618	.820

Independent 2-sample T-Test

Group Statistics

	Which payment mechanism did the project adopt?	N	Mean	Std. Deviation	Std. Error Mean
Risk 1: Disputes may arise due to the changes in scope of work	Guaranteed maximum price	30	3.90	.712	.130
	Target cost contracting	10	3.40	1.265	.400
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Guaranteed maximum price	30	3.17	.986	.180
	Target cost contracting	10	2.90	1.287	.407
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Guaranteed maximum price	30	4.00	.871	.159
	Target cost contracting	9	3.56	1.014	.338
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Guaranteed maximum price	30	3.10	.923	.168
	Target cost contracting	10	2.70	1.252	.396
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Guaranteed maximum price	30	3.57	.935	.171
	Target cost contracting	9	3.22	1.394	.465
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Guaranteed maximum price	30	3.60	.894	.163
	Target cost contracting	10	3.00	1.054	.333
Risk 7: Difficult to use successfully on contracts where many changes are expected	Guaranteed maximum price	30	3.33	1.213	.221
	Target cost contracting	10	3.30	1.418	.448
Risk 8: Contractor may not foresee design development risks thus taking more risks	Guaranteed maximum price	30	3.70	.794	.145
	Target cost contracting	10	3.50	1.354	.428
Risk 9: Client may carry more risks than the traditional procurement approach	Guaranteed maximum price	30	2.40	.724	.132
	Target cost contracting	10	3.40	1.075	.340
Risk 10: Variations may cost more than under the traditional procurement approach	Guaranteed maximum price	30	2.43	.626	.114
	Target cost contracting	10	2.50	.972	.307

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Risk 1: Disputes may arise due to the changes in scope of work	Equal variances assumed	12.303	.001	1.565	38	.126	.500	.320	-.147	1.147
	Equal variances not assumed			1.189	10.963	.260	.500	.421	-.426	1.426
Risk 2: Difficult to evaluate the revised contract price when an alternative design is proposed and it takes time to reassess the cost of the entire project	Equal variances assumed	1.766	.192	.686	38	.497	.267	.389	-.520	1.054
	Equal variances not assumed			.599	12.713	.559	.267	.445	-.697	1.230
Risk 3: Inexperienced or claim conscious contractors jeopardize GMP/TCC process	Equal variances assumed	.879	.355	1.294	37	.204	.444	.343	-.252	1.140
	Equal variances not assumed			1.190	11.776	.257	.444	.373	-.371	1.260
Risk 4: The client may pay more because contractor may inflate the estimated costs to cover his additional risks	Equal variances assumed	1.002	.323	1.084	38	.285	.400	.369	-.347	1.147
	Equal variances not assumed			.930	12.431	.370	.400	.430	-.534	1.334
Risk 5: Contractor may earn lower profit or even incur a loss due to unclear definition of scope of work	Equal variances assumed	4.188	.048	.862	37	.394	.344	.400	-.465	1.154
	Equal variances not assumed			.696	10.253	.502	.344	.495	-.755	1.444
Risk 6: No standard form leads to misunderstanding of liabilities between parties	Equal variances assumed	.080	.778	1.758	38	.087	.600	.341	-.091	1.291
	Equal variances not assumed			1.616	13.595	.129	.600	.371	-.198	1.398
Risk 7: Difficult to use successfully on contracts where many changes are expected	Equal variances assumed	.861	.359	.072	38	.943	.033	.462	-.901	.968
	Equal variances not assumed			.067	13.672	.948	.033	.500	-1.042	1.108
Risk 8: Contractor may not foresee design development risks thus taking more risks	Equal variances assumed	10.811	.002	.572	38	.570	.200	.349	-.507	.907
	Equal variances not assumed			.442	11.138	.667	.200	.452	-.793	1.193
Risk 9: Client may carry more risks than the traditional procurement approach	Equal variances assumed	4.606	.038	-3.337	38	.002	-1.000	.300	-1.607	-.393
	Equal variances not assumed			-2.742	11.843	.018	-1.000	.365	-1.796	-.204
Risk 10: Variations may cost more than under the traditional procurement approach	Equal variances assumed	4.058	.051	-.253	38	.802	-.067	.264	-.601	.468
	Equal variances not assumed			-.203	11.593	.842	-.067	.328	-.784	.651

CRITICAL SUCCESS FACTORS FOR GMP/TCC PROJECTS

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
CSF 1: Standard form of contract for GMP/TCC projects	Client	14	3.29	1.204	.322	2.59	3.98	1	5
	Contractor	14	3.64	1.082	.289	3.02	4.27	2	5
	Consultant	11	3.36	.924	.279	2.74	3.98	2	5
	Total	39	3.44	1.071	.172	3.09	3.78	1	5
CSF 2: Well defined scope of work in client's project brief	Client	15	4.20	.775	.200	3.77	4.63	2	5
	Contractor	14	4.71	.469	.125	4.44	4.98	4	5
	Consultant	12	4.25	.965	.279	3.64	4.86	2	5
	Total	41	4.39	.771	.120	4.15	4.63	2	5
CSF 3: Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	Client	15	4.13	.743	.192	3.72	4.54	2	5
	Contractor	14	4.29	.469	.125	4.02	4.56	4	5
	Consultant	12	4.08	.793	.229	3.58	4.59	2	5
	Total	41	4.17	.667	.104	3.96	4.38	2	5
CSF 4: A right selection of project team	Client	15	4.53	.834	.215	4.07	5.00	2	5
	Contractor	14	4.43	.514	.137	4.13	4.73	4	5
	Consultant	12	4.42	.900	.260	3.84	4.99	2	5
	Total	41	4.46	.745	.116	4.23	4.70	2	5
CSF 5: Reasonable share of cost saving and fair risk allocation	Client	15	4.53	.516	.133	4.25	4.82	4	5
	Contractor	14	4.64	.633	.169	4.28	5.01	3	5
	Consultant	12	4.42	.515	.149	4.09	4.74	4	5
	Total	41	4.54	.552	.086	4.36	4.71	3	5
CSF 6: Partnering spirit from all contracting parties	Client	15	4.60	.632	.163	4.25	4.95	3	5
	Contractor	14	4.64	.497	.133	4.36	4.93	4	5
	Consultant	12	4.33	.651	.188	3.92	4.75	3	5
	Total	41	4.54	.596	.093	4.35	4.72	3	5
CSF 7: Early involvement of the contractor in design development	Client	15	4.33	.617	.159	3.99	4.68	3	5
	Contractor	13	4.62	.506	.140	4.31	4.92	4	5
	Consultant	12	3.92	.669	.193	3.49	4.34	3	5
	Total	40	4.30	.648	.103	4.09	4.51	3	5
CSF 8: Establishment of adjudication committee and meeting	Client	15	3.67	.900	.232	3.17	4.16	2	5
	Contractor	14	3.93	.829	.221	3.45	4.41	3	5
	Consultant	12	3.92	.669	.193	3.49	4.34	3	5
	Total	41	3.83	.803	.125	3.58	4.08	2	5
CSF 9: Proactive main contractor throughout the GMP/TCC process	Client	15	4.67	.488	.126	4.40	4.94	4	5
	Contractor	14	4.21	.699	.187	3.81	4.62	3	5
	Consultant	12	4.17	.718	.207	3.71	4.62	3	5
	Total	41	4.37	.662	.103	4.16	4.57	3	5
CSF 10: Open book accounting regime as provided by the main contractor in support of his tender pricing	Client	14	4.00	.877	.234	3.49	4.51	2	5
	Contractor	14	4.07	.730	.195	3.65	4.49	3	5
	Consultant	12	4.08	.793	.229	3.58	4.59	3	5
	Total	40	4.05	.783	.124	3.80	4.30	2	5

ONE-WAY ANOVA TEST

		Sum of Squares	df	Mean Square	F	Sig.
CSF 1: Standard form of contract for GMP/TCC projects	Between Groups	.973	2	.486	.411	.666
	Within Groups	42.617	36	1.184		
	Total	43.590	38			
CSF 2: Well defined scope of work in client's project brief	Between Groups	2.249	2	1.124	1.987	.151
	Within Groups	21.507	38	.566		
	Total	23.756	40			
CSF 3: Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	Between Groups	.298	2	.149	.323	.726
	Within Groups	17.507	38	.461		
	Total	17.805	40			
CSF 4: A right selection of project team	Between Groups	.117	2	.058	.100	.905
	Within Groups	22.079	38	.581		
	Total	22.195	40			
CSF 5: Reasonable share of cost saving and fair risk allocation	Between Groups	.331	2	.165	.530	.593
	Within Groups	11.864	38	.312		
	Total	12.195	40			
CSF 6: Partnering spirit from all contracting parties	Between Groups	.714	2	.357	1.007	.375
	Within Groups	13.481	38	.355		
	Total	14.195	40			
CSF 7: Early involvement of the contractor in design development	Between Groups	3.073	2	1.537	4.266	.022
	Within Groups	13.327	37	.360		
	Total	16.400	39			
CSF 8: Establishment of adjudication committee and meeting	Between Groups	.626	2	.313	.473	.627
	Within Groups	25.179	38	.663		
	Total	25.805	40			
CSF 9: Proactive main contractor throughout the GMP/TCC process	Between Groups	2.155	2	1.078	2.666	.082
	Within Groups	15.357	38	.404		
	Total	17.512	40			
CSF 10: Open book accounting regime as provided by the main contractor in support of his tender pricing	Between Groups	.055	2	.027	.042	.958
	Within Groups	23.845	37	.644		
	Total	23.900	39			

Independent 2-sample T-Test

Independent Samples Test – Contractors and Consultants

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
CSF 1: Standard form of contract for GMP/TCC projects	Equal variances assumed	.361	.554	.682	23	.502	.279	.410	-.568	1.126
	Equal variances not assumed			.695	22.796	.494	.279	.402	-.552	1.110
CSF 2: Well defined scope of work in client's project brief	Equal variances assumed	4.502	.044	1.597	24	.123	.464	.291	-.136	1.064
	Equal variances not assumed			1.520	15.366	.149	.464	.306	-.186	1.114
CSF 3: Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	Equal variances assumed	.079	.781	.806	24	.428	.202	.251	-.316	.721
	Equal variances not assumed			.776	17.267	.449	.202	.261	-.348	.752
CSF 4: A right selection of project team	Equal variances assumed	1.646	.212	.042	24	.967	.012	.282	-.570	.594
	Equal variances not assumed			.041	16.880	.968	.012	.294	-.609	.632
CSF 5: Reasonable share of cost saving and fair risk allocation	Equal variances assumed	.055	.817	.988	24	.333	.226	.229	-.246	.699
	Equal variances not assumed			1.004	23.949	.325	.226	.225	-.239	.691
CSF 6: Partnering spirit from all contracting parties	Equal variances assumed	1.175	.289	1.373	24	.182	.310	.225	-.156	.775
	Equal variances not assumed			1.344	20.423	.194	.310	.230	-.170	.789
CSF 7: Early involvement of the contractor in design development	Equal variances assumed	.013	.911	2.961	23	.007	.699	.236	.211	1.187
	Equal variances not assumed			2.927	20.472	.008	.699	.239	.202	1.196
CSF 8: Establishment of adjudication committee and meeting	Equal variances assumed	1.261	.273	.040	24	.969	.012	.299	-.605	.629
	Equal variances not assumed			.041	23.931	.968	.012	.294	-.595	.618
CSF 9: Proactive main contractor throughout the GMP/TCC process	Equal variances assumed	.001	.972	.171	24	.866	.048	.278	-.527	.622
	Equal variances not assumed			.171	23.191	.866	.048	.279	-.529	.625
CSF 10: Open book accounting regime as provided by the main contractor in support of his tender pricing	Equal variances assumed	.185	.671	-.040	24	.969	-.012	.299	-.629	.605
	Equal variances not assumed			-.040	22.666	.969	-.012	.301	-.635	.611

Group Statistics

	Which payment mechanism did the project adopt?	N	Mean	Std. Deviation	Std. Error Mean
CSF 1: Standard form of contract for GMP/TCC projects	Guaranteed maximum price	29	3.59	1.086	.202
	Target cost contracting	9	2.89	.928	.309
CSF 2: Well defined scope of work in client's project brief	Guaranteed maximum price	30	4.53	.571	.104
	Target cost contracting	10	3.90	1.101	.348
CSF 3: Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	Guaranteed maximum price	30	4.23	.626	.114
	Target cost contracting	10	4.00	.816	.258
CSF 4: A right selection of project team	Guaranteed maximum price	30	4.37	.809	.148
	Target cost contracting	10	4.80	.422	.133
CSF 5: Reasonable share of cost saving and fair risk allocation	Guaranteed maximum price	30	4.47	.571	.104
	Target cost contracting	10	4.70	.483	.153
CSF 6: Partnering spirit from all contracting parties	Guaranteed maximum price	30	4.47	.571	.104
	Target cost contracting	10	4.70	.675	.213
CSF 7: Early involvement of the contractor in design development	Guaranteed maximum price	29	4.31	.660	.123
	Target cost contracting	10	4.20	.632	.200
CSF 8: Establishment of adjudication committee and meeting	Guaranteed maximum price	30	3.90	.712	.130
	Target cost contracting	10	3.60	1.075	.340
CSF 9: Proactive main contractor throughout the GMP/TCC process	Guaranteed maximum price	30	4.20	.664	.121
	Target cost contracting	10	4.80	.422	.133
CSF 10: Open book accounting regime as provided by the main contractor in support of his tender pricing	Guaranteed maximum price	30	3.93	.785	.143
	Target cost contracting	9	4.44	.726	.242

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
CSF 1: Standard form of contract for GMP/TCC projects	Equal variances assumed	.269	.607	1.735	36	.091	.697	.402	-.118	1.512
	Equal variances not assumed			1.888	15.451	.078	.697	.369	-.088	1.482
CSF 2: Well defined scope of work in client's project brief	Equal variances assumed	2.456	.125	2.369	38	.023	.633	.267	.092	1.175
	Equal variances not assumed			1.743	10.663	.110	.633	.363	-.169	1.436
CSF 3: Familiarity with and experience of GMP/TCC methodology amongst client, consultants, main contractor and subcontractors	Equal variances assumed	.109	.743	.945	38	.351	.233	.247	-.266	.733
	Equal variances not assumed			.826	12.722	.424	.233	.282	-.378	.845
CSF 4: A right selection of project team	Equal variances assumed	3.726	.061	-1.613	38	.115	-.433	.269	-.977	.110
	Equal variances not assumed			-2.178	30.414	.037	-.433	.199	-.839	-.027
CSF 5: Reasonable share of cost saving and fair risk allocation	Equal variances assumed	2.884	.098	-1.158	38	.254	-.233	.201	-.641	.174
	Equal variances not assumed			-1.261	18.128	.223	-.233	.185	-.622	.155
CSF 6: Partnering spirit from all contracting parties	Equal variances assumed	.297	.589	-1.069	38	.292	-.233	.218	-.675	.208
	Equal variances not assumed			-.982	13.573	.343	-.233	.238	-.744	.278
CSF 7: Early involvement of the contractor in design development	Equal variances assumed	.559	.460	.460	37	.648	.110	.240	-.375	.596
	Equal variances not assumed			.470	16.296	.644	.110	.235	-.386	.607
CSF 8: Establishment of adjudication committee and meeting	Equal variances assumed	3.827	.058	1.011	38	.318	.300	.297	-.301	.901
	Equal variances not assumed			.824	11.746	.426	.300	.364	-.495	1.095
CSF 9: Proactive main contractor throughout the GMP/TCC process	Equal variances assumed	2.678	.110	-2.669	38	.011	-.600	.225	-1.055	-.145
	Equal variances not assumed			-3.329	24.791	.003	-.600	.180	-.971	-.229
CSF 10: Open book accounting regime as provided by the main contractor in support of his tender pricing	Equal variances assumed	.079	.781	-1.741	37	.090	-.511	.294	-1.106	.084
	Equal variances not assumed			-1.816	14.107	.091	-.511	.281	-1.114	.092